

# वार्षिक प्रतिवेदन 2024-25

# ANNUAL REPORT 2024-25

ICAR-INDIAN INSTITUTE OF FARMING SYSTEMS RESEARCH ANNUAL REPORT 2024-25



## जैविक खेती पर अखिल भारतीय नेटवर्क कार्यक्रम All India Network Programme on Organic Farming



भा.कृ.अनु.प. भारतीय कृषि प्रणाली अनुसंधान संस्थान  
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## ***ICAR-IIFSR***

ICAR Indian Institute of Farming Systems Research (IIFSR) formerly Project Directorate for Farming Systems Research (PDFSR) was established by Indian Council of Agricultural Research New Delhi in April 1989 at Modipuram Meerut Uttar Pradesh.

### **Vision**

Management of natural source of holistic improvement of small and marginal farmers through Integrated Farming Systems

### **Mission**

Improve food, nutrition, livelihood and financial security of small and marginal households through climate smart Integrated Farming Systems (to make marginal and small households as bountiful)

### **Mandate**

- Research in integrated farming Systems on production technologies for improving productivity and resource use efficiencies
- Develop efficient, economically viable and environmentally sustainable integrated farming system models for different farming situations.
- On-farm testing, verification and refinement of system-based farm production technologies.
- Co-ordinate and monitor integrated farming system research in the country

All India Coordinating Coordinated Research Project on Integrated Farming System (AICRP on IFS) is an integral part of ICAR-IIFSR with 74 centres to undertake on-station main (25 no's.) on-station sub (11 no's.) on-station voluntary (6 no's) and on-farm research (32 no's) spread across length and breadth of the country. The institute is also leading an All India Network Programme on Organic Farming (AI-NPOF) with 20 centres

# Annual Report

## 2024-25



**All India Network Programme on Organic Farming**  
Modipuram, Meerut – 250 110, India



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### **Important Notes:**

- This compilation is a joint contribution of all the scientists involved in All India Network Programme on Organic Farming (AI-NPOF) at 20 centres including 7 new centres started from 2015-16 and ICAR-IIFSR, Modipuram (report writing, compilation, editing and printing).
- The Annual Report 2024-25 is based on experimental data generated during kharif, rabi and summer seasons of 2023-24. The other details are relevant up to March 2025.
- The report includes both processed and semi-processed data, generated in different experiments under All India Network Programme on Organic Farming (AI-NPOF) and as such no material/ data should be reproduced in any form without prior written permission and due credit to the concerned scientist (s).

## ACKNOWLEDGEMENT

All India Network Programme on Organic Farming (AI-NPOF) initiated during 2004 having mandate to develop package of practices and technologies for organic production system is currently operating with 20 co-operating centres covering 16 states by involving 11 State Agricultural Universities, 7 ICAR institutes and 1 deemed university. Results of the study, experiments and demonstrations conducted during 2023-24 at 20 co-operating centres are processed, compiled, and published as Annual Report 2024-25. I take this opportunity to record my sincere thanks to **Dr Himanshu Pathak**, Former Secretary, Department of Agricultural Research and Education and Director General, Indian Council of Agricultural Research, New Delhi for the support being extended to the scheme. I also take this opportunity to thank **Dr M.L. Jat**, Secretary, Department of Agricultural Research and Education and Director General, Indian Council of Agricultural Research, New Delhi for the support. I also extend my gratitude to **Dr. S.K. Chaudhari**, Former Deputy Director General (Natural Resource Management) for his constant guidance and mentoring the scheme to develop organic farming packages. I extend my gratitude to **Dr. A.K. Nayak**, Deputy Director General (Natural Resource Management) for his technical guidance in organizing the activities and research programmes. Inputs and support received from **Dr Rajbir Singh**, Former Assistant Director General (Agronomy, Agroforestry and Climate Change), **Dr A. Velmurugan**, Assistant Director General (SWM) and **Dr Rakesh Kumar**, Assistant Director General-Acting (AAF&CC) for improving the output of the scheme is duly acknowledged. The guidance and support received from **Dr Sunil Kumar**, Director, ICAR-Indian Institute of Farming Systems Research, Modipuram are duly acknowledged. Scientific inputs received from Quinquennial Review Team (QRT), Research Advisory Committee (RAC) and Institute Management Committee (IMC) is thankfully acknowledged.

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The contributions of all the other scientific, technical, administrative, and skilled supporting staff either directly or indirectly at various levels during preparation of this report are duly acknowledged. Findings from the scheme especially package of practices, varietal identification and findings of natural farming will pave way for alternate production strategies promotion in potential domains for organic and natural farming across different ecosystems.

**National Principal Investigator, AINP-OF**



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## ABSTRACT

### Salient research findings

#### Evaluation of organic, inorganic and integrated production packages for crops and cropping systems

**Bajaura:** The performance of vegetable crops, evaluated under four cropping systems and three input organic, inorganic, and towards organic approaches, with most crops performing in the order: organic < towards organic-I < inorganic (FP). Under organic management, the yields recorded during the kharif season were 4908 kg/ha for french bean, 627 kg/ha for black gram, and 12554 kg/ha for lady's finger. Compared to the towards organic approach, the yield of french bean, blackgram and okra were 15.4, 7.2% and 5.4% lower, respectively. When compared to the inorganic approach, the organic package resulted in 28.8%, 16.3%, and 9.2% lower yields for french bean, black gram, and lady's finger, respectively. During rabi, average yield of cauliflower recorded of 11474 kg/ha under organic management which is about 21% lower than inorganic (FP). Yield of pea with organic practice also lower (17.8%) compared to farmers practice. In summer, frenchbean, tomato and summer squash recorded yield under organic of 4868, 22841 and 28870 kg/ha which were 26.1, 13.5 and 14.2% lower compared to inorganic with farmers practice. In terms of system equivalent yield (cauliflower equivalent yield), the cropping system cauliflower–tomato recorded the highest yield among all systems at 44,793 kg/ha. Among different management practices, inorganic management following state recommendations resulted in the highest cauliflower equivalent yield (38117 kg/ha), followed by the integrated approach. Compared to inorganic, the organic system showed a reduction of 17.6%, while the integrated system showed reduction of 11% in cauliflower equivalent yield.

**Bhopal:** Soybean-based cropping systems involving wheat, mustard, chickpea, and linseed were evaluated under organic, inorganic, and towards organic practices. The performance of majority of crops during kharif and rabi was in the order of inorganic < organic < towards organic. Organic management resulted in yield level of 1034, 3560, 1170, 1330 and 1091 kg/ha for soybean, wheat, mustard, chickpea and linseed which was 5.4, 4.2, 7.1, 5.3 and 7.1% lower than towards organic respectively. When compared to the inorganic approach, the organic package resulted in 7.5%, 4.1%, 3.5% and 10.3 higher yields for soybean, wheat, mustard, chickpea respectively whereas linseed recorded 3.8 lower yield. In terms of system equivalent yield (soybean equivalent), it was also followed the same order of inorganic < organic < towards organic management. Among the cropping systems, soybean-wheat recorded higher soybean equivalent yield of 2473 kg/ha followed by soybean-chickpea (2243 kg/ha).

**Calicut:** Ginger and turmeric were evaluated under organic, inorganic and towards organic approaches. The performance of ginger was in the order of inorganic < organic < towards organic, whereas, yield of turmeric been in order of towards organic < organic < inorganic. Organic management package resulted in yield of ginger 12270 kg/ha which was 3.2% lower than towards organic but 36.8% higher than inorganic. Yield of turmeric fresh and dry recorded of 42900 and 12000 kg/ha under organic management package resulted in numerically higher than towards organic but about 2.0 and 2.4% lower than inorganic respectively.

**Coimbatore:** Vegetables such as brinjal, chilli, and tomato grown in the kharif, in combination with pearl millet, barnyard millet, and finger millet in the rabi season, were evaluated in a system mode under organic, inorganic, and towards organic approaches. All the vegetable crops and millets performed better in order to organic < towards organic < inorganic. Organic management resulted in yield level of 20512, 14814 and 18584 kg/ha in kharif which is 3.8, 2.4 and 7.2% lower than towards



organic for brinjal, chilli and tomato respectively. Similar trends were observed for rabi wherein pearl millet, barnyard millet, and finger millet recorded of yield 2078, 1690 & 2645 kg/ha with organic practice but slightly lower than towards organic by 3.8, 1.2 and 2.5%. When compared to inorganic, it showed reduction by 11.4, 4.8 & 11.2% respectively. System equivalent yield (brinjal equivalent) recorded in order to organic < towards organic < inorganic among the nutrient management practices. Among the cropping systems, brinjal - pearl millet - green manure (dhaincha) resulted in higher equivalent yield of 24801 kg/ha which was about 3.0 and 8.0% higher than chilli - barnyard millet and tomato - finger millet respectively

**Dharwad:** Pigeon pea and cotton based inter cropping systems was evaluated under organic, inorganic and towards organic nutrient management practices. Crops green gram, soybean and groundnut was taken as intercrop with pigeon pea and cotton. Pigeon pea + green gram and cotton+ soybean system showed the trend in order to inorganic<organic<toward organic while cropping systems, pigeon pea +soybean, pigeon pea +groundnut and cotton +green gram found in order to toward organic< inorganic<organic. Among different combinations of intercropping system pigeon pea equivalent resulted in higher in order of towards organic < inorganic < organic. Pigeon pea+ soybean recorded highest PEY (2348 kg/ha) among the other intercropping systems.

**Jabalpur:** Soybean-based cropping systems involving wheat (duram), mustard, berseem (seed and fodder), lentil and sorghum (fodder) was evaluated. During kharif, performance of soybean recorded in order of inorganic < towards organic < organic which was 6.2 and 17.4% higher than inorganic and towards organic approaches. In rabi, most of the crops performed better in order of towards organic < organic < inorganic. Organic management resulted in yield level of 2087, 680, 6600(F)+112(S) and 321 kg/ha in rabi for wheat, mustard, berseem (F+S) and lentil. Similar trends were observed for summer crops. Total mean productivity in terms of soybean equivalent was recorded higher with 100% inorganic nutrient management (2622 kg/ha) followed by organic (2066 kg/ha) among the production packages. Among cropping systems, soybean–berseem seed & fodder led to record maximum soybean equivalent yields (3522 kg/ha) followed by soybean – mustard–green gram of 1978 kg/ha.

**Karjat:** The rice-based cropping systems involving vegetable crops (brinjal, chickpea, field bean and white onion) were evaluated. Rice crop performed better in order to organic < inorganic < towards organic. Organic management resulted in mean yield of rice 3231 kg/ha which was 3.7 and 1.6% lower than towards organic and inorganic. During rabi, yield of brinjal found to be 13.3% lower with organic than inorganic, however, chickpea, field bean resulted in higher yield with organic which was 6.7 and 4.6% increase than towards organic respectively. When compare to inorganic, yield of chickpea and field bean found to be higher to the tune of 26.6 and 16.3% with organic practice. Performance of white onion was in order of inorganic < organic < towards organic. Organic management resulted in yield of onion 14602 kg/ha. Trend of system productivity in term of rice equivalent was in the order of inorganic < towards organic < organic. Organic management resulted in system equivalent yield of 20615 kg/ha which was about 21.6 and 25.9% higher than towards organic and inorganic management practice respectively. Among the cropping systems, rice- brinjal system produced maximum rice equivalent yield (24534 kg/ha) than others cropping systems whereas rice-chickpea produced lowest REY (8557 kg/ha).

**Ludhiana:** Four cropping systems comprising two rice-based systems, one moong–wheat–summer moong system, and one sesame–lentil system were evaluated under organic, inorganic, and towards organic management approaches. Yield trend of basmati rice was in order of organic < inorganic < towards organic. Organic management resulted in mean yield of basmati rice 3815 kg/ha which was only 4.5 and 3.8% lower than towards organic and inorganic respectively. Organic management resulted in yield level of 1260 and 1350 kg/ha for chick pea and lentil which was 12.5 and 68% higher than towards organic and inorganic management practice whereas, lentil recorded 15.6 and 17.7% lower yield compared to towards organic and inorganic. System productivity in term of rice equivalent was in order of inorganic < organic< towards organic. Organic management practice recorded system equivalent of 9375 kg/ha which is decrease by 4.8% towards organic but about 2% higher to inorganic management practice. Among cropping systems, basmati rice-wheat-green manure resulted in higher system productivity of 11317 kg/ha followed by kharif moong-wheat-summer moong.

**Modipuram:** Four cropping systems consisting of black rice, finger millet, okra and black gram in kharif and lentil, barley pea and tomato in rabi were evaluated. In kharif, yield trend of sesame found to be in order to inorganic < towards organic < organic. Sesame and vegetable pea recorded higher yield with organic management practice of 371 and 6067 kg/ha which was 7.5 & 2.1% higher compared to towards organic-I and 8.5 & 3.1 inorganic. Okra, black gram, lentil and barley recorded maximum yield with towards organic which were higher to the tune of 2.1, 40.4, 14.5 and 13% when compared to organic-I practice. Finger millet, tomato and vegetable cowpea resulted in higher under inorganic management with farmers practice. Reduction in organic-I found to be to the tune of 22.9, 2.9 and 1% respectively when compared to inorganic. Trend for system productivity in term of rice equivalent was in order of inorganic < organic < towards organic. Black gram-tomato-green manure (sunhemp) recorded higher rice equivalent yield of 15212 kg/ha because of higher yield of tomato and good premium price followed by Okra – vegetable pea – sesbania aculeata green manure of 12454 kg/ha among the cropping systems.

**Pantnagar:** Basmati rice based cropping systems was evaluated under organic, inorganic and towards organic approaches. Performance of majority of crops was in the order of inorganic < organic < towards organic. Organic management resulted in yield level of 4719, 4534, 1539 4307 and 11429 for basmati rice, wheat, mustard, vegetable pea and potato. Under organic management yield difference for basmati rice was only 36 kg/ha. Other crops, wheat, mustard and pea showed reduction in yield to the tune of 6.1, 13.3 and 17.1% when compared to towards organic respectively. However, potato produced maximum yield with organic management and higher by 6.7% over towards organic. System productivity in terms of basmati rice equivalent yield recorded higher with towards organic-I having 50% nutrients through organic manures + 50% nutrients through inorganic sources (8311 kg/ha) followed by organic and inorganic. Among all the cropping systems, higher system productivity was recorded with basmati rice-mustard system (8373 kg/ha) followed basmati rice-wheat (8271 kg/ha).

**Raipur:** Soybean based cropping systems were evaluated involving maize (sweet corn), field bean, tomato, and cabbage under organic, inorganic and towards organic approaches. Performance of soybean and sweet corn crop was in the order inorganic < towards organic < organic, while, field bean, tomato and cabbage performed in order to inorganic < organic < towards organic. Organic management resulted in yield level of 1958, 3530, 1400, 38000 and 48000 kg/ha for soybean, sweet corn, field bean, tomato and cabbage and the difference in the yield found to be 5.0, 105, 22, 315 and 542 kg/ha when compared to towards organic. System equivalent yield (soybean equivalent) among the nutrient management practices was in order of towards organic < inorganic < organic. Among the cropping systems, soybean-cabbage resulted in higher equivalent of 14311 kg/ha followed by soybean-tomato (10151 kg/ha).

**Ranchi:** Performance of rice-based cropping systems were evaluated involving wheat, onion, potato and okra. The yield of rice and potato was in the order of inorganic < towards organic < organic while performance of other crops such as wheat, onion and okra found in order to inorganic < organic < towards organic. Organic management practice resulted in higher mean yield of rice (3370 kg/ha) which was 5.3 and 19.6% higher than towards organic and inorganic. Likewise, potato also followed the same trend and yielded 23633 kg/ha. In rabi, wheat, onion and okra found to be higher with towards organic approach. The reduction in yield under organic was 11.9, 2.2 and 2.4% over towards organic respectively. System equivalent yield (rice equivalent) among the nutrient management practices was in order of inorganic < towards organic < organic. Among the cropping systems, rice-onion resulted in higher equivalent of 13141 kg/ha followed by rice-potato (12997 kg/ha).

**Umiam:** The performance of four okra based cropping system involving carrot, potato, french bean and tomato were evaluated. Yield trend for okra was in order of inorganic < organic, towards organic. Among the management practices, performance of rice was in order to towards organic (Integrated) < inorganic and organic. Among the varieties, Lampnah recorded highest grain yield of 4200 kg/ha. Yield of okra recorded with organic was 8998 kg/ha and showed in reduction over towards organic was 7.7%. Organic management resulted in yield level of 17500, 17400, 4800 and 16300 kg/ha for carrot, potato, frenchbean and tomato respectively. System equivalent yield (okra equivalent) among the nutrient management practices was in order of inorganic < organic < towards organic. Among the cropping systems, okra-tomato resulted in higher equivalent of 23625 kg/ha closely followed by okra-carrot (23200 kg/ha).



**Ajmer:** Spices crops coriander and fennel was evaluated consisting four cropping system under organic, inorganic and towards organic approaches. The performance of majority of the crops was in the order of organic < towards organic < inorganic. Organic management resulted in mean yield of cowpea as sole and inter crop recorded of 671 & 735 kg/ha which was about 68 & 42 kg/ha higher than towards organic respectively. Yield of fennel and coriander under organic management recorded of 750 and 583 kg/ha which was about 7.5 and 6.0% lower than towards organic respectively. Among the management practice, system equivalent yield (cowpea equivalent) was in the order of organic < towards organic < inorganic. Among cropping systems, cow pea + maize (4:2) - fennel + cabbage (2:1) recorded highest equivalent yield of 3417 kg/ha followed by Cow pea + maize (4:2) -coriander + cabbage (2:1) (2022 kg/ha).

**Almora:** Two cropping systems consisting of grain amaranth and finger millet in kharif and wheat in rabi was evaluated. The performance of the majority of crops was in the order of inorganic < towards organic < organic. During kharif organic management resulted in yield level of 1114 kg/ha for grain amaranth and 581+617 kg/ha for finger millet & intercrop soybean which was 52.8, 36.4 & 48.0% higher over towards organic respectively. Similar trends was observed for rabi crops. Average yield level of wheat, intercrop lentil and toria under organic practice recorded 998, 127 and 131 kg/ha which were higher by 71.2, 32.3 and 21.3% compared to towards organic practice. System equivalent yield recorded followed the same trend as yield of crops. Among the systems, grain finger millet + black soybean (2:1) - wheat + toria (2:1) recorded highest equivalent yield of 1967 kg/ha which was about 4% higher than grain amaranth-wheat + lentil.

**Gangtok:** Maize based cropping system was evaluated with organic management practice under 100% as per NPOP standard and 50% nutrients through organic sources + NF practice. Organic management (100%) resulted in average yield of maize (3220 kg/ha) which was about 7.7% higher than Organic-II [50% nutrients through organic sources + NF practice]. Similar trends for rabi crops were observed where french bean, soybean, rajmash, black gram produced higher yield in organic I. System equivalent yield in term of maize also higher with organic-I than to organic-II.

**Narendrapur:** Rice based cropping systems was evaluated. The performance of rice was in the order of towards organic < organic < inorganic. Inorganic management resulted in higher yield (kg/ha) of rice varieties Gobindo bhog (2340), Kanakchur (800), Dudheswar (2870) and Shatabdi (2870). Average yield of rice under organic management recorded of 1980 kg/ha which about 5.3% higher than towards organic-II but 5.7% lower than towards-I. In rabi, majority of the crops was in order of organic < towards organic < inorganic. Organic nutrient practice resulted in reduction in yield of rabi rice by 13.5 and 14.8% than towards organic-II and inorganic respectively. System equivalent yield was also resulted in the order of organic < towards organic < inorganic. Among the systems, rice (shatabdi) -pea recorded highest equivalent yield followed by rice (Dudheswar)- red amaranthus +cucumber.

**Sardarkrushinagar:** Performance of majority of the crops was in the order of organic < towards organic < inorganic. Organic management resulted in yield level of green gram and groundnut of 636 and 1022 kg/ha. Reduction in yield for green gram under organic found to be about 2.6, and 11.9% over towards organic respectively. Difference in yield of groundnut over towards organic-I was only 3 kg/ha but when compared to inorganic (farmers practice) it was 10.9% . In rabi yield trend for amaranth, mustard and lucerne (fodder) crop recorded in same order as kharif organic < towards organic < inorganic organic. Difference between organic and towards organic-I was about 8, 22 and 1305 kg/ha for amaranth, mustard and lucerne (f) respectively. System equivalent yield (ground nut equivalent) among management practice was in order of organic < towards organic < inorganic. Cropping systems, ground - lucerne - lucerne resulted in higher equivalent yield of 2852 kg/ha which is 65% higher by green gram –mustard and 46.6% higher by green gram-amaranth system.

**Thiruvananthapuram:** Cassava and taro was evaluated with cowpea, ground nut, black gram and green gram in system mode under organic inorganic and towards organic approaches. The performance of the cassava was in the order of organic < towards organic < inorganic. Organic management resulted in yield level of cassava (30290 kg/ha) and taro (7750 kg/ha mean) which was 13.1% lower than towards organic-I but taro recorded by higher by 175% with organic over towards organic-I. System equivalent (cassava equivalent) was in the order of inorganic < towards organic < organic.

**Udaipur:** Performance of majority of crops was in the order of organic < inorganic < towards organic. During kharif organic management resulted in yield level for maize (2490kg/ha), black gram (475 kg/ha), sweet corn (2575kg/ha) and green gram (535 kg/ha) which were 10.6, 24.0, 9.5 and 20.7% lower than towards organic respectively. Similar trends was observed for rabi crops wheat durum & aestivum, chickpea and fenugreek which were 5.8, 7.5, 12.2 and 12.6% respectively also lower than towards organic-I. System equivalent yield was in order of organic < inorganic < towards norganic. Among the cropping systems, maize + blackgram–wheat (durum)–sesbania (GM) and sweet corn + black gram– chickpea resulted in higher equivalent yield of 9092 and 9079 kg/ha.

## Evaluation of response of different varieties of major crops for Organic Farming

**Bajaura:** Maize and wheat varieties were evaluated for their suitability under organic management practices. Among the maize varieties, variety Bajaura Makka recorded significantly tallest plant (259.8cm), cob length (21.4cm), cob diameter (5 cm) and number of rows per cob (17.3) resulted in higher grain yield (4248 kg/ha), followed by Girija, and Palampur Sankar Makka-II which is statistically at par. Further, the maximum net returns (32985 Rs. /ha) and B:C (1.31) was also found in variety Bajaura Makka. Among the wheat varieties, variety HPW-368 recorded significantly higher plant height (94.8 cm), number of tillers/ meter row (68.7) grain yield (3732 kg/ha) followed by HPW-373 (3524 kg/ha), HPW-349 (3518 kg/ha). likewise, the maximum net returns (Rs. 59068/ha) and B:C (1.56) was found maximum in variety HPW-368.

**Bhopal:** Twelve varieties of each for groundnut and mustard were evaluated under organic management practices. Among the groundnut varieties, cultivar GPBD-5 out performed in terms of plant height (37.9cm), pods/plant (37.3), seed yield (2111 kg ha<sup>-1</sup>) and biomass yield followed by GJG-17, DH-256, ICGV-16690. Among the mustard varieties of grown under similar organic nutrient source and doses, the cultivar ARAVALI out performed in terms of seed yield followed by CS-52, MAYA, DRMR-150-35, NRCDR-2, PGN-229, PUSA MAHAK, DRMR-IJ – 31, NRCDR-601, NRCHB-101 and RH-749. Seed yield of ARAVALI (1223 kg ha<sup>-1</sup>) and total biomass (4209 kg ha<sup>-1</sup>) was found significantly higher than others.

**Calicut:** Among the turmeric varieties variety Sudarsana (60.1 t/ha) recorded significantly higher yield followed by Sugna (54.9 t/ha), whereas the lowest yield was found in Pratibha variety (26.6 t/ha).

**Coimbatore:** Different varieties rice followed by green gram were evaluated. Among the twelve traditional rice cultures grown organically, significantly the highest plant height at harvest was recorded in Kuzhiadichan (106.3 cm) which is at par with Athur Kichii samba and Garudan samba. Maximum productive tillers/ hill were found in Poonkar (15) which was at par with Milagu samba, Thanga samba, Kuzhiadichan and Kullakar. Maximum panicle length was recorded in Kuzhiadichan (26.6 cm) which is statically at par with Illuppaipoo samba and Thulasi vasa samba.

Grain yield difference was observed significantly among the green gram varieties ranged from 652 to 972 kg/ha. VBN-4 recorded highest grain yield (972 kg/ha), followed by VBN-2 (942 kg/ha), while VGG-15-013 had lowest grain yield (652 kg/ha). The variety VBN-4 yielded the highest net returns (Rs. 36,871 per hectare).

**Dharwad:** Five varieties of soybean, wheat and four varies of groundnut were evaluated for their performance under organic conditions which were observed significant different among all the traits. the soybean variety Dsb-23 (3847 kg/ha), wheat variety UAS- 247 (2903 kg/ha) and groundnut variety Dh- 256 (2707 kg/ha) recorded significantly higher yield. Whereas the lowest yield was found in soybean variety MACS, wheat variety UAS DW- 30508 and groundnut variety DBG-4.

**Jabalpur:** Twelve varieties of soybean and chickpea in system mode were evaluated for their performance and suitability under organic nutrient management. Maximum seed yield of soybean was recorded with variety JS 20-69 (902 Kg/ha) which was significantly higher than the rest of the varieties whereas the lowest seed yield was found in variety RSC 11-42. Maximum seed yield of chickpea (1299 kg ha<sup>-1</sup>) was recorded with the variety JG 322 which was statistically at par with JG 12 and closely followed by JG 16. Whereas variety JG 30 recorded lowest seed yield.



**Karjat:** Fifteen varieties of rice during Kharif including early, mid-late and late maturity category (4 varieties in each) including 3 popular among the farmers were evaluated for their suitability under organic condition. Among the rice varieties Sahyadri-3 was found maximum grain yield (4599 kg/ha) and straw yield (6349 kg/ha) which is statistically at par with variety Ratnagiri-8 and Sahyadri-4 and the least grain yield was recorded in variety Ratnagiri – 1. Fifteen varieties of cowpea during Rabi was grown in which the significantly higher seed yield was found in variety Konkan Sadabahar (1386 kg/ha) which was significantly at par with variety Phule Pandhari, Phule sonali and Dalkhan Local. Whereas Panvel Red produced lower yield among the varieties. Significantly higher rice equivalent yield (REY 109423 kg/ha), net return (124829 Rs/ha) and benefit cost ratio (1.78) were recorded with Ratnagiri- 8 (rice) in kharif and Konkan Sadabahar (cowpea) in rabi compared to other varieties evaluated in the system. Lowest system equivalent yield and net return was recorded in rice (karjat-2) – cowpea (Panvel red).

**Ludhiana:** Sixteen varieties of rice and twelve varieties of wheat were evaluated for their performance under organic production. Basmati rice variety Basmati 386 attained the highest plant height (163.1 cm) which was significantly higher than rest of the varieties. The lowest plant height was observed in Pusa Basmati- 1509. The maximum number of effective tillers/m<sup>2</sup> (370), panicle length (31.5 cm), Grains/ panicle (66.4), grain yield (4030 kg/ha) and straw yield (7120 kg/ha) in variety Punjab Basmati- 7 which is statistically at par with Pusa Basmati- 1718, Pusa Basmati- 1637 and Pusa Basmati- 1718. The highest plant height (123.5 cm) was observed in wheat variety C-306 which was significantly higher than all the other wheat varieties. The lowest plant height was observed in Punjab Shingar and it was significantly lower than all the other wheat varieties. The maximum number of effective tillers per m<sup>2</sup> (354.3), Grain per spike (46.1), 1000 grain weight (43.7 g), grain yield 4570 (kg/ha) and straw yield (6280 kg/ha) was recorded in variety Unnat PBW 550 which was statistically at par with variety BWL 3498 in terms of yield. Among which the maximum grains/ panicle (66.4) was also found in treatment Pusa Basmati-7 which was non-significant. Whereas the Kandi Area Landmark, Bansi Gold, and Punjab Shingar are least productive.

**Modipuram:** Nine promising varieties of brinjal and veg. pea in brinjal-veg. pea system were evaluated with similar nutrient source and doses under organic condition. Among the tested varieties of brinjal, highest yield (17111 kg/ha), net return (232383 Rs/ha) B:C ratio (3.60) was recorded under Pragati variety and least by Kashi Uttam variety which was higher than rest of the varieties. Cost of cultivation was similar among different varieties. Among the tested varieties of vegetable pea, highest yield (6204 kg/ha), highest net return (112793 Rs/ha) and B:C ratio (3.67) was recorded under Vasundhara which was higher than rest of the varieties. Cost of cultivation was similar among different varieties and the least yield, net return and B:C ratio was recorded in variety PB- 89.

**Pantnagar:** Total twelve varieties of rice and wheat were evaluated under organic cultivation. Plant height of different rice varies from 101 to 147 cm. Hansraj reported tallest plant height (147.0 cm) which is statistically at par with Kalanamak rice and the least height was found in variety CGZR-1. Among all varieties, PD-24 under HYVs recorded the highest Effective tillers/m<sup>2</sup> (255) grain wt./ panicle (2.44 g), 1000 grain wt. (27.2 g), grain yield (5719 kg/ha), Net return (Rs.1,72,640/ha) and B:C ratio (3.63). Plant height at harvest of different wheat varieties ranged from 83 to 105 cm, tallest variety was being sonalika, (105 cm) followed by UP- 2565 (97 cm) while smallest was recorded with WH-1105 (83.3 cm). Test weight (1000-grains weight) of different wheat varieties recorded in range from 23.5 to 35.3 g. The highest grain yield (5032 kg/ha), straw yield (5754 kg/ha), net return 88521 (Rs/ha) and B:C ratio (2.55) was noticed in HD-2903 which was at par with WH 1142, UP2 855 and UP 2565.

**Raipur:** The response of fifteen rice varieties, as well as eleven improved chickpea varieties, was assessed under an organic production system. Among all the rice varieties tested, the traditional scented variety Indira Sugandhit Dhan 1 recorded the highest grain yield (2895 kg/ha), Straw yield 8272 (kg/ha), gross return (88655 Rs/ha), net return (46515 Rs/ha) and B:C ratio (2.04) which was significantly superior to most other varieties. This was followed closely by C.G. Sugandhit Bhog and CG Devbhog, both of which were statistically at par. Whereas the least grain yield was observed in Chinni Kapoor, a traditional scented variety. Performance of different pea varieties based on yield attributes, economic returns, and yield

stability showed that the number of pods per plant ranged from 25.42 in PeasTSx10 to 32.74 in Vikash. Seed yield varied from 1024 kg/ha (PeasTSx10) to 1276 kg/ha (Vikash). Net returns ranged between ₹13,633/ha and ₹22,159/ha, with Vikash showing the highest return. The benefit-cost (B:C) ratio ranged from 2.25 to 3.18, and the yield stability index (YSI) ranged from 0.53 to 0.79.

**Ranchi:** Ten varieties of rice and wheat were assessed for their suitability in organic farming system. The highest rice yield was recorded in MTU1010 (4084 kg/ha), followed by Lalat (3962 kg/ha) and Naveen (3726 kg/ha) which are statistically at par. In terms of profitability, MTU1010 gave the maximum net return (Rs 63,332/ha), followed by Lalat (Rs 60,013/ha) and Naveen (Rs 53,548/ha). The highest wheat yield was recorded in K-1008 (3179 kg/ha), followed by HD-2967, HI- 1563 and DBW- 107 these were statistically at par with each other. The lowest yield was recorded in Govind Bhog. In terms of profitability DBW-107 (Rs 31,441/ha) and HI-1563 (Rs 32,071/ha) showed the highest net returns, followed by JKW-261 (Rs 26,606/ha).

**Umiam:** Groundnut and mustard varieties were evaluated for their performance and suitability organic production. There was a wide variation in pod yield among groundnut varieties, ranging from 450 to 1770 kg/ha. The highest pod yield was recorded in GG7 (1770 kg/ha), which was significantly superior to all other varieties. This was followed by GJG18 (1180 kg/ha) and ICGS76 (890 kg/ha). Seed yield among rapeseed varieties showed moderate variability, ranging from 280 to 450 kg/ha. The highest seed yield was recorded in DRMR (450 kg/ha), followed by PM-25 (430 kg/ha). These top-yielding varieties are likely statistically at par, given the close range of values. The lowest seed yield was found in PT-303 (280 kg/ha), Topeshwari (330 kg/ha), TL-15 (330 kg/ha), and NRCNB (330 kg/ha).

**Ajmer:** The total eight varieties each of fenugreek and nigella were assessed under organic cultivation. Plant height at harvest ranged from 45.5 cm (Hisar Sonali) to 55.6 cm (Ajmer Fenugreek-1). Number of primary branches per plant varied from 3.2 (RMT-143) to 5.3 (Ajmer Fenugreek-3). The number of pods per plant ranged between 16.4 (RMT-361) and 27.5 (Ajmer Fenugreek-3), while the number of seeds per pod was statistically non-significant and varied from 15.6 to 17.4. The seed yield among the varieties ranged from 1142 kg/ha (RMT-361) to 1658 kg/ha (Ajmer Fenugreek-3). Ajmer Fenugreek-3 was identified as the best-performing varieties and recorded the highest seed yield (1658 kg/ha), maximum number of pods per plant (27), and the highest number of primary branches (5.3). Hisar Sonali also showed also good performance with a yield (1618 kg/ha), a good number of pods (22.0), and tallest number of seeds per pod (17.4), making both varieties suitable for cultivation under the tested conditions. The seed yield ranged from 135 to 180 kg/ha. The highest seed yield was recorded in Ajmer Nigella-20 (180 kg/ha), which was significantly superior to all other varieties. It was followed by Indra Nigella-1 (165 kg/ha) and Pant Krishna (151 kg/ha).

**Gangtok:** Maize and buckwheat varieties were undertaken to test their suitability under organic production. Vivek Sankul-35 was the best performing variety, with the highest grain yield (4160 kg/ha), superior LAI (4.77), maximum cobs per row (14.69), and good cob girth. Vivek Sankul-35, Vivek Sankul-31, Seti Makkai, Vivek Sankul-37, RCM 1-3, and RCM 1-1 can be considered at par for grain yield. Kalo Makkai recorded the lowest yield, along with Vivek Sankul-35 having the lowest cob length. Among the maize cultivars, Vivek Sankul-35 emerged as the best cultivar in terms of highest gross return (85.43 ₹×103 ha<sup>-1</sup>), net return (42.26 ₹×103 ha<sup>-1</sup>), return per rupee (1.94), and profitability per day (116.14), which were statistically at par with Vivek Sankul-31 and Seti Makkai. Vivek Sankul-35. Whereas Kalo Makkai had the lowest economic returns and profitability, with poor return per rupee invested. Differences among the buckwheat varieties for yield ranged from 980 to 2190 kg/ha. Maximum grain yield (2190 kg ha<sup>-1</sup>), gross return (84.26 ₹×103 ha<sup>-1</sup>), net return (40.68 ₹×103 ha<sup>-1</sup>) rupee-1 invested (1.89), profitability (111.55 ₹/ha/day) was recorded under IC 109433 which was statistically at par with IC 49671, Local Meethay, and IC 104727

**Sardarkrushinagar:** Five varieties of each crop were cultivated in a cowpea-amaranth system to evaluate their performance under organic farming conditions. Yield attributing characters, number of pods/plants (9.55), and 1000 grain wt. (9.87 g) resulted in significantly higher seed yield (838 kg/ha), net return (41641 ₹/ha) and benefit cost ratio (0.92) were recorded in



Gujrat cowpea 4, which was statistically at par with Gujrat cowpea 3. Whereas Gujarat Cowpea 5 was the least productive and economical. Among different variety of amaranth, Gujarat Amaranth 5 recorded the highest Plant population per meter row length (11.5), plant height (156.5 cm), length of inflorescence (63.4) grain yield (1176 kg/ha), straw yield (2662 kg/ha), net return (28929 ₹/ha) and B:C ratio (0.56), which was statistically at par with Gujarat Amaranth 6 and Gujarat Amaranth 3. Whereas BGA 2, recorded the least yield and economically profitable.

**Thiruvananthapuram:** Tuber yield of greater yam varieties ranged between 9490 to 13280 kg/plant and found to be non-significant to each other. The maximum tuber yield was found in variety Orissa Elite (13280 kg/plant). In terms of profitability the highest net income was under Orissa Elite (425639 Rs/ha) and B:C ratio (2.15) which was higher than the rest of the varieties. Whereas the least tuber yield, net income and B:C ratio was found in variety Sree Keerthi, and is less preferable compared to others.

**Udaipur:** Maize and wheat varieties were evaluated. Among the twelve varieties of maize grown under organic farming, IPU-11-02 excelled across almost all parameters such as plant height (57.2 cm), branches/ plant (7.33), pods/ plant (32), seeds/pod (6.75), test weight (37.8), seed yield (787 kg/ha) and stover yield (1705 kg/ ha), net return (56899 Rs/ha) and net return (2.46). making it the most promising and profitable variety. Which was statistically at par with KU-3, PU-1, MU-2, and IPU-10-26 in terms of yield and economic returns, though slightly lower than IPU-11-02. Whereas the variety UDAI consistently underperformed in all agronomic and economic parameters and is not recommended for cultivation under similar conditions. Among the twelve varieties of mustard, DRMR-IJ-31 excelled across almost all parameters such as plant height (194.35 cm), branches/ plant (10), no of siliqua/ plant (186), seeds/siliqua (14.88), test weight (4.97), seed yield (1475 kg/ha) and stover yield (5162 kg/ ha), net return (90934 Rs/ha) and net return (3.81). making it the most promising and profitable variety. Which was statistically at par with NRC-HB-101, PM-25, DRMR-150-35, PM-30 in terms of yield and profitability. Whereas the variety DRMR-1165-40 consistently underperformed in all agronomic and economic parameters and is not recommended for cultivation under similar conditions.

## Evaluation of Natural Farming Practices in different agro ecologies

Ajmer, Udaipur and Sardarkrushinagar undertaken the same cropping system of Groundnut + sesame – fennel + cabbage.

**Ajmer:** Complete natural farming recorded system equivalent yield of 2487 kg/ha which is 10.9% and 9.3% decrease than organic and integrated crop management + chemical pesticides (ICMCP) respectively. Under complete natural farming, soil organic carbon recorded higher (0.36%) compared to control (0.26%). Complete natural farming recorded net return of Rs. 1,29,980 with cost of cultivation of Rs. 52,487. Natural farming resulted in reduction in cost of cultivation by 44.3% and 23.5% over organic and integrated crop management + chemical pesticides (ICMCP) respectively.

**Udaipur:** Complete natural farming recorded system equivalent yield of 3093 kg/ha which is 27.3% and 33.9% decrease than organic and integrated crop management + chemical pesticides (ICMCP) respectively. Under complete natural farming, soil organic carbon recorded numerically higher (0.70%) compared to control (0.66%). Complete natural farming recorded net return of Rs. 2,40,953 with cost of cultivation of Rs. 68,485. Natural farming resulted in reduction in cost of cultivation by 36.8% and 24.3% over organic and integrated crop management + chemical pesticides (ICMCP) respectively.

**Sardarkrushinagar:** Complete natural farming recorded system equivalent yield of 2527 kg/ha which is 9.1% and 17.8% decrease than organic and integrated crop management + chemical pesticides (ICMCP) respectively. Under complete natural farming, soil organic carbon recorded numerically higher (0.21%) compared to control (0.16%). Complete natural farming recorded net return of Rs. 1,02,900 with cost of cultivation of Rs. 86,932. Natural farming resulted in reduction in cost of cultivation by 24.2% and 2.4% over organic and integrated crop management + chemical pesticides (ICMCP) respectively.

Location Almora, Bajaura and Gangtok undertaken the same cropping system of Soybean + maize – garden pea + green coriander

**Almora:** Complete natural farming recorded system equivalent yield of 7431 kg/ha which is 26.8% and 38.4% decrease than organic and integrated crop management + chemical pesticides (ICMCP) respectively. Under complete natural farming, soil organic carbon recorded numerically higher (1.27%) compared to control (1.06%). Complete natural farming recorded net return of Rs. 1,28,969 with cost of cultivation of Rs. 1,72,418. Natural farming resulted in reduction in cost of cultivation by 8.8% and –4.6% over organic and integrated crop management + chemical pesticides (ICMCP) respectively.

**Bajaura:** Complete natural farming recorded system equivalent yield of 7578 kg/ha which is 17.6% and 25.3% decrease than organic and integrated crop management + chemical pesticides (ICMCP) respectively. Under complete natural farming, soil organic carbon recorded numerically higher (0.76%) compared to control (0.71%). Complete natural farming recorded net return of Rs. 2,45,213 with cost of cultivation of Rs. 2,23,176. Natural farming resulted in reduction in cost of cultivation by 24.5% and 4.3% over organic and integrated crop management + chemical pesticides (ICMCP) respectively.

**Gangtok:** Complete natural farming recorded system equivalent yield of 8076 kg/ha which is 8.2% increase than organic. Under complete natural farming, soil organic carbon recorded numerically higher (1.55%) compared to control (1.52%). Complete natural farming recorded net return of Rs. 201 with cost of cultivation of Rs. 36,020. Natural farming resulted in increase in cost of cultivation by 8.1% over organic.

Location Bhopal, Jabalpur and Raipur undertaken the same cropping system of Soybean + maize – wheat + mustard

**Bhopal:** Complete natural farming recorded system equivalent yield of 2180 kg/ha which is 23.7% and 38.6% decrease than organic and integrated crop management + chemical pesticides (ICMCP) respectively. Under complete natural farming, soil organic carbon recorded numerically higher (0.67%) compared to control (0.61%). Complete natural farming recorded net return of Rs. 55,159 with cost of cultivation of Rs. 41,362. Natural farming resulted in reduction in cost of cultivation by 23.3% and 21.9% over organic and integrated crop management + chemical pesticides (ICMCP) respectively.

**Jabalpur:** Complete natural farming recorded system equivalent yield of 1316 kg/ha which is 17.8% and 52.9% decrease than organic and integrated crop management + chemical pesticides (ICMCP) respectively. Under complete natural farming, soil organic carbon recorded numerically higher (0.62%) compared to control (0.60%). Complete natural farming recorded net return of Rs. 38,668 with cost of cultivation of Rs. 36,630. Natural farming resulted in reduction in cost of cultivation by 29.3% and 25.7% over organic and integrated crop management + chemical pesticides (ICMCP) respectively.

**Raipur:** Complete natural farming recorded system equivalent yield of 2580 kg/ha which is 28.3% and 33.2% decrease than organic and integrated crop management + chemical pesticides (ICMCP) respectively. Under complete natural farming, soil organic carbon recorded numerically higher (0.62%) compared to control (0.55%). Complete natural farming recorded net return of Rs. 70,029 with cost of cultivation of Rs. 59,397. Natural farming resulted in reduction in cost of cultivation by 26.1% and 18.2% over organic and integrated crop management + chemical pesticides (ICMCP) respectively.

Coimbatore and Dharwad followed the same cropping system: cotton + green gram – sorghum + chickpea

**Coimbatore:** Complete natural farming recorded system equivalent yield of 2794 kg/ha which is 8.7% and 17.9% decrease than organic and integrated crop management + chemical pesticides (ICMCP) respectively. Under complete natural farming, soil organic carbon recorded numerically higher (1.11%) compared to control (0.81%). Complete natural farming recorded net return of Rs. 81,008 with cost of cultivation of Rs. 1,08,260. Natural farming resulted in reduction in cost of cultivation by 17.9% and 24.6% over organic and integrated crop management + chemical pesticides (ICMCP) respectively.

**Dharwad:** Complete natural farming recorded system equivalent yield of 3216 kg/ha which is 3.3% decrease than organic and 2.0% increase over integrated crop management + chemical pesticides (ICMCP).



Karjat, Ranchi and Narendrapur followed same cropping system i.e. Rice + dhaincha – maize grain/sweet corn + cow pea

**Karjat:** Complete natural farming recorded system equivalent yield of 7951 kg/ha which is 36.3% and 43.6% decrease than organic and integrated crop management + chemical pesticides (ICMCP) respectively. Under complete natural farming, soil organic carbon recorded numerically higher (1.05%) compared to control (1.00%). Complete natural farming recorded net return of Rs. 65,147 with cost of cultivation of Rs. 99,793. Natural farming resulted in reduction in cost of cultivation by 25.4% and 15.5% over organic and integrated crop management + chemical pesticides (ICMCP) respectively.

**Ranchi:** Complete natural farming recorded system equivalent yield of 4112 kg/ha which is 11.8% and 14.1% decrease than organic and integrated crop management + chemical pesticides (ICMCP) respectively. Under complete natural farming, soil organic carbon recorded numerically higher (0.64%) compared to control (0.59%). Complete natural farming recorded net return of Rs. 1,40,296 with cost of cultivation of Rs. 61,700. Natural farming resulted in reduction in cost of cultivation by 16.3% and 21.6% over organic and integrated crop management + chemical pesticides (ICMCP) respectively.

**Narendrapur:** Complete natural farming recorded system equivalent yield of 9370 kg/ha. Under complete natural farming, soil organic carbon recorded numerically higher (0.57%) compared to control (0.50%). Complete natural farming recorded net return of Rs. 1,01,222 with cost of cultivation of Rs. 97,428.

Ludhiana, Modipuram and Pantnagar followed the same cropping system i.e. Maize + cowpea – wheat + chickpea

**Ludhiana:** Complete natural farming recorded system equivalent yield of 9131 kg/ha which is 35.7% and 44.7% decrease than organic and integrated crop management + chemical pesticides (ICMCP) respectively. Under complete natural farming, soil organic carbon recorded numerically higher (0.47%) compared to control (0.44%). Complete natural farming recorded net return of Rs. 1,41,422 with cost of cultivation of Rs. 83,839. Natural farming resulted in reduction in cost of cultivation by 6.7% and 14.4% over organic and integrated crop management + chemical pesticides (ICMCP) respectively.

**Modipuram:** Complete natural farming recorded system equivalent yield of 4569 kg/ha which is 33.4% and 48.3% decrease than organic and integrated crop management + chemical pesticides (ICMCP) respectively. Under complete natural farming, soil organic carbon recorded numerically higher (0.45%) compared to control (0.43%). Complete natural farming recorded net return of Rs. 68,657 with cost of cultivation of Rs. 86,100. Natural farming resulted in reduction in cost of cultivation by 37.1% and 19.0% over organic and integrated crop management + chemical pesticides (ICMCP) respectively.

**Pantanagar:** Complete natural farming recorded system equivalent yield of 9201 kg/ha which is 22.6% and 37.2% decrease than organic and integrated crop management + chemical pesticides (ICMCP) respectively. Under complete natural farming, soil organic carbon recorded numerically higher (0.88%) compared to control (0.73%). Complete natural farming recorded net return of Rs. 1,60,280 with cost of cultivation of Rs. 44,845. Natural farming resulted in reduction in cost of cultivation by 32.5% and 29.4% over organic and integrated crop management + chemical pesticides (ICMCP) respectively.

**Thiruvananthapuram:** Cassava+ vegetable cowpea – green gram was evaluated. Complete natural farming recorded system equivalent yield of 74,491 kg/ha which is 1.3% increase over organic and 29.0% decrease than integrated crop management + chemical pesticides (ICMCP). Under complete natural farming, soil organic carbon recorded numerically higher (1.08%) compared to control (1.01%). Complete natural farming recorded net return of Rs. 11,60,702 with cost of cultivation of Rs. 3,34,840. Natural farming resulted in reduction in cost of cultivation by 15.7% and 17.8% over organic and integrated crop management + chemical pesticides (ICMCP) respectively.

## Development of Integrated Organic Farming System models

**Calicut (Kerala):** Out of the total income of ₹4,38,102 generated through the system, livestock (comprising two cows) contributed the highest share of ₹3,58,152, accounting for 81.75% of the total. This included income from milk production (₹2,83,952) and cow dung (₹74,200), highlighting the economic significance of integrating dairy in organic systems.

The cropping systems occupied an area of 0.36 ha and included coconut, turmeric, and fodder crops. Together, they contributed ₹75,000, making up 17.12% of the total income. Among these, coconut (with 55 palms) contributed ₹45,000, and turmeric added ₹30,000, while fodder, although essential for livestock sustainability, did not generate income because of feed to the animals. Horticultural crops such as banana, tapioca, and vegetable cowpea were grown on 0.03 ha and contributed ₹4,950, representing only 1.13% of the income, suggesting their supportive role in household nutrition and income diversification. The total expenditure incurred for running the IOFS model was ₹2,41,800, leading to a net profit of ₹1,96,302. Additionally, the model generated 322 man-days of employment per year, indicating its potential in promoting rural livelihood and sustainable employment.

**Thiruvananthapuram (Kerala):** The results of the Integrated Organic Farming System (IOFS) model present a comprehensive details of diversified and sustainable income generation through the integration of crop and animal enterprises. The total gross income from the system was ₹12,55,597, of which the animal components were the major contributors, accounting for ₹8,79,659 or approximately 72% of the total income. Among animal-based outputs, milk yielded ₹4,80,287 from 8,576.55 litres, followed by cow urine which remarkably contributed ₹3,28,600, and cow dung adding ₹70,772—demonstrating the effective utilization of livestock by-products. The crop component, though secondary in income share, added ₹3,30,439 with a total tuber equivalent yield (TEY) of 11,014.62 kg. Fodder grass alone contributed ₹2,25,000, highlighting its dual role in supporting livestock nutrition and income. Other key crops such as cucumber (₹30,245), cassava (₹20,853), amaranthus (₹20,207), and banana (₹10,850) also contributed significantly, while minor crops like bhindi, brinjal, cowpea, and lemongrass added to diversity and market resilience. The total cost of running the IOFS model was ₹11,47,650, with ₹2,40,400 spent on crops and a significantly higher ₹9,07,250 on animal components. IOFS model achieved a net income of ₹1,07,947 with a benefit:cost ratio of 1.09.

**Coimbatore (Tamil Nadu):** The Integrated Organic Farming System (IOFS) model at Coimbatore, established on 0.40 ha, integrates multiple components—cropping systems, livestock, composting and recycling units, boundary plantations, agroforestry, beekeeping, and pest-repellent plants—to enhance productivity, sustainability, and year-round income through optimal resource recycling. The model achieved an annual gross return of ₹2,87,206 with a cultivation cost of ₹2,24,221, resulting in a net return of ₹62,985 and a B:C ratio of 1.28, while the five-year Sustainable Value Index stood at 0.19. Among its components, boundary plantations contributed the highest share of income (32.2%) with a net return of ₹20,798, followed by the okra–maize–green manure system (31.4%, net return ₹14,470), the dairy unit (16.6%, net return ₹10,709), and composting and recycling (about 9.9% direct income plus 9.8% equivalent savings). Fodder crops, agroforestry, beekeeping, and pest-repellent plants, though generating little or no direct income, played crucial roles in supporting livestock, reducing input costs, improving soil health, and delivering ecosystem services such as pollination, pest regulation, and biodiversity conservation, thereby demonstrating the economic and ecological viability of organic farming on smallholdings.

**Gangtok (Sikkim):** An IOFS model was developed in 0.6 ha area at research farm of ICAR-Sikkim Centre, Tadong, Sikkim. The IOFS model maintains a wide bio-diversity having fishery, dairy, poultry, large cardamom nursery, field crops, etc., maize/rice-based cropping system has been the backbone of the farmers' economy and livelihood security in Sikkim. From an 0.6 ha IOFS model, net return of Rs 77,002 was received by crop component from 0.47 ha area, Rs 64,676 was received by dairy (0.05 ha), Rs 22,320 and 7,404 obtained from poultry and fishery, whereas Rs 6000 was received from vermicomposting. From large cardamom, Rs 17,000 was received. From this 0.60 ha IOFS model, gross income of Rs. 3,10,144 was obtained with total cost of the Rs. 1,32,744 per annum resulted in net return of Rs. 1,77,400 was realized with BCR of 3.05.

**Ludhiana (Punjab):** Under the IOFS model at Ludhiana (4000 m<sup>2</sup>), diversified organic cropping systems combined high yields with good profitability and a low environmental footprint. The Basmati rice–wheat system produced 340–374 kg, Kharif moong–wheat–summer moong yielded 30, 218 and 39 kg respectively on 500 m<sup>2</sup>, maize–gobhi sarson gave 282 and 120 kg, and maize–berseem produced high fodder (3344 kg maize and 9773 kg berseem on 1000 m<sup>2</sup>), while sugarcane (3790 kg) and turmeric (1150 kg) on 500 m<sup>2</sup> each showed strong potential. Crops generated gross returns of ₹70,843 with



costs of ₹27,258, giving net returns of ₹43,585 and a B:C ratio of 1.60. The dairy unit (one cow) yielded gross returns of ₹48,563 (including ₹4,200 from dung) at a cost of ₹32,161, resulting in net returns of ₹16,402 and highlighting its role in nutrient cycling. Overall, the integrated system earned ₹1,19,406 gross returns with a total cost of ₹59,419, net returns of ₹59,987, and a B:C ratio of 1.01, demonstrating economic viability and self-sustenance. Environmentally, GHG emissions were highest from Basmati rice–wheat (70.5 kg CO<sub>2</sub>-e) and lowest from diversified or legume-based systems such as maize–gobhi sarson (32.1 kg) and turmeric (33.2 kg), indicating the system's potential for reducing the carbon footprint under organic management.

**Pantnagar (Uttarakhand):** The Integrated Organic Farming System (IOFS) model at Pantnagar demonstrated commendable performance through diversified cropping, integrated fishery, and seasonal vegetable cultivation. Among the crop systems, PB-1509–Sugarcane + Lentil + Garlic emerged as the most profitable, generating ₹46,648 per 750 m<sup>2</sup>, primarily due to high returns from sugarcane and garlic. Tilak Chandan–Black Wheat followed with ₹17,273, while Type-3 Sarbati earned ₹15,914. Winter vegetables contributed ₹24,565, with onion and tomato being the major contributors, whereas summer vegetables fetched ₹11,130. Fish farming, integrated within the system, yielded 21 kg of fish worth ₹3,255. From an economic standpoint, PB-1509–Sugarcane + Lentil + Garlic had the highest net return (₹12,828) and the lowest cultivation cost (₹3,567), indicating strong economic efficiency. Winter vegetables, despite higher input costs, provided the maximum net return (₹16,335), while Tilak Chandan–Black Wheat and Type-3 Sarbati generated ₹12,225 and ₹10,567, respectively. In terms of system productivity, Tilak Chandan–Black Wheat recorded the highest yield (4240 kg/ha), while PB-1509-based systems achieved the highest economic return (₹1,84,373/ha). Overall, the IOFS model at Pantnagar proved to be both productive and profitable, with integrated units like cattle shed, fish pond, compost pits, and fortified cow urine chamber—currently under construction—expected to further enhance system sustainability and resource recycling.

**Raipur (Chhattisgarh):** The IOFS model at Raipur showed that integrating diverse crops and farm components can deliver high returns and sustainability. Rice–Wheat–Green gram gave the highest net return (₹16,491) at the lowest cost, while Rice–Sweet corn–Green gram achieved the highest productivity (2049 kg). Altogether, seven cropping systems produced 8,730 kg output with ₹80,391 net return. Component-wise, cropping was the main income source, dairy and goatry added substantial returns but had higher emissions, fishery was low-emission, vermi-compost had high recycling value but highest GHGs, biogas/compost pit improved energy and water productivity, and horticulture created the most jobs and residue recycling. One hectare of IOFS generated a net return of ₹2,27,635 and acted as a significant GHG sink (31,816.8 kg CO<sub>2</sub>-e), showing its potential for profitable, climate-friendly organic farming.

**Sardarkrushinagar (Gujarat):** The Integrated Organic Farming System (IOFS) model at Sardarkrushinagar, Gujarat (0.40 ha) demonstrated high productivity, profitability, and energy efficiency. It comprised cropping systems (0.38 ha), livestock and allied enterprises (0.02 ha), and boundary plantations. Cropping produced a groundnut equivalent yield of 1109 kg/ha with a cost of ₹60,900 and net return of ₹15,714. Livestock and allied units, though on only 0.02 ha, gave 2346 kg/ha equivalent yield with a cost of ₹1,50,896 and net return of ₹11,195, while boundary plantations added 219 kg/ha with minimal cost (₹1,524) and high net return (₹13,629). Overall, the IOFS model achieved 3674 kg/ha yield, ₹2,13,320 cost, and ₹40,538 net return, translating into 25.17 kg productivity and ₹278 profitability per hectare per day and 0.35 man-days employment. Energy analysis showed outstanding efficiency, with the cowpea–wheat–fodder pearl millet system achieving the highest net energy return (587,587 MJ/ha) and boundary plantations recording an exceptional energy use efficiency of 24,819.

**Udaipur (Rajasthan):** The IOFS model at Udaipur integrated crops, fodder, vegetables, fruits, and compost units to enhance productivity and sustainability. In cropping, sweet corn + black gram yielded 1,395 kg MEY with ₹19,812 net return (₹1.58/₹ invested), while rabi wheat achieved 2,210 kg MEY with a high net return of ₹51,204 (₹3.78/₹ invested). Fodder crops like berseem gave exceptional returns of ₹29,175 (₹8.04/₹ invested). Vegetables were less profitable, with okra and pea yielding modest returns, and guava fruit gave ₹1,000 net return. The compost unit produced large quantities of NADEP,

vermi-compost, vermi-wash, and biodynamic inputs to improve soil fertility. Overall, the model generated a gross return of ₹1,12,280, demonstrating an economically viable and sustainable integrated farming system..

**Umiam (Meghalaya):** The IOFS model (0.43 ha) integrated diverse enterprises—cereals (rice, maize), pulses (lentil, pea), oilseeds (soybean, rapeseed), vegetables (French bean, tomato, carrot, okra, brinjal, cabbage, potato, broccoli, cauliflower, chili, coriander), fruits (Assam lemon, papaya, peach), fodder crops (broom, guinea, Napier), a dairy unit (two milch cows + calf), fish pond with aquaculture, duckery, and manure/vermi-composting. A 460 m<sup>2</sup> pond supported irrigation and fish, with climbing vegetables grown on its dyke; dairy washings enriched plankton for fish, and solid waste fed composting. Economically, the model incurred a cost of ₹62,945/year and achieved a gross return of ₹1,49,934 and a net return of ₹86,989, outperforming local mono-cropping. Crops contributed the highest net return (₹43,025), followed by dairy (₹34,490) and fishery (₹8,090). Nutrient recycling met over 98% N, 84% P<sub>2</sub>O<sub>5</sub> and 99% K<sub>2</sub>O requirements internally, drastically reducing external inputs. Energy analysis showed a total input of 50,351 MJ and output of 1,28,307 MJ with a net energy gain of 77,956 MJ, energy use efficiency of 2.54 and favorable balances across components, especially crops.



# 1

## INTRODUCTION

Globally organic farming is promoted in 188 countries with an area of 98.9 million ha during 2024-25. The key countries contributing to area include Australia (53 million ha), India (4.5 million ha) and Argentina (4.0 million ha). In addition, Wild Harvest Area are is about 32 million ha at global level. Global market Size was 136 billion Euros with USA (43.2%), EU (34.1%) and China (9.3%) having larger market share. India's position in terms of export value is \$494.8 million. Product focus by India is primarily in grains and raw commodities, lacking market presence in fruits, vegetables, dairy, and meat products. In India, government initiatives for promotion of organic and natural farming include a) Namami Ganga: Chemical-free farming along the 5 km stretches of the Ganga basin; b) PKVY (Paramparagat Krishi Vikas Yojana): Development of traditional agricultural practices, c) MOVCD-NER (Mission Organic Value Chain Development for North Eastern Region): Supports organic value chains and d) Marketing & Certification. Besides, these Government of India, launched National Mission on Natural Farming (NMNF) during November 2024 having the components of Natural farming clusters, research and model farms through States, Central and State Institutions for which development of protocols and packages from All India Network Programme on Organic Farming was essential. Key metrics in India indicates that 3.97 million ha (Fig) is under third-party certification and conversion during 2024-25, 1.8 m ha under Participatory Guarantee System. India accounts for 5.8% of the world's organic farming area (ranks 2<sup>nd</sup>) and 56 % of the world's organic producers. Area under natural Farming is about 7 lakh ha (data from NITI, 2024). The main focus is for sustainable practices that enhance natural soil flora and fauna, ecological balance, and biodiversity through locally available on-farm inputs.

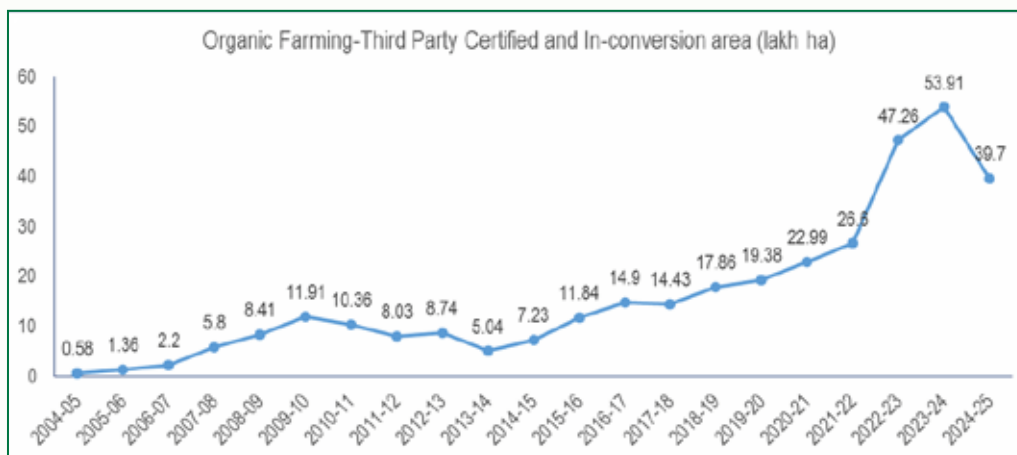


Fig. Trend in third party certified and conversion area under organic farming in India

To develop package of practices for organic farming in a system perspective, a Network Project on Organic Farming (NPOF) was initiated during 2004-05 by Indian Council of Agricultural Research (ICAR), New Delhi with ICAR-Indian Institute of Farming Systems Research (IIFSR) as lead centre. Initially, the project was operating with 13 centres covering 12 states. During XII plan, the numbers of centres of have been increased to 20 covering 16 states. Results of multi-location study and experiments conducted under the scheme on organic and natural farming including geo-tagged characterization of organic and natural farming farmers, demonstration of organic farming packages, development of integrated organic farming systems and natural farming are presented in the report besides other aspects such as publications, human resource development etc. Findings of the experiment conducted during the year will help to identify the potential areas and crops for promotion of organic and natural farming in the country.

## 2

# MATERIALS AND METHODS

## Scheme Objectives

- To study productivity, profitability, sustainability, quality and input-use-efficiencies of different crops and cropping systems under organic farming in different agro-ecological regions
- To develop efficient crop and soil management options for organic farming
- To develop need-based cost-effective new techniques for farm-waste recycling

## Methodology

The experiments in the project have been designed mainly to evaluate the relative performance of location-specific, important cropping systems under organic and conventional (chemical) farming, and assess agronomic efficiency of different production systems. Cropping systems, which are under evaluation, involve cereal crops (mainly basmati rice, coarse rice, wheats durum and aestivum, sorghum, barley and maize), pulses and oilseeds (blackgram, cowpea, pigeonpea, chickpea, lentil, linseed, green gram, soybean, mustard, sunflower, safflower and groundnut), spices (black pepper, ginger, turmeric, chillies, onion and garlic), vegetables (potato, okra, baby corn, cowpea, pea, tomato, frenchbean, summer squash, beetroot, carrot, dolichos bean, coriander and cauliflower), cotton and fodder crops (sorghum, maize, cow pea and berseem) in location-specific cropping systems. During 2023-24, following experiments/study were undertaken at different centers:

### Programme 1: Characterization of Organic and Natural Farming Inputs and Practices

- Geo-tagged characterization of organic and natural farming farmers
- Documentation & validation of organic ITKs.
- Biochemical characterization & molecular identification of microbial population of different organic and natural farming inputs

### Programme 2: Development and validation of scientific package of practices for organic and natural farming

- Evaluation of organic, inorganic and integrated production systems for crops and cropping systems
- Evaluation of response of different varieties of major crops for organic farming
- Evaluation of organic management practices for insect pest in various crops
- Evaluation of organic management practice for diseases in crops
- Evaluation and validation of natural farming practices in different agro-ecologies
- Farmers participatory validation of organic and natural farming practices in farmers field under SCSP/STC sub plans

### Programme 3: Integrated Organic Farming Systems

- Development of Integrated Organic Farming System Model

### Programme 4: Capacity Building including Policy Support to Central and States Agencies

- Value chain development with aggregation model for organic farming

The objectives, locations and treatment details of each experiment at various locations are presented in chapter 7 and at respective tables. General guidelines and standards for the production of organic production, as suggested under National Standards for Organic Production (NSOP), forms the basis for raising the experimental crops in the project. A compact



block of land has been earmarked at each of the cooperating centres for experimental purposes, as far as possible. The plot identified was in general, free from hazards of erosion, sediments, chemical pollutants and contaminants. Shelterbelts have been developed by planting multi-purpose trees/shrubs etc. such as Subabul, Sesbania spp. etc. around the field. The individual centre has been advised to select organic sources of nutrients depending upon the local availability and also in suitable combination(s) to fulfill the entire requirement of nitrogen and 80-90% requirement of phosphorus and potassium for each cropping system. Cooperating centers have also been advised that each centre should select only those crops for organic farming research in which effective organic (non-chemical) measures are available for plant protection to avoid failure of crops at later stages. Bulky manures were prepared within the premises of cooperating centres under the project itself or under any other project going on at university/institute/ centre in order to ensure proper quality of inputs. Inputs related to plant protection, bio-fertilizers etc are procured from reliable sources only. Adequate care has also been taken by the centres that seeds purchased from outside are not treated with any chemical seed dresser.

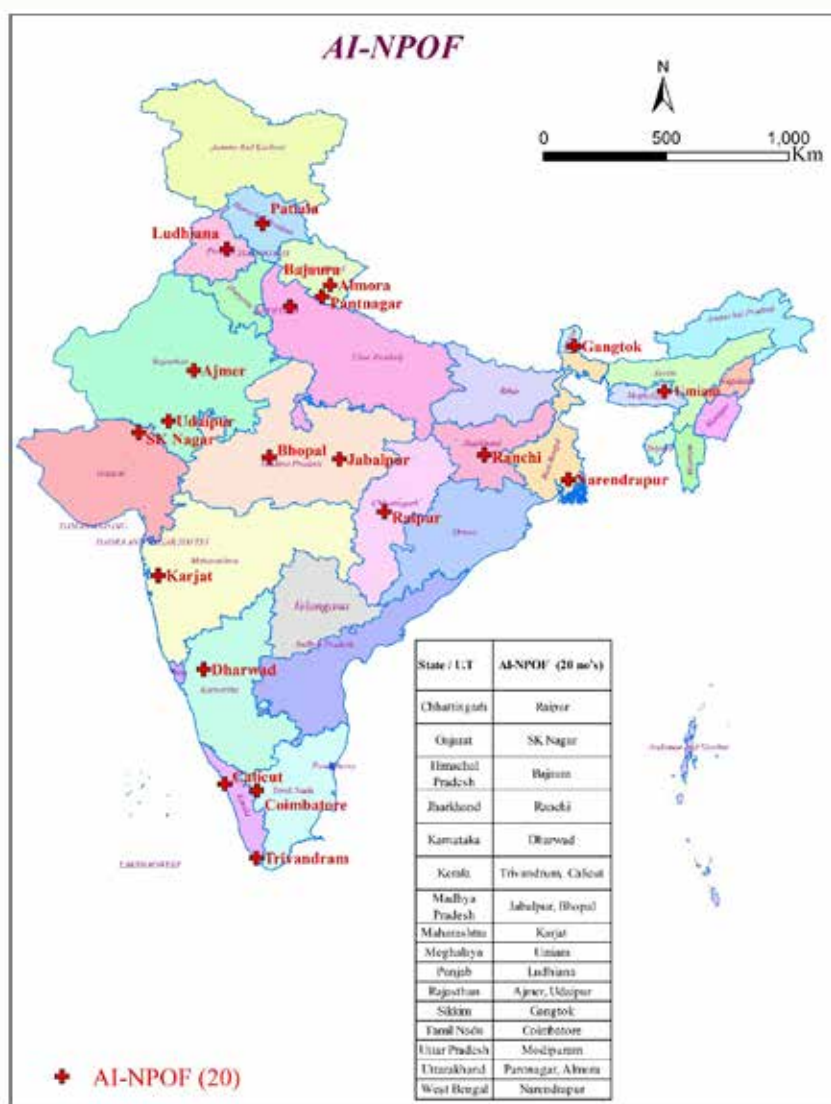
## 3

## LOCATIONS

Multi-location experiments were conducted during 2023-24 at 20 research centers of SAUs/ ICAR Institutes in 16 states. Statewise details of centres are given below in the order of results presented in the chapter 7.

| Sl. No.                                 | State            | Location of centre | Address of SAU/ICAR institute                                                                     |
|-----------------------------------------|------------------|--------------------|---------------------------------------------------------------------------------------------------|
| <b>Centres functioning from 2004-05</b> |                  |                    |                                                                                                   |
| 1.                                      | Chhattisgarh     | Raipur             | Indira Gandhi Krishi Vishwavidyalaya, Raipur-492 012                                              |
| 2.                                      | Himachal Pradesh | Bajaura            | CSK HPKV Hill Agri. Res. & Extn. Centre, Bajaura, Kullu-175 125                                   |
| 3.                                      | Jharkhand        | Ranchi             | Birsa Agricultural University, Kanke, Ranchi – 834 006                                            |
| 4.                                      | Karnataka        | Dharwad            | University of Agricultural Sciences, Yettinagudda Campus, Krishinagar, Dharwad-580 005            |
| 5.                                      | Kerala           | Calicut            | ICAR-Indian Institute of Spices Research, P.B. No. 1701, Marikunnu PO, Calicut – 673 012          |
| 6.                                      | Madhya Pradesh   | Bhopal             | ICAR-Indian Institute of Soil Science, Nabi Bagh, Berasia Road, Bhopal – 462 038                  |
| 7.                                      |                  | Jabalpur           | Jawaharlal Nehru Krishi Viswa Vidyalyaya, Jabalpur-482 004                                        |
| 8.                                      | Maharashtra      | Karjat             | Dr. Balasaheb Sawant Konkan Krishi Vidypeeth, RARS, Karjat, Dist. Raigad – 410 201                |
| 9.                                      | Meghalaya        | Uiam               | ICAR Research Complex for NEH Region, Uiam – 737 102                                              |
| 10.                                     | Punjab           | Ludhiana           | Punjab Agricultural University, Ludhiana-141 004                                                  |
| 11.                                     | Tamil Nadu       | Coimbatore         | Tamil Nadu Agricultural University, Coimbatore – 641 003                                          |
| 12.                                     | Uttarakhand      | Pantnagar          | G.B. Pant University of Agriculture Sciences & Technology, Pantnagar, Udham Singh Nagar – 263 145 |
| 13.                                     | Uttar Pradesh    | Modipuram          | ICAR-Indian Institute of Farming Systems Research, Modipuram, Meerut -250 110                     |

| Sl. No.                                 | State       | Location of centre | Address of SAU/ICAR institute                                                                                         |
|-----------------------------------------|-------------|--------------------|-----------------------------------------------------------------------------------------------------------------------|
| <b>Centres functioning from 2015-16</b> |             |                    |                                                                                                                       |
| 14.                                     | Gujarat     | Sardar Krushinagar | Sardar Krushinagar-Dantiwada Agricultural University, Sardar Krushinagar, Banaskantha –385 506                        |
| 15.                                     | Rajasthan   | Ajmer              | ICAR-National Research Centre on Seed Spices, Tabiji, Ajmer-305 206,                                                  |
| 16.                                     |             | Udaipur            | Agricultural Research Station, Maharana Pratap University of Agriculture & Technology, Udaipur- 313 001               |
| 17.                                     | Sikkim      | Gangtok            | ICAR Research Complex for NEH Region, Sikkim Centre, Tadong, Gangtok -737102                                          |
| 18.                                     | Uttarakhand | Almora             | ICAR-Vivekananda Parvatiya Krishi Anusandhan Sansthan, Almora-263 601                                                 |
| 19.                                     | West Bengal | Narendrapur        | School of Agriculture & Rural Development, Ramakrishna Mission Vivekananda University, PO Belur Math, Howrah-711 202, |
| 20.                                     | Kerala      | Thiruvananthapuram | ICAR-Central Tuber Crops Research Institute, Sreekariyam, Thiruvananthapuram - 695 017                                |





## 4

## MANPOWER

No regular posts, in any category, have been provided and the responsibility was assigned to a scientist, nominated as Principal Investigator of AI-NPOF, by the parent institute/ university (Names and contact addresses of PI's are given in Annexure10). The scientists of related disciplines were also involved in the research programme by the respective institution. In addition, two senior research fellows (as contractual staff) have been provided at each centre.

## 5

## SOIL AND CLIMATE

Soil type, weather parameters and initial values of soil physico-chemical properties at various locations are presented below.

**Soil type, weather, latitude and longitude of the various centres**

| Sl. No.                          | Name of centre | Soil Type                                                              | Weather       |                  |       |         | Latitude (N)       | Longitude (E)      |
|----------------------------------|----------------|------------------------------------------------------------------------|---------------|------------------|-------|---------|--------------------|--------------------|
|                                  |                |                                                                        | Rainfall (mm) | Temperature (°C) |       | R.H (%) |                    |                    |
|                                  |                |                                                                        |               | Max.             | Mini. |         |                    |                    |
| Centres functioning from 2004-05 |                |                                                                        |               |                  |       |         |                    |                    |
|                                  | Bajura         | Silty loam                                                             | 979.5         | 30.4             | 16.6  | -       | 31.80 <sup>o</sup> | 77.00 <sup>o</sup> |
|                                  | Bhopal         | Vertisols, Clay Montmorillonite/ smectite type                         | 906.2         | 32.7             | 20.9  | 58.8    | 23°18’             | 77°24’             |
|                                  | Calicut        | Clay loam, ustic Humitropept                                           | 4121          | 31.8             | 22.0  | 68      | 11°34’             | 75°48’             |
|                                  | Coimbatore     | Sandy, Clay, Loam soil                                                 | 700           | 35.9             | 19.8  | 87.3    | 11°24’             | 77°.30’            |
|                                  | Dharwad        | Clay loam                                                              | 1110.6        | 30.2             | 185   | 66.5    | 15°26’             | 75°07’             |
|                                  | Jabalpur       | Vertisols, Chromusterts                                                | 1312.10       | 32.4             | 17.7  | 78.2    | 23°09’             | 79°90’             |
|                                  | Karjat         | Red and medium black                                                   | 3794.8        | 40.7             | 11.4  | 97.1    | 18°92’             | 77°33’             |
|                                  | Ludhiana       | Ustochrepts-Ustic prammments association, alluvial, sandy & sandy loam | 806.4         | 33.5             | 17.02 | 76.22   | 24°35’             | 74°42’             |

| Sl. No.                          | Name of centre     | Soil Type                                               | Weather       |                  |       |         | Latitude (N) | Longitude (E) |
|----------------------------------|--------------------|---------------------------------------------------------|---------------|------------------|-------|---------|--------------|---------------|
|                                  |                    |                                                         | Rainfall (mm) | Temperature (°C) |       | R.H (%) |              |               |
|                                  |                    |                                                         |               | Max.             | Mini. |         |              |               |
|                                  | Modipuram          | Alluvium soils<br>Typic ustochrept                      | 747.0         | 42.5             | 5.4   | 76.8    | 29°4'        | 77°46'        |
|                                  | Pantnagar          | Hapludolls, very deep<br>alluvium coarse loomy<br>soils | 1300          | 30.1             | 17.7  | 84.2    | 29°N         | 79°30'        |
|                                  | Raipur             | Ochraquals<br>association,<br>deep black soil           | 1267.8        | 32.7             | 21.0  | 64.0    | 21°16'       | 81°36'        |
|                                  | Ranchi             | Ultic Palesustalfs,<br>very deep soils                  | 1818.7        | 31.4             | 17.7  | 77.9    | -            | -             |
|                                  | Umiyam             | Clay loam                                               | 2631.9        | 26.2             | 15.3  | 63.6    | 24°44'       | 76°48'        |
| Centres functioning from 2015-16 |                    |                                                         |               |                  |       |         |              |               |
|                                  | Ajmer              | Sandy loam                                              | 450           | -                | -     | -       | 36°01'       | 22°31'        |
|                                  | Almora             | -                                                       | -             | -                | -     | -       | -            | -             |
|                                  | Gangtok            |                                                         | 3196.8        | 23.6             | 14.8  | 69.1    | 27°32'       | 88°60'        |
|                                  | Narendrapur        |                                                         |               |                  |       |         |              |               |
|                                  | Sardar Krushinagar |                                                         | 1422.9        | 41.3             | 5.6   | 96      | 24°-19'      | 72°-17'       |
|                                  | Thiruvananthapuram |                                                         | 2117          | 34.4             | 21.1  | 95.5    | -            | -             |
|                                  | Udaipur            | Clay loam                                               | 795.9         | 40               | 4.6   | 87.6    | 24°35'       | 74°42'        |

### Initial nutrient status of soil (2023-24)

| Centre                                  | OC (%) | pH   | EC (ds/m) | N (kg/ha) | P (kg/ha) | K (kg/ha) | S (ppm) | Fe (ppm) | Mn (ppm) | Zn (ppm) | Cu (ppm) |
|-----------------------------------------|--------|------|-----------|-----------|-----------|-----------|---------|----------|----------|----------|----------|
| <b>Centres functioning from 2004-05</b> |        |      |           |           |           |           |         |          |          |          |          |
| Bajaura                                 | 1.49   | 6.9  | -         | 265.1     | 76.5      | 248.9     |         | 17.0     | 12.2     | 3.73     | 2.63     |
| Bhopal                                  | 0.53   | 7.85 | 0.50      | 154.2     | 12.8      | 530       | 4.92    | 5.52     |          | 0.74     |          |
| Calicut                                 | 1.42   | 5.05 | 0.32      | 156       | 4.4       | 171       |         | 25.0     | 3.1      | 0.46     | 0.58     |
| Coimbatore                              | 0.66   | 8.3  | 0.06      | 247       | 17.5      | 495       |         | 30.40    |          | 4.10     |          |
| Dharwad                                 | 5.87   | 7.5  | 0.13      | 273.9     | 28.40     | 359       | 13.06   | 9.50     |          | 1.46     |          |
| Jabalpur                                | 0.71   | 7.22 | 0.23      | 260       | 11.5      | 282       | 9.6     | 2.39     |          | 0.35     |          |
| Karjat                                  | 1.14   | 7.02 | 0.284     | 230       | 20.0      | 327       |         |          |          |          |          |
| Ludhiana                                | 0.46   | 8.1  | 0.50      | 278       | 36.3      | 134       |         |          |          |          |          |
| Modipuram                               |        |      |           |           |           |           |         |          |          |          |          |
| Pantnagar                               | 0.57   | 7.34 | 0.409     | 158.6     | 15.9      | 221.8     | -       | 30.69    | 6.25     | 0.96     | 2.13     |
| Raipur                                  | 0.64   | 7.67 | 0.28      | 237       | 13.0      | 274       |         |          |          |          |          |
| Ranchi                                  | 0.38   | 5.60 |           | 220       | 48        | 270       |         |          |          |          |          |
| Umiyam                                  | 2.22   | 5.14 |           | 230.7     | 21.5      | 258.2     |         | 65.2     | 6.3      | 0.51     | 1.12     |



| Centre                                  | OC (%)   | pH      | EC (ds/m) | N (kg/ha) | P (kg/ha) | K (kg/ha) | S (ppm) | Fe (ppm) | Mn (ppm) | Zn (ppm) | Cu (ppm) |
|-----------------------------------------|----------|---------|-----------|-----------|-----------|-----------|---------|----------|----------|----------|----------|
| <b>Centres functioning from 2015-16</b> |          |         |           |           |           |           |         |          |          |          |          |
| Ajmer                                   | 0.28     | 8.13    | 0.13      | 124.6     | 11.9      | 336.2     |         |          |          |          |          |
| Almora                                  | 0.54     | 6.47    | 0.16      | 382.0     | 16.2      | 152.0     |         |          |          |          |          |
| Gangtok                                 | 0.88     | 5.57    |           | 237.6     | 14.07     | 273.6     |         |          |          |          |          |
| Narendrapur                             | 0.80     | 6.96    | 0.38      |           | 64.34     | 242.8     |         |          |          |          |          |
| Sardar Kru-shinagar                     | 0.33     | 7.22    | 0.15      | 141       | 13.5      | 180.0     | 8.20    | 8.40     | 0.68     |          |          |
| Thiruvanan-thapuram                     | 1.33     | 4.54    |           | 148.11    | 66.82     | 198.04    |         |          |          |          |          |
| Udaipur                                 | 0.6-0.76 | 7.8-8.4 | 0.7-0.9   |           |           |           |         |          |          |          |          |

# BUDGET

A total budget of Rs. 252.58 lakhs were released to 21 centers during 2023-24. The centre wise allocations of funds are given below.

| Name of University /Institutes    | A. Other than STC/SCSP/NEH |                   |                     |           |                        |           |               |           | STC (TSP) Component             |                        |                     |           | SCSP Component  |                        |            |                |           |            |                        |                   | Grant-in-Aid, under NEH Component |           |       |       | Grand Total |       |
|-----------------------------------|----------------------------|-------------------|---------------------|-----------|------------------------|-----------|---------------|-----------|---------------------------------|------------------------|---------------------|-----------|-----------------|------------------------|------------|----------------|-----------|------------|------------------------|-------------------|-----------------------------------|-----------|-------|-------|-------------|-------|
|                                   | Grant-in-Aid 'General'     |                   |                     |           | Grant-in-Aid 'Capital' |           |               |           | Total Other than STC/ SCSP/ NEH | Grant-in-Aid 'General' |                     |           | Total STC (TSP) | Grant-in-Aid 'Capital' |            |                |           | Total SSCP | Grant-in-Aid 'General' |                   |                                   |           |       |       |             |       |
|                                   | Domestic T.A.              | Research Expenses | Operational charges | Sub Total | Equipments (1)         | Works (2) | Livestock (4) | Sub Total |                                 | Research Expenses      | Operational charges | Sub Total |                 | Equipments (11)        | Works (12) | Livestock (14) | Sub Total |            | Domestic T.A.          | Research Expenses | Operational charges               | Total NEH |       |       |             |       |
|                                   |                            |                   |                     |           |                        |           |               |           |                                 |                        |                     |           |                 |                        |            |                |           |            |                        |                   |                                   |           |       |       |             |       |
| IGKV, Raipur                      | 0.13                       | 1.50              | 4.30                | 5.93      | 2.00                   | 0.00      | 0.00          | 2.00      | 7.93                            | 0.00                   | 0.00                | 0.00      | 0.00            | 0.00                   | 0.00       | 0.00           | 0.00      | 0.00       | 0.00                   | 0.00              | 0.00                              | 0.00      | 0.00  | 0.00  | 7.93        |       |
| SDAU, S.K.Nagar                   | 0.23                       | 2.00              | 5.55                | 7.78      | 0.00                   | 0.00      | 0.00          | 0.00      | 7.78                            | 0.00                   | 0.00                | 0.00      | 0.00            | 0.00                   | 0.00       | 0.00           | 0.00      | 0.00       | 0.00                   | 0.00              | 0.00                              | 0.00      | 0.00  | 0.00  | 7.78        |       |
| HAREC, Bajaura                    | 0.42                       | 1.00              | 4.15                | 5.57      | 0.00                   | 0.00      | 0.00          | 0.00      | 5.57                            | 0.00                   | 0.00                | 0.00      | 0.00            | 1.00                   | 1.00       | 2.00           | 0.00      | 0.00       | 0.00                   | 2.00              | 0.00                              | 0.00      | 0.00  | 0.00  | 7.57        |       |
| BAU, Ranchi                       | 0.33                       | 1.00              | 2.46                | 3.79      | 0.00                   | 0.00      | 0.00          | 0.00      | 3.79                            | 0.00                   | 0.00                | 0.00      | 0.00            | 0.00                   | 0.00       | 0.00           | 0.00      | 0.00       | 0.00                   | 0.00              | 0.00                              | 0.00      | 0.00  | 0.00  | 3.79        |       |
| ICAR-IISR, Calicut                | 0.99                       | 2.00              | 6.25                | 9.24      | 0.00                   | 0.00      | 0.00          | 0.00      | 9.24                            | 0.00                   | 0.00                | 0.00      | 0.00            | 0.00                   | 0.00       | 0.00           | 0.00      | 0.00       | 0.00                   | 0.00              | 0.00                              | 0.00      | 0.00  | 0.00  | 9.24        |       |
| ICAR-CTCRI, Trivandram            | 0.25                       | 1.75              | 7.50                | 9.50      | 0.00                   | 0.00      | 0.00          | 0.00      | 9.50                            | 0.00                   | 0.00                | 0.00      | 0.00            | 2.50                   | 5.00       | 7.50           | 0.00      | 1.20       | 2.00                   | 3.20              | 10.70                             | 0.00      | 0.00  | 0.00  | 20.20       |       |
| UAS, Dharwad                      | 0.50                       | 2.00              | 6.24                | 8.74      | 0.00                   | 0.00      | 0.00          | 0.00      | 8.74                            | 0.00                   | 0.00                | 0.00      | 0.00            | 0.00                   | 0.00       | 0.00           | 0.00      | 0.00       | 0.00                   | 0.00              | 0.00                              | 0.00      | 0.00  | 0.00  | 8.74        |       |
| JNKVV,Jabalpur                    | 0.13                       | 1.00              | 3.50                | 4.63      | 0.00                   | 0.00      | 0.00          | 0.00      | 4.63                            | 0.00                   | 0.00                | 0.00      | 0.00            | 0.00                   | 0.00       | 0.00           | 0.00      | 0.00       | 0.00                   | 0.00              | 0.00                              | 0.00      | 0.00  | 0.00  | 4.63        |       |
| ICAR-ISS, Bhopal                  | 0.39                       | 2.25              | 8.00                | 10.64     | 0.00                   | 0.00      | 0.00          | 0.00      | 10.64                           | 0.00                   | 0.00                | 0.00      | 0.00            | 0.00                   | 0.00       | 0.00           | 0.00      | 0.00       | 0.00                   | 0.00              | 0.00                              | 0.00      | 0.00  | 0.00  | 10.64       |       |
| KKV, Dapoli                       | 0.23                       | 1.00              | 3.18                | 4.41      | 0.00                   | 0.00      | 0.00          | 0.00      | 4.41                            | 0.00                   | 0.00                | 0.00      | 0.00            | 0.00                   | 0.00       | 0.00           | 0.00      | 0.00       | 0.00                   | 0.00              | 0.00                              | 0.00      | 0.00  | 0.00  | 4.41        |       |
| ICAR Res. Comp., Umiam            | 0.00                       | 0.00              | 0.00                | 0.00      | 0.00                   | 0.00      | 0.00          | 0.00      | 0.00                            | 1.00                   | 2.50                | 3.50      | 3.50            | 0.00                   | 0.00       | 0.00           | 0.00      | 0.00       | 0.00                   | 0.00              | 0.00                              | 1.40      | 1.00  | 12.50 | 14.90       | 18.40 |
| PAU, Ludhiana                     | 0.48                       | 2.00              | 4.41                | 6.89      | 0.00                   | 0.00      | 0.00          | 0.00      | 6.89                            | 0.00                   | 0.00                | 0.00      | 0.00            | 0.00                   | 0.00       | 0.00           | 0.00      | 0.00       | 0.00                   | 0.00              | 0.00                              | 0.00      | 0.00  | 0.00  | 6.89        |       |
| MPUA&T, Udaipur                   | 0.44                       | 1.30              | 10.15               | 11.89     | 0.00                   | 0.00      | 0.00          | 0.00      | 11.89                           | 2.50                   | 5.00                | 7.50      | 7.50            | 1.00                   | 1.00       | 2.00           | 0.00      | 0.00       | 0.00                   | 2.00              | 0.00                              | 0.00      | 0.00  | 0.00  | 21.39       |       |
| ICAR-NRC Seed Spices, Ajmer       | 0.43                       | 1.00              | 6.55                | 7.98      | 0.00                   | 0.00      | 0.00          | 0.00      | 7.98                            | 0.00                   | 0.00                | 0.00      | 0.00            | 0.00                   | 0.00       | 0.00           | 0.00      | 0.00       | 0.00                   | 0.00              | 0.00                              | 0.00      | 0.00  | 0.00  | 7.98        |       |
| ICAR-RC-NEH, Gangtok              | 0.00                       | 0.00              | 0.00                | 0.00      | 0.00                   | 0.00      | 0.00          | 0.00      | 0.00                            | 1.00                   | 2.50                | 3.50      | 3.50            | 0.00                   | 0.00       | 0.00           | 0.00      | 0.00       | 0.00                   | 0.00              | 0.60                              | 1.00      | 13.50 | 15.10 | 18.60       |       |
| TNAU, Coimbatore                  | 0.70                       | 2.00              | 5.41                | 8.11      | 0.00                   | 0.00      | 1.00          | 1.00      | 9.11                            | 5.40                   | 10.48               | 15.88     | 15.88           | 3.00                   | 7.88       | 10.88          | 1.48      | 0.00       | 0.09                   | 1.57              | 12.45                             | 0.00      | 0.00  | 0.00  | 37.44       |       |
| ICAR-IISR, Modipuram              | 0.34                       | 0.66              | 9.60                | 10.60     | 0.00                   | 0.00      | 0.00          | 0.00      | 10.60                           | 0.00                   | 0.00                | 0.00      | 0.00            | 0.00                   | 0.00       | 0.00           | 0.00      | 0.00       | 0.00                   | 0.00              | 0.00                              | 0.00      | 0.00  | 0.00  | 10.60       |       |
| National P.I,ICAR-IISR, Modipuram | 0.80                       | 0.00              | 9.38                | 10.18     | 0.00                   | 0.00      | 0.00          | 0.00      | 10.18                           | 0.00                   | 0.00                | 0.00      | 0.00            | 0.00                   | 0.00       | 0.00           | 0.00      | 0.00       | 0.00                   | 0.00              | 0.00                              | 0.00      | 0.00  | 0.00  | 10.18       |       |
| GBPUA&T, Pantnagar                | 0.59                       | 2.00              | 8.88                | 11.47     | 2.50                   | 3.62      | 0.00          | 6.12      | 17.59                           | 0.00                   | 0.00                | 0.00      | 0.00            | 0.00                   | 0.00       | 0.00           | 0.00      | 0.00       | 0.00                   | 0.00              | 0.00                              | 0.00      | 0.00  | 0.00  | 17.59       |       |
| ICAR-VPKAS, Almora                | 0.18                       | 1.50              | 4.05                | 5.73      | 0.00                   | 0.00      | 0.00          | 0.00      | 5.73                            | 0.00                   | 0.00                | 0.00      | 0.00            | 0.00                   | 0.00       | 0.00           | 0.00      | 0.00       | 0.00                   | 0.00              | 0.00                              | 0.00      | 0.00  | 0.00  | 5.73        |       |
| RMVU, Narendrapur                 | 1.54                       | 1.83              | 6.98                | 10.35     | 2.50                   | 0.00      | 0.00          | 2.50      | 12.85                           | 0.00                   | 0.00                | 0.00      | 0.00            | 0.00                   | 0.00       | 0.00           | 0.00      | 0.00       | 0.00                   | 0.00              | 0.00                              | 0.00      | 0.00  | 0.00  | 12.85       |       |
| Total                             | 9.10                       | 27.79             | 116.54              | 153.43    | 7.00                   | 3.62      | 1.00          | 11.62     | 165.05                          | 9.90                   | 20.48               | 30.38     | 30.38           | 7.50                   | 14.88      | 22.38          | 1.48      | 1.20       | 2.09                   | 4.77              | 27.15                             | 2.00      | 26.00 | 30.00 | 252.58      |       |



# 7

## RESEARCH RESULTS

### 7.1 Programme: Characterization of organic and natural farming inputs and practices

#### 7.1.1: Geo-tagged characterization of organic and natural farming farmers

In order to understand the successful practices and constraints of organic farmers, a study on geo referenced characterization of organic farmers was initiated during 2014-15. A minimum of 30 farms household was fixed as target for collection of information. However, some centers have collected information from less or more number of farmers depending on the resources. The objective of the study was

- To understand and characterize the practices and constraints of organic farmers
- To access the technological gaps of organic farmers

Centre wise results for each centre are presented below

#### Bhopal

- Geo-referenced survey was conducted in villages of Gamakhar and Pachma located in Ganj Basoda Tehsil of district Vidisha, Madhya Pradesh. Thirty farmers 15 each practicing organic and natural farming were surveyed. Maximum land holding of respondent was 21 acre while minimum was 0.5 acre of which the maximum area under organic farming and natural farming was 7.5 acre and minimum was 0.5 acre.
- The major crops grown included soybean, rice, and blackgram during the kharif season, and wheat and chickpea during the rabi season.
- Organic farmers primarily used farmyard manure (FYM) and vermicompost, while natural farming practitioners applied Jeevamrit (500–1000 kg/ha), Ghanjeevamrit (1000 kg/ha), and Beejamrit (1–2 kg/kg of seed) as nutrient sources. In addition to these inputs, Crop residue recycled by the respondents was ranged between 1 to 30 tonnes annually.
- Pest management under organic farming involved neem kadha, buttermilk, and neem oil, while natural farmers used Neemastra, Brahmastra, Panchpatti, and Dashparni. However, most natural farmers were not fully implementing techniques like intercropping and mulching.
- Only 10–20% of the organic produce was retained for household use, with the remainder sold in Krishi Mandis or local markets.
- Yield gaps between on-station trials and farmers' fields were recorded at 23.1% for soybean and 32.9% for wheat under organic farming, and 9.4% and 15.4% under natural farming, respectively.

#### Calicut

- A geo-referenced characterization of organic and natural farming clusters was conducted in Kozhikode district, covering six villages across three blocks. Fourteen farmers participated in the survey, with four practicing organic and ten practicing natural farming.
- On average, organic farmers maintained five cattle, six goats, 15 poultry birds, and 25 ducks, while natural farmers kept around 19 cattle.
- Major crops grown under organic farming such as pepper, turmeric, ginger, nutmeg.
- Organic nutrient sources included FYM, neem cake, and groundnut cake, while natural farming relied on Jeevamrit, Ghanjeevamrit, and Beejamrit, along with mulching (glyricidia) and intercropping practices.
- For plant protection, organic farmers used Bordeaux mixture and Pseudomonas, while natural farmers applied Jeevamrit (1000 kg/ha), Ghanjeevamrit (1500 kg/ha), and Beejamrit (750 ml/kg). Weed management was done manually or with grass cutters

- Yield gaps between on-station trials and farmers' fields were significant: 76.5%, 44.4%, and 50% for pepper, turmeric, and ginger respectively under organic farming, and 73.3%, 40%, and 33.3% under natural farming.

### Coimbatore

- A geo-tagged characterization survey was conducted among 35 farmers 20 practicing organic farming and 15 practicing natural farming across 15 villages in five districts: Coimbatore, Tiruppur, Thiruvallur, Trichy, and Virudhunagar.
- The average landholding was 3.0 ha for organic farmers and 1.5 ha for those practicing natural farming. Organic farmers maintained an average of two cattle, two goats, and eight poultry birds, while natural farmers had two cattle, three goats, and six poultry birds per household.
- Nutrient sources in organic farming included FYM, vermicompost, green manure, and biofertilizers, primarily used in crops like banana, onion, coconut, arecanut, and tomato. Natural farming inputs included Jeevamrit, Ghanjeevamrit, FYM, intercropping, and mulching.
- Pest control under organic farming involved neem seed kernel extract, fish amino acids, herbal leaf extracts, buttermilk, and insect traps, whereas natural farming used Neemastra, Brahmastra, and NSKE (5%)..
- The yield gaps under organic farming were 37.5% in tomato, 25.7% in brinjal, 31.8% in bhendi, 36.7% in onion, 20.8% in coconut, 18.2% in arecanut, and 26.7% in turmeric. Under natural farming, yield gaps were 18.5% in banana, 12.3% in onion, 25% in coconut, 12.5% in arecanut, and 20% in tomato, while paddy, coconut, and brinjal showed 12.8%, 25%, and 16.7% yield reductions, respectively.

### Dharwad

- A geo-tagged survey was conducted among 14 natural farming farmers across ten villages in seven blocks located in Belagavi, Dharwad, Gadag, and Haveri districts. The average landholding was 5.4 ha for large, 2.06 ha for small, and 1.15 ha for marginal farmers.
- Livestock per household included 2.3 dairy cattle/buffaloes, 3 desi cows, 0.92 goats, 2.53 poultry birds, and 0.92 bullocks. The main crops were vegetables grown from desi seeds, along with cucumber, brinjal, drumstick, papaya, and mixed cropping on bunds including groundnut, wheat, chilli, onion, moth bean, sorghum, bajra, and ajwain.
- Practices adopted by the farmers under NF are Cow womb fermented water, Fish amino acid, Gokrupamrit Sour butter milk, Fruit enzymes, Sea weed, Fish amino acid Metarhizium. Bevaria Gokrupamrit 2-3 sprays, organic chemicals of green planet Sour Butter milk Neem leaf soaked and sprayed after 3 days, Ghana jeevamrit soaked & sprayed Gonanda jala, Egg+Lime fermented astra, Agni astra, Dhashaparni, Brmhastra Mulching, Beejamrit, Jeevamrit, Ghanjeevamrit, Intercropping, Neemastra, Agniaster, Brahmastra, Dashaparni ark and Sour Buttermilk, Dashaparni, Bilva rasayana, Soya rasayana, Fruit and herbal concoction.
- Plant protection input under NF practicing by the farmers are 500 l/ha Neemastra, 15 ltr /ha Agniaster, Brahmastra, Dashaparni.
- Yield gaps compared to on-station trials were 14% in green gram, 6% in soybean, 28.6% in groundnut, 8.3% in rabi sorghum, 16.7% in chickpea, and 15% in sugarcane. Interestingly, chilli and millets showed higher yields at the farmers' fields by 8% and 16%, respectively.

### Jabalpur

- Geo-tagged characterization of organic farmers was taken at 5 villages of Kalgodi, Kuda, Pipariya, Vikrampur, Jamuniya in Jabalpur-one block and natural farming farmers covered 6 villages Lamti, Amna, Bichhiya, .Phular, Bhikampur and Khairi located in Majhouli and Patan block of Jabalpur district in Madhya Pradesh.
- Total 50 farmers were surveyed under organic and natural farming out of which 30 farmers were under natural farming. Farmers those practicing organic holding the land size large: 2.10 ha, small: 1.14 ha & marginal: 0.38 ha whereas those practicing NF farming having land size of large: 2.34 ha small: 1.28 ha & marginal :0.72 ha.
- Name of livestock maintained by farmers dairy (cattle/buffalo): 1.5, goat:4, poultry: 6 under organic farming while natural farming farmers maintained dairy (cattle/buffalo): 2.6. Name of the organic manures applied by farmers FYM and vermicompost for organic and those practicing NF also using FYM, in addition to these Beejamrit, Jeevamrit, Ghanjeevamrit also used.



- Rice, wheat, mustard, chickpea are the major crops grown by the organic farmers. Arhar, Kodo, Kutki, field pea are grown under NF practice. Cow urine, Neem leaf extract, Dashparni ark (plant extracts), butter milk etc. are the major plant protection input.
- The yield for wheat and mustard under organic farming at farmers field was noted to decrease by 61 & 75%.

### Karjat

- total of 30 farmers were surveyed under geo-referenced characterization in Shahapur block of Thane district, Maharashtra. The average landholding of organic farmers was small, at 1.2 hectares per farm.
- All the surveyed farmers were using FYM (farmyard manure) and vermi-compost as the major sources of nutrients. In addition, they were also practicing green manuring. Rice, pulses, and vegetables were the major crops grown under organic farming. Cow urine, Dashparni Ark, and Trichoderma were the major plant protection inputs used. The majority of farmers controlled weeds through hand weeding in seasonal crops.
- The yield gap of major crops grown under organic farming was observed to be 29.4% in rice, 51.2% in pulses, and 17.2% in vegetables—lower at farmers' fields compared to on-station experiments.
- The major constraints reported were: Low yield, high labor wages and non-availability of farm labor due to urbanization, large quantity of organic inputs required, uncertain availability of organic markets and premium prices and lack of knowledge about organic certification.

### Ludhiana

- The geo-tagged characterization was conducted in Barnala district of Punjab. A total of 28 organic growers were characterized. Among characterized farmers, 100 per cent were doing organic farming and no farmer was practicing complete natural farming. 20 per cent farmers were using concoctions of natural farming along with organic farming. The proportion of area under organic farming out of total land holding of surveyed farmers was 21.5 per cent. Out of total organic farmers, 85.7 per cent were marginal farmers followed by small (14.3%) farmers.
- Twenty-one per cent adopted organic farming during 2023 followed by Nineteen per cent during 2022, 18 per cent during 2016 and 2017. Fifteen percent farmers were adopting organic farming during 2009. In year 2015 and 2020 13% farmers were adopting organic farming. Nine percent farmers were adopting in year 2008 and 2011. Four per cent farmers adopted organic farming during 2001, 2007, 2013, 2014 and 2019. (Fig. 1).
- In Barnala district of Punjab, basmati rice, wheat and pulses were the prominent crops being grown by farmers. The 67% and 88% basmati rice and wheat were grown during kharif and rabi season, respectively under organic farming in this district. Kharif moong (35%) and gobhi sarson (45%) were major crops grown by farmers under organic farming during kharif and rabi respectively. Kharif maize and Gram was being grown by 26 and 37 per cent of farmers, respectively. The kharif and rabi vegetables were being grown by 17 and 20 per cent of farmers, respectively. Eleven percent farmers had grown sugarcane. The kharif and rabi fodders were being grown by 33 and 35 per cent of farmers, respectively (Fig. 2 & 3).
- Farmyard manure (FYM) was the major source of nutrition, being used by 85 and 93 percent of the organic farmers in kharif and rabi season, respectively. Green manuring was the second major source of nutrition used by 55 per cent of farmers in kharif season. Vermicompost was used by 30 and 30 per cent of farmers during both seasons. The jeevamrit was used by 20 and 23 per cent of farmers during both seasons (Fig. 4 & 5).
- In rabi season, FYM was the predominant source of nutrition being used by 93 per cent farmers, however, FYM and green manure were predominant source of nutrition in kharif season being used by 85 and 55 per cent farmers. Bacterial culture was used by 12 and 17 per cent of farmers during both seasons.
- The hand weeding was the predominant method of weed control employed by 85 and 80 per cent of farmers in kharif and rabi crops, respectively (Fig. 6 and 7). Mulching to suppress weeds was used by 55 and 40 per cent farmers in kharif and rabi crops, respectively. Twenty-five and thirty-five per cent of farmers used mechanical methods to control weeds during kharif and rabi season, respectively. Cutting as a method of weed management was used by 10 and 6 per cent farmers in both seasons.
- The sour butter milk was used by 55 and 72 per cent of farmers in kharif and rabi crops, respectively. Neem based pesticides were used by 80 and 75 per cent of farmers during kharif and rabi seasons, respectively. Farmers also use natural farming concoctions agniastara and brahmastra to control diseases and insect-pests and 32 and 30 per cent

farmers used these products during both seasons. Trichocards were used by 27 per cent farmers during kharif season, mostly in basmati rice crop.

- The economic yields of almost all the crops were lower under organic cultivation as compared to conventional cultivation of these crops. The reason behind this might be use of lower dose of FYM or other composts and less N content in these composts. The FYM used by farmers generally is not fully decomposed due to many factors, so it does not produce desired yields. Poor control of insect-pests and diseases also contributes to lower grain yields under organic production.
- The organic farmers got price premium on 72 per cent of crops which include wheat, sarson oil, pulses, products from sugarcane, turmeric powder, maize flour and millets. However, farmers get no premium on 28 per cent of crops which include basmati rice, maize grains, rice and some vegetables (Fig. 10). The organic farmers sell their produce in local market and big cities. Some of organic farmers had sale point of their produce at their farms itself.
- The main reason for adopting organic farming as told by farmers was human health benefits due to healthy food production in organic farming (63%). The healthy environment was the reason to adopt organic farming by 10 per cent of farmers. Other reasons for opting organic farming included passion (4%), business (20%) and peace of mind (3%).
- The major constraint faced by farmers in adoption of organic farming was lack of marketing facility and weed problems (38% and 25% each). Other constraints were intensive labour cost (22%) and low yield (7%). Lack of premium on organic products (6%), non-availability of subsidized inputs, difficulty in pest and disease management, limited availability of organic manures and lack of technical knowledge for organic farming etc. were also the constraints in adoption of organic farming in Punjab.

### Modipuram

- Geo-referenced characterization of organic farmers' inputs and practices was carried out in Meerut district, where a total of 32 farmers were surveyed, and 100% of them were practicing organic farming.
- The average landholding size of the farmers was 0.49 hectares. All farmers maintained dairy cattle (cows and buffaloes), with an average herd size of 5.47 animals. The major crops grown were sugarcane, wheat, mustard, and forage crops such as sorghum and berseem.
- FYM, vermi-compost, mustard cake, Jeevamrit, and PROM were the major sources of nutrients, and most of the farmers were regularly using these inputs.
- For pest and disease management, farmers applied Herbal Preparations (2 to 3 sprays per crop) and neem oil (one spray per crop). For weed management, farmers practiced hand weeding, inter-cultivation, and mechanical weeding.
- The productivity of major field crops (sugarcane, wheat, and mustard) was found to be lower at farmers' fields compared to on-station crop yields. The yield gap between on-station experiments and farmers' fields was observed to be approximately 41% for sugarcane and 15.6% for wheat.

### Pantnagar

- A total 50 nos. of organic farming farmers were surveyed under geo-referenced characterization in 08 villages namely Dhamar Devi, Ginitiganw, Hawal Kota, Kalyanpur, SaunjalaNarSingh, Nathujala, Bhandari Simal, Mayarampur located in Kotabagh block of Nainital district of Uttarakhand. There were no natural farming practicing in surveyed villages.
- Average holding size of organic farmer/farm per hectare large: 3.50, small: 0.35 and marginal: 1.50. Average livestock population cow 5-6, buffalo 2-3, and goat-2 maintaining by the farmers.
- Farmers are using FYM, vermi-compost and green manuring as source of organic manure, and cow urine fortified with neem leaves/neem oil/garlic paste using for plant protection management. Generally weeding is being done manually.
- In surveyed area, most of the farmers are growing traditional organic basmati rice (organic basmati PUSA-1509) followed by wheat and other crops. Rabi crops kept mostly for their own consumptions. Productivity of the traditional basmati rice (Pusa 1509) is 26% less than the on-station trial; however, wheat yield is 28.6% less than the on-station experimentation.
- Availability of sufficient and quality organic inputs, organic seeds and quality bio-inoculants, disease infestation, termite problems and premium price of wheat are the major constraints.

### Raipur

- Geo-referenced characterization of 23 organic farmers was carried out in 3 village located under Mahasamund & Bagbahra block of Raipur district, Chhattisgarh. All the farmers practicing organic farming.



- Mean holding size of surveyed farmers are large 1.0 ha, small 0.2 ha and marginal 0.09 ha. Average livestock population maintained by the farmers are dairy (cattle/buffalo):02, goat-8 and poultry 15 numbers per households.
- Rice, chickpea wheat are the major crops grown under organic farming. Farm yard manure is main source of organic manure prepared from the livestock maintained at farm and on an average 1.0 t/ha FYM is used.
- For plant protection management, neem oil, seed treatment with Trichoderma was used. Neemashttra, Beejamsrit, Agneashtra input used. Ploughing, hand weeding practice adopted by majority of farmers for weed management in various crops.
- Average yield at farmers field for rice, chickpea and wheat recorded of 2980, 1030 and 1325 kg/ha which is was 34, 35 & 39% lower than to on-station experiment respectively. 25.3 percent farmers have certification. Weed and insect pest was observed as major constraints.

## **Ranchi**

- Geo-tagged characterization of organic farmers was conducted in Akashi village of Lohardaga district, while two villages were surveyed for natural farming in Latehar district of Jharkhand. In all surveyed districts, most of the large farmers were practicing natural farming, whereas small farmers were using mainly FYM-based practices.
- A total of 95 farmers were surveyed, out of which 45 farmers were practicing natural farming. In the surveyed villages, 45 small and 5 marginal farmers were practicing organic farming. The average landholding size (in hectares) for natural farming was: large farmers – 4 ha, small – 3 ha, and marginal – 1 ha.
- Most of the organic farmers were using FYM, vermicompost, neem cake, and karanj cake as sources of organic manure. Natural farming practitioners also used FYM and vermicompost, along with mulching and intercropping practices. Under organic farming, all farmers applied 5–8 tonnes/ha FYM and 0.5–2 tonnes/ha vermicompost in rice cultivation.
- In Lohardaga district, rice was the major crop, cultivated by 70% of the farmers, followed by finger millet, arhar, black gram, cowpea, horse gram (kulthi), and niger during kharif. Other crops included onion, okra, potato, French bean, and chilli.
- In Latehar district, rice was also the major crop, cultivated by 50% of the natural farming farmers, followed by finger millet, arhar, black gram, cowpea, horse gram (kulthi), and niger during kharif. Other crops included drumstick, papaya, lemon, medicinal plants, millets, field bean, chilli, and groundnut.
- Neem-based products were used as plant protection inputs in organic farming, while in natural farming, Dashparni was applied at 10 litres/ha for pest and disease management.
- In the case of scented small-grain rice like BVS-1, Govindbhog, Kalazeera, Katarni, and BR-9, yields under organic farming (1.8–2.0 t/ha) were comparable to chemical-based farming (2.0–2.1 t/ha). However, when hybrid rice was cultivated, the yield reduction under organic farming was up to 50%. For pulses such as black gram, lentil, chickpea, red gram, green gram, horse gram, niger, and linseed, no significant yield reduction was observed under organic farming compared to chemical-based farming.
- For crops like colocasia, desi sem (Indian bean), spinach, and elephant foot yam (ol), most farmers were not using any chemicals and were practicing organic and natural farming using FYM and crop residues. Finger millet performed very well under organic conditions, with yields ranging from 1.5 to 2.0 t/ha.
- According to farmers' experiences and opinions, not all crops gave good yields under organic farming. However, fruit crops, pulses (like arhar, black gram, lentil, linseed), leafy vegetables, cucurbits, finger millet, cowpea, and French bean performed well under organic systems.
- During farmer interactions in Akashi (Lohardaga) and Barwadih block (Latehar), it was observed that many poor farmers, especially those from SC/ST communities, were practicing organic and natural farming by default, but were not receiving remunerative prices for their produce.

## **Umiam**

- Geo-referenced characterization of organic farmers was conducted in three villages—Mynsain, Pynthor, and Umden Umbathiang—in the Ri-Bhoi district of Meghalaya. A total of 310 farmers were surveyed, and all of them were practicing organic farming. The area experiences a subtropical highland climate, which supports diverse agricultural practices. The predominant soil type in these villages is red loamy soil, with some patches of alluvial and laterite soils.

- Almost all farmers maintain an average of 3–4 farm animals, including goats, cows, pigs, and poultry. The primary crops cultivated during the Kharif season include rice, maize, French beans, ginger, colocasia, sweet potato, and turmeric, followed by Rabi vegetables such as French beans, cole crops, mustard, radish, tomato, potato, and peas. The post-Rabi season features the cultivation of various cucurbits. However, the overall cropping intensity remains low, at just over 130%.
- Farmyard manure, cow dung, pig manure, poultry manure, vermicompost, and other composted materials serve as the main sources of organic nutrients. Most farmers collect manure from their own livestock sheds, while a few purchase additional inputs.
- Most villagers depend on manual and traditional methods of pest management. Since many farmers grow local pest-resistant varieties, the incidence of large-scale pest attacks is very low. However, with the introduction of high-yielding cultivars, some pest problems have been reported. After scientific interventions and regular diagnostic visits by ICAR, organic pest management options are being promoted.
- The major crops grown under organic farming include: rice, maize, ginger, turmeric, potato, French bean, cabbage, okra, pumpkin, yam, sweet potato, carrot, cauliflower, chilli, and lettuce.
- Weed management is primarily carried out using mechanical or manual methods, involving physical removal or disturbance of weeds. Techniques include hoeing with spades, hand pulling, soil tilling before or after weed emergence, and mowing.
- Pest management is also practiced through manual and traditional methods. As most farmers grow local pest-resistant varieties, large-scale pest infestations are uncommon. However, with the introduction of high-yielding varieties, organic plant protection inputs such as *Trichoderma viride*, *Beauveria bassiana*, vermiwash, and neem oil are increasingly being used.
- The average yield at farmers' fields for rice, maize, potato, and French bean was recorded at 3352, 2579, 15,220, and 4075 kg/ha, respectively. These yields are 26.1%, 39.6%, 22.1%, and 19.8% lower than those obtained in on-station experiments. The crops produced are either consumed at the household level or sold in markets if surplus is available.
- The major constraints reported by farmers include, lack of PGS certification, water unavailability during the winter season, limited access to quality seed materials, and unavailability of organic pesticides.

### Ajmer

- Total 35 farmers from Bhilwara district of Rajasthan were Characterized under geo-referenced characterization survey out of which 30 come under organic farming and 5 natural farming farmers.
- Sixty seven percent farmers are having sandy loam in nature and 33% farmers having black soil. 100 % farmers are having soil type of sandy loam in nature practicing natural farming.
- The average holding size for organic farmers/farms is 0.73 hectares, categorizing them as small farms. Under natural farming practices, the average holding size was 0.6 hectares. The livestock maintained by farmers per household includes an average of 3 dairy cattle (cows/buffaloes) and 1 goat under organic farming, and 6 dairy cattle (cows/buffaloes) under natural farming.
- Maize, groundnut, wheat, chickpea, and cumin are the major crops grown under organic farming. In natural farming practices, maize and wheat are the primary crops grown.
- Farmers practicing organic farming use 6.0-7.0 t/ha of FYM (Farmyard Manure) plus 300 kg of vermicompost as nutrient sources for crop production. The practices adopted by farmers under natural farming include Beejamrit, Jeevamrit, and intercropping.
- For plant protection, organic farmers use *Trichoderma viridae*, neem oil, and neem-aak-dhatu leaf extract. Natural farming practices utilize neem oil and homemade pesticides. Farmers in both categories control weeds through hand weeding.
- The average recorded yield at farmers' fields under organic farming was 2200 kg/ha for maize and 2800 kg/ha for wheat. In natural farming practices, the average yield at farmers' fields was 1800 kg/ha for maize and 2400 kg/ha for wheat.

### Almora

- A total of 25 farmers were surveyed for geo-referenced characterization at Takula block and Dhaur village in Almora district. The average holding size 0.148 ha of the organic farmers was characterized as 0.3 small farm holder.



- Livestock maintained by farmers are cow/buffalo, goat and poultry with average population 1.6, 0.12, and 0.32. numbers per household.
- The crops cultivated under organic farming are finger millet, paddy, soybean, horse gram, wheat, toria, and lentil.
- Farmers consistently apply an average of 2.5 tonnes of self-prepared farmyard manure (FYM) per hectare as their nutrient source, incurring no cost for manuring. No plant protection inputs are used, and all weeding is managed manually through family labour, also at no monetary cost.
- A noticeable yield gap when comparing average on-station experiment yields with farmer field yields for crops like finger millet (11712 kg/ha), black soybean (1145.0 kg/ha), soybean (1058 kg/ha), wheat (1252 kg/ha), and paddy (1172 kg/ha) yield gap between on-station and farmers field of major crops found to be 53.6 57.2, 74.9, 59.8 and 113.3% lower at farmers field respectively.
- The major constraints faced by these farmers include damage from wild animals such as monkeys, wild boars, and apes, as well as a prevalent lack of irrigation water

### **Gangtok**

- Geo-tagged characterization of organic and natural farming has been undertaken in villages Timpyem & Shajong located in Martam Rumtek block in Gangtok district of Sikkim, with thirty numbers of each OF & NF farming progressive farmers. Average land holding size under organic farming characterized as large holding-4, small-17 & marginal 09 farms/farmers whereas under natural farming characterized as large holding-5, small-18 & marginal 07 farmers/farm.
- Average livestock population per household with organic farming recorded dairy cattle (cow/buffalo)-3, Goat-7, poultry-30 and pig-3. Natural farming farmers maintaining average population of livestock dairy cattle (cow/buffalo)-4, Goat-6, poultry-30 and pig-2.
- Maize, buckwheat, ginger, turmeric, rice, rajmash, soyabean, mustard, black gram, seasonal vegetables, large cardamom are the crops growing under organic farming. Major crops grown under NF also maize, soyabean, ricebean, green pea and coriander.
- All the surveyed farmers using farmyard manure (FYM), Pig manure, poultry manure, vermicompost as source of nutrient. Input as organic manures applied by farmers in natural farming are Jeevamrit (1500 litres/ha), Ghanajeevamirth (1000 kg/ha/irrigation or twice in a month), Beejamrit (80 gm /kg of seeds), in addition to these, mulching, and intercropping also adopting.
- Neem oil, Blitox, COC, locals botanicals are the input using for organic cultivation while, on farm available local botanical spray 3% per litre of water used for natural farming.
- Yield for maize & soybean recorded by 40.5 & 41% lower with farmers field as compared to on-station experiment under organic farming while it was 24.4 & 15.3% lower under natural farming. Other crops such as rice and buckwheat recorded yield gap about 1733 and 416 kg/ha respectively.

### **Sardarkrushinagar**

- A total of 30 farmers/farms were surveyed under the geo-tagged characterization of organic and natural farming. Among them, 4 organic farmers were identified from 2 villages in the Danta block of Banaskantha district, Gujarat. Out of these 30 farmers, 26 also practice partial natural farming.
- The average land holding size is 0.5 ha for organic farming (OF) farmers and 0.41 ha for natural farming (NF) farmers. The average number of animals per household is 5.0 for OF farmers and 4.0 for NF farmers. Major crops grown under organic farming were cotton, groundnut, wheat, brinjal, chilli, tomato while wheat for natural farming.
- Organic farmers applied manures such as vermicompost and biogas slurry. Natural farming farmers used inputs like Jivamrut, vermicompost, and biogas slurry.
- For insect pest management, they applied formulations such as neem oil, Nimastra, Agniashtra, Dashparni Ark, and Bramhastra. Weed management in natural farming was primarily done through hand weeding.
- The average yield under on-station experiments was 2785 kg/ha for wheat, 1352 kg/ha for groundnut, and 1800 kg/ha for cotton. The yield gap between on-station experiments and farmers' fields under organic farming was recorded at 10.23%, 9.39%, and 22.20% for wheat, groundnut, and cotton respectively. For natural farming, the on-station yields were 1800 kg/ha for cotton, 2750 kg/ha for wheat, 2000 kg/ha for soybean, and 2400 kg/ha for maize, with corresponding yield gaps of 23.00%, 4.69%, 10.00%, and 14.83% respectively.

## Thiruvananthapuram

- Geo-referenced survey of 30 champion farmers practicing natural farming carried out in Oachira, Chavara, Eravipuram, Chathanthoor, Kundara, Sasthamcotta, Kottarakara, Vettikavala, Chadayamangalam, Anchal and Punalur blocks of Kollam district and Kazhakuttam block of Thiruvananthapuram district.
- The soil type was laterite (100%). Most of the farming situation surveyed was rainfed (80%) and the remaining was irrigated. The majority of these farmers operate on small and marginal holdings 55.6% on small farms averaging 1.64 hectares and 37.0% on marginal farms of 0.57 hectares. Only 3.7% farmers characterized under large farm holding which is having average land holding of 1.6 ha.
- Livestock integration is notable, with average households maintaining 5 cattle, 4 goats, and 20 poultry birds, along with limited apiculture and pisciculture units. About 45% of the surveyed farmers owned cow, 10% had goat, 40% had poultry, 10% had apiary and 10% had pisciculture. Most of the farmers are maintaining indigenous breeds of livestock. The native breeds of cows include Vechur, Cheruvally, Kasargod kullam, Gir, Sahiwal, Sindhi etc and that of goat include Malabari, Attapadi black etc. Major fish breeds grown by farmers are GIFT Tilapia and Varaal.
- Farmers cultivating a wide range of cereals (rice, maize, millets), fruits (such as banana, mango, jackfruit, and dragon fruit), vegetables, root crops, spices, and plantation crops like coconut, rubber, and cashew.
- Farmers extensively adopt NF practices including jeevamrit (used by 75%), intercropping and mulching (60% each), ghanjeevamrit (40%), and beejamrit (30%). On average, 350 litres of jeevamrit and 300 kg of ghanjeevamrit are applied per hectare. Organic manures like neem cake, panchagavya, vermicompost, and poultry manure are used at 7–8 tonnes per hectare. sources for natural farming constituted cow dung slurry/FYM (95%), poultry manure (56.66%), vermicompost (53.33%), neem cake, groundnut and cow dung slurry, compost prepared from crop residue, cow dung, cow urine, panchagavya (43.33%), ash (40%), vermicompost, biogas slurry, water from fish pond, PGPR, Mycorrhiza, green manuring (40%) and natural farming formulations beejamrit (35%), jeevamrit (75%) and ghanjeevamrit (45%). Majority of farmers conducted soil testing before raising the crop.
- Mainly through application of different leaf extracts and their combination with chilli, garlic and neem oil extracts, Trichoderma & Pseudomonas (76.67%), neem oil & neem oil garlic emulsion (70%), fish amino acid & egg amino acid (63.33%), PGPR (60%), cowurine (60%), Beauveria (56.66%), chilli-garlic emulsion (50%), nanma, menma, shreya (40%), tobacco decoction (33.33%), papaya leaf extract (36.67%), lantana leaf extract, pathila kashayam, vrikshayurveda, haritha kashayam, neemasthra, agniasthra, brahmastra, karinochi ila kashayam, sarvanivarini, Gliricidia leaf extract. Also practicing cultural methods, intercropping, trap crops on field bunds, different types of traps and some indigenous practices.
- There was yield gap of -33.78% due to higher onstation yield from cassava variety Sree Reksha.
- Non-availability of suitable markets, low price of the produce, labour shortage and high wage, climate change and damage due to wild boar, peacock and other wild animals are the constraints faced by the farmers.

## Udaipur

- A total of 30 organic farmers from Bheelo Ka Jhopda Redwas (Kotri block) and 5 natural farmers from Kodukota village (Suvana block) of Bhilwara district were surveyed under geo-referenced on-farm characterization.
- The average landholding was 2.23 ha (organic) and 3.3 ha (natural), with 1.02 ha and 0.70 ha under organic and natural farming, respectively. Farmers owned average livestock population (numbers per households) dairy (cattle/buffalo): 8, goat: 3 with organic farming and 15 cow/buffalo & 20 goats with natural farming.
- Maize and wheat were the major crops grown under organic cultivation and in addition, Blackgram, gram, chilli and tomato were also cultivated under natural farming.
- Organic farmers used FYM and vermicompost as a source of nutrients, while natural farmers used jeevamrit, beejamrit, panchagavya, dashparni, neemasthra, matakakhad, and mulching. Both used gomutra, neem extracts, and fermented buttermilk for plant protection.
- Mean yield of maize, blackgram, wheat and chickpea recorded of 2905, 400, 2845 & 1025 kg/ha at farmers field with yield gap 26, 18.7, 46 & 26.3% lower than on-station experiments under organic farming condition. Same crops grown under natural farming, the yield of 2755, 390, 2775 & 1005 kg/ha at farmers field and gap for yield found to be 32.8, 21.8, 49.7 & 28.8%.
- Weed management included hand weeding and hoeing/mulching, requiring 34 (organic) and 24 (natural) man-days in Kharif, and 24 (organic) and 16 (natural) man-days in rabi.



Table 7.1.1.1: Basic details of organic and natural farming farmers/farms

| States/Centre name Organic farming | Name of districts |                          | Number of blocks |    | Number of villages surveyed |       | Number of farmers surveyed |                 | Holding size (ha) |                            |                            |
|------------------------------------|-------------------|--------------------------|------------------|----|-----------------------------|-------|----------------------------|-----------------|-------------------|----------------------------|----------------------------|
|                                    | Natural farming   | OF                       | NF               | OF | NF                          | Total | Organic farming            | Natural farming | Organic farming   | Natural farming            |                            |
| Bhopal                             | Madhya Pradesh    | Vidisha                  | 1                | 1  | 2                           | 2     | 30                         | 15              | 15                | -                          | -                          |
| Calicut                            | Kerala            | Kozhikode                | 3                | 5  | 6                           | 10    | 14                         | 4               | 10                | S                          | S                          |
| Coimbatore                         | Tamil Nadu        | Coimbatore and Thiruppur | 3                | 12 | 4                           | 11    | 35                         | 20              | 15                | 3.0                        | 1.5                        |
| Dharwad                            | Karnataka         | -                        | -                | 7  | -                           | 10    | 14                         | -               | 14                | -                          | L=5.4<br>S=2.06<br>M=1.15  |
| Jabalpur                           | Madhya Pradesh    | Jabalpur                 | 1                | 2  | 5                           | 6     | 50                         | 20              | 30                | L=2.10<br>S=1.14<br>M=0.38 | L=2.34<br>S=1.28<br>M=0.72 |
| Karjat                             | Maharashtra       | Thane                    | 1                | -  | 8                           | -     | 30                         | 30              | -                 | S=1.2                      | -                          |
| Ludhiana                           | Punjab            | Barnala                  | 3                | -  | 21                          | -     | 28                         | 28              | -                 | S                          | -                          |
| Modipuram                          | Uttar Pradesh     | Meerut                   | 4                | -  | 8                           | -     | 32                         | 32              | -                 | M=0.49                     | -                          |
| Panthenagar                        | Uttarakhand       | Nainital                 | 1                | -  | 8                           | -     | 50                         | 50              | -                 | L=3.50<br>S=0.35<br>M=1.50 | -                          |
| Raipur                             | Chhattisgarh      | Mahasamund               | 2                | -  | 3                           | -     | 23                         | 23              | -                 | L=1.0<br>S=0.2<br>M=0.09   | -                          |
| Ranchi                             | Jharkhand         | Lohardaga                | 1                | 2  | 1                           | 2     | 95                         | 50              | 45                | S                          | L=4.0<br>S=3.0<br>M=1.0    |
| Umiam                              | Meghalaya         | Ri Bhoi                  | 1                | -  | 3                           | -     | 310                        | 310             | -                 | S=1.7<br>M=0.8             | -                          |

| States/Centre name Organic farming | Name of districts |             | Number of blocks |    | Number of villages surveyed |       | Number of farmers surveyed |                 | Holding size (ha) |                                           |
|------------------------------------|-------------------|-------------|------------------|----|-----------------------------|-------|----------------------------|-----------------|-------------------|-------------------------------------------|
|                                    | Natural farming   | OF          | NF               | OF | NF                          | Total | Organic farming            | Natural farming | Organic farming   | Natural farming                           |
| Ajmer                              | Bhilwara          | Bhilwara    | 2                | 2  | 4                           | 2     | 35                         | 30              | 5                 | S=0.73 S=0.6                              |
| Almora                             | Uttarakhand       | -           | 1                | -  | 1                           | -     | 25                         | 25              | -                 | M=0.148 -                                 |
| Gangtok                            | Sikkim            | Gangtok     | 1                | 1  | 1                           | 1     | 60                         | 30              | 30                | L=4 L=5 S=18 S=17 M=7 M=9                 |
| Sardarkrushinagar                  | Gujarat           | Banaskantha | 1                | 1  | 2                           | 4     | 30                         | 04              | 26                | M=0.5 M=0.41                              |
| Thiruvananthapuram                 | Kerala            | -           | -                | 11 | -                           | 27    | 27                         | -               | 27                | L=10.6 L=10.6 S=1.64 S=1.64 M=0.57 M=0.57 |
| Udaipur                            | Rajasthan         | Bhilwara    | 1                | 1  | 1                           | 2     | 35                         | 30              | 5                 | L=4 L=5 S=23 S=23 M=3 M=3                 |

Table 7.1.1.2: Mean livestock population and input of organic and natural farming maintained by farmers at different locations

| Name of centre | Name of the district surveyed                                          | Average livestock population/ household (Nos.)     |                    |                 | Input of organic manures etc. applied (per ha) |                     |                          | Input of Natural Farming practice by the farmers |                                                 |                          |
|----------------|------------------------------------------------------------------------|----------------------------------------------------|--------------------|-----------------|------------------------------------------------|---------------------|--------------------------|--------------------------------------------------|-------------------------------------------------|--------------------------|
|                |                                                                        | Livestock                                          | Organic farming    | Natural farming | Name of input                                  | Aver. quantity used | Cost of manuring (Rs/ha) | Name of input                                    | Aver. quantity used                             | Cost of manuring (Rs/ha) |
| Bhopal         | Vidisha                                                                | Dairy (cattle/ buffalo)                            | -                  | -               | Vermicompost & FYM                             | 2-3 tonnes/ha       | Rs 2800/ha               | Jeevamrit<br>Ghanjeevamrit<br>Beejamirt          | 500-1000 litre/ha<br>1000 kg/ha<br>1-2 litre/kg | 300-500 Rs/ha            |
| Calicut        | Kozhikode                                                              | Dairy (cattle/ buffalo)<br>Goat<br>Poultry<br>Duck | 5<br>6<br>15<br>25 | 19              | FYM,<br>Neem cake<br>Groundnut cake            | 5365 kg/ha          | 3500/ha                  | Jeevamrit<br>Ghanjeevamrit<br>Beejamirt -        | 1000 litre/ha<br>1500 kg/ha<br>750 kg/kg        | 6899 Rs/ha               |
| Coimbatore     | Coimbatore,<br>Thiruppur<br>Thiruvapur ,<br>Trichy and<br>Viruthunagar | Dairy (cattle/ buffalo)<br>Goat<br>Poultry         | 2<br>2<br>8        | 2<br>3<br>6     | FYM<br>Vermicompost                            | 2-3 tonnes/ha       | Rs. 6250/ha              | Jeevamrit,<br>Ghanjeevamrit                      | 1000 litre/ha<br>500 kg/ha                      | Rs.2250/ha               |



| Name of centre | Name of the district surveyed    | Average livestock population/ household (Nos.)                      |                 |                                  | Input of organic manures etc. applied (per ha)       |                                                  |                          | Input of Natural Farming practice by the farmers |                                  |                          |
|----------------|----------------------------------|---------------------------------------------------------------------|-----------------|----------------------------------|------------------------------------------------------|--------------------------------------------------|--------------------------|--------------------------------------------------|----------------------------------|--------------------------|
|                |                                  | Livestock                                                           | Organic farming | Natural farming                  | Name of input                                        | Aver. quantity used                              | Cost of manuring (Rs/ha) | Name of input                                    | Aver. quantity used              | Cost of manuring (Rs/ha) |
| Dharwad        | Belagavi, Dharwad, Gadag, Haveri | Dairy (cattle/ buffalo)<br>Deshi cow<br>Goat<br>Poultry<br>Bullocks | -               | 2.3<br>3<br>0.92<br>2.53<br>0.92 | FYM<br>Vermicompost                                  | -                                                | -                        | Jeevamrut, Ghanjeevamrut<br>Beejamrut            | 1000-2000/ha, 800 l/ha<br>5 l/kg | 4500-7500 Rs/ha          |
| Jabalpur       | Jabalpur                         | Dairy (cattle/ buffalo)<br>Goat<br>Poultry                          | 1.5<br>4<br>6   | 2.6                              | FYM<br>Vermicompost                                  | 2.6 tonnes/ha                                    | 4500 Rs/ha               | -                                                | -                                | -                        |
| Karjat         | Thane                            | Dairy (cattle/ buffalo)<br>Goat<br>Poultry                          | 1<br>1<br>3     | -                                | FYM,<br>Vermicompost<br>Green manuring               | 16 qntl/ha                                       | 24000 Rs/ha              | -                                                | -                                | -                        |
| Ludhiana       | Barnala                          | Dairy (cattle/ buffalo)                                             | 4               | -                                | FYM,<br>Vermicompost,<br>jeevamrit,<br>ghanjeevamrit | 17 tonnes/ha                                     | 6000 Rs/ha               | -                                                | -                                | -                        |
| Modipuram      | Meerut                           | Dairy (cattle/ buffalo)                                             | 5.47            |                                  | FYM<br>Vermicompost<br>PROM                          | 40.98 tonne/ha<br>1.05 tonne/ha<br>0.22 tonne/ha | Rs.27953/ha/yr           |                                                  |                                  |                          |
| Panthenagar    | Nainital                         | Dairy (cattle/ buffalo)<br>buffalo<br>Goat                          | 5-6<br>2-3<br>2 | -                                | FYM,<br>Vermicompost,<br>Green manure                | 10 t/ha                                          | Self made                | -                                                | -                                | -                        |
| Raipur         | Mahasamund                       | Dairy(cattle/ buffalo)<br>Goat:<br>Poultry:                         | 2<br>8<br>15    |                                  | FYM                                                  | 1 t/ha                                           | 200 Rs/ha                | -                                                | -                                | -                        |

| Name of centre     | Name of the district surveyed | Average livestock population/ household (Nos.) |                 |                 |  | Input of organic manures etc. applied (per ha) |                           |                          |                | Input of Natural Farming practice by the farmers |                          |  |
|--------------------|-------------------------------|------------------------------------------------|-----------------|-----------------|--|------------------------------------------------|---------------------------|--------------------------|----------------|--------------------------------------------------|--------------------------|--|
|                    |                               | Livestock                                      | Organic farming | Natural farming |  | Name of input                                  | Aver. quantity used       | Cost of manuring (Rs/ha) | Name of input  | Aver. quantity used                              | Cost of manuring (Rs/ha) |  |
| Ranchi             | Lohardaga, Latehar            | Dairy(cattle/ buffalo)                         | 2               | 2               |  | FYM,                                           | 2-2.5 tone/ha             | 5000-6000 Rs/ha          | Mulching,      | -                                                | 10000 Rs/ha              |  |
|                    |                               | Goat:                                          | 4               | 4               |  | Vermicompost,                                  |                           |                          | Intercropping  |                                                  |                          |  |
| Umiam              | Ri Bhoi                       | Poultry:                                       | 2               | 10              |  | Neem cake,                                     |                           |                          |                |                                                  |                          |  |
|                    |                               |                                                |                 |                 |  | Karanj cake                                    |                           |                          |                |                                                  |                          |  |
| Ajmer              | Bhilwara                      | Dairy (cattle/ buffalo)                        | 0.16            | -               |  | Vermicompost,                                  | 4-5 tonne/ha              | 10000 Rs/ha              | -              | -                                                | -                        |  |
|                    |                               | Goat                                           | 0.12            |                 |  | FYM, Compost,                                  |                           | 30000-35000 Rs/ha        |                |                                                  |                          |  |
| Almora             | Almora                        | Poultry                                        | 10              |                 |  | Poultry manure,                                |                           |                          |                |                                                  |                          |  |
|                    |                               | Piggery                                        | 1.6             |                 |  | Pig manure                                     |                           |                          |                |                                                  |                          |  |
| Gangtok            | Gangtok                       | Dairy (cattle/ buffalo)                        | 3               | 6               |  | FYM+                                           | 6.0-7.0 t/ha              | 18000 Rs/ha              | Jeevamrit      | 500 lit                                          | 800-1000 Rs/ha           |  |
|                    |                               | Goat                                           | 1               |                 |  | Vermicompost                                   | FYM + 300 kg Vermicompost |                          | Beejamrit      | 1 lit/10 kg seeds                                |                          |  |
| S K Nagar          | Banaskantha                   | Dairy (cattle/ buffalo)                        | 1.6             |                 |  | FYM                                            | 2.5 t/ha                  | self-prepared            | -              | -                                                | -                        |  |
|                    |                               | Goat                                           | 0.12            |                 |  |                                                |                           |                          |                |                                                  |                          |  |
| Thiruvananthapuram | Kollam                        | Poultry                                        | 0.32            |                 |  |                                                |                           |                          |                |                                                  |                          |  |
|                    |                               | Pig                                            |                 |                 |  |                                                |                           |                          |                |                                                  |                          |  |
| Udaipur            | Bhilwara                      | Dairy (cattle/ buffalo)                        | 3               | 4               |  | FYM, Pig                                       | 5.0 - 7.0 t/ha            | 3000-4000 Rs/ha          | Jeevamrit      | 1500 litres/ha                                   | 2000-3000 Rs/ha          |  |
|                    |                               | Goat:                                          | 5               | 6               |  | manure, Poultry                                |                           |                          | Ghanajeevamrit | 1000 litres/ha                                   |                          |  |
|                    |                               | Poultry                                        | 7               | 30              |  | manure,goat                                    |                           |                          | Beejamrit      | 80 gm /kg of seeds                               |                          |  |
|                    |                               | Apiculture                                     | 3               | 2               |  | manure,                                        |                           |                          |                |                                                  |                          |  |
|                    |                               | Pisciculture                                   |                 |                 |  | Vermicompost                                   |                           |                          | Jeevamrit      | 405 l/ha                                         | 523 Rs/ha                |  |
|                    |                               |                                                |                 |                 |  |                                                |                           |                          |                |                                                  |                          |  |
|                    |                               | Dairy (cattle/ buffalo)                        | 5               | 4               |  | Vermicompost,                                  | 525 kg/ha                 | Nil                      | Jeevamrit      |                                                  |                          |  |
|                    |                               | Goat:                                          |                 |                 |  | Bio gas slurry                                 |                           |                          |                |                                                  |                          |  |
|                    |                               | Poultry                                        | -               | 5               |  | -                                              |                           |                          | Jeevamrit      | 350 lit/ha                                       | 20000 Rs/ha              |  |
|                    |                               | Apiculture                                     |                 | 4               |  |                                                |                           |                          | Ghanajeevamrit | 300 kg/ha                                        |                          |  |
|                    |                               | Pisciculture                                   |                 | 20              |  |                                                |                           |                          | Beejamrit      | 5 litres/kg                                      |                          |  |
|                    |                               |                                                |                 | 1               |  |                                                |                           |                          |                |                                                  |                          |  |
|                    |                               | Dairy (cattle/ buffalo)                        | 2               | 2               |  |                                                |                           |                          |                |                                                  |                          |  |
|                    |                               | Goat:                                          |                 |                 |  |                                                |                           |                          | Jeevamrit:     | 500 lit/ha                                       | 20000                    |  |
|                    |                               | Poultry                                        | 8               | 15              |  | FYM and                                        | 9.55 t/ha                 | 95500 Rs/ha              |                |                                                  |                          |  |
|                    |                               | Goat:                                          | 3               | 20              |  | Vermicompost                                   |                           |                          |                |                                                  |                          |  |



Table 7.1.1.3: Major crop grown and yield under organic/natural farming at different location

| Centre name | Name of the districts surveyed                                | Name of blocks                                             | Name of villages                                                                                                                             | Major crops grown under organic and natural farming | Average yield of major crops at on-station and farmers filed |                       |               |                          |                       |               |
|-------------|---------------------------------------------------------------|------------------------------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------|-----------------------------------------------------|--------------------------------------------------------------|-----------------------|---------------|--------------------------|-----------------------|---------------|
|             |                                                               |                                                            |                                                                                                                                              |                                                     | Organic farming                                              |                       |               | Natural farming          |                       |               |
|             |                                                               |                                                            |                                                                                                                                              |                                                     | On-station yield (kg/ha)                                     | On-farm yield (kg/ha) | Yield gap (%) | On-station yield (kg/ha) | On-farm yield (kg/ha) | Yield gap (%) |
| Bhopal      | Vidisha                                                       | Ganj Basoda                                                | Gamakhar, Pachma                                                                                                                             | Soybean                                             | 1034                                                         | 840                   | 23.1          | 460                      | 420                   | 9.5           |
|             |                                                               |                                                            |                                                                                                                                              | Wheat                                               | 3217                                                         | 2420                  | 32.9          | 1728                     | 1497                  | 15.4          |
| Calicut     | Kozhikode & Wayanad                                           | Kunnummal, balussery, perambra Panamaram ,Wayand           | Koorachund, Naduvannur, Kuttilyadi, Peruvennamuzhi, Avadukka, Unnikulam Arinhemala, Chundakunnu, Chekaloor, Nellartt kunnu, Pullolyl Pothade | Pepper                                              | 1500                                                         | 850                   | 76.5          | 1300                     | 750                   | 73.3          |
|             |                                                               |                                                            |                                                                                                                                              | Turmeric                                            | 8000                                                         | 5500                  | 45.4          | 7000                     | 5000                  | 40.0          |
|             |                                                               |                                                            |                                                                                                                                              | Ginger                                              | 15000                                                        | 10000                 | 50.0          | 12000                    | 9000                  | 33.3          |
| Coimbatore  | Coimbatore and Thiruppur Thiruvarur , Trichy and Viruthunagar | I r u t t u p a l l a m , Avinashipalayam and Thondamuthur | Mathappati,Semmedu, Kerudamuthur and Ramegoundapalayam                                                                                       | Banana                                              | 27000                                                        | 22000                 | 18.5          | -                        | -                     | -             |
|             |                                                               |                                                            |                                                                                                                                              | Onion                                               | 6600                                                         | 5790                  | 12.3          | -                        | -                     | -             |
|             |                                                               |                                                            |                                                                                                                                              | Tomato                                              | 20000                                                        | 16000                 | 20.0          | -                        | -                     | -             |
|             |                                                               |                                                            |                                                                                                                                              | Arecanut                                            | 1200                                                         | 1050                  | 12.5          | -                        | -                     | -             |
|             |                                                               |                                                            |                                                                                                                                              | Coconut                                             | 12 nuts                                                      | 90 nuts               | 25.0          | 12 nuts                  | 90 nuts               | 25.0          |
|             |                                                               |                                                            |                                                                                                                                              | Paddy                                               | -                                                            | -                     | -             | 2245                     | 1956                  | 12.8          |
|             |                                                               |                                                            |                                                                                                                                              | Brinjal                                             | -                                                            | -                     | -             | 35000                    | 30000                 | 16.7          |
|             |                                                               |                                                            |                                                                                                                                              | Green gram                                          | -                                                            | -                     | -             | 700                      | 600                   | -14.0         |
| Dharwad     | Belagavi, Dharwad, Gadag & Haveri                             | 7 Nos.                                                     | 10 Nos.                                                                                                                                      | Soybean                                             | -                                                            | -                     | -             | 2500                     | 2350                  | -6.0          |
|             |                                                               |                                                            |                                                                                                                                              | Chilli                                              | -                                                            | -                     | -             | 500                      | 541                   | 8.2           |
|             |                                                               |                                                            |                                                                                                                                              | Groundnut                                           | -                                                            | -                     | -             | 2800                     | 2000                  | -28.57        |
|             |                                                               |                                                            |                                                                                                                                              | Millets                                             | -                                                            | -                     | -             | 1500                     | 1750                  | 16.0          |
|             |                                                               |                                                            |                                                                                                                                              | Rabi Sorghum                                        | -                                                            | -                     | -             | 1500                     | 1375                  | -8.33         |
|             |                                                               |                                                            |                                                                                                                                              | Chickpea                                            | -                                                            | -                     | -             | 1500                     | 1250                  | -16.66        |
|             |                                                               |                                                            |                                                                                                                                              | Sugarcane                                           | -                                                            | -                     | -             | 150000                   | 127000                | -15.0         |

| Centre name | Name of the districts surveyed | Name of blocks                     | Name of villages                              | Major crops grown under organic and natural farming | Average yield of major crops at on-station and farmers filed |                       |               |                          |                       |               |
|-------------|--------------------------------|------------------------------------|-----------------------------------------------|-----------------------------------------------------|--------------------------------------------------------------|-----------------------|---------------|--------------------------|-----------------------|---------------|
|             |                                |                                    |                                               |                                                     | Organic farming                                              |                       |               | Natural farming          |                       |               |
|             |                                |                                    |                                               |                                                     | On-station yield (kg/ha)                                     | On-farm yield (kg/ha) | Yield gap (%) | On-station yield (kg/ha) | On-farm yield (kg/ha) | Yield gap (%) |
| Jabalpur    | Jabalpur                       | Jabalpur - one                     | Kalgodi , Kuda, Pipariya, Vikrampur, Jamuniya | Rice                                                | -                                                            | 1450                  | -             | -                        | -                     | -             |
|             |                                |                                    |                                               | Wheat                                               | 3156                                                         | 1236                  | 61            | -                        | -                     | -             |
|             |                                |                                    |                                               | Arhar                                               | -                                                            | 460                   | -             | -                        | -                     | -             |
|             |                                |                                    |                                               | Kodo                                                | -                                                            | 325                   | -             | -                        | -                     | -             |
|             |                                |                                    |                                               | Kutki                                               | -                                                            | 300                   | -             | -                        | -                     | -             |
|             |                                |                                    |                                               | Field pea                                           | -                                                            | 400                   | -             | -                        | -                     | -             |
|             |                                |                                    |                                               | Chickpea                                            | -                                                            | 378                   | -             | -                        | -                     | -             |
|             |                                |                                    |                                               | Mustard                                             | 1786                                                         | 443                   | 75            | -                        | -                     | -             |
|             |                                |                                    |                                               | Wheat + Mustard                                     | 1552+446                                                     | -                     | -             | -                        | -                     | -             |
| Karjat      | Thane                          | Shahapur                           |                                               | Rice                                                | 3572                                                         | 2760                  | 29.42         | -                        | -                     | -             |
|             |                                |                                    |                                               | Pulses                                              | 1225                                                         | 810                   | 51.2          | -                        | -                     | -             |
|             |                                |                                    |                                               | Vegetables                                          | 14115                                                        | 12040                 | 17.2          | -                        | -                     | -             |
| Ludhiana    | Barnala                        | 3 (Barnala, Sehna and Mehal Kalan) |                                               | Basmati rice                                        | 3850                                                         | 3660                  | 4.9           | -                        | -                     | -             |
|             |                                |                                    |                                               | Maize                                               | 3831                                                         | 3567                  | 6.9           | -                        | -                     | -             |
|             |                                |                                    |                                               | Summer moong                                        | 780                                                          | 648                   | 16.9          | -                        | -                     | -             |
|             |                                |                                    |                                               | Wheat                                               | 3950                                                         | 3575                  | 9.5           | -                        | -                     | -             |
| Modipuram   | -                              | -                                  | -                                             | Chickpea                                            | 1260                                                         | 1110                  | 11.9          | -                        | -                     | -             |
|             |                                |                                    |                                               | Sugarcane                                           | 110000                                                       | 65000                 | 40.91         | -                        | -                     | -             |
|             |                                |                                    |                                               | Wheat                                               | 4500                                                         | 3800                  | 15.55         | -                        | -                     | -             |



| Centre name | Name of the districts surveyed | Name of blocks | Name of villages                                                                                       | Major crops grown under organic and natural farming | Average yield of major crops at on-station and farmers filed |                       |               |                          |                       |               |
|-------------|--------------------------------|----------------|--------------------------------------------------------------------------------------------------------|-----------------------------------------------------|--------------------------------------------------------------|-----------------------|---------------|--------------------------|-----------------------|---------------|
|             |                                |                |                                                                                                        |                                                     | Organic farming                                              |                       |               | Natural farming          |                       |               |
|             |                                |                |                                                                                                        |                                                     | On-station yield (kg/ha)                                     | On-farm yield (kg/ha) | Yield gap (%) | On-station yield (kg/ha) | On-farm yield (kg/ha) | Yield gap (%) |
| Pantnagar   | Nainital                       | Kotabagh       | Dhamar Devi, GinitiGanw, Hawal Kota, Kalyanpur, SaunjalaNarSingh, Nathujala, Bhandari Simal,Mayarampur | Rice                                                | 4765                                                         | 3525                  | 26.02%        | -                        | -                     | -             |
|             |                                |                |                                                                                                        | Wheat                                               | 4534                                                         | 3238                  | 28.58%        | -                        | -                     | -             |
|             | Raipur                         | Mahasamund     | Mahasamund & Bagbahra                                                                                  |                                                     | Rice                                                         | 45.20                 | 29.80         | 34                       | -                     | -             |
| Chickpea    | 18.00                          |                |                                                                                                        |                                                     | 10.30                                                        | 35                    | -             | -                        | -                     |               |
| Wheat       | 22.00                          |                |                                                                                                        |                                                     | 13.25                                                        | 39                    | -             | -                        | -                     |               |
| Ranchi      | Lohardaga & Latehar            |                | Akashi                                                                                                 | Rice                                                | 3369                                                         | 2729                  | -19.00        | 1800                     | 1400                  | 22.2          |
|             |                                |                |                                                                                                        | Potato                                              | 18754                                                        | 16315                 | -13.00        | -                        | -                     | -             |
|             |                                |                |                                                                                                        | Okra                                                | 7479                                                         | 5983                  | -19.99        | -                        | -                     | -             |
|             |                                |                |                                                                                                        | Onion                                               | 13590                                                        | 10600                 | -22.00        | -                        | -                     | -             |
|             |                                |                |                                                                                                        | Black gram                                          | -                                                            | -                     | -             | 1200                     | 1000                  | 16.6          |
|             |                                |                |                                                                                                        | Lentil                                              | -                                                            | -                     | -             | 800                      | 700                   | 12.5          |
|             |                                |                |                                                                                                        | Linseed                                             | -                                                            | -                     | -             | 800                      | 600                   | 25.0          |
| Umiam       | Ri Bhoi                        | Bhoirymbong    | Mynsain, Pynthor and Umden Umbathiang                                                                  | Rice                                                | 4230                                                         | 3352                  | 26.19         | -                        | -                     | -             |
|             |                                |                |                                                                                                        | Maize                                               | 3600                                                         | 2579                  | 39.59         | -                        | -                     | -             |
|             |                                |                |                                                                                                        | Potato                                              | 18580                                                        | 15220                 | 22.08         | -                        | -                     | -             |
|             |                                |                |                                                                                                        | French bean                                         | 4880                                                         | 4075                  | 19.75         | -                        | -                     | -             |
| Ajmer       | Bhilwara                       | Bagore, Mandal | Chandras, Mali kheda, Peethas, Kaloo khera Jorawarpura & Chandras                                      | Maize                                               | -                                                            | 2200                  | -             | -                        | 1800                  | -             |
|             |                                |                |                                                                                                        | Wheat                                               | -                                                            | 2800                  | -             | -                        | 2400                  | -             |

| Centre name | Name of the districts surveyed | Name of blocks | Name of villages  | Major crops grown under organic and natural farming | Average yield of major crops at on-station and farmers filed |                       |               |                          |                       |               |
|-------------|--------------------------------|----------------|-------------------|-----------------------------------------------------|--------------------------------------------------------------|-----------------------|---------------|--------------------------|-----------------------|---------------|
|             |                                |                |                   |                                                     | Organic farming                                              |                       |               | Natural farming          |                       |               |
|             |                                |                |                   |                                                     | On-station yield (kg/ha)                                     | On-farm yield (kg/ha) | Yield gap (%) | On-station yield (kg/ha) | On-farm yield (kg/ha) | Yield gap (%) |
| Almora      | Almora                         | Takula         | Dhaur             | Finger millet                                       | 1800                                                         | 1171.9                | 53.6          | -                        | -                     | -             |
|             |                                |                |                   | Black soybean                                       | 1800                                                         | 1145.0                | 57.2          | -                        | -                     | -             |
|             |                                |                |                   | Soybean                                             | 1850                                                         | 1057.7                | 74.9          | -                        | -                     | -             |
|             |                                |                |                   | Wheat                                               | 1500                                                         | 1251.8                | 59.8          | -                        | -                     | -             |
|             |                                |                |                   | Paddy                                               | 2000                                                         | 1171.9                | 113.3         | -                        | -                     | -             |
| Gangtok     | Gangtok                        | Martam Rumtek  | Timpyem & Shajong | Rice                                                | 3878                                                         | 2145                  | 44.7          | -                        | -                     | -             |
|             |                                |                |                   | Maize                                               | 3516                                                         | 2091                  | 40.5          | 3027                     | 2289                  | 24.4          |
|             |                                |                |                   | Soybean                                             | 1801                                                         | 1063                  | 41.0          | 1491                     | 1263                  | 15.3          |
|             |                                |                |                   | Buckwheat                                           | 1713                                                         | 1297                  | 24.3          | -                        | -                     | -             |
| S K Nagar   | Banaskantha                    | Danta          |                   | Groundnut                                           | 1352                                                         | 1225                  | 9.39          | -                        | -                     | -             |
|             |                                |                |                   | Wheat                                               | 2785                                                         | 2500                  | 10.23         | 2750                     | 2621                  | 4.69          |
|             |                                |                |                   | Cotton                                              | 1800                                                         | 1400                  | 22.20         | 1800                     | 1386                  | 23.00         |
|             |                                |                |                   | Soybean                                             | -                                                            | -                     | -             | 2000                     | 1800                  | 10.00         |
|             |                                |                |                   | Maize                                               | -                                                            | -                     | -             | 2400                     | 2044                  | 14.83         |



| Centre name        | Name of the districts surveyed | Name of blocks                                                                                                                     | Name of villages                                                                                                                                                                                                                                                                                                                                | Major crops grown under organic and natural farming | Average yield of major crops at on-station and farmers filed |                       |               |                          |                       |               |
|--------------------|--------------------------------|------------------------------------------------------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------------------------------------------|--------------------------------------------------------------|-----------------------|---------------|--------------------------|-----------------------|---------------|
|                    |                                |                                                                                                                                    |                                                                                                                                                                                                                                                                                                                                                 |                                                     | Organic farming                                              |                       |               | Natural farming          |                       |               |
|                    |                                |                                                                                                                                    |                                                                                                                                                                                                                                                                                                                                                 |                                                     | On-station yield (kg/ha)                                     | On-farm yield (kg/ha) | Yield gap (%) | On-station yield (kg/ha) | On-farm yield (kg/ha) | Yield gap (%) |
| Thiruvananthapuram | Kollam                         | (11) Ochira, Chavara, Eravipuram, Chathanthoor, Kundara, Sasthamcotta, Kottarakkara, Vettikavala, Chadayamangalam, Anchal, Punalur | (27): Clappana, Thevalakkara, Panmana, Elampalloor, Maruthady, Kootikkada, Kottamkara, Chathanthoor, Kalluvathukkal, Paravoor, Nedumpana, East Kallada, Mukkoodu, Kunnathoor, Sooranad South, Mynagapally, Sooranad North, Neduvathoor, Kottarakara, Kalayapuram, Kulakkada, Kadakkal, Malapperoor, Vettuvazhy, Edayam, Bharathipuram, Pattazhy | Cassava                                             | 71358                                                        | 47250                 | 37.78         |                          |                       |               |
| Udaipur            | Bhilwara                       | Kotri & Suwana                                                                                                                     | Bheelo Ka Jhopda , Redwas Kodukota & Suwana                                                                                                                                                                                                                                                                                                     | Maize                                               | 3660                                                         | 2905                  | 25.98         | 3660                     | 2755                  | 32.84         |
|                    |                                |                                                                                                                                    |                                                                                                                                                                                                                                                                                                                                                 | Blackgram                                           | 475                                                          | 400                   | 18.75         | 475                      | 390                   | 21.79         |
|                    |                                |                                                                                                                                    |                                                                                                                                                                                                                                                                                                                                                 | Wheat                                               | 4155                                                         | 2845                  | 46.04         | 4155                     | 2775                  | 49.72         |
|                    |                                |                                                                                                                                    |                                                                                                                                                                                                                                                                                                                                                 | Chickpea                                            | 1295                                                         | 1025                  | 26.34         | 1295                     | 1005                  | 28.85         |

Table 7.1.1.4: Name of the plant protection practiced and weeding cost of organic/natural farmers at different location

| Centres    | District surveyed                 | Plant protection input used (Insect pest & disease management practice)                                   |              |                                                                                                                    |                                     | Weed management practice and cost                                      |                  |             | Major constraints                                                                                                                        |
|------------|-----------------------------------|-----------------------------------------------------------------------------------------------------------|--------------|--------------------------------------------------------------------------------------------------------------------|-------------------------------------|------------------------------------------------------------------------|------------------|-------------|------------------------------------------------------------------------------------------------------------------------------------------|
|            |                                   | Organic farming                                                                                           |              | Natural farming                                                                                                    |                                     | Name of practices                                                      | Organic (Rs./ha) | NF (Rs./ha) |                                                                                                                                          |
|            |                                   | Input name & average quantity inputs used (per ha)                                                        | Cost (Rs/ha) | Input name & average quantity inputs used (per ha)                                                                 | Cost (Rs/ha)                        |                                                                        |                  |             |                                                                                                                                          |
| Bhopal     | Vidisha                           | Neem Kadaha: 5-6 litre<br>Buttermilk: 5-6 litre<br>Neem oil: 1-2 litre                                    | 650          | Panchpatti, Neemastra, Brahmastra, Dashparni<br>5-6 litre                                                          | 400-500                             | Hand weeding                                                           | 7000             | 7000        | No premium price, Less yield, More weed, incidence, Pest and disease attack, Less profit, Marketing problem                              |
| Calicut    | Kozhikode                         | Boudreaux mixture: 300 kg<br>Pseudomonas: 2.5 kg                                                          | 2500         | Coconut water – 25 liters<br>Butter milk – 10 liters<br>Trichoderma – 2kg<br>Neem oil – 1.2l<br>Pseudomonas – 2.5l | 2500<br>3596<br>300<br>3200<br>1250 | Hand weeding & brush cutter                                            | 26000            | 26000       |                                                                                                                                          |
| Coimbatore | Coimbatore & Thiruppur            | Neem seed kernel extract - 250 l/ha;<br>Neem oil -7.5 l/ha,<br>Fish amino acid - 5 l/ha;<br>Traps- 12 /ha | 3500         | Agniastra - 12.5 l/ha, Neemastra - 425 l/ha, NSKE 5%                                                               | Prepared from own farm input        | Hand weeding, Mechanical weeding<br>Mulching                           | 8000<br>3000     | 5200        | Requirement of large quantities of organic inputs<br>Weed problem<br>Inadequate market facilities for sale<br>No premium price guarantee |
| Dharwad    | Belagavi, Dharwad, Gadag , Haveri |                                                                                                           | 1000         | Neemastra, 500 l/ha<br>Agniaster:15ltr/ha, Brahmaster, Dashaparni                                                  | 1000                                | Hand weeding, Inter-cultivation, growing intercrops to smotherer crops |                  | 15000       | Less yield, non-availability of required organic input, organized market facility, no premium price                                      |
| Jabalpur   | Jabalpur                          | -                                                                                                         |              | -                                                                                                                  | -                                   | Manual weeding                                                         |                  |             | Lack of awareness regarding certification and marketing, un-availability of organic plant protection inputs                              |



| Centres   | District surveyed | Plant protection input used (Insect pest & disease management practice)                                                   |              |                                                    |              |                                              | Weed management practice and cost |                  |                                                                                                                                                                                          | Major constraints |
|-----------|-------------------|---------------------------------------------------------------------------------------------------------------------------|--------------|----------------------------------------------------|--------------|----------------------------------------------|-----------------------------------|------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------------|
|           |                   | Organic farming                                                                                                           |              | Natural farming                                    |              |                                              | Name of practices                 | Organic (Rs./ha) | NF (Rs./ha)                                                                                                                                                                              |                   |
|           |                   | Input name & average quantity inputs used (per ha)                                                                        | Cost (Rs/ha) | Input name & average quantity inputs used (per ha) | Cost (Rs/ha) |                                              |                                   |                  |                                                                                                                                                                                          |                   |
| Karjat    | Thane             | Cow urine, Dashparni arc, Tricoderma : 10 L ha <sup>-1</sup>                                                              | 2800         | -                                                  | -            | Hand weeding                                 | 28000                             |                  | Low yield, large quantity of organic inputs required, un-assured availability of organic market and premium price                                                                        |                   |
| Ludhiana  | Barnala           | Homemade neem extract = 10 ltr/ha<br>Mix leaf extract = 10 ltr/ha<br>Agniaster = 10 ltr/ha<br>Fermented butter milk - 20% | 1800         | -                                                  | -            | Hand hoeing, mechanical weeding and mulching | 7500                              | -                | Low yields, Marketing Premium price<br>Weeds problem<br>High labour cost<br>Lack of quality biofertilizers                                                                               |                   |
| Modipuram | Meerut            | Herbal Preparation -2 to 3 spray/crop<br>Neem oil- 01 spray/crop                                                          | 2120         | -                                                  | -            | Hand Weeding                                 | 18114                             | -                | Lower productivity<br>Labour Intensive<br>Lack of marketing facilities<br>No premium price for wheat                                                                                     |                   |
| Pantnagar | Nainital          | 45-50 litre cow urine fortified with neem leaves and garlic paste                                                         | 300          | -                                                  | -            | Hand weeding                                 | Family labourers                  | -                | Availability of sufficient and quality organic inputs.<br>Organic seeds and quality bio-inoculants<br>Disease infestation<br>Termite problems<br>Premium price of wheat is not obtained. |                   |
| Raipur    | Mahasamund        | Neemashtira, Beejamsrit, Agneashtra 15.00 litres                                                                          | 200          | -                                                  | -            | Hand weeding                                 | 4500                              | -                | Weeds, insects                                                                                                                                                                           |                   |

| Centres   | District surveyed   | Plant protection input used (Insect pest & disease management practice) |              |                                                                                                                             |                                | Weed management practice and cost                    |                  |             | Major constraints                                                                                                                   |
|-----------|---------------------|-------------------------------------------------------------------------|--------------|-----------------------------------------------------------------------------------------------------------------------------|--------------------------------|------------------------------------------------------|------------------|-------------|-------------------------------------------------------------------------------------------------------------------------------------|
|           |                     | Organic farming                                                         |              | Natural farming                                                                                                             |                                | Name of practices                                    | Organic (Rs./ha) | NF (Rs./ha) |                                                                                                                                     |
|           |                     | Input name & average quantity inputs used (per ha)                      | Cost (Rs/ha) | Input name & average quantity inputs used (per ha)                                                                          | Cost (Rs/ha)                   |                                                      |                  |             |                                                                                                                                     |
| Ranchi    | Lohardaga & Latehar | Neem based product<br>Neem oil,<br>Karanj oil                           | 2000         | Dashparni 10 lit/ha                                                                                                         | 500                            | Hand weeding, summer ploughing                       | 3000             | 15000       | Lack of skill in preparation of Beejaamrit, Ghanjaamrit and Jeevaamrit, Lack of local var. Marketing, Premium price                 |
| Umiam     | Ri Bhoi             | Trichoderma Viride, Beaveria bassiana, Vermiwash, Neem oil 500ml        | 5000-7500    | -                                                                                                                           |                                | Hand Weeding and manual Weeding by spade, wheel, hoe |                  |             | Water unavailability in winter season, Quality seed materials, organic pesticides                                                   |
| Ajmer     | Bhilwara            | Trichoderma 1-2 kg and Neem oil 2.0 lit                                 | 2000         | Jeevamrit (500 lit)<br>Beejamrit (1.0 lit/ 10 kg seeds)                                                                     | 800-1000                       | Hand weeding                                         | 6000             |             | Pest and disease control, weed control and low yield                                                                                |
| Almora    | Almora              | -                                                                       | -            | -                                                                                                                           |                                | Manual                                               | -                | -           | Wild Animal (monkey, wild boar, ape), Lack of irrigation water                                                                      |
| Gangtok   | Gangtok             | Neem oil, Blitox, COC, local botanicals<br>3-4 ml/lit of water          | 2000         | Jeevamrit (1500 litres/ha)<br>Ghanajeevamirth (1000 kg/ha/irrigation or twice in a month)<br>Beejamrit (80 gm /kg of seeds) | 2000-3000                      | Hand Weeding, Mulching, Zero tillage                 | 3000-4000        | 3000-4000   | Lack of availability of quality seeds and planting materials. pest and diseases management. Premium market price.                   |
| S K Nagar | Banaskantha         | Neem oil, Dashparni Ark 18 lit/ha                                       | 675          | Neem oil-12.5 lit/ha, Nimastra-32.15 lit/ha, Agniastra- 50 lit/ha, Dashparni ark-32 lit/ha & Bramhastra-75lit/ha            | 4835 Rs/lit, Homemade material | Hand weeding                                         | 18000            | 6000-7000   | Lack of labour availability<br>No assured market and lack of premium price, low productivity of crops<br>Lack of organic pesticides |



| Centres            | District surveyed | Plant protection input used (Insect pest & disease management practice)             |              |                                                                                                                                                    |              | Weed management practice and cost |                  |             | Major constraints                                                                                                                                                           |
|--------------------|-------------------|-------------------------------------------------------------------------------------|--------------|----------------------------------------------------------------------------------------------------------------------------------------------------|--------------|-----------------------------------|------------------|-------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
|                    |                   | Organic farming                                                                     |              | Natural farming                                                                                                                                    |              | Name of practices                 | Organic (Rs./ha) | NF (Rs./ha) |                                                                                                                                                                             |
|                    |                   | Input name & average quantity inputs used (per ha)                                  | Cost (Rs/ha) | Input name & average quantity inputs used (per ha)                                                                                                 | Cost (Rs/ha) |                                   |                  |             |                                                                                                                                                                             |
| Thiruvananthapuram | Kollam            | -                                                                                   | -            | Neem oil: 6 l/ha<br>Beauveria liquid 4 l/ha or Beauveria WP 4 kg/ha<br>Trichoderma: 100 kg/ha<br>Pseudomonas: 100 kg/ha<br>Fish amino acid: 5 l/ha | 15000        | Hand weeding, mulching            | -                | 50000       | Non-availability of suitable markets, low price of the produce, pest and disease incidences, labour shortage and high wage, damage due to wild boar and other wild animals. |
| Udaipur            | Bhilwara          | 30 lit/ha neem leaf extract, 30 liter/ha cow urine & 50 lit/ha fermented buttermilk | 2000         | 70 kg/ha neem leaf paste, 60liter/ha cow urine, 50 lit/ha fermented buttermilk                                                                     | 3000         | Hand weeding, hand hoeing         | 7000             | 4000        | Low yield of crops<br>Marketing problem<br>Poor technical knowledge<br>Timely availability of inputs<br>Lack of premium price<br>Nutrient deficiency and disease problem    |

## 7.1.2: Documentation and validation of organic ITKs

### Objective

- To document popular ITKs in Organic Farming
- To test the documented ITKs

**Year of start:** 2015-16

**Locations:** (5) Ajmer and Udaipur (Rajasthan), Coimbatore (Tamil Nadu), Gangtok (Sikkim), Narendrapur (West Bengal).

### Results:

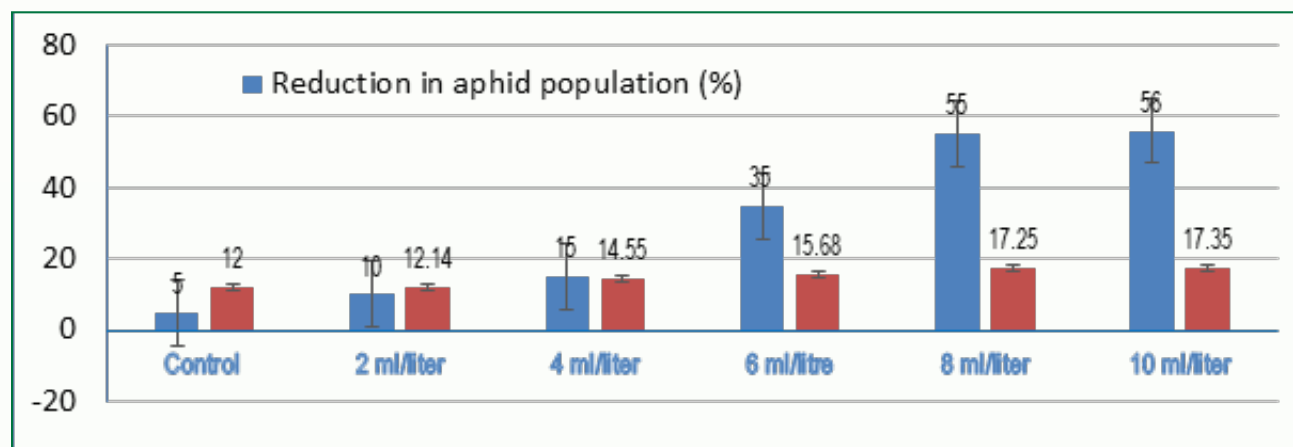
Centre-wise results for each centre are presented below.

#### Ajmer

- ITKs: Bio-pesticide (Katyasani, Merta, rajsthan): Management of sucking pest in fenugreek

Content:

- 20 liters desi cow urine
- 5 kg Aak leaves, 5 kg Datura leaves
- 5 kg neem leaves or 1.5 kg neem kernals
- 2 kg desi cow butter milk
- Some pieces of copper metal



#### Udaipur

**Effect of different concentration of Agniastra on insect management in cabbage:** The experiment was undertaken for validation of organic ITK Agniastra with the objectives to study the effect of various doses of agniastra on growth, yield, economics and insect management in cabbage.

Name of ITKs: Agniastra

Treatment details

A. Rate of Agniastra (Foliar application)

1. Control
2. Agniastra@2.5%
3. Agniastra@5%
4. Agniastra@7.5%



5. Agniastra@10%
6. Agniastra@12.5%

#### Agniastra preparation:

**Inputs required:** 20 litre cow urine, 2 kg pulp of neem leaves, 500 gm tobacco powder, 500 gm green chilli, 250 gm garlic paste and 200 gm turmeric powder

#### Input preparation:

Step 1: Add 20 litre cow urine to a container. Then add 2 kg neem leaves paste, 500 gm tobacco powder, 500 gm green chilli paste, 250 gm garlic paste and 250 gm turmeric powder.

Step 2: Stir the solution and boiled it.

Step 3: After boiling, keep it under shade, cooling up to 48 hours. Stir the components twice a day.

Step 4: After 48 hours, filter with a cloth and store it. It can be stored for 3 months.

#### Result:

Indigenous ITK Agniastra evaluated for their efficacy on growth and yield of cabbage through foliar application of different concentration. Yield progressively increased with higher concentrations of Agniastra. The highest plant height, head diameter, yield, net return of cabbage was obtained with Agniastra @ 12.5% (5100 kg/ha), indicating a positive correlation between Agniastra concentration and yield improvement. Application of 10 % Agniastra being the next performing treatment which resulted 5030 kg/ha of yield.

All Agniastra treatments reduced pest incidence, with effectiveness increasing alongside concentration: Effect of different concentration of agniastra showed that highest reduction% at the highest dose (12.5%), were most significant for diamond black moth, Spodoptera litura and Aphids on cabbage followed by 10% (Table 7.1.2.1).

**Table 7.1.2.1: Effect of different concentration of Agniastra on yield & insect management in cabbage**

| Treatments        | Growth and yield  |                    |                    | Mean Reduction (%) |                   |        | Economics                   |                    |
|-------------------|-------------------|--------------------|--------------------|--------------------|-------------------|--------|-----------------------------|--------------------|
|                   | Plant height (cm) | Head diameter (cm) | Head yield (kg/ha) | Diamond Backmoth   | Spodoptera litura | Aphids | Cost of cultivation (Rs/ha) | Net return (Rs/ha) |
| Control           | 28.00             | 15.50              | 3875               | -                  | -                 | -      | 41000                       | 75250              |
| Agniastra @ 2.5%  | 31.00             | 16.80              | 4365               | 30.54              | 23.49             | 29.92  | 41500                       | 89450              |
| Agniastra @ 5%    | 33.50             | 17.20              | 4500               | 34.61              | 31.38             | 34.41  | 42000                       | 93000              |
| Agniastra @ 7.5%  | 35.50             | 18.00              | 4775               | 41.32              | 37.84             | 40.49  | 42500                       | 100750             |
| Agniastra @ 10%   | 37.50             | 18.25              | 5030               | 47.25              | 42.81             | 45.48  | 43000                       | 107900             |
| Agniastra @ 12.5% | 38.00             | 18.70              | 5100               | 50.20              | 50.47             | 52.92  | 43500                       | 109500             |
| CD (p=0.05)       | 2.64              | 1.36               | 360.5              | -                  | -                 | -      | -                           | -                  |



Effect of different concentration of Agniastra on insect management in cabbage

## Coimbatore

Name of the ITKs identified for validation

- 3G extract (Ginger, Garlic and Green chilli)
- Lantana - Calotropis extract
- Cow dung -Cow urine extract

Among the different ITKs evaluated in cotton, okra and maize, 3G extract (Ginger, Garlic and Green chilli) @ 5% was recorded most effective against sucking pests infesting viz., leafhoppers, thrips whiteflies and aphids in cotton & okra crop resulted in recorded higher yield of 1514 and 11764 kg/ha respectively. In maize crop, 3G extract @ 5% was also performed better in term of reduction in incidence over control (52.62%) for fall armyworm and recorded highest yield of 5123 kg/ha. (Table 7.1.2.2).

**Table 7.1.2.2: Performance of 3G extract on sucking pests in cotton, okra and maize crop at Coimbatore**

| Name of the Crop | Insect pest   | Best performing treatment                     | Reduction in incidence compared to control (%) | Yield (kg/ha) |
|------------------|---------------|-----------------------------------------------|------------------------------------------------|---------------|
| Cotton           | Leafhoppers   | Ginger, garlic and green chilli extract @ 5 % | 46.22                                          | 1514          |
|                  | Thrips        |                                               | 40.36                                          |               |
|                  | Whiteflies    |                                               | 49.12                                          |               |
|                  | Aphids        |                                               | 64.21                                          |               |
| Okra             | Leafhoppers   | Ginger, garlic and green chilli extract @ 5 % | 44.82                                          | 11764         |
|                  | Whiteflies    |                                               | 46.54                                          |               |
|                  | Aphids        |                                               | 53.77                                          |               |
| Maize            | Fall armyworm | Ginger, garlic and green chilli extract @ 5 % | 52.62                                          | 5123          |

## Gangtok

ITK 1: Application of wood ash, lime and table salt:

- For the storage of cereals and pulses, wood ash is applied as a protective agent.
- Ash is mixed thoroughly @ 20 g kg<sup>-1</sup> seeds for the storage of maize, rice bean, green gram, pahenlo dal and okra seeds meant for seed purposes.
- In Sikkim, wood ash is widely used by farmers to manage key vegetable pests such as ants, cutworms, and white grubs.
- Application of ash and salt is done at a distance of 10 to 15 cm from the plant's root area.
- Table salt, lime and wood ash also used for the management of leech.
- Farmers also frequently paint lime on the trunks of mandarin plants infested with gummosis (*Phytophthora* spp.), trunk borer, and bark-eating caterpillar.

ITK 2: Use of kerosene:

- In Mandarin, kerosene is used to control trunk and stem borer infestations.
- After applying kerosene, mud or cow dung is used to seal the hole created by the trunk and stem borer.
- In the Dzongu region of North Sikkim, some farmers also store pulses for sowing in kerosene.

ITK 3: Cow urine and cow dung extract:

- ginger, Sikkim mandarin, and various vegetables, cow urine and cow dung extracts are used in both for enriching nutrients and for protecting against pests and diseases.
- To protect against trunk borers and bark-eating caterpillars, cow dung mixed with mud is coated on the tree's trunk.



- Due to its ability to repel, cow urine is effective in managing fruit borers and the leaf beetle (*Epilachna vigintioctopunctata*).
- Earhead bugs, BPH, leaf folders, stem borers, and caterpillars were effectively controlled with a 2% cow dung extract concentration.
- Farmers employ bamboo structures, plastered with cow dung and clay (bhakari), to store grains and large cardamom.

#### ITK 4: Insertion of bamboo peg:

- For controlling the trunk borer (*Anoplophora versteegi*), farmers insert bamboo pegs into the tree trunks.

#### ITK 5: Mulching:

- After planting ginger, beds are mulched with an 8–10 cm layer of forest litter, along with titeypati (*Artemisia vulgaris*), chilouney (*Schima wallichii*), and banmara (*Chromolaena odorata*).
- In addition to suppressing weeds, mulching safeguards ginger plants against pests and diseases and promotes better germination (Rahman et al. 2009).
- It also helps prevent soil erosion on slopes. Kumar et al. (2012) reported that mulching with chilouney (*Schima wallichii*) effectively controlled soft rot and bacterial wilt in ginger grown in Sikkim

**Table 7.1.2.4: Botanical based pest and disease management practices in Sikkim**

| Name of the plant                                                                                                                                                                                  | Disease or pest controlled in crops                                                                                                                                                                       | Local practices                                                                                                                                                                                                                                                                                                                                                                                                                              |
|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Banmara ( <i>Chromolaena odorata</i> )                                                                                                                                                             | Ginger soft rot, bacterial wilt and fusarium dry rot.                                                                                                                                                     | used for cut wounds to stop bleeding                                                                                                                                                                                                                                                                                                                                                                                                         |
| Titeypati ( <i>Artemisia vulgaris</i> )                                                                                                                                                            | i. To prevent bird damage and disease in ragi, the nursery bed is covered as a protective measure.<br>ii. It is used as mulching material to manage soft rot, bacterial wilt, Fusarium dry rot in Ginger. | i. It exhibits insecticidal, antibacterial, and antifungal activities.<br>ii. Mulching would increase germination reduce weed growth and soft rot in ginger                                                                                                                                                                                                                                                                                  |
| Chilouney ( <i>Schima wallichii</i> )                                                                                                                                                              | In Ginger it is used as mulching material to manage soft rot, bacterial wilt, and Fusarium dry rot.                                                                                                       | effective in the management of soft rot in ginger                                                                                                                                                                                                                                                                                                                                                                                            |
| Turmeric ( <i>Curcuma longa</i> )                                                                                                                                                                  | Management of ant                                                                                                                                                                                         | A measured quantity of turmeric powder is blended with water and poured around the base of ant-infested plants as a soil drench.                                                                                                                                                                                                                                                                                                             |
| Bokey Timbur ( <i>Zanthoxylum allatum</i> )                                                                                                                                                        | Used against leech and other insect pests                                                                                                                                                                 | -                                                                                                                                                                                                                                                                                                                                                                                                                                            |
| Fermented plant extract of titeypati ( <i>Artemisia vulgaris</i> ), angeri ( <i>Lyonia ovalifolia</i> ), ban mara ( <i>Chromolaena odorata</i> ), piro unew ( <i>Christella acuminata</i> ) (fern) | A combination of fermented plant extract is used in Sikkim Mandarin to control ants, aphids, bark-eating caterpillar and trunk borer.                                                                     | i. The plants undergo a 21-day fermentation period after being crushed with water.<br>ii. Following 21 days, the fermented plant extract concoction is applied to the soil in Sikkim Mandarin to protect it from ants, bark-eating caterpillars, and trunk borer infestations.<br>iii. Due to its foul odour, the fermented plant extract serves as both a repellent and an anti-feedant, making it effective against multiple insect pests. |

### 7.1.3: Bio-chemical characterization & molecular identification of microbial population of different Organic and Natural Farming inputs

#### Objective

- To characterize the indigenous organic input preparations
- To identify the microbes and other parameters of indigenous manure

**Year of start:** 2015-16, initially it was start at Narendrapur later on from 2020-21, 4 more centres were included for characterization of inputs.

**Location:** (5) Narendrapur (West Bengal), Calicut (Kerala), Coimbatore (Tamil Nadu), Ludhiana (Punjab), and Udaipur (Rajasthan).

#### Centre wise results are presented below

#### Narendrapur

- Physico-chemical, biochemical, and microbial characterization of Brahmastra and Agniastra preparations made using dairy excreta from native and crossbred animals at Narendrapur. In the case of Brahmastra, formulations using native breed excreta showed higher pH, EC (18.07 vs 9.16 ms/cm), and better concentrations of organic carbon (0.67% vs 0.48%), total soluble proteins, alkaloids, and free fatty acids compared to those from crossbred excreta. Notably, microbial populations like total bacteria ( $0.18 \times 10^{11}$  vs  $0.01 \times 10^{11}$  CFU/ml), fungi, and potassium-solubilizing bacteria were significantly higher in the native breed-based formulation, indicating more active microbial properties. However, crossbreed formulations had higher values of available phosphorus, total carbohydrates, phenolics, and gibberellins (Table 7.1.3.1).
- In contrast, Agniastra prepared from native breed excreta also exhibited superior electrical conductivity (28.40 vs 12.24 ms/cm), organic carbon (0.92% vs 0.55%), soluble protein, free fatty acids, and water-soluble extracts. The native breed formulation displayed a significantly higher total bacterial count ( $53 \times 10^{11}$  vs  $16.63 \times 10^{11}$  CFU/ml) and *Pseudomonas* ( $179 \times 10^8$  vs  $0.92 \times 10^8$  CFU/ml), indicating enhanced bioactivity. However, total actinomycetes and gibberellin content were considerably greater in the crossbreed-based Agniastra. Interestingly, the growth index (GI) and moisture content were higher in crossbred variants for both Brahmastra and Agniastra. Overall, formulations from native breed excreta generally showed richer microbial and biochemical profiles, suggesting a more potent bio-input potential (Table 7.1.3.2).

**Table 7.1.3.1: Physico-chemical, bio-chemical and microbial characterization of Brahmastra at Narendrapur**

| Parameters            | Unit  | Prepared from dairy excreta native breeds | Prepared from dairy excreta cross breeds |
|-----------------------|-------|-------------------------------------------|------------------------------------------|
|                       |       | Value                                     | Value                                    |
| pH                    |       | 5.37±0.006                                | 4.82±0.006                               |
| EC                    | ms/cm | 18.07±0.235                               | 9.16±0.099                               |
| Organic C             | %     | 0.67±0.078                                | 0.48±0.041                               |
| Total soluble Protein | ppm   | 17.98±1.034                               | 12.97±0.084                              |
| Total Carbohydrate    | ppm   | 16.23±1.33                                | 28.57±1.575                              |
| Available Nitrogen    | %     | 0.07±0.001                                | 0.02±0.001                               |
| Available Phosphorus  | %     | 0.03±0.000                                | 0.12±0.001                               |



| Parameters                                               | Unit      | Prepared from dairy excreta native breeds | Prepared from dairy excreta cross breeds |
|----------------------------------------------------------|-----------|-------------------------------------------|------------------------------------------|
|                                                          |           | Value                                     | Value                                    |
| Available Potassium                                      | %         | 0.42±0.004                                | 0.15±0.003                               |
| Total Phenolics                                          | ppm       | 1351.12±33.104                            | 2781.33±9.813                            |
| Total Flavonoids                                         | ppm       | 73.33±10.434                              | 175.20±2.310                             |
| Total Tannins                                            | ppm       | 32348.15±733.595                          | 26466.67±622.751                         |
| Total Alkaloids                                          | ppm       | 253.88±7.957                              | 128.58±10.985                            |
| Total Indole                                             | ppm       | 242.58±11.773                             | 272.42±1.294                             |
| Total gibberellins                                       | ppm       | 8066.67±276.727                           | 8720.00±394.631                          |
| Free Fatty acid                                          | mg KOH/ml | 5.62±0.079                                | 2.36±0.120                               |
| Water soluble extract                                    | %         | 38.53±1.325                               | 29.28±1.019                              |
| Ethanol soluble extract                                  | %         | 13.52±0.482                               | 11.23±0.096                              |
| Total dissolved solids                                   | (g per l) | 29.63±3.676                               | 42.58±2.131                              |
| Total ash                                                | %         | 24.76±0.0646                              | 23.21±0.115                              |
| Moisture content                                         | %         | 96.24±0.046                               | 97.52±0.251                              |
| GI                                                       | %         | 82.12±10.164                              | 111.82±7.124                             |
| Total Bacteria (10 <sup>11</sup> )                       | CFU/ml    | 0.18±0.000                                | 0.01±0.000                               |
| Total Fungi (10 <sup>2</sup> )                           | CFU/ml    | 243.67±9.620                              | 1.83±0.610                               |
| Total Actinomycetes (10 <sup>7</sup> )                   | CFU/ml    | 3.71±0.080                                | 44.33±5.610                              |
| Total Free living nitrogen fixer(10 <sup>6</sup> )       | CFU/ml    | 0.077±0.010                               | 104±12.660                               |
| Total Phosphate solublizing bacteria(10 <sup>6</sup> )   | CFU/ml    | 22.3±1.880                                | 193.67±25.210                            |
| Total Potassium solubilising bacteria (10 <sup>6</sup> ) | CFU/ml    | 230.67±13.550                             | 48±10.160                                |
| Total Rhizobium (10 <sup>7</sup> )                       | CFU/ml    | 0.01±0.000                                | 8.33±1.760                               |
| Total Pseudomonas (10 <sup>8</sup> )                     | CFU/ml    | 2.45±0.150                                | 5.83±1.210                               |
| Ampicillin resistant bacteria (10 <sup>5</sup> )         | CFU/ml    | 0.33±0.020                                | 23.33±13.860                             |
| Tetracycline resistant bacteria (10 <sup>5</sup> )       | CFU/ml    | 2.33±0.180                                | 68.33±6.640                              |

**Table 7.1.3.2: Physico-chemical, bio-chemical and microbial characterization of Agniastra at Narendrapur**

| Parameters            | Unit  | Prepared from native breeds dairy excreta | Prepared from cross breeds dairy excreta |
|-----------------------|-------|-------------------------------------------|------------------------------------------|
|                       |       | Value                                     | Value                                    |
| pH                    |       | 4.64±0.000                                | 4.89±0.000                               |
| EC                    | ms/cm | 28.40±0.086                               | 12.24±0.152                              |
| Organic C             | %     | 0.92±0.03                                 | 0.55±0.034                               |
| Total soluble Protein | ppm   | 21.42±2.377                               | 9.44±0.000                               |

| Parameters                                               | Unit      | Prepared from native breeds dairy excreta | Prepared from cross breeds dairy excreta |
|----------------------------------------------------------|-----------|-------------------------------------------|------------------------------------------|
|                                                          |           | Value                                     | Value                                    |
| Total Carbohydrate                                       | ppm       | 0.74±0.036                                | 0.26±0.016                               |
| Available Nitrogen                                       | %         | 0.0518±0.001                              | 0.03±0.001                               |
| Available Phosphorus                                     | %         | 0.03±0.001                                | 0.14±0.002                               |
| Available Potassium                                      | %         | 0.43±0.004                                | 0.23±0.000                               |
| Total Phenolics                                          | ppm       | 1196.00±77.577                            | 1810.00±17.328                           |
| Total Flavonoids                                         | ppm       | 508.80±13.647                             | 163.77±27.152                            |
| Total Tannins                                            | ppm       | 15659.56±354.20                           | 16086.22±365.743                         |
| Total Alkaloids                                          | ppm       | 2.39±0.398                                | 4.16±0.131                               |
| Total Indole                                             | ppm       | 50.92±1.355                               | 64.17±2.854                              |
| Total gibberellins                                       | ppm       | 8393.33±144.376                           | 9353.33±387.528                          |
| Free Fatty acid                                          | mg KOH/ml | 6.402±0.079                               | 3.44±0.060                               |
| Water soluble extract                                    | %         | 48.13±1.356                               | 31.01±1.258                              |
| Ethanol soluble extract                                  | %         | 13.55±0.903                               | 14.77±0.974                              |
| Total dissolved solids                                   | (g per l) | 28.58±3.162                               | 19.26±0.325                              |
| Total ash                                                | %         | 21.91±0.030                               | 22.95±0.020                              |
| Moisture content                                         | %         | 96.60±0.697                               | 98.05±0.993                              |
| GI                                                       | %         | 55.22±4.027                               | 79.07±1.402                              |
| Total Bacteria (10 <sup>11</sup> )                       | CFU/ml    | 53±20.750                                 | 16.63±3.290                              |
| Total Fungi (10 <sup>2</sup> )                           | CFU/ml    | 13.27±0.580                               | 0.00±0.000                               |
| Total Actinomycetes (10 <sup>7</sup> )                   | CFU/ml    | 1.04±0.300                                | 223.67±8.010                             |
| Total Free living nitrogen fixer(10 <sup>6</sup> )       | CFU/ml    | 0.03±0.000                                | 2.63±0.300                               |
| Total Phosphate solubilizing bacteria(10 <sup>6</sup> )  | CFU/ml    | 1.14±0.370                                | 1.43±0.630                               |
| Total Potassium solubilising bacteria (10 <sup>6</sup> ) | CFU/ml    | 0.96±0.280                                | 0.1±0.020                                |
| Total Rhizobium (10 <sup>7</sup> )                       | CFU/ml    | 0.31±0.090                                | 0.31±0.030                               |
| Total Pseudomonas (10 <sup>8</sup> )                     | CFU/ml    | 179±26.290                                | 0.92±0.360                               |
| Ampicillin resistant bacteria (10 <sup>5</sup> )         | CFU/ml    | 2.03±0.300                                | 0.31±0.020                               |
| Tetracycline resistant bacteria (10 <sup>5</sup> )       | CFU/ml    | 3.23±0.310                                | 6.87±1.180                               |

### Coimbatore

Natural Farming inputs characterized: Neemastra and brahmastra

- Natural farming input such as Neemastra and brahmastra prepared using the cow dung and cow urine collected from native breed (Kangayam), cross-bred (Holstein Friesian) and from both native and cross breed. Microbial population of bacteria, fungi and actinomycetes, recorded higher with native breed (Kangayam) followed by native+ HF among the NF input.



- Organic carbon content was recorded to be the maximum of 2.87% in Neemastra 3, prepared using the cow dung and cow urine of both native and cross breed, as against the lowest organic carbon content of 0.59% in Neemastra 1 prepared from cow dung and cow urine of native breed (Kangeyam). Similar trend was recorded with respect to Brahmastra also with the highest organic carbon content of 0.52% in Brahmastra 3 as against the lowest content of 0.27% in Brahmastra 1.
- Regarding N content, the maximum of 0.025% and 0.093% N was recorded in Neemastra 2 and Brahmastra 3, respectively. P content was recorded to be the maximum of 0.31% in Neemastra 3 and 0.34% in Brahmastra 1. K content was recorded to be the maximum 0.13% in Neemastra 2 and 0.87% in Brahmastra 1.

**Table 7.1.3.3: Microbial population in natural farming inputs prepared from cow dung and cow urine of native bred, cross breed and native+HF cow**

| Microorganisms           | Neemastra (48 HAP)        |                                     |            | Brahmastra (48 HAP)       |                                     |            |
|--------------------------|---------------------------|-------------------------------------|------------|---------------------------|-------------------------------------|------------|
|                          | Native bred cow (Kangeym) | Cross breed cow (Holstein Friesian) | Native +HF | Native bred cow (Kangeym) | Cross breed cow (Holstein Friesian) | Native +HF |
| Bacteria ( $10^7$ )      | 24.0                      | 18.0                                | 21.0       | 6.0                       | 3.0                                 | 4.5        |
| Fungi ( $10^3$ )         | 11.5                      | 5.0                                 | 8.5        | -                         | -                                   | -          |
| Actinomycetes ( $10^2$ ) | 3.0                       | 1.0                                 | 1.5        | -                         | -                                   | -          |

HAP - Hours after preparation

**Table 7.1.3.4: Nutrient content in different natural farming inputs**

| Name of the input  | Organic carbon (%) | N (%) | P (%) | K (%) |
|--------------------|--------------------|-------|-------|-------|
| Neemastra 1 (NB)   | 0.59               | 0.016 | 0.20  | 0.07  |
| Neemastra 2 (CB)   | 1.77               | 0.025 | 0.25  | 0.13  |
| Neemastra 3 (Mix)  | 2.87               | 0.022 | 0.31  | 0.09  |
| Brahmastra 1 (NB)  | 0.27               | 0.070 | 0.34  | 0.87  |
| Brahmastra 2 (CB)  | 0.37               | 0.065 | 0.25  | 0.79  |
| Brahmastra 3 (Mix) | 0.52               | 0.093 | 0.27  | 0.77  |

NB - Native breed; CB - Cross breed; Mix - Mix of NB and CB

### Metagenomic analysis of microbial diversity in different formulations of Neemastra.

#### a. Heatmap

The heatmap shows the abundance of the micro-organisms in various samples and groups. Based on the color scale provided color “yellow” indicates high abundance and “blue” indicates low abundance. There are two heatmaps provided at the taxonomic levels Phylum and Genus.

At Phylum level, we can see that the phyla Firmicutes, Bacteroidetes, Proteobacteria etc have fair amount of abundance in all the samples. Cyanobacteria is highly abundant in N3 sample whereas very low in all N1 and N2. The phyla Verrucomicrobia, Kiritimatiellaeota and Epsilonbacteraeota is low in abundance in all samples.

At Genus level, the abundant genera are Bacteroides, Streptococcus etc. The sample N1 has very low abundance of Bilophila, Desulfovibrio, Aerococcus, Stenotrophomonas etc compared to other two. The genera Anaerosinusa and Pseudomonas are very low only in N3 sample. The genus Aeromonas is high in N1 compared to other two.

#### b. Relative Abundance Plot

The relative abundance plot depicts the abundance of microorganisms in relation to other samples. We have given the results in the form a bar plot. Each Phylum/Genus is given a specific color and the size/area of that color indicates it's abundance.

The X axis shows sample names and the Y axis depicts abundance in percentage. The plot depicts the abundance of phylas and genera after excluding the OTUs that have NA.

At phylum level, N3 sample has significant presence of Cyanobacteria and Firmicutes whereas Proteobacteria and Bacteroidetes are predominant in N1 and N2. The Epsilonbacteraeota and Verrucomicrobia also have presence in the samples.

The N1 sample composition is majorly made of Akkermansia, Bacteroides and Comamonas. Bacteroides has high abundance in sample N2 comparatively.

### c. Krona chart

The Krona chart is an interactive visualization tool for exploring the composition of metagenomes. The Krona features a red-green color gradient signifying average e-values within each taxon, with red being the highest observed e-value (least significant) and green being the lowest (most significant). The plot shows all taxonomic levels starting from super kingdom to family level and the associated abundances based on the number of identified spectra. It allows hierarchical data to be explored with zooming, multi-layered pie charts. The percentage of abundance of each microorganism is displayed and the value in one sample can be compared to other samples by selecting desired ones.

### d. Bar plot

The bar plot also gives the richness of the microorganisms in various samples. At phylum level, N3 sample has significant presence of Cyanobacteria and Firmicutes whereas Proteobacteria and Bacteroidetes is predominant in N1 and N2.

The sample N1 has high abundance of Aeromonas compared to others. The genera Anaerostipes and Pseudomonas are very low only in N3 sample.

### e. Alpha Diversity Box plot

Alpha-diversity is the richness of an average sample. Alpha diversity metrics summarize the structure of an ecological community with respect to its richness (number of taxonomic groups), evenness (distribution of abundances of the groups), or both. Here the Shannon index is given along with observed OTUs to give richness of the community in different groups. Shannon's diversity index quantifies the uncertainty in predicting the species identity of an individual that is taken at random from the dataset. Alpha diversity just counts up the number of different taxa observed in a sample at a given taxonomic level, usually species. The microbiome diversity of the neemastira sample is given with a Shannon index between 3.4 and 3.6.

### f. Rarefaction curves

A rarefaction curve can be used to determine whether a sample has been sequenced to an extent sufficient to represent its true diversity. The overall diversity of a metagenome can be viewed as the combination of the number of types of sequences present and the relative abundance of these sequences. The OTU identified and number of sequences per sample is given for each sample.

Rarefaction curves generally grow rapidly at first, as the most common species are found, but the curves plateau as only the rarest species remain to be sampled. Here, in the plot we could see that the samples have got a plateau curve indicating the OTUs are adequately identified for the number of raw reads obtained. The sample N1 is having the lowest number of OTUs and N3 is having the highest number.

### g. PCA Plot

The PCA plot shows clusters of samples based on their similarity. PC1 reveals the most variation, while PC2 reveals the second most variation. The position of data points in the PCA plot provides insights into the data's structure and relationships. Clusters or patterns in the plot can indicate groupings or similarities among data points. Here the highest variance between samples is 70.16 %.

### h. Beta diversity plot

Beta diversity is species diversity b/w two adjacent ecosystems and is obtained by comparing the number of species unique to each ecosystem. It measures the distance or dissimilarity between each sample pair. The analysis compares distances of samples within the same group to distances of samples from different groups. The plot shows whether the samples are having similar microbial composition and whether they have been grouped together based on condition. The bray curtis index values varies between 0 and 1, where 0 means the two samples have the same composition (that is they share all the species), and 1 means the two samples do not share any species. Here 0 is given the color red and 1 is given the color blue.

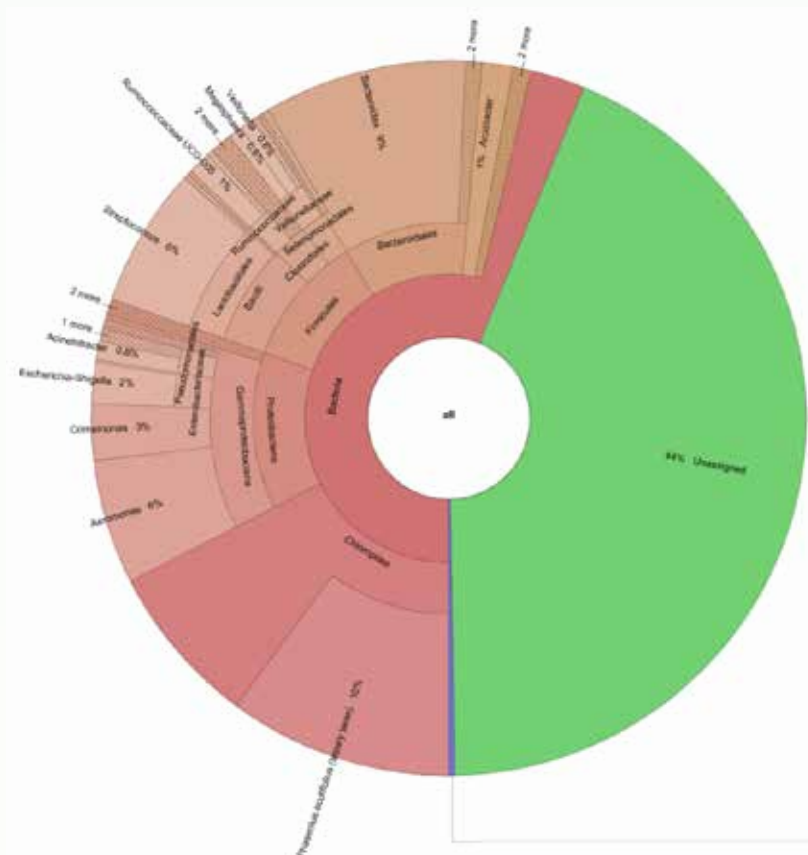
### i. Phylogenetic Tree

A phylogenetic tree is a branching diagram or a tree showing the evolutionary relationships among various biological species. Here the entire community identified in the whole samples is depicted to show their taxonomic levels upto genus. Each phylum is assigned different colored circles and the OTU belonging to the same phyla are given similar color.

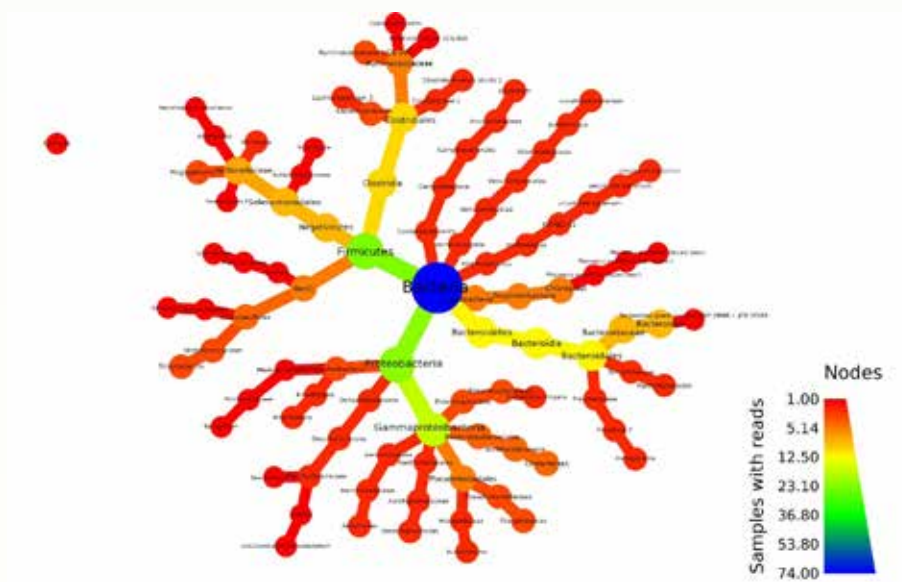


### j. Heat Tree Heat

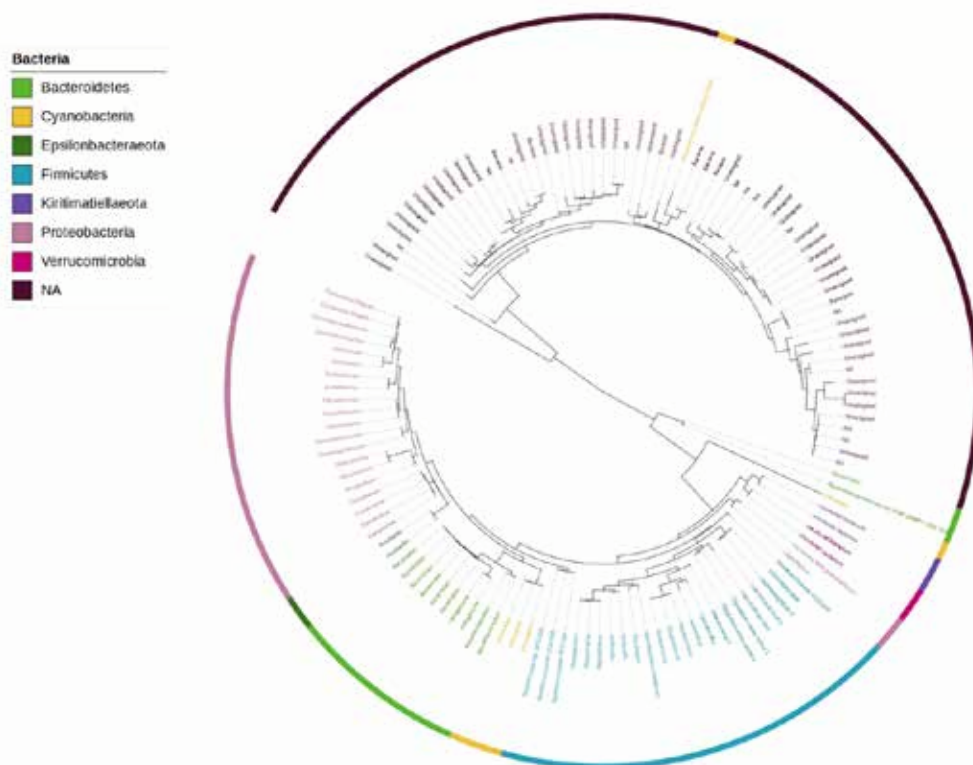
Tree is a powerful method which allows users to visually compare abundance between two groups at different taxonomic levels. It uses hierarchical structure of taxonomic classifications to quantitatively (based on median abundance) depict taxon differences among communities. Each taxonomic level is given a different color and the size of the nodes indicate the abundance of the particular level. It can be derived that the phyla Firmicutes, Proteobacteria etc. are quite abundant.



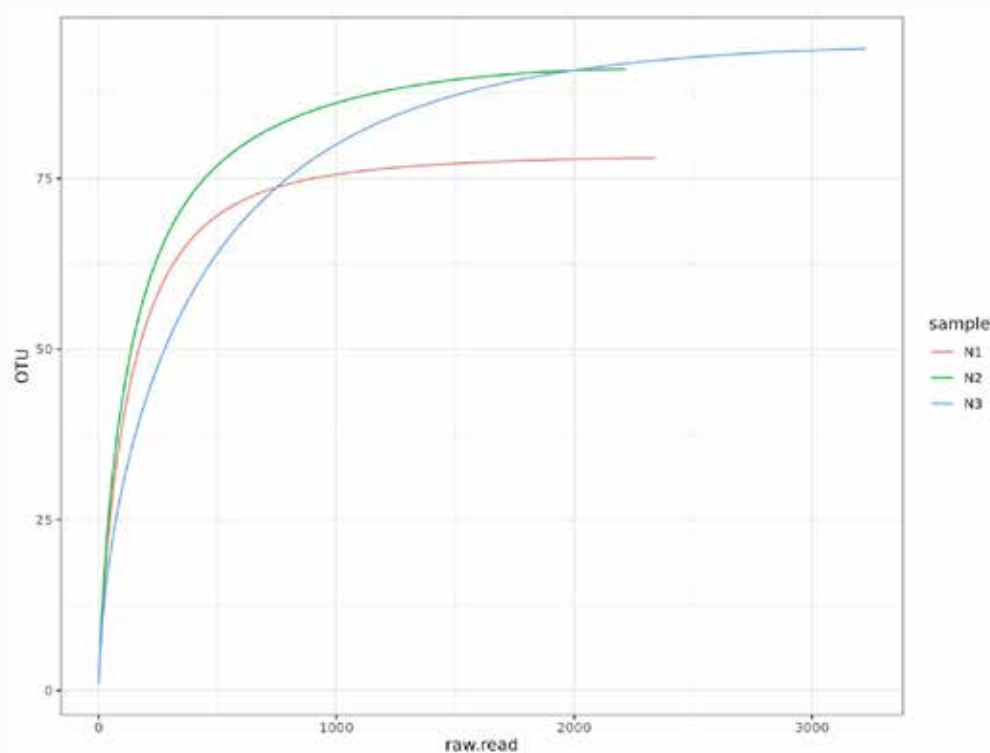
Krona plot of Neemastra



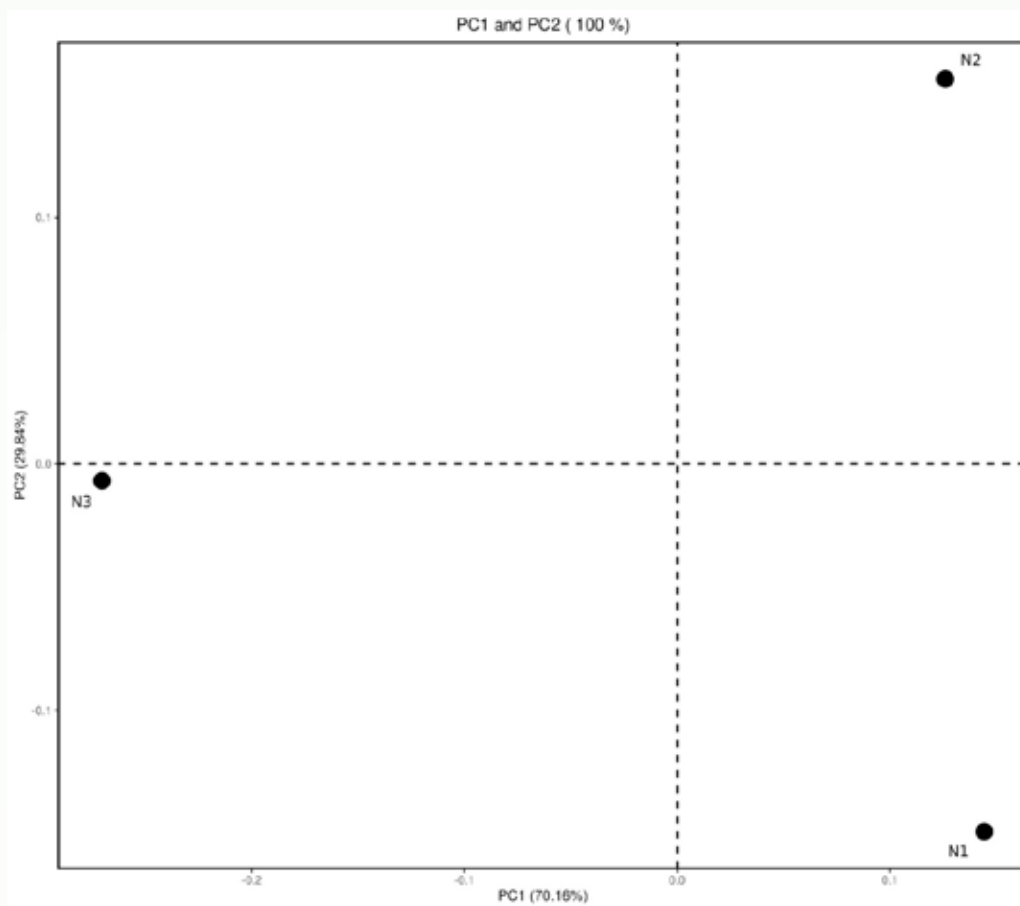
Heat Tree of Neemastra



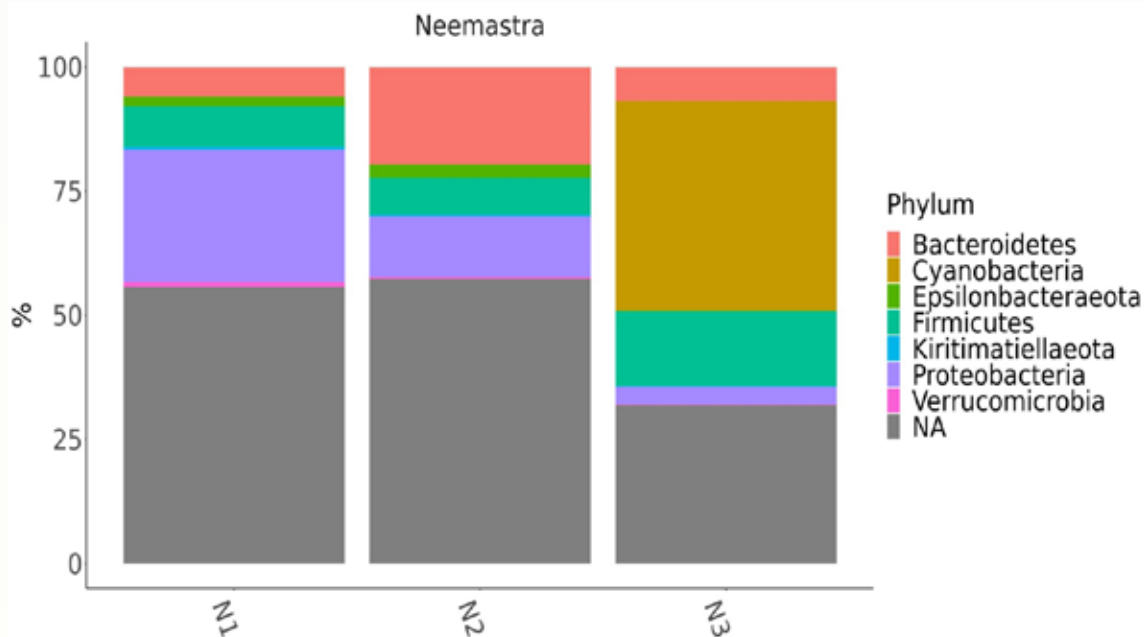
Phylogenetic Tree of Neemastra



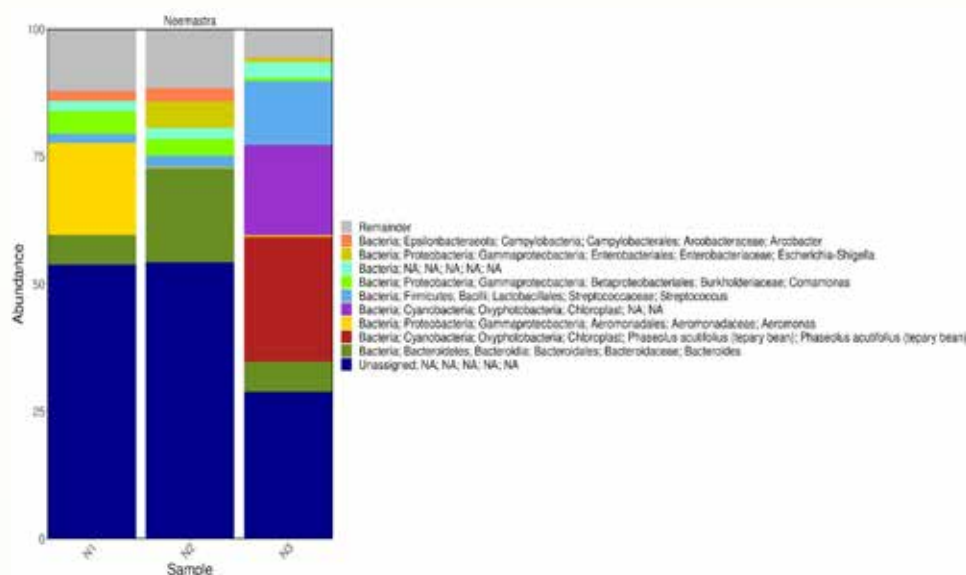
Rarefaction Curves of Neemastra



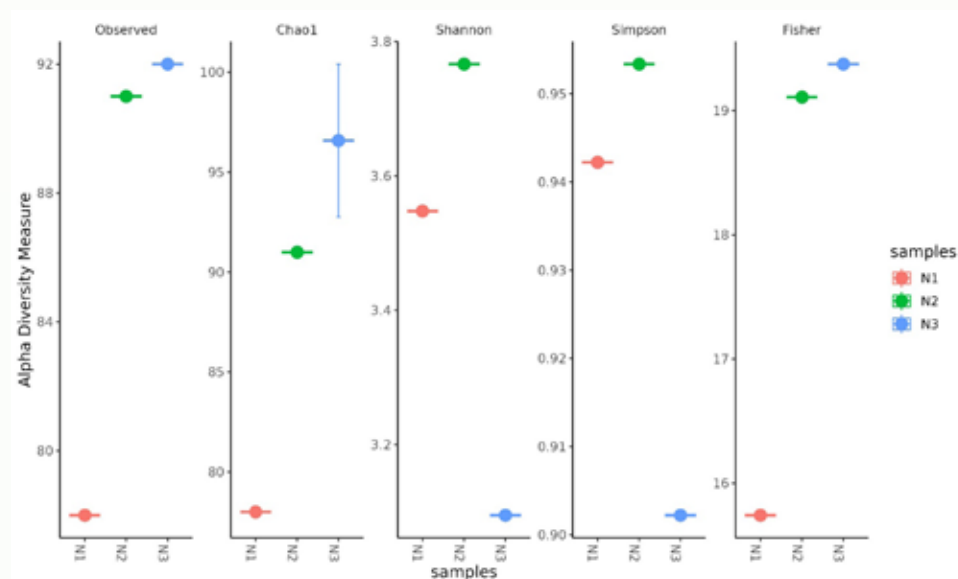
Principal component analysis (PCA) plot of Neemastra



Relative Abundance Plot – Phylum of Neemastra



Relative Abundance Bar Plot - Genus level of Neemastra



Alpha diversity analysis of Neemastra

## Metagenomic analysis of microbial diversity in different formulations of Brahmastra

### a. Heatmap

The heatmap shows the abundance of the microorganisms in various samples and groups. Based on the color scale provided color “yellow” indicates high abundance and “blue” indicates low abundance. There are two heatmaps provided at the taxonomic levels Phylum and Genus.

At Phylum level, the phyla Firmicutes is quite abundant in all the samples. The phyla Bacteroidetes is abundant in B1 sample whereas very low in other two samples. In B3 sample, the phyla Cyanobacteria is having high abundance compared to others.

At Genus level, the genera Lysinibacillus is abundant in all three samples comparatively. Bacteroides shows low abundance



in B2 and B3 samples. The genera Comamonas, Enterobacter, Escherichia-Shigella, Bacillus etc. are quite abundant in B1 but is having low abundance in B2 and B3 samples.

#### **b. Relative Abundance Plot**

The relative abundance plot depicts the abundance of microorganisms in relation to other samples. We have given the results in the form a bar plot. Each Phylum/Genus is given a specific color and the size/area of that color indicates its abundance. The X axis shows sample names and the Y axis depicts abundance in percentage. The plot depicts the abundance of phylas and genera after excluding the OTUs that have NA.

At phylum level, B1 sample is showing a difference in microbial composition comparatively. Other two samples have high presence of Firmicutes whereas the B1 sample has Proteobacteria and Bacteroidetes in significant amount.

The genera Bacillus is very low in abundance in B2 sample compared other two. The samples B2 and B3 have high abundance of Lysinibacillus whereas B1 sample does not have significant abundance of the same. The genera Comamonas, Enterobacter, Escherichia-Shigella, Bacillus etc. are quite abundant in B1 sample.

#### **c. Krona chart**

The Krona chart is an interactive visualization tool for exploring the composition of metagenomes. The Krona features a red-green color gradient signifying average e-values within each taxon, with red being the highest observed e-value (least significant) and green being the lowest (most significant). The plot shows all taxonomic levels starting from superkingdom to family level and the associated abundances based on the number of identified spectra. It allows allows hierarchical data to be explored with zooming, multi-layered pie charts. The percentage of abundance of each microorganism is displayed and the value in one sample can be compared to other samples by selecting desired ones.

#### **d. Bar plot**

The bar plot also gives the richness of the microorganisms in various samples. At phylum level, the phyla Firmicutes is abundant in B2 and B3 sample. There is no presence of Bacteroidetes in these two samples. At genus level, the genera Solibacillus is significantly abundant in B2 and B3 samples. There is presence of a genus belonging to Enterobacteriaceae, Bacteroides, Comamonas etc. in sample B1.

#### **e. Alpha Diversity**

Box plot Alpha-diversity is the richness of an average sample. Alpha diversity metrics summarize the structure of an ecological community with respect to its richness (number of taxonomic groups), evenness (distribution of abundances of the groups), or both. Here the Shannon index is given along with observed OTUs to give richness of the community in different groups. Shannon's diversity index quantifies the uncertainty in predicting the species identity of an individual that is taken at random from the dataset. Alpha diversity just counts up the number of different taxa observed in a sample at a given taxonomic level, usually species. The microbiome diversity of the Brahmastra sample is given with a Shannon index of >2.75.

#### **f. Rarefaction curves**

A rarefaction curve can be used to determine whether a sample has been sequenced to an extent sufficient to represent its true diversity. The overall diversity of a metagenome can be viewed as the combination of the number of types of sequences present and the relative abundance of these sequences. The OTU identified and number of sequences per sample is given for each sample.

Rarefaction curves generally grow rapidly at first, as the most common species are found, but the curves plateau as only the rarest species remain to be sampled. Here, in the plot we could see that the samples have got a plateau curve indicating the OTUs are adequately identified for the number of raw reads obtained. The sample B3 is having the lowest number of OTUs and B1 is having the highest number.

#### **g. PCA Plot**

The PCA plot shows clusters of samples based on their similarity. PC1 reveals the most variation, while PC2 reveals the second most variation. The position of data points in the PCA plot provides insights into the data's structure and relationships. Clusters or patterns in the plot can indicate groupings or similarities among data points. Here the highest variance between samples is 87.48 %.

#### **h. Beta diversity plot**

Beta diversity is species diversity b/w two adjacent ecosystems and is obtained by comparing the number of species unique to each ecosystem. It measures the distance or dissimilarity between each sample pair. The analysis compares distances of samples within the same group to distances of samples from different groups. The plot shows whether the samples are having similar microbial composition and whether they have been grouped together based on condition. The bray curtis index values vary between 0 and 1, where 0 means the two samples have the same composition (that is they share all the species), and 1 means the two samples do not share any species. Here 0 is given the color red and 1 is given the color

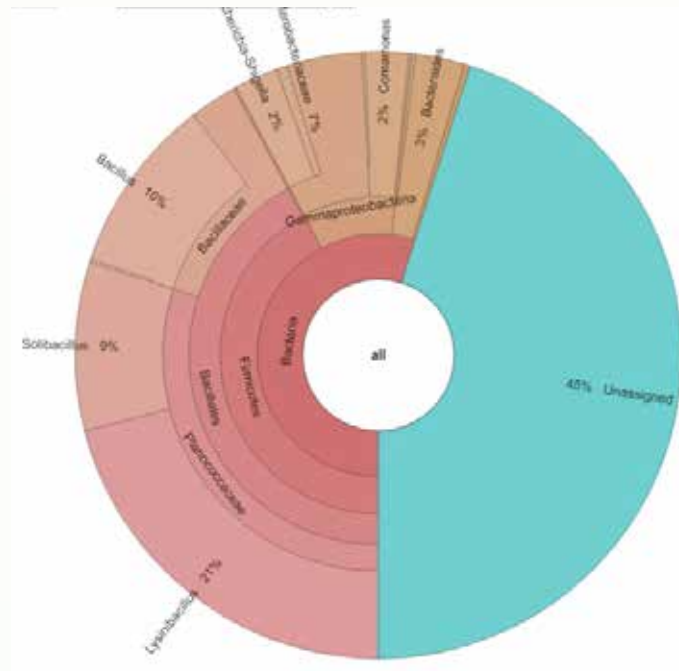
blue. Hence, it is concluded that the samples B2 and B3 share similar composition with each other compared to B1 sample.

#### i. Phylogenetic Tree

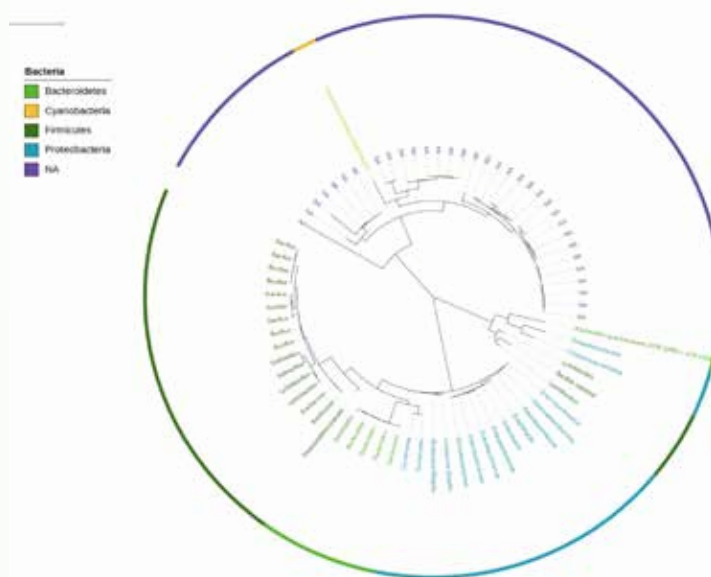
A phylogenetic tree is a branching diagram or a tree showing the evolutionary relationships among various biological species. Here the entire community identified in the whole samples is depicted to show their taxonomic levels upto genus. Each phylum is assigned different colored circles and the OTU belonging to the same phyla are given similar color

#### j. Heat Tree

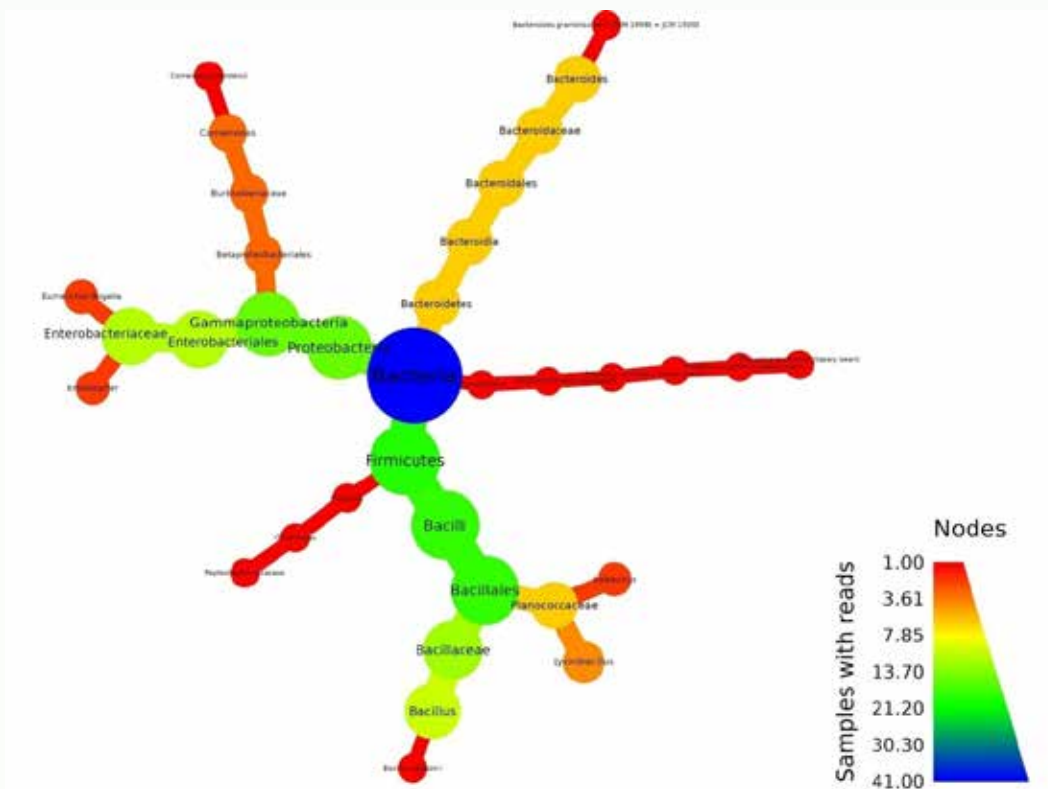
Heat Tree is a powerful method which allows users to visually compare abundance between two groups at different taxonomic levels. It uses hierarchical structure of taxonomic classifications to quantitatively (based on median abundance) depict taxon differences among communities. Each taxonomic level is given a different color and the size of the nodes indicates the abundance of the particular level. It can be derived that the phyla Firmicutes, Proteobacteria etc. are quite abundant.



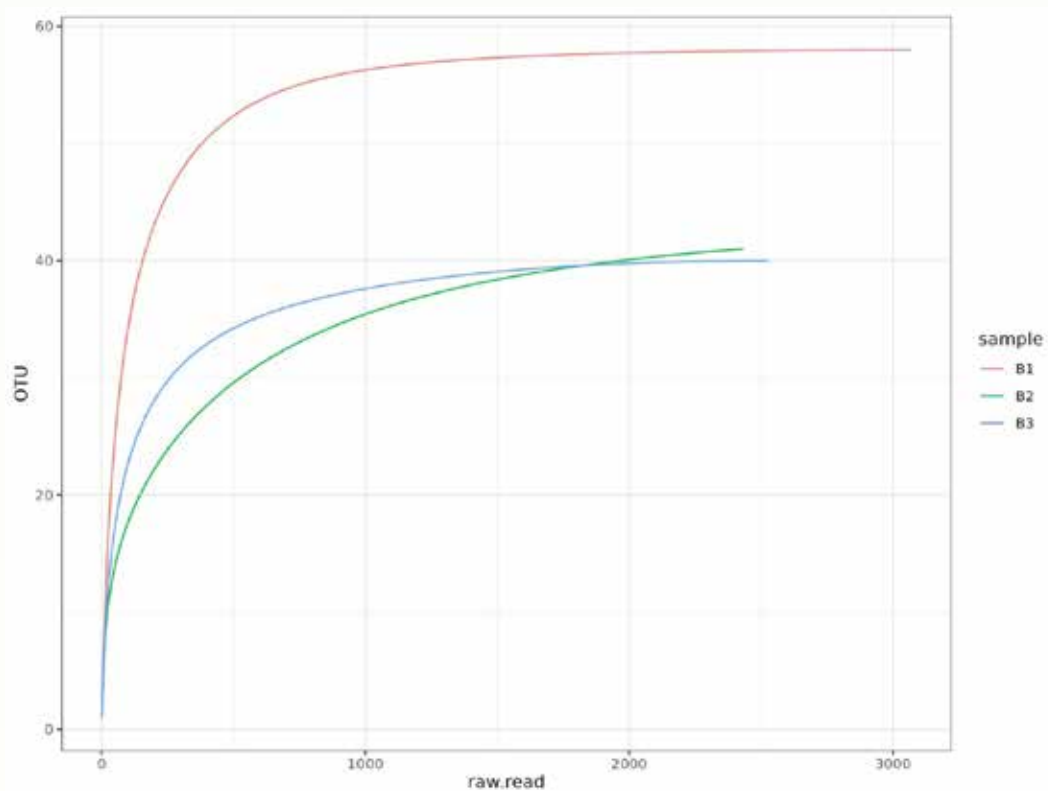
Krona plot of Brahmastra



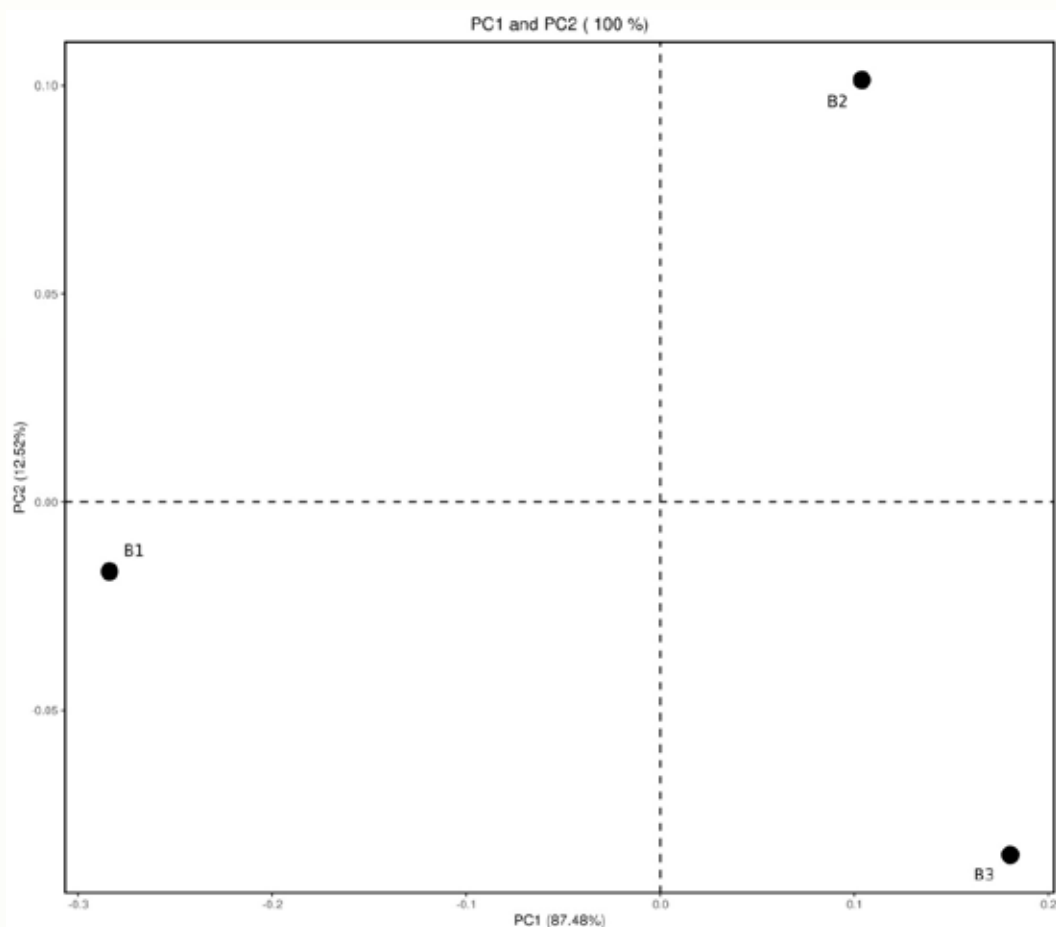
Phylogenetic Tree of Brahmastra



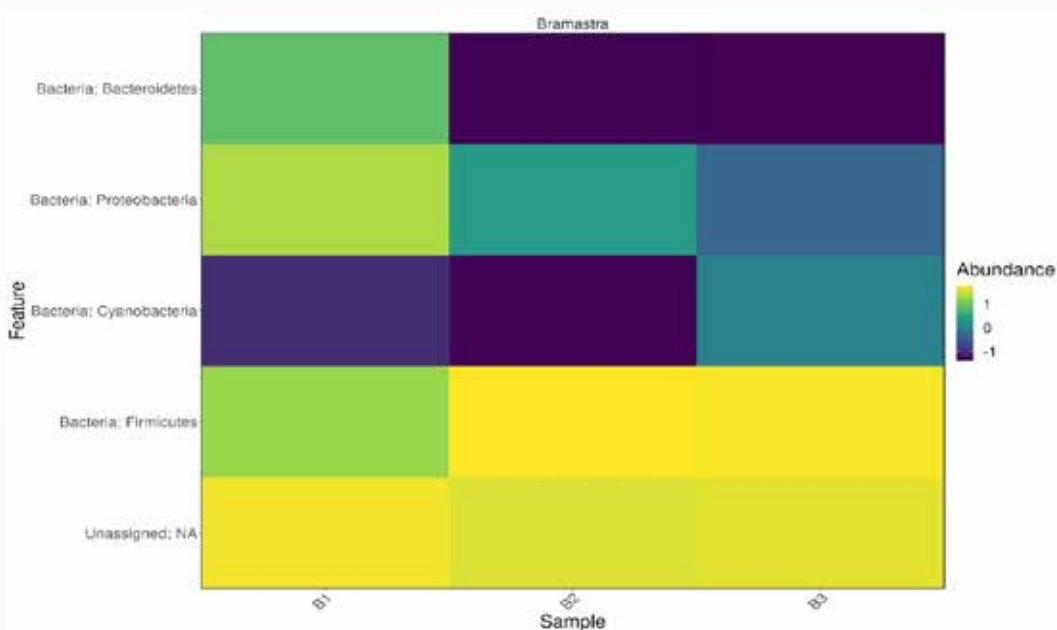
Heat Tree of Brahmastra



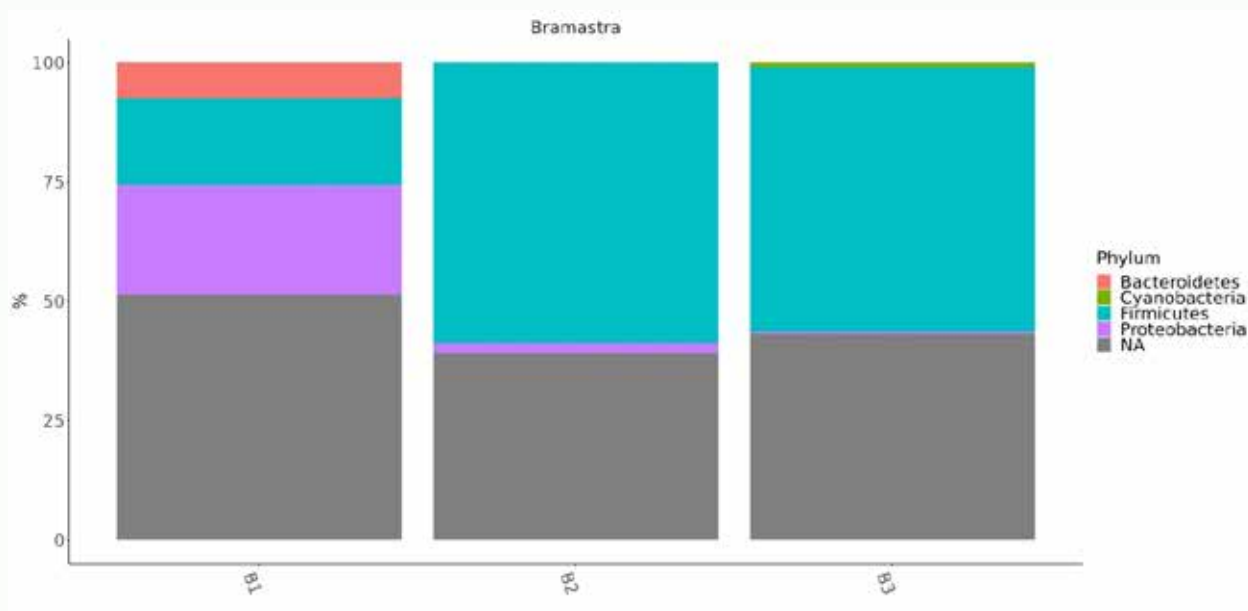
Rarefaction Curves of Brahmastra



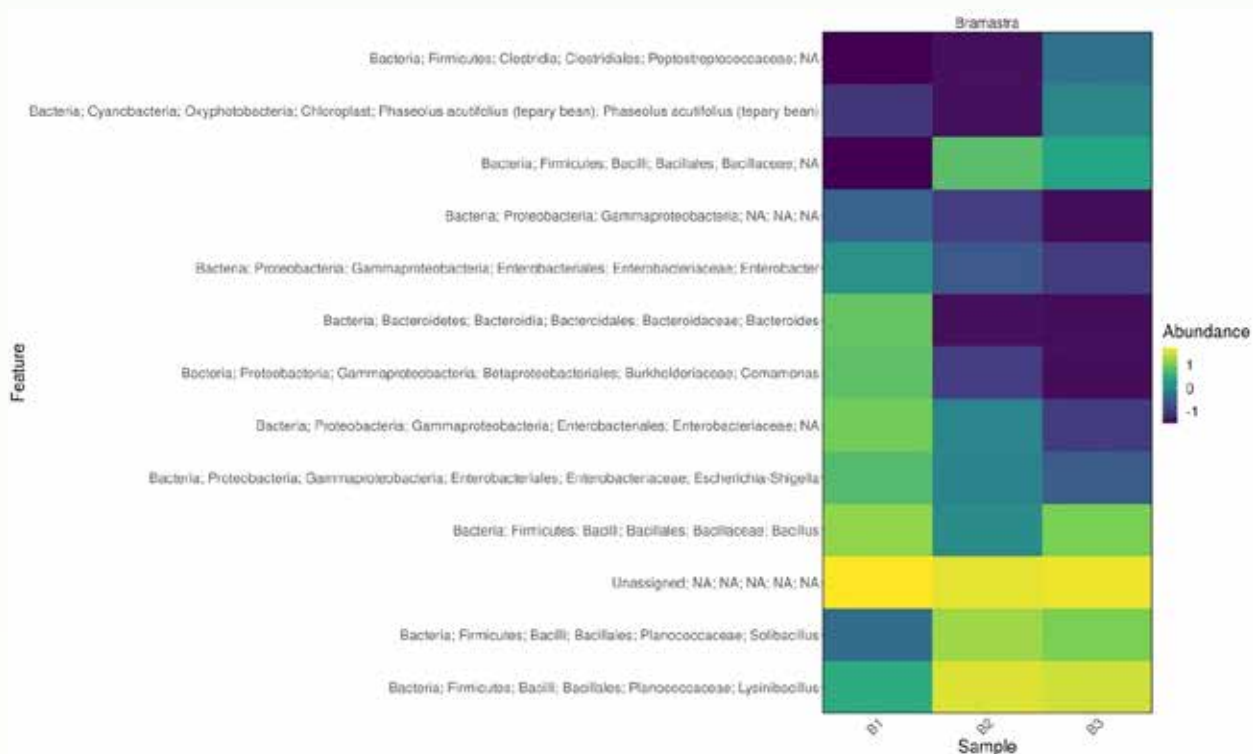
Principal component analysis (PCA) plot of Brahmastra



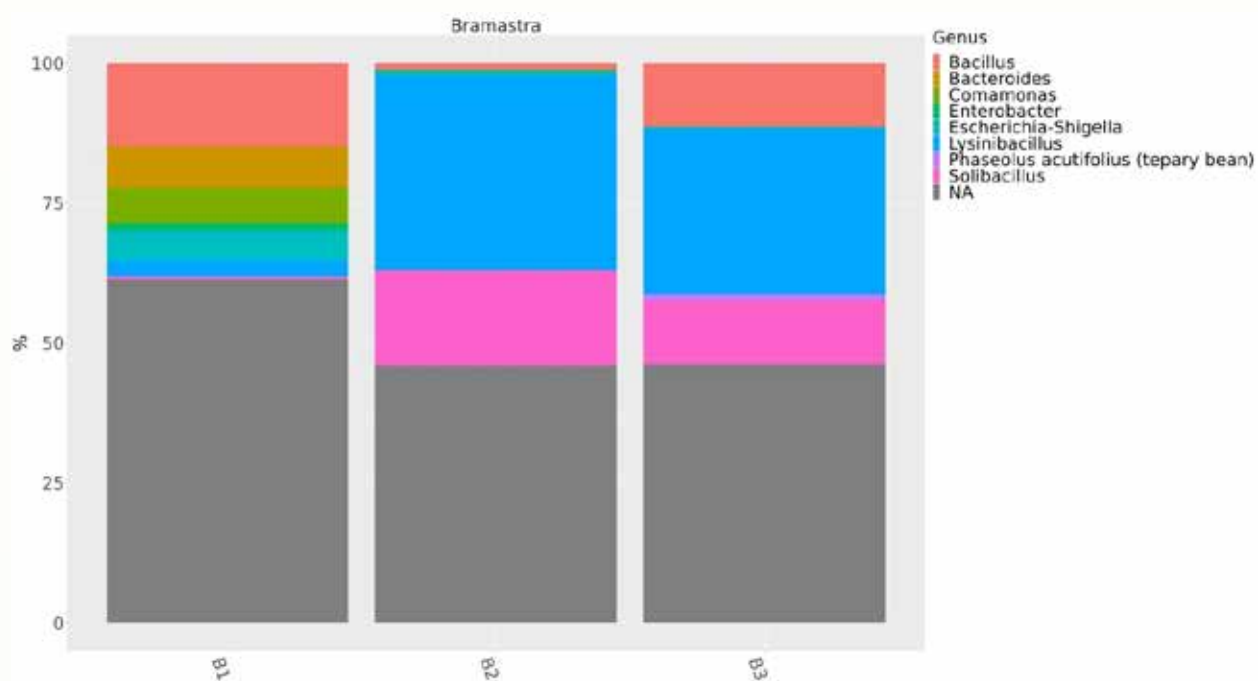
Relative Abundance Plot – Phylum



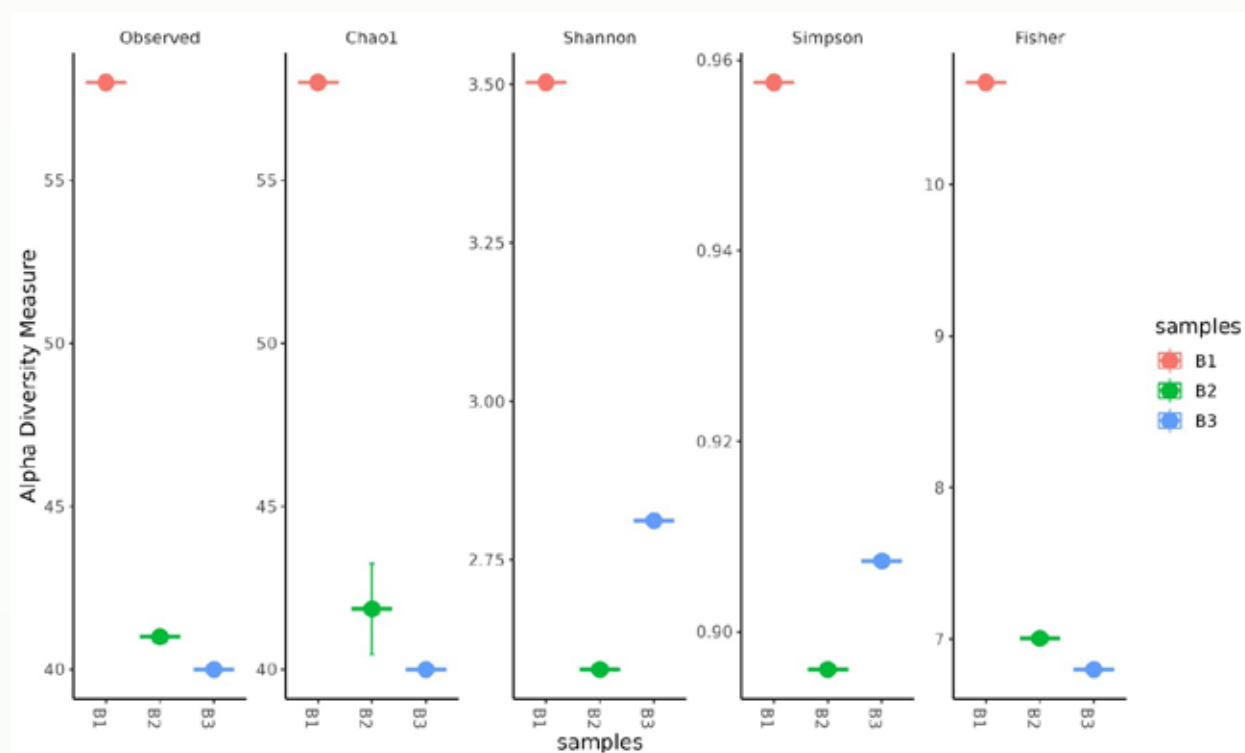
Relative Abundance Bar Plot - Phylum level of Brahmastra



Relative Abundance Plot – Genus of Brahmastra



Relative Abundance Bar Plot - Genus level of Brahmastra



Alpha diversity analysis of Brahmastra



## Ludhiana

### Characterization of natural farming inputs (Jeevamrit, Ghanjeevamrit and Beejamrit)

**Methodology:** The NF inputs namely Jeevamrit, Ghanjeevamrit, and Beejamrit were prepared at the research farm of School of Organic Farming and brought to laboratory for its chemical, biochemical and microbial characterization. These inputs were prepared using dung and urine of native breeds and HF cows.

### Results

- Microbial Population in Jeevamrit, Ghanjeevamrit, and Beejamrit (Day 1 & 2) table 7.1.3.4. Data shows microbial counts (bacteria, fungi, and actinomycetes) in three organic formulations made from Desi cow, HF (Holstein Friesian) cow, and their combination over two days. Overall, microbial populations increased on the second day. Jeevamrit consistently recorded the highest bacterial counts, peaking at  $195 \times 10^5$  (Desi cow) and  $196 \times 10^5$  (HF cow). Fungal counts were highest in Desi+HF cow Jeevamrit on Day 1 ( $10 \times 10^4$ ) but declined by Day 2. Actinomycetes were moderately present across all treatments, with a slight increase on Day 2, indicating active microbial multiplication during the fermentation period.
- Chemical Characterization at different fermentation intervals (24, 48, and 96 Hours) which data given in table 7.1.3.5 presents pH, EC, organic carbon, and available nutrients (N, P, K) in Jeevamrit, Ghanjeevamrit, and Beejamrit. Across treatments, pH values ranged from neutral to mildly alkaline, with HF cow-based Jeevamrit showing the highest pH (8.48). Electrical conductivity (EC) and organic carbon (OC) were generally higher in Ghanjeevamrit and Beejamrit, particularly from Desi+HF sources, indicating greater nutrient solubilization. Available nitrogen and phosphorus levels fluctuated, with some peaks at 48 hours but a drop by 96 hours. Notably, Beejamrit prepared from Desi+HF cow at 24 hours showed higher values for P and K, reflecting the nutrient richness shortly after preparation.
- Data in table 7.1.3.6 shows the biochemical dynamics of the same formulations over time at 0, 48, and 96 Hours represent carbohydrate, total soluble protein, and free fatty acid contents across all three formulations and animal sources. Carbohydrate and protein contents decreased steadily, especially in Jeevamrit, indicating rapid microbial utilization. In contrast, free fatty acids increased significantly, especially in Desi+HF Ghanjeevamrit, which rose from 2.81% to 6.80% over 96 hours, suggesting intense microbial activity and lipid breakdown. Overall, Ghanjeevamrit from Desi+HF cow dung consistently showed superior biochemical richness, while Jeevamrit remained more diluted and less nutrient-dense. The results suggest that Desi+HF-based Ghanjeevamrit, particularly after 48–96 hours of fermentation, offers the most robust nutrient and microbial profile for organic farming use.

**Table 7.1.3.4: Population of different Microbial populations (CFU)/g in Jeevamrit, Ghanjeevamrit and Beejamrit during first and second day after preparation**

| Treatment     | DAP | Bacteria( $10^5$ ) |                |            | Fungi ( $10^4$ ) |                |            | Actinomycetes ( $10^3$ ) |                |            |
|---------------|-----|--------------------|----------------|------------|------------------|----------------|------------|--------------------------|----------------|------------|
|               |     | Jeevam-rit         | Ghanjee-vamrit | Beejam-rit | Jeevam-rit       | Ghanjee-vamrit | Beejam-rit | Jeevam-rit               | Ghanjee-vamrit | Beejam-rit |
| Desi cow      | 1   | 135                | 44             | 39         | 6                | 2.6            | 1.8        | 2                        | 1.4            | 1.8        |
|               | 2   | 195                | 58             | 45         | 3                | 1.5            | 2.2        | 2                        | 1.6            | 2.2        |
| HF cow        | 1   | 143                | 50             | 36         | 8                | 2.7            | 2.1        | 1                        | 1.8            | 2.1        |
|               | 2   | 196                | 63             | 48         | 3                | 1.8            | 1.7        | 2                        | 1.3            | 1.7        |
| Desi + HF cow | 1   | 142                | 55             | 42         | 10               | 2.4            | 2.0        | 1                        | 1.4            | 2.0        |
|               | 2   | 188                | 70             | 61         | 5                | 1.6            | 2.4        | 3                        | 1.6            | 2.4        |

CFU stands for colony forming units; Days after preparation

**Table 7.1.3.5: Chemical characterization of Jeevamrit, Ghanjeevamrit and Beejamrit prepared from native, HF and NB+HF breed at different time intervals at Ludhiana centre**

| Treatments    | Hours after preparation | pH (1:10)  |                 |            | EC (dSm <sup>-1</sup> ) |                 |            | OC (%)     |                 |            | Available N (%) |                 |            | Available P (%) |                 |            | Available K (%) |                 |            |
|---------------|-------------------------|------------|-----------------|------------|-------------------------|-----------------|------------|------------|-----------------|------------|-----------------|-----------------|------------|-----------------|-----------------|------------|-----------------|-----------------|------------|
|               |                         | Jee-vamrit | Ghan-jee-vamrit | Bee-jamrit | Jee-vamrit              | Ghan-jee-vamrit | Bee-jamrit | Jee-vamrit | Ghan-jee-vamrit | Bee-jamrit | Jee-vamrit      | Ghan-jee-vamrit | Bee-jamrit | Jee-vamrit      | Ghan-jee-vamrit | Bee-jamrit | Jee-vamrit      | Ghan-jee-vamrit | Bee-jamrit |
| Desi cow (NB) | 24                      | 7.80       | 6.83            | 6.60       | 0.24                    | 2.11            | 2.19       | 0.37       | 7.55            | 7.35       | 0.013           | 0.21            | 0.18       | 0.021           | 0.17            | 0.014      | 0.012           | 0.011           | 0.012      |
|               | 48                      | 7.45       | 7.13            | 6.68       | 0.33                    | 2.36            | 2.22       | 0.31       | 7.43            | 7.15       | 0.018           | 0.033           | 0.031      | 0.011           | 0.11            | 0.012      | 0.006           | 0.08            | 0.08       |
|               | 96                      | 7.13       | 7.11            | 6.43       | 0.42                    | 2.35            | 2.12       | 0.26       | 7.38            | 7.68       | 0.019           | 0.007           | 0.0016     | 0.0013          | 0.006           | 0.012      | 0.0011          | 0.004           | 0.0016     |
| HF cow        | 24                      | 8.48       | 6.42            | 6.67       | 0.17                    | 2.19            | 2.40       | 0.35       | 7.52            | 7.43       | 0.007           | 0.005           | 0.010      | 0.020           | 0.14            | 0.08       | 0.023           | 0.007           | 0.012      |
|               | 48                      | 8.25       | 6.46            | 6.55       | 0.40                    | 2.48            | 2.38       | 0.21       | 7.49            | 7.56       | 0.010           | 0.017           | 0.013      | 0.006           | 0.07            | 0.012      | 0.0024          | 0.06            | 0.044      |
|               | 96                      | 8.21       | 6.36            | 6.10       | 0.44                    | 2.45            | 2.51       | 0.16       | 7.36            | 7.27       | 0.0012          | 0.006           | 0.0011     | 0.0011          | 0.005           | 0.0010     | 0.0013          | 0.003           | 0.009      |
| NB + HF       | 24                      | 7.82       | 6.68            | 6.33       | 0.15                    | 2.68            | 2.58       | 0.42       | 7.42            | 7.23       | 0.012           | 0.011           | 0.016      | 0.023           | 0.24            | 0.17       | 0.012           | 0.12            | 0.012      |
|               | 48                      | 7.67       | 6.69            | 6.58       | 0.37                    | 2.70            | 2.50       | 0.28       | 7.21            | 7.16       | 0.0012          | 0.031           | 0.023      | 0.016           | 0.05            | 0.04       | 0.014           | 0.06            | 0.08       |
|               | 96                      | 7.77       | 6.66            | 6.35       | 0.44                    | 2.78            | 2.32       | 0.19       | 7.36            | 7.12       | 0.046           | 0.004           | 0.0017     | 0.0021          | 0.006           | 0.0017     | 0.0012          | 0.010           | 0.009      |

**Table 7.1.3.6: Biochemical characterization of Jeevamrit, Ghanjeevamrit and Beejamrit at 0, 48 and 96 hours after preparation at Ludhiana centre**

| Treatments    |               | Carbohydrate (%) |        |        | Total soluble protein (%) |        |        | Free fatty acid (%) |        |        |
|---------------|---------------|------------------|--------|--------|---------------------------|--------|--------|---------------------|--------|--------|
|               |               | 0 hrs            | 48 hrs | 96 hrs | 0 hrs                     | 48 hrs | 96 hrs | 0 hrs               | 48 hrs | 96 hrs |
| Desi cow      | Jeevamrit     | 2.4              | 2.1    | 1.4    | 1.9                       | 1.5    | 0.7    | 0.5                 | 1.1    | 2.3    |
|               | Ghanjeevamrit | 12.8             | 11.2   | 8.5    | 14.2                      | 9.3    | 7.3    | 1.70                | 3.15   | 4.40   |
|               | Beejamrit     | 12.4             | 11.0   | 9.4    | 10.9                      | 8.0    | 7.8    | 1.54                | 3.60   | 3.96   |
| HF cow        | Jeevamrit     | 3.3              | 2.6    | 1.5    | 1.4                       | 1.3    | 0.5    | 0.6                 | 1.5    | 2.5    |
|               | Ghanjeevamrit | 10.3             | 9.2    | 7.9    | 15.5                      | 13.0   | 10.5   | 1.67                | 4.39   | 5.58   |
|               | Beejamrit     | 10.7             | 9.2    | 8.1    | 14.2                      | 8.5    | 7.3    | 2.35                | 3.43   | 3.60   |
| Desi + HF cow | Jeevamrit     | 3.6              | 2.3    | 1.4    | 1.8                       | 1.4    | 0.8    | 0.2                 | 1.3    | 2.8    |
|               | Ghanjeevamrit | 14.5             | 11.7   | 7.3    | 16.7                      | 10.2   | 9.9    | 2.81                | 5.22   | 6.80   |
|               | Beejamrit     | 16.4             | 12.1   | 6.5    | 16.4                      | 10.5   | 9.7    | 2.03                | 2.62   | 3.28   |



Table 7.1.3.7: Characterization of natural farming bio-pesticides

| Parameters                | Organic Inputs   |                  |                  |
|---------------------------|------------------|------------------|------------------|
|                           | Agniastra        | Brahmastra       | Neemastra        |
| Total Bacterial count     | $16 \times 10^6$ | $35 \times 10^6$ | $13 \times 10^5$ |
| Total Fungal Count        | $13 \times 10^4$ | $21 \times 10^4$ | Absent           |
| Total Actinomycetes Count | Absent           | Absent           | Absent           |
| E. coli                   | Absent           | Absent           | Absent           |
| Faecal coliforms          | Absent           | Absent           | Absent           |
| Total Coliforms           | Absent           | Absent           | Absent           |
| Staphylococcus aureus     | Absent           | Absent           | Absent           |
| Proteus mirabilis         | Absent           | Absent           | Absent           |
| Klebsiella pneumoniae     | Absent           | Absent           | Absent           |

### Udaipur

The table presents the biochemical characterization of five organic and natural farming inputs—Vermiwash, Compost tea, Vermicompost, Neemastra, and Brahmastra used at Udaipur. These inputs are evaluated based on their content of nitrogen (N), phosphorus (P), potassium (K), and populations of bacteria, fungi, and actinomycetes. Among all inputs, vermicompost exhibited the highest nutrient content, especially in nitrogen (1.11–1.18%) and phosphorus (0.80–0.85%), along with a significantly higher bacterial load ( $18.45 \times 10^8$  –  $21.50 \times 10^8$  cfu/ml), indicating its superior microbial and nutrient profile. Vermiwash and compost tea also showed moderate nutrient and microbial concentrations, with compost tea having relatively higher phosphorus (0.149–0.160%) and potassium (0.477–0.490%) values. Neemastra and Brahmastra, both fermented liquid bio-inputs, contained comparatively lower nitrogen and phosphorus levels, but Brahmastra had exceptionally high potassium content (2.731–2.745%), making it a potential K-rich input. Microbial counts were generally lower in Neemastra and Brahmastra, with Brahmastra showing slightly higher microbial activity among the two. Overall, the table highlights the diverse nutrient and microbial profiles of each input, reflecting their complementary roles in organic and natural farming.

Table 7.1.3.16: Bio-chemical characterization of organic and natural farming inputs at Udaipur

| Parameters   | N (%)       | P (%)       | K (%)       | Bacterial count (cfu/ml)                  | Fungal count (cfu/ml)                   | Actinomycetes count (cfu/ml)            |
|--------------|-------------|-------------|-------------|-------------------------------------------|-----------------------------------------|-----------------------------------------|
| Vermiwash    | 0.219-0.228 | 0.597-0.605 | 0.156-0.165 | $5.33 \times 10^8$ - $7.33 \times 10^8$   | $4.1 \times 10^4$ - $5.8 \times 10^4$   | $2.4 \times 10^5$ – $3.65 \times 10^5$  |
| Compost tea  | 0.391-0.399 | 0.149-0.160 | 0.477-0.490 | $0.14 \times 10^8$ - $0.30 \times 10^8$   | $0.98 \times 10^5$ - $2.3 \times 10^5$  | $0.56 \times 10^5$ - $0.70 \times 10^5$ |
| Vermicompost | 1.11-1.18   | 0.80-0.85   | 0.20-0.1.0  | $18.45 \times 10^8$ – $21.50 \times 10^8$ | $1.25 \times 10^5$ - $2.75 \times 10^5$ | $0.85 \times 10^5$ - $1.75 \times 10^5$ |
| Neemastra    | 0.200-0.205 | 0.004-0.005 | 0.660-0.669 | $6.04 \times 10^6$ - $8.04 \times 10^6$   | $0.81 \times 10^4$ - $1.91 \times 10^4$ | $4.50 \times 10^3$ – $6.0 \times 10^3$  |
| Bhramastra   | 0.302-0.309 | 0.005-0.007 | 2.745-2.731 | $10.69 \times 10^6$ - $12.69 \times 10^6$ | $1.21 \times 10^4$ – $2.15 \times 10^4$ | $2.95 \times 10^3$ – $4.10 \times 10^3$ |

## 7.2 Programme : Development and validation of scientific package of practices for organic and natural farming

**Evaluation of organic, inorganic and towards organic (integrated) production packages for crops and cropping systems and its influence on crop productivity and soil health**

### Objectives

The experiment was conducted at all the 20 locations with the following objectives.

- To study the impact of organic, conventional and integrated management practices on crop productivity and soil health
- To study the impact of various management practices on microbial population of soil and economics

**Year of start:** The experiment was originally planned during 2004-05. However, the year of start varied with the centres depending upon the establishment of infrastructure for conducting the experiments. All the centres started the experiment during 2004-05 except Modipuram and Umiam where it was started during 2005-06. From 2015-16, 7 new centres were included and start the experiment namely Ajmer, Almora, Narendrapur, Sardarkrushinagar, Gangtok, Thiruvananthapuram and Udaipur.

**Treatments:** The experiment was conducted in strip plot design as un-replicated trial. However, Karjat and Umiam centre have conducted the experiment with three replications in split plot design. The experiment stands modified by dividing the organic, inorganic and integrated plots divided into two for each cropping systems.

The treatments imposed in main plots are given below.

|           |                                    |                                                                                                                                                                                                                                                                      |
|-----------|------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Main plot | Organic management                 | 100% organic<br>(Organic manures equivalent to 100 % N requirement of the system)                                                                                                                                                                                    |
|           |                                    | Organic [Supply of only 50% nutrients through organic sources + seed/seedling treatment with Beejamrit + application of Ghanjeevamrit @ 250kg/ha, Jeevamrit @ 500 litres /ha /time twice a month with irrigation water and complete organic management as per NPOP]  |
|           | Inorganic management<br>(Chemical) | 100 % inorganic package (No organic manures)                                                                                                                                                                                                                         |
|           |                                    | State recommendation or farmers package (Choice to centres)                                                                                                                                                                                                          |
| Sub plot  | Cropping Systems                   | 50% organic + 50% inorganic source of nutrients management                                                                                                                                                                                                           |
|           |                                    | Towards Organic (ICM): 25% nutrients through organic +25% nutrients through inorganic source of nutrients + seed/seedling treatment with Beejamrit + application of Ghanjeevamrit @ 250 kg/ha, Jeevamrit @ 500 litres / ha /time twice a month with irrigation water |
|           |                                    | Location specific cropping system 1                                                                                                                                                                                                                                  |
|           |                                    | Location specific cropping system 2                                                                                                                                                                                                                                  |
|           |                                    | Location specific cropping system 3                                                                                                                                                                                                                                  |
|           |                                    | Location specific cropping system 4                                                                                                                                                                                                                                  |

The cropping system was selected, as per suitability for the location and was assigned into the sub plots. The number of cropping systems ranged from 3 (Calicut, Coimbatore and SK Nagar) to as high as 5 (Dharwad) in various centres. The details of cropping systems are given in tables along with experimental results. Nutrient package for the organic and integrated management packages were formulated based on recommended nitrogen dose of each system.



Locations: The experiment was conducted in five eco-systems as mentioned below. These locations represent the different ecological regions of Agro-ecological zone.

| Eco-system | Locations (State)           |
|------------|-----------------------------|
| Arid       | Ajmer (Rajasthan)           |
|            | Dharwad (Karnataka)         |
|            | Sardar Krushinagar (Gujrat) |
| Semi-arid  | Bhopal (Madhya Pradesh)     |
|            | Coimbatore (Tamil Nadu)     |
|            | Ludhiana (Punjab)           |
|            | Modipuram (Uttar Pradesh)   |
|            | Udaipur (Rajasthan)         |
| Sub-humid  | Almora (Uttarakhand)        |
|            | Gangtok (Sikkim)            |
|            | Jabalpur (Madhya Pradesh)   |
|            | Raipur (Chhattisgarh)       |
|            | Ranchi (Jharkhand)          |
| Humid      | Bajaura (Himachal Pradesh)  |
|            | Pantnagar (Uttarakhand)     |
|            | Narendrapur (west Bengal)   |
|            | Uiam (Meghalaya)            |
| Coastal    | Calicut (Kerala)            |
|            | Karjat (Maharashtra)        |
|            | Thiruvananthapuram (Kerala) |

The details of inputs used for organic nutrient management and their nutrient content at various locations are given below.

Source of nutrient inputs and their NPK content at various locations

| Centre  | Nutrient Sources | NPK contents on dry weight basis (%) |      |      |
|---------|------------------|--------------------------------------|------|------|
|         |                  | N                                    | P    | K    |
| Bajaura | Vermi-compost    | 0.90                                 | 0.20 | 0.75 |
|         | FYM              | 0.98                                 | 0.25 | 0.90 |
|         | Urea             | 46.0                                 | -    | -    |
|         | SSP              | -                                    | 16.0 | -    |
|         | MOP              | -                                    | -    | 58.0 |
|         | Rock phosphate   | -                                    | 34.0 | -    |
| Bhopal  | Vermi-compost    | 1.14                                 | 0.72 | 0.68 |
|         | Neem cake        | 1.50                                 | 0.92 | 1.04 |
|         | Sesbaniarostrata | 2.90                                 | 0.7  | 1.54 |

| Centre     | Nutrient Sources               | NPK contents on dry weight basis (%) |      |      |
|------------|--------------------------------|--------------------------------------|------|------|
|            |                                | N                                    | P    | K    |
| Calicut    | Farm Yard Manure               | 0.75                                 | 1.0  | 0.55 |
|            | Neem cake                      | 1.50                                 | 0.36 | 1.51 |
|            | Ash                            | -                                    | 0.20 | 6.3  |
|            | Vermi-compost                  | 0.76                                 | 0.88 | 0.65 |
|            | Green leaf manure              | 2.02                                 | 0.16 | 1.10 |
|            | Rajphos                        | -                                    | 18.5 | -    |
|            | Urea                           | 46                                   | -    | -    |
|            | MOP                            | -                                    | -    | 58   |
| Coimbatore | Vermi-compost                  | -                                    | -    | -    |
|            | Neem cake                      | -                                    | -    | -    |
|            | Sesbaniarostrata               | -                                    | -    | -    |
| Dharwad    | Enriched compost               | 0.70                                 | 0.40 | 0.80 |
|            | Vermi-compost                  | 1.00                                 | 0.86 | 0.98 |
|            | Farm yard manure               | 0.50                                 | .025 | 0.49 |
|            | Glyricidia (Green leaf manure) | 0.50                                 | 0.32 | 1.15 |
| Jabalpur   | Green manure (Sun hemp)        | 0.66                                 | 0.13 | 0.50 |
|            | FYM                            | 0.54                                 | 0.20 | 0.26 |
|            | Vermi-compost                  | 1.6                                  | 0.75 | 1.00 |
|            | Neem Oil Cake                  | 5.2                                  | 1.10 | 1.50 |
|            | Urea                           | 46                                   | -    | -    |
|            | SSP                            | -                                    | 16   | -    |
|            | MOP                            | -                                    | -    | 60   |
| Karjat     | F.Y.M.                         | 0.50                                 | 0.25 | 0.50 |
|            | Neem cake                      | 5.20                                 | 1.00 | 1.40 |
|            | Vermi-compost                  | 1.50                                 | 1.00 | 1.50 |
|            | Glyricidia green leaves        | 2.74                                 | 0.50 | 1.15 |
|            | Paddy straw                    | 0.61                                 | 0.16 | 1.14 |
| Ludhiana   | Urea                           | 46.0                                 | -    | -    |
|            | DAP                            | 18.0                                 | 46.0 | -    |
|            | MOP                            | -                                    | -    | 60.0 |
| Modipuram  | FYM                            | 0.51                                 | 0.30 | 0.65 |
|            | VC                             | 1.28                                 | 0.47 | 1.39 |
|            | Sesbania                       | 2.25                                 | 0.41 | 3.01 |
|            | Urea                           | 46.0                                 | -    | -    |
|            | DAP                            | 18.0                                 | 46.0 | -    |
|            | MOP                            | -                                    | -    | 60.0 |



| Centre             | Nutrient Sources         | NPK contents on dry weight basis (%) |       |       |
|--------------------|--------------------------|--------------------------------------|-------|-------|
|                    |                          | N                                    | P     | K     |
| Raipur             | Enriched compost         | 0.40                                 | 0.36  | 0.56  |
|                    | Cow dung manure          | 0.57                                 | 0.39  | 0.72  |
|                    | NEOC–Non edible oil cake | 3.2                                  | 0.72  | 1.59  |
|                    | Rock phosphate           |                                      | 22    |       |
| Ranchi             | FYM                      | 0.50                                 | 0.30  | 0.50  |
|                    | Vermi compost            | 1.2                                  | 0.45  | 1.4   |
|                    | Karanj cake              | 4.0                                  | 1.0   | 1.0   |
|                    | Urea                     | 46.0                                 |       |       |
|                    | SSP                      |                                      | 16.0  |       |
|                    | MOP                      |                                      |       | 60.0  |
| Umiam              | F.Y.M.                   | 0.72                                 | 0.29  | 0.61  |
|                    | Vermicompost             | 1.50                                 | 0.62  | 1.00  |
|                    | Rock phosphate           | -                                    | 18.00 | -     |
|                    | Tephrosiaspp             | 3.31                                 | 0.44  | 1.46  |
| Narendrapur        | Vermicompost             | 1.5                                  | 1.0   | 0.5   |
|                    | Sashyagavya              | 1.0                                  | 0.015 | 0.125 |
|                    | Panchagavya              | 1.8                                  | 0.23  | 0.44  |
|                    | Kunapajala               | 2.34                                 | 1.23  | 1.12  |
| SardarKrushinagar  | -                        | -                                    | -     | -     |
| Thiruvananthapuram | Green manure cowpea      | 2.80                                 | 0.52  | 2.02  |
|                    | FYM                      | 1.28                                 | 0.50  | 0.28  |
|                    | Neem cake                | 0.95                                 | 0.29  | 0.59  |
|                    | Vermi compost            | 0.97                                 | 0.42  | 0.45  |
|                    | Ash                      | 1.40                                 | 0.29  | 4.65  |
|                    | Panchagavya              | 0.22                                 | 0.061 | 0.40  |
|                    | Vermi wash               | 0.02                                 | 0.004 | 0.20  |
| Udaipur            | Vermicompost             | 1.114                                | 0.278 | 0.317 |
|                    | Neem Cake                | 5.091                                | 1.135 | 1.397 |
|                    | NADEP Compost            | 1.04                                 | 0.382 | 1.071 |
|                    | Enriched Compost         | 1.361                                | 0.472 | 0.973 |
|                    | FYM                      | 0.502                                | 0.248 | 0.507 |

## Results

### Studies on comparative efficiency of organic, inorganic and towards organic (integrated) management practices on crop productivity and system equivalent yield of different cropping systems (Table 1-2)

**Bajaura:** The performance of vegetable crops, evaluated under four cropping systems and three input organic, inorganic, and towards organic approaches, with most crops performing in the order: organic < towards organic-I < inorganic (FP). Under organic management, the yields recorded during the kharif season were 4908 kg/ha for french bean, 627 kg/ha for black gram, and 12554 kg/ha for lady's finger. Compared to the towards organic approach, the yield of french bean, blackgram and okra were 15.4, 7.2% and 5.4% lower, respectively. When compared to the inorganic approach, the organic package resulted in 28.8%, 16.3%, and 9.2% lower yields for french bean, black gram, and lady's finger, respectively. During rabi, average yield of cauliflower recorded of 11474 kg/ha under organic management which is about 21% lower than inorganic (FP). Yield of pea with organic practice also lower (17.8%) compared to farmers practice. In summer, frenchbean, tomato and summer squash recorded yield under organic of 4868, 22841 and 28870 kg/ha which were 26.1, 13.5 and 14.2% lower compared to inorganic with farmers practice.

In terms of system equivalent yield (cauliflower equivalent yield), the cropping system cauliflower–tomato recorded the highest yield among all systems at 44,793 kg/ha. Among different management practices, inorganic management following state recommendations resulted in the highest cauliflower equivalent yield (38117 kg/ha), followed by the integrated approach. Compared to inorganic, the organic system showed a reduction of 17.6%, while the integrated system showed reduction of 11% in cauliflower equivalent yield.



**Bhopal:** Soybean-based cropping systems involving wheat, mustard, chickpea, and linseed were evaluated under organic, inorganic, and towards organic practices. The performance of majority of crops during kharif and rabi was in the order of inorganic < organic < towards organic. Organic management resulted in yield level of 1034, 3560, 1170, 1330 and 1091 kg/ha for soybean, wheat, mustard, chickpea and linseed which was 5.4, 4.2, 7.1, 5.3 and 7.1% lower than towards organic respectively. When compared to the inorganic approach, the organic package resulted in 7.5%, 4.1%, 3.5% and 10.3 higher yields for soybean, wheat, mustard, chickpea respectively whereas linseed recorded 3.8 lower yield.

In terms of system equivalent yield (soybean equivalent), it was also followed the same order of inorganic < organic < towards organic management. Among the cropping systems, soybean-wheat recorded higher soybean equivalent yield of 2473 kg/ha followed by soybean-chickpea (2243 kg/ha).



Performance of soybean and wheat under organic package



Performance of mustard, chickpea and linseed under organic and towards organic package at Bhopal

**Calicut:** Ginger and turmeric were evaluated under organic, inorganic and towards organic approaches. The performance of ginger was in the order of inorganic < organic < towards organic, whereas, yield of turmeric been in order of towards organic < organic < inorganic. Organic management package resulted in yield of ginger 12270 kg/ha which was 3.2% lower than towards organic but 36.8% higher than inorganic. Yield of turmeric fresh and dry recorded of 42900 and 12000 kg/ha under organic management package resulted in numerically higher than towards organic but about 2.0 and 2.4% lower than inorganic respectively.



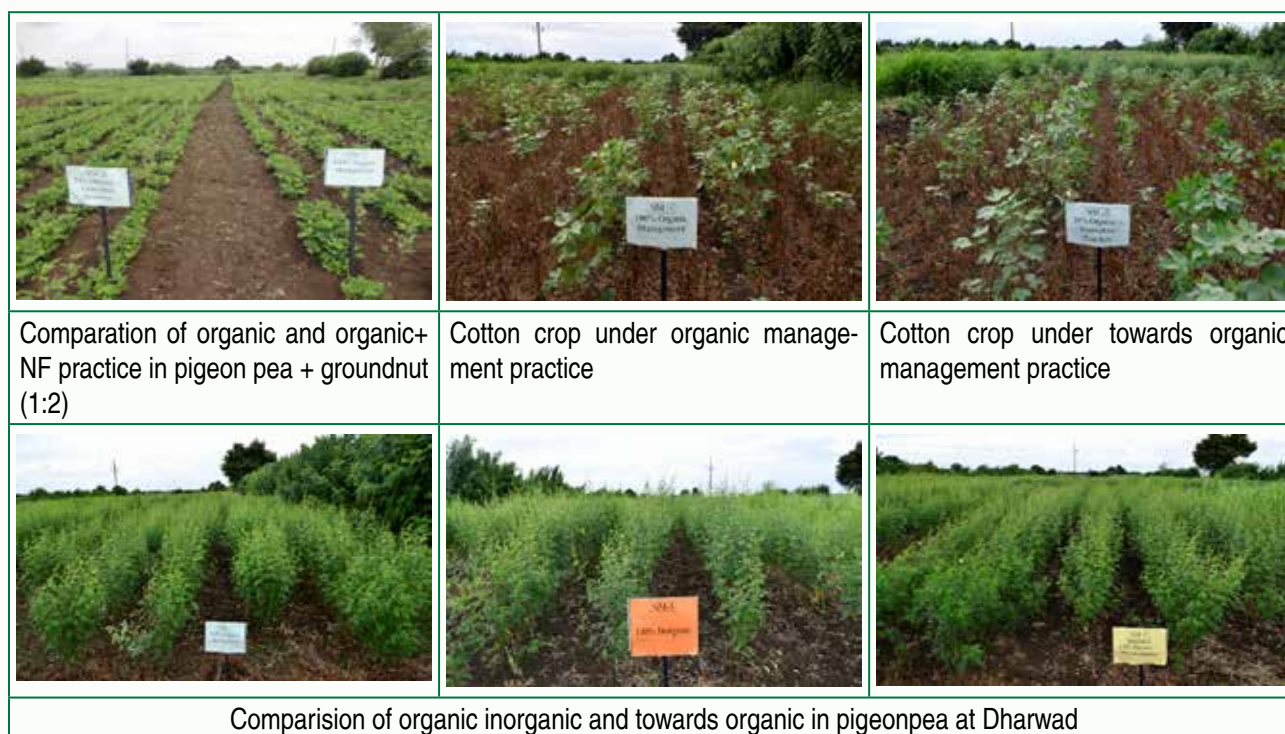
Ginger and turmeric under organic management at Calicut

**Coimbatore:** Vegetables such as brinjal, chilli, and tomato grown in the kharif, in combination with pearl millet, barnyard millet, and finger millet in the rabi s.ctively. Similar trends were observed for rabi wherein pearl millet, barnyard millet, and finger millet recorded of yield 2078, 1690 & 2645 kg/ha with organic practice but slightly lower than towards organic by 3.8, 1.2 and 2.5%. When compared to inorganic, it showed reduction by 11.4, 4.8 & 11.2% respectively.

System equivalent yield (brinjal equivalent) recorded in order to organic < towards organic < inorganic among the nutrient management practices. Among the cropping systems, brinjal - pearl millet - green manure (dhaincha) resulted in higher equivalent yield of 24801 kg/ha which was about 3.0 and 8.0% higher than chilli - barnyard millet and tomato - finger millet respectively.



**Dharwad:** Pigeon pea and cotton based inter cropping systems was evaluated under organic, inorganic and towards organic nutrient management practices. Crops green gram, soybean and groundnut was taken as intercrop with pigeon pea and cotton. Pigeon pea + green gram and cotton+ soybean system showed the trend in order to inorganic<organic<toward organic while cropping systems, pigeon pea +soybean, pigeon pea +groundnut and cotton +green gram found in order to toward organic< inorganic<organic. Among different combinations of intercropping system pigeon pea equivalent resulted in higher in order of towards organic < inorganic < organic. Pigeon pea+ soybean recorded highest PEY (2348 kg/ha) among the other intercropping systems.



**Jabalpur:** Soybean-based cropping systems involving wheat (duram), mustard, berseem (seed and fodder), lentil and sorghum (fodder) was evaluated. During kharif, performance of soybean recorded in order of inorganic < towards organic < organic which was 6.2 and 17.4% higher than inorganic and towards organic approaches. In rabi, most of the crops performed better in order of towards organic < organic < inorganic. Organic management resulted in yield level of 2087, 680, 6600(F)+112(S) and 321 kg/ha in rabi for wheat, mustard, berseem (F+S) and lentil. Similar trends were observed for summer crops. Total mean productivity in terms of soybean equivalent was recorded higher with 100% inorganic nutrient management (2622 kg/ha) followed by organic (2066 kg/ha) among the production packages. Among cropping systems, soybean-berseem seed & fodder led to record maximum soybean equivalent yields (3522 kg/ha) followed by soybean – mustard-green gram of 1978 kg/ha.



Comparison of soybean under organic, towards organic and farmers practice at Jabalpur



Comparison of wheat under organic, farmers practice and towards organic at Jabalpur

**Karjat:** The rice-based cropping systems involving vegetable crops (brinjal, chickpea, field bean and white onion) were evaluated. Rice crop performed better in order to organic < inorganic < towards organic. Organic management resulted in mean yield of rice 3231 kg/ha which was 3.7 and 1.6% lower than towards organic and inorganic. During rabi, yield of brinjal found to be 13.3% lower with organic than inorganic, however, chickpea, field bean resulted in higher yield with organic which was 6.7 and 4.6% increase than towards organic respectively. When compare to inorganic, yield of chickpea and field bean found to be higher to the tune of 26.6 and 16.3% with organic practice. Performance of white onion was in order of inorganic < organic < towards organic. Organic management resulted in yield of onion 14602 kg/ha. Trend of system productivity in term of rice equivalent was in the order of inorganic < towards organic < organic. Organic management resulted in system equivalent yield of 20615 kg/ha which was about 21.6 and 25.9% higher than towards organic and inorganic management practice respectively. Among the cropping systems, rice- brinjal system produced maximum rice equivalent yield (24534 kg/ha) than others cropping systems whereas rice-chickpea produced lowest REY (8557 kg/ha).



Performance of rice under organic and 50% organic +NF and Field bean crop towards organic



Performance of brinjal, chickpea and onion under towards organic management at Karjat

**Ludhiana:** Four cropping systems comprising two rice-based systems, one moong-wheat-summer moong system, and one sesame-lentil system were evaluated under organic, inorganic, and towards organic management approaches. Yield trend of basmati rice was in order of organic < inorganic < towards organic. Organic management resulted in mean yield of basmati rice 3815 kg/ha which was only 4.5 and 3.8% lower than towards organic and inorganic respectively. Organic management resulted in yield level of 1260 and 1350 kg/ha for chick pea and lentil which was 12.5 and 68% higher than towards organic and inorganic management practice whereas, lentil recorded 15.6 and 17.7% lower yield compared to towards organic and inorganic. System productivity in term of rice equivalent was in order of inorganic < organic < towards organic. Organic management practice recorded system equivalent of 9375 kg/ha which is decrease by 4.8% towards organic but about 2% higher to inorganic management practice. Among cropping systems, basmati rice-wheat-green manure resulted in higher system productivity of 11317 kg/ha followed by kharif moong-wheat-summer moong.



Performance of basmati rice under organic and inorganic management practice at Ludhiana

Performance of wheat under organic and inorganic management practice at Ludhiana

**Modipuram:** Four cropping systems consisting of black rice, finger millet, okra and black gram in kharif and lentil, barley pea and tomato in rabi were evaluated. In kharif, yield trend of sesame found to be in order to inorganic < towards organic < organic. Sesame and vegetable pea recorded higher yield with organic management practice of 371 and 6067 kg/ha which was 7.5 & 2.1% higher compared to towards organic-I and 8.5 & 3.1 inorganic. Okra, black gram, lentil and barley recorded maximum yield with towards organic which were higher to the tune of 2.1, 40.4, 14.5 and 13% when compared to organic-I practice. Finger millet, tomato and vegetable cowpea resulted in higher under inorganic management with farmers practice. Reduction in organic-I found to be to the tune of 22.9, 2.9 and 1% respectively when compared to inorganic. Trend for system productivity in term of rice equivalent was in order of inorganic < organic < towards organic. Black gram-tomato-green manure (sunhemp) recorded higher rice equivalent yield of 15212 kg/ha because of higher yield of tomato and good premium price followed by Okra – vegetable pea – sesbania aculeata green manure of 12454 kg/ha among the cropping systems.

**Pantnagar:** Basmati rice based cropping systems was evaluated under organic, inorganic and towards organic approaches. Performance of majority of crops was in the order of inorganic < organic < towards organic. Organic management resulted in yield level of 4719, 4534, 1539 4307 and 11429 for basmati rice, wheat, mustard, vegetable pea and potato. Under organic

management yield difference for basmati rice was only 36 kg/ha. Other crops, wheat, mustard and pea showed reduction in yield to the tune of 6.1, 13.3 and 17.1% when compared to towards organic respectively. However, potato produced maximum yield with organic management and higher by 6.7% over towards organic. System productivity in terms of basmati rice equivalent yield recorded higher with towards organic-I having 50% nutrients through organic manures + 50% nutrients through inorganic sources (8311 kg/ha) followed by organic and inorganic. Among all the cropping systems, higher system productivity was recorded with basmati rice-mustard system (8373 kg/ha) followed basmati rice-wheat (8271 kg/ha).

**Raipur:** Soybean based cropping systems were evaluated involving maize (sweet corn), field bean, tomato, and cabbage under organic, inorganic and towards organic approaches. Performance of soybean and sweet corn crop was in the order inorganic < towards organic < organic, while, field bean, tomato and cabbage performed in order to inorganic < organic < towards organic. Organic management resulted in yield level of 1958, 3530, 1400, 38000 and 48000 kg/ha for soybean, sweet corn, field bean, tomato and cabbage and the difference in the yield found to be 5.0, 105, 22, 315 and 542 kg/ha when compared to towards organic. System equivalent yield (soybean equivalent) among the nutrient management practices was in order of towards organic < inorganic < organic. Among the cropping systems, soybean-cabbage resulted in higher equivalent of 14311 kg/ha followed by soybean-tomato (10151 kg/ha).



Maize and tomato crop under towards organic management practice at Raipur

**Ranchi:** Performance of rice-based cropping systems were evaluated involving wheat, onion, potato and okra. The yield of rice and potato was in the order of inorganic < towards inorganic < organic while performance of other crops such as wheat, onion and okra found in order to inorganic < organic < towards organic. Organic management practice resulted in higher mean yield of rice (3370 kg/ha) which was 5.3 and 19.6% higher than towards organic and inorganic. Likewise, potato also followed the same trend and yielded 23633 kg/ha. In rabi, wheat, onion and okra found to be higher with towards organic approach. The reduction in yield under organic was 11.9, 2.2 and 2.4% over towards organic respectively. System equivalent yield (rice equivalent) among the nutrient management practices was in order of inorganic < towards organic < organic. Among the cropping systems, rice-onion resulted in higher equivalent of 13141 kg/ha followed by rice-potato (12997 kg/ha).



Rice crop under organic and organic + NF practice at Raipur



Glimpse of field crops at Ranchi

**Umiam:** The performance of four okra based cropping system involving carrot, potato, french bean and tomato were evaluated. Yield trend for okra was in order of inorganic < organic, towards organic. Among the management practices, performance of rice was in order to towards organic (Integrated) < inorganic and organic. Among the varieties, Lampnah recorded highest grain yield of 4200 kg/ha. Yield of okra recorded with organic was 8998 kg/ha and showed in reduction over towards organic was 7.7%. Organic management resulted in yield level of 17500, 17400, 4800 and 16300 kg/ha for carrot, potato, frenchbean and tomato respectively. System equivalent yield (okra equivalent) among the nutrient management practices was in order of inorganic < organic < towards organic. Among the cropping systems, okra-tomato resulted in higher equivalent of 23625 kg/ha closely followed by okra-carrot (23200 kg/ha).

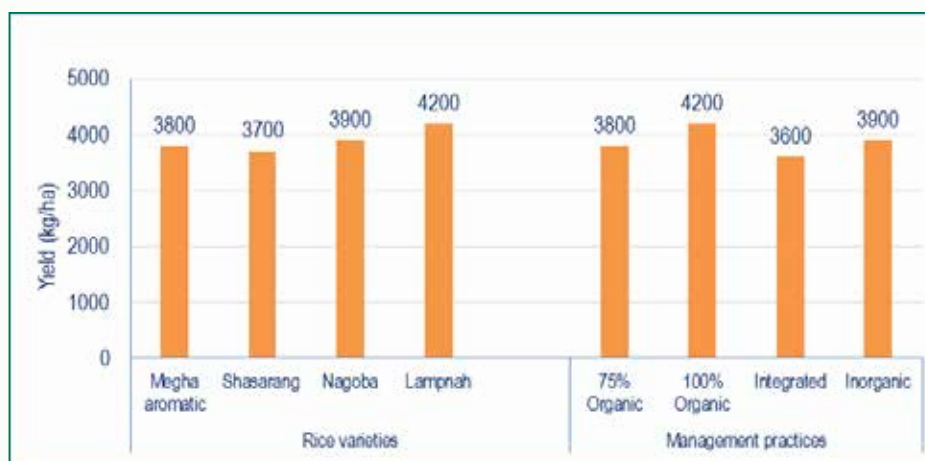


Fig. Yield of rice varieties under sunken bed as influenced by management practices at Umiam



Different crops grown on raised and sunken beds at Umiam, Meghalaya

**Ajmer:** Spices crops coriander and fennel was evaluated consisting four cropping system under organic, inorganic and towards organic approaches. The performance of majority of the crops was in the order of organic < towards organic < inorganic. Organic management resulted in mean yield of cowpea as sole and inter crop recorded of 671 & 735 kg/ha which was about 68 & 42 kg/ha higher than towards organic respectively. Yield of fennel and coriander under organic management recorded of 750 and 583 kg/ha which was about 7.5 and 6.0% lower than towards organic respectively. Among the management practice, system equivalent yield (cowpea equivalent) was in the order of organic< towards organic< inorganic. Among cropping systems, cow pea + maize (4:2) - fennel + cabbage (2:1) recorded highest equivalent yield of 3417 kg/ha followed by Cow pea + maize (4:2) -coriander + cabbage (2:1) (2022 kg/ha).



Coriander and fennel with inter crop cabbage under towards organic practice at Ajmer



Cowpea +maize and cowpea sole under towards organic practice at Ajmer

**Almora:** Two cropping systems consisting of grain amaranth and finger millet in kharif and wheat in rabi was evaluated. The performance of the majority of crops was in the order of inorganic < towards organic < organic. During kharif organic management resulted in yield level of 1114 kg/ha for grain amaranth and 581+617 kg/ha for finger millet & intercrop soybean which was 52.8, 36.4 & 48.0% higher over towards organic respectively. Similar trends was observed for rabi crops. Average yield level of wheat, intercrop lentil and toria under organic practice recorded 998, 127 and 131 kg/ha which were higher by 71.2, 32.3 and 21.3% compared to towards organic practice. System equivalent yield recorded followed the same trend as yield of crops. Among the systems, grain finger millet + black soybean (2:1) - wheat + toria (2:1) recorded highest equivalent yield of 1967 kg/ha which was about 4% higher than grain amaranth-wheat + lentil.

**Gangtok:** Maize based cropping system was evaluated with organic management practice under 100% as per NPOP standard and 50% nutrients through organic sources + NF practice. Organic management (100%) resulted in average yield of maize (3220 kg/ha) which was about 7.7% higher than Organic-II [50% nutrients through organic sources + NF practice]. Similar trends for rabi crops were observed where french bean, soybean, rajmash, black gram produced higher yield in organic I. System equivalent yield in term of maize also higher with organic-I than to organic-II.

**Narendrapur:** Rice based cropping systems was evaluated. The performance of rice was in the order of towards organic < organic < inorganic. Inorganic management resulted in higher yield (kg/ha) of rice varieties Gobindo bhog (2340), Kanakchur (800), Dudheswar (2870) and Shatabdi (2870). Average yield of rice under organic management recorded of 1980 kg/ha which about 5.3% higher than towards organic-II but 5.7% lower than towards-I. In rabi, majority of the crops was in order of organic < towards organic < inorganic. Organic nutrient practice resulted in reduction in yield of rabi rice by 13.5 and 14.8% than towards organic-II and inorganic respectively. System equivalent yield was also resulted in the order of organic < towards organic < inorganic. Among the systems, rice (shatabdi) -pea recorded highest equivalent yield followed by rice (Dudheswar)- red amaranthus +cucumber.

**Sardarkrushinagar:** Performance of majority of the crops was in the order of organic < towards organic < inorganic. Organic management resulted in yield level of green gram and groundnut of 636 and 1022 kg/ha. Reduction in yield for green gram under organic found to be about 2.6, and 11.9% over towards organic respectively. Difference in yield of groundnut over towards organic-I was only 3 kg/ha but when compared to inorganic (farmers practice) it was 10.9% . In rabi yield trend for amaranth, mustard and lucerne (fodder) crop recorded in same order as kharif organic < towards organic < inorganic organic. Difference between organic and towards organic-I was about 8, 22 and 1305 kg/ha for amaranth, mustard and lucerne (f) respectively. System equivalent yield (ground nut equivalent) among management practice was in order of organic < towards organic < inorganic. Cropping systems, ground - lucerne - lucerne resulted in higher equivalent yield of 2852 kg/ha which is 65% higher by green gram –mustard and 46.6% higher by green gram-amaranth system.





Green gram, coriander and fennel under organic management practice at SK Nagar

**Thiruvananthapuram:** Cassava and taro was evaluated with cowpea, ground nut, black gram and green gram in system mode under organic inorganic and towards organic approaches. The performance of the cassava was in the order of organic < towards organic < inorganic. Organic management resulted in yield level of cassava (30290 kg/ha) and taro (7750 kg/ha mean) which was 13.1% lower than towards organic-I but taro recorded by higher by 175% with organic over towards organic-I. System equivalent (cassava equivalent) was in the order of inorganic < towards organic < organic.



Cassava

Taro



vegetable cowpea

Ground nut

**Udaipur:** Performance of majority of crops was in the order of organic < inorganic < towards organic. During kharif organic management resulted in yield level for maize (2490kg/ha), black gram (475 kg/ha), sweet corn (2575kg/ha) and green gram (535 kg/ha) which were 10.6, 24.0, 9.5 and 20.7% lower than towards organic respectively. Similar trends was observed for rabi crops wheat durum & aestivum, chickpea and fenugreek which were 5.8, 7.5, 12.2 and 12.6% respectively also lower than towards organic-I. System equivalent yield was in order of organic < inorganic < towards norganic. Among the cropping systems, maize + blackgram–wheat (durum)–sesbania (GM) and sweet corn + black gram– chickpea resulted in higher equivalent yield of 9092 and 9079 kg/ha.



Maize + black gram and sweet corn + black gram under organic management practice at Udaipur



Wheat aestivum and durum under organic management practice at Udaipur



Performance of soybean and black gram under towards organic management practice



Fenugreek and chickpea under towards organic management practice at Udaipur



**Table 7.2.1: Influence of organic, inorganic and integrated management practice on grain yield (kg/ha) of various crops in cropping systems at different locations**

| Locations & cropping systems          | Organic                                  |       |        |                                                                                    |       |        | Inorganic                              |      |        |                                             |       |        | Towards organic (Integrated)                               |       |        |                                                                                                                          |       |        |
|---------------------------------------|------------------------------------------|-------|--------|------------------------------------------------------------------------------------|-------|--------|----------------------------------------|------|--------|---------------------------------------------|-------|--------|------------------------------------------------------------|-------|--------|--------------------------------------------------------------------------------------------------------------------------|-------|--------|
|                                       | Organic-I<br>[100% as per NPOP standard] |       |        | Organic-II<br>[Supply of only 50% nutrients through organic sources + NF practice] |       |        | 100% Inorganic<br>(No organic manures) |      |        | State recommendations<br>or Farmers package |       |        | Towards organic-I<br>(50% Organic + 50% Inorganic manures) |       |        | Towards organic-II<br>(25% nutrients through organic +25% nutrients through inorganic source of nutrients + NF practice) |       |        |
|                                       | Kharif                                   | Rabi  | Summer | Kharif                                                                             | Rabi  | Summer | Kharif                                 | Rabi | Summer | Kharif                                      | Rabi  | Summer | Kharif                                                     | Rabi  | Summer | Kharif                                                                                                                   | Rabi  | Summer |
| Bajaura (Himachal Pradesh)            |                                          |       |        |                                                                                    |       |        |                                        |      |        |                                             |       |        |                                                            |       |        |                                                                                                                          |       |        |
| French bean - cauliflower-french bean | 4908                                     | 10839 | 4868   | 4836                                                                               | 9551  | 4764   | 3489                                   | 8023 | 3298   | 6897                                        | 14710 | 6587   | 5802                                                       | 12552 | 5264   | 5068                                                                                                                     | 11242 | 4901   |
| Fallow-Cauliflower-tomato             | -                                        | 11852 | 22841  | -                                                                                  | 10264 | 20986  | -                                      | 9217 | 14047  | -                                           | 15263 | 26412  | -                                                          | 13358 | 23884  | -                                                                                                                        | 12631 | 22611  |
| Black gram-cauliflower-summer Squash  | 627                                      | 11731 | 28870  | 579                                                                                | 11174 | 27067  | 458                                    | 8652 | 19242  | 749                                         | 13515 | 33644  | 676                                                        | 12230 | 30828  | 612                                                                                                                      | 11673 | 29550  |
| Okra-pea                              | 12554                                    | 6743  | -      | 12090                                                                              | 5871  | -      | 10245                                  | 4233 | -      | 13824                                       | 8207  | -      | 13268                                                      | 7258  | -      | 12695                                                                                                                    | 6612  | -      |
| Bhopal                                |                                          |       |        |                                                                                    |       |        |                                        |      |        |                                             |       |        |                                                            |       |        |                                                                                                                          |       |        |
| Soybean-durum wheat                   | 1005                                     | 3560  | -      | 779                                                                                | 3093  | -      | 995                                    | 3377 | -      | 943                                         | 3420  | -      | 1052                                                       | 3717  | -      | 733                                                                                                                      | 2920  | -      |
| Soybean- mustard                      | 1121                                     | 1170  | -      | 852                                                                                | 1027  | -      | 978                                    | 1083 | -      | 946                                         | 1130  | -      | 1220                                                       | 1260  | -      | 740                                                                                                                      | 906   | -      |
| Soybean- chickpea                     | 1106                                     | 1330  | -      | 836                                                                                | 1086  | -      | 886                                    | 1150 | -      | 942                                         | 1260  | -      | 1169                                                       | 1404  | -      | 808                                                                                                                      | 995   | -      |
| Soybean- linseed                      | 904                                      | 1091  | -      | 852                                                                                | 880   | -      | 988                                    | 1125 | -      | 933                                         | 1134  | -      | 930                                                        | 1175  | -      | 745                                                                                                                      | 853   | -      |
| Mean soybean                          | 1034                                     |       |        | 830                                                                                |       |        | 962                                    |      |        | 941                                         |       |        | 1093                                                       |       |        | 757                                                                                                                      |       |        |
| Calicut                               |                                          |       |        |                                                                                    |       |        |                                        |      |        |                                             |       |        |                                                            |       |        |                                                                                                                          |       |        |
| Ginger-fallow                         | 12270                                    | -     | -      | 10130                                                                              | -     | -      | 8970                                   | -    | -      | -                                           | -     | -      | 12670                                                      | -     | -      | 9130                                                                                                                     | -     | -      |
| Turmeric (Rhizome fresh yield)-fallow | 42900                                    | -     | -      | 27500                                                                              | -     | -      | 43700                                  | -    | -      | -                                           | -     | -      | 42500                                                      | -     | -      | 42600                                                                                                                    | -     | -      |

| Turmeric (dry yield)-fallow             | 12000       | -                   | -     | 7700        |                    |      | 12300      | -                   | -    | -           | -                  | 11900       | -                  | 12100       | -                  | -    |
|-----------------------------------------|-------------|---------------------|-------|-------------|--------------------|------|------------|---------------------|------|-------------|--------------------|-------------|--------------------|-------------|--------------------|------|
| Coimbatore                              |             |                     |       |             |                    |      |            |                     |      |             |                    |             |                    |             |                    |      |
| Brinjal - pearl millet - green manure   | 20512       | 2078                |       | 17676       | 1845               |      | 17968      | 1897                |      | 24882       | 2345               | 21254       | 2156               | 17803       | 1967               |      |
| Chilli - barnyard millet - green manure | 14814       | 1690                |       | 13023       | 1570               |      | 14730      | 1653                |      | 17533       | 1775               | 15180       | 1710               | 13740       | 1684               |      |
| Tomato - finger millet - green manure   | 18584       | 2645                |       | 16156       | 2245               |      | 17573      | 2512                |      | 24090       | 2975               | 20036       | 2712               | 16634       | 2398               |      |
| Dharwad                                 |             |                     |       |             |                    |      |            |                     |      |             |                    |             |                    |             |                    |      |
| Pigeonpea + green gram (1:2)            | 1502 + 138  |                     |       | 1385 + 140  |                    |      | 1066 + 136 |                     |      | 1449 + 136  |                    | 1533 + 175  |                    | 1214 + 139  |                    |      |
| Pigeonpea + soybean (1:2)               | 1215 + 1638 |                     |       | 1191 + 1625 |                    |      | 841 + 1575 |                     |      | 1159 + 1665 |                    | 1029 + 1673 |                    | 805 + 1521  |                    |      |
| Pigeonpea + groundnut (1:2)             | 1731 + 849  |                     |       | 1834 + 1096 |                    |      | 1629 + 897 |                     |      | 1593 + 1030 |                    | 1298 + 1094 |                    | 1036 + 1065 |                    |      |
| Cotton + green gram (1:2)               | 949 + 142   |                     |       | 633 + 167   |                    |      | 731 + 216  |                     |      | 912 + 226   |                    | 667 + 148   |                    | 589 + 187   |                    |      |
| Cotton + soybean (1:2)                  | 600 + 1534  |                     |       | 650 + 1832  |                    |      | 581 + 1393 |                     |      | 651 + 1627  |                    | 672 + 1978  |                    | 572 + 1450  |                    |      |
| Jabalpur                                |             |                     |       |             |                    |      |            |                     |      |             |                    |             |                    |             |                    |      |
| Soybean- wheat                          | 624         | 2087                |       | 574         | 2167               |      | 561        | 3156                |      | 356         | 1952               | 515         | 2066               | 554         | 2278               |      |
| Soybean-mustard- greengram              | 614         | 680                 | 110   | 551         | 721                | 145  | 603        | 1786                | 88   | 388         | 985                | 555         | 884                | 567         | 389                | 210  |
| Soybean-berseem (F & S)                 | 625         | (F) 66000 + (S) 112 |       | 581         | (F) 62000 + (S) 54 |      | 583        | (F) 75500 + (S) 148 |      | 389         | (F) 63000 + (S) 39 | 567         | (F) 72800 + (S) 42 | 594         | (F) 69900 + (S) 76 |      |
| Soybean- lentil- sorghum (F)            | 621         | 321                 | 11594 | 554         | 310                | 9024 | 593        | 264                 | 7414 | 351         | 222                | 479         | 212                | 573         | 348                | 9998 |
| Mean soybean                            | 621         |                     |       | 565         |                    |      | 585        |                     |      | 371         |                    | 529         |                    | 572         |                    |      |
| Karjat                                  |             |                     |       |             |                    |      |            |                     |      |             |                    |             |                    |             |                    |      |
| Rice – brinjal                          | 3576        | 27345               |       | 3180        | 23230              |      | 3555       | 31539               |      | 2986        | 18148              | 3580        | 28241              | 3150        | 24856              |      |



|                                                         |      |            |      |            |      |            |      |            |       |           |       |            |      |
|---------------------------------------------------------|------|------------|------|------------|------|------------|------|------------|-------|-----------|-------|------------|------|
| Rice – chick pea                                        | 2857 | 1453       | 2642 | 1143       | 3011 | 1148       | 2705 | 1015       | 3068  | 1362      | 2843  | 1212       |      |
| Rice – field bean                                       | 3181 | 1148       | 2791 | 996        | 3214 | 987        | 2806 | 858        | 3297  | 1098      | 2987  | 920        |      |
| Rice – white onion                                      | 3311 | 14602      | 3063 | 9678       | 3359 | 12825      | 2955 | 9330       | 3480  | 15128     | 3070  | 11298      |      |
| Rice mean                                               | 3231 |            | 2919 |            | 3285 |            | 2863 |            | 3356  |           | 3013  |            |      |
| Ludhiana                                                |      |            |      |            |      |            |      |            |       |           |       |            |      |
| Basmati rice-chickpea-green manure                      | 3850 | 1260       | 3860 | 970        | 3930 | 700        | 3990 | 750        | 4050  | 1120      | 3930  | 1020       |      |
| Basmati rice-wheat-green manure (GM)                    | 3780 | 3950       | 3830 | 3530       | 3900 | 4650       | 3940 | 4800       | 3910  | 4350      | 3880  | 3650       |      |
| Kharif moong-wheat-summer moong                         | 640  | 4840       | 780  | 4510       | 530  | 5260       | 510  | 5410       | 660   | 5150      | 580   | 4680       | 750  |
| Sesame-lentil                                           | 650  | 1350       | 570  | 1190       | 510  | 1640       | 490  | 1540       | 620   | 1600      | 580   | 1290       |      |
| Modipuram                                               |      |            |      |            |      |            |      |            |       |           |       |            |      |
| Sesame –lentil – vegetable cowpea (pod)                 | 350  | 808        | 4355 | 850        | 3951 | 767        | 346  | 900        | 4382  | 675       | 342   | 925        | 4072 |
| Finger millet – barley – sesbania rostrata green manure | 1947 | 2683       | -    | 1758       | 2273 | 2350       | 2527 | 2208       | 1900  | 3033      | 2053  | 2950       |      |
| Okra – vegetable pea – sesbania aculeata green manure   | 9961 | 6067       | 9754 | 5572       | 8571 | 5886       | 7099 | 5801       | 10140 | 5942      | 10166 | 5181       |      |
| Black gram – tomato – sunhemp green manure              | 1063 | 15875      | 1225 | 13006      | 1092 | 15392      | 1198 | 16350      | 1325  | 15171     | 1492  | 14258      |      |
| Pantnagar                                               |      |            |      |            |      |            |      |            |       |           |       |            |      |
| Basmati rice - wheat                                    | 4765 | 4534       | 4231 | 3742       | 4305 | 4942       | 4453 | 5223       | 4831  | 5372      | 4187  | 4663       |      |
| Basmati rice – mustard                                  | 4520 | 1539       | 4335 | 1419       | 4416 | 1671       | 4535 | 1556       | 4631  | 1776      | 4313  | 1444       |      |
| Basmati rice – vegetable pea + coriander (4:2)          | 4908 | 4307 + 667 | 4528 | 4586 + 167 | 4750 | 3793 + 417 | 4854 | 3586 + 167 | 5017  | 5193 + 62 | 4565  | 4964 + 183 |      |
| Basmati rice – potato                                   | 4683 | 11429      | 4350 | 9286       | 4631 | 8929       | 4387 | 10071      | 4542  | 10714     | 4157  | 10429      |      |
| Mean basmati rice                                       | 4719 |            | 4361 |            | 4526 |            | 4557 |            | 4755  |           | 4306  |            |      |

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**वार्षिक प्रतिवेदन 2024-25**





**Table 7.2.2: Influence of organic, inorganic and integrated management package on systems productivity (kg/ ha) at various locations**

| Locations & cropping systems             | Organic                               |                                                                  | Inorganic                           |                                          | Towards organic (Integrated )                             |                                                                                                                       | Mean  |
|------------------------------------------|---------------------------------------|------------------------------------------------------------------|-------------------------------------|------------------------------------------|-----------------------------------------------------------|-----------------------------------------------------------------------------------------------------------------------|-------|
|                                          | Organic-I [100% as per NPOP standard] | Organic-II [50% nutrients through organic sources + NF practice] | 100% inorganic (No organic manures) | State recommendations or farmers package | Towards Organic-I [50% Organic +50% Inorganic nutrient's] | Towards Organic-II [25% nutrients through organic +25% nutrients through inorganic source of nutrients + NF practice] |       |
| <b>Bajaura (Cauliflower equivalent))</b> |                                       |                                                                  |                                     |                                          |                                                           |                                                                                                                       |       |
| French bean - cauliflower- french bean   | 25503                                 | 23951                                                            | 18202                               | 34936                                    | 29152                                                     | 26196                                                                                                                 | 26323 |
| Cauliflower-tomato                       | 46113                                 | 41743                                                            | 30287                               | 54880                                    | 49185                                                     | 46547                                                                                                                 | 44793 |
| Black gram-cauliflower-summer Squash     | 31339                                 | 29484                                                            | 22052                               | 36516                                    | 33218                                                     | 31497                                                                                                                 | 30684 |
| Okra-pea                                 | 22669                                 | 20896                                                            | 16595                               | 26135                                    | 24155                                                     | 22613                                                                                                                 | 22177 |
| Mean                                     | 31406                                 | 29019                                                            | 21784                               | 38117                                    | 33928                                                     | 31713                                                                                                                 |       |
| <b>Bhopal (Soybean equivalent)</b>       |                                       |                                                                  |                                     |                                          |                                                           |                                                                                                                       |       |
| Soybean-durum wheat                      | 2659                                  | 2242                                                             | 2503                                | 2502                                     | 2841                                                      | 2090                                                                                                                  | 2473  |
| Soybean- mustard                         | 2356                                  | 1990                                                             | 2186                                | 2218                                     | 2524                                                      | 1780                                                                                                                  | 2176  |
| Soybean- chickpea                        | 2447                                  | 2010                                                             | 2212                                | 2311                                     | 2640                                                      | 1838                                                                                                                  | 2243  |
| Soybean- linseed                         | 2280                                  | 1882                                                             | 2307                                | 2297                                     | 2583                                                      | 1777                                                                                                                  | 2188  |
| Mean                                     | 2436                                  | 2031                                                             | 2302                                | 2332                                     | 2647                                                      | 1871                                                                                                                  |       |
| <b>Coimbatore (Brinjal equivalent)</b>   |                                       |                                                                  |                                     |                                          |                                                           |                                                                                                                       |       |
| Brinjal - pearl millet - green manure    | 24945                                 | 21629                                                            | 22642                               | 30533                                    | 26404                                                     | 22655                                                                                                                 | 24801 |
| Chilli - barnyard millet - green manure  | 23083                                 | 21445                                                            | 24185                               | 28225                                    | 24816                                                     | 22835                                                                                                                 | 24098 |
| Tomato - finger millet - green manure    | 22816                                 | 19748                                                            | 21592                               | 28850                                    | 24375                                                     | 20471                                                                                                                 | 22975 |
| Mean                                     | 23615                                 | 20941                                                            | 22806                               | 29203                                    | 25198                                                     | 21987                                                                                                                 |       |
| <b>Dharwad (Pigeon pea equivalent)</b>   |                                       |                                                                  |                                     |                                          |                                                           |                                                                                                                       |       |
| Pigeonpea + green gram (1:2)             | 1657                                  | 1543                                                             | 1220                                | 1603                                     | 1731                                                      | 1370                                                                                                                  | 1521  |
| Pigeonpea + soybean (1:2)                | 2540                                  | 2506                                                             | 2116                                | 2507                                     | 2383                                                      | 2035                                                                                                                  | 2348  |
| Pigeonpea + groundnut (1:2)              | 2359                                  | 2645                                                             | 2292                                | 2355                                     | 2108                                                      | 1824                                                                                                                  | 2264  |
| Cotton + green gram (1:2)                | 1071                                  | 777                                                              | 918                                 | 1107                                     | 804                                                       | 750                                                                                                                   | 905   |
| Cotton + soybean (1:2)                   | 1548                                  | 1783                                                             | 1442                                | 1656                                     | 1894                                                      | 1468                                                                                                                  | 1632  |
| Mean                                     | 1835                                  | 1851                                                             | 1598                                | 1846                                     | 1784                                                      | 1489                                                                                                                  |       |
| <b>Jabalpur (Soybean)</b>                |                                       |                                                                  |                                     |                                          |                                                           |                                                                                                                       |       |
| Soybean- wheat                           | 1656                                  | 1646                                                             | 2122                                | 1321                                     | 1537                                                      | 1681                                                                                                                  | 1661  |

|                                                         |       |       |       |       |       |       |       |
|---------------------------------------------------------|-------|-------|-------|-------|-------|-------|-------|
| Soybean-mustard- greengram                              | 1652  | 1974  | 3042  | 1749  | 2044  | 1406  | 1978  |
| Soybean-berseem (F & S)                                 | 3495  | 3277  | 3866  | 3128  | 3732  | 3633  | 3522  |
| Soybean- lentil- sorghum (F)                            | 1460  | 1125  | 1458  | 704   | 860   | 1148  | 1126  |
| Mean                                                    | 2066  | 2006  | 2622  | 1726  | 2043  | 1967  |       |
| Karjat (Rice equivalent)                                |       |       |       |       |       |       |       |
| Rice – brinjal                                          | 30206 | 25853 | 27345 | 16868 | 24958 | 21975 | 24534 |
| Rice – chick pea                                        | 10856 | 9111  | 7846  | 6961  | 8707  | 7862  | 8557  |
| Rice – field bean                                       | 11547 | 10074 | 8668  | 7494  | 9233  | 8094  | 9185  |
| Rice – white onion                                      | 29852 | 21007 | 21619 | 16313 | 24906 | 19182 | 22147 |
| Mean                                                    | 20615 | 16511 | 16370 | 11909 | 16951 | 14278 |       |
| Ludhiana (Wheat equivalent)                             |       |       |       |       |       |       |       |
| Basmati rice-chickpea-green manure                      | 10100 | 9400  | 8900  | 9200  | 10200 | 9700  | 9583  |
| Basmati rice-wheat-green manure (GM)                    | 10900 | 10600 | 11900 | 12100 | 11600 | 10800 | 11317 |
| Kharif moong-wheat-summer moong                         | 10200 | 9200  | 9400  | 9600  | 10700 | 9700  | 9800  |
| Sesame-lentil                                           | 6300  | 5500  | 6600  | 6200  | 6900  | 5800  | 6217  |
| Mean                                                    | 9375  | 8675  | 9200  | 9275  | 9850  | 9000  |       |
| Modipuram (Rice equivalent)                             |       |       |       |       |       |       |       |
| Sesame –lentil – vegetable cowpea (pod)                 | 5994  | 6006  | 5829  | 6259  | 5552  | 6163  | 5967  |
| Finger millet – barley – sesbania rostrata green manure | 5952  | 4952  | 6285  | 6642  | 6162  | 6380  | 6062  |
| Okra – vegetable pea – sesbania aculeata green manure   | 13272 | 12634 | 12073 | 10907 | 13281 | 12554 | 12454 |
| Black gram – tomato – sunhemp green manure              | 15293 | 13737 | 15037 | 15968 | 15669 | 15566 | 15212 |
| Mean                                                    | 10128 | 9332  | 9806  | 9944  | 10166 | 10166 |       |
| Pantnagar (Rice equivalent)                             |       |       |       |       |       |       |       |
| Basmati rice - wheat                                    | 8121  | 7002  | 8554  | 8943  | 9449  | 7559  | 8271  |
| Basmati rice – mustard                                  | 7927  | 7478  | 8830  | 8643  | 9322  | 8038  | 8373  |
| Basmati rice – vegetable pea + coriander (4:2)          | 8538  | 6721  | 7177  | 7085  | 7299  | 6936  | 7293  |
| Basmati rice – potato                                   | 7652  | 6762  | 6824  | 6860  | 7174  | 6718  | 6998  |
| Mean                                                    | 8060  | 6991  | 7846  | 7883  | 8311  | 7313  |       |
| Raipur (Soybean equivalent)                             |       |       |       |       |       |       |       |
| Soybean-sweet corn                                      | 10922 | 9772  | 8674  | 9441  | 8481  | 7458  | 9125  |
| Soybean- field bean                                     | 8416  | 6501  | 6577  | 7288  | 5949  | 5333  | 6677  |
| Soybean-tomato                                          | 12972 | 10460 | 9234  | 11519 | 9180  | 7539  | 10151 |
| Soybean-cabbage                                         | 17943 | 14687 | 13877 | 15169 | 13367 | 10825 | 14311 |
| Mean                                                    | 12563 | 10355 | 9591  | 10854 | 9244  | 7789  |       |



|                                                           |       |       |       |      |       |       |       |
|-----------------------------------------------------------|-------|-------|-------|------|-------|-------|-------|
| Ranchi (Rice equivalent)                                  |       |       |       |      |       |       |       |
| Rice– wheat                                               | 5945  | 6329  | 5600  | 3558 | 5518  | 6183  | 5522  |
| Rice - onion                                              | 15833 | 14835 | 10746 | 8347 | 13938 | 15145 | 13141 |
| Rice - potato                                             | 17415 | 16055 | 10641 | 7325 | 12498 | 14047 | 12997 |
| Rice - okra                                               | 10152 | 10039 | 7938  | 5530 | 8083  | 9680  | 8570  |
| Mean                                                      | 12336 | 11815 | 8731  | 6190 | 10009 | 11264 |       |
| Umiyam (Rice equivalent)                                  |       |       |       |      |       |       |       |
| Okra - carrot                                             | 26600 | 17100 | 23100 | -    | 26000 | -     | 23200 |
| Okra - potato                                             | 23500 | 17700 | 18100 | -    | 22000 | -     | 20325 |
| Okra - french bean                                        | 13300 | 12500 | 14800 | -    | 15500 | -     | 14025 |
| Okra - tomato                                             | 25600 | 20300 | 21000 | -    | 27600 | -     | 23625 |
| Mean                                                      | 22250 | 16900 | 19250 |      | 22775 |       |       |
| Ajmer (Cowpea equivalent)                                 |       |       |       |      |       |       |       |
| Cow pea + maize (4:2) -coriander + cabbage (2:1)          | 1798  | 2064  | 2089  | 2294 | 1815  | 2070  | 2022  |
| Cow pea + maize (4:2)- fennel + cabbage (2:1)             | 3458  | 3096  | 3353  | 3905 | 3402  | 3287  | 3417  |
| Cow pea (sole)-fennel                                     | 1731  | 1863  | 2018  | 2085 | 1768  | 1720  | 1864  |
| Cow pea (sole)-coriander                                  | 1360  | 1337  | 1353  | 1480 | 1327  | 1411  | 1378  |
| Mean                                                      | 2087  | 2090  | 2203  | 2441 | 2078  | 2122  |       |
| Almora (Wheat equivalent)                                 |       |       |       |      |       |       |       |
| Grain amaranth - wheat + lentil (2:1)                     | 2864  | 2623  | 924   |      | 1457  |       | 1967  |
| Finger millet + black soybean (2:1) - wheat + toria (2:1) | 2750  | 2320  | 984   |      | 1520  |       | 1893  |
| Mean                                                      | 2807  | 2471  | 954   |      | 1488  |       |       |
| Gangtok (Maize equivalent)                                |       |       |       |      |       |       |       |
| Maize + ginger (1:1) - french bean                        | 12940 | 10280 |       |      |       |       |       |
| Maize - soybean – buckwheat                               | 6070  | 5290  |       |      |       |       |       |
| Maize + turmeric (1:1) - rajmash                          | 12050 | 9070  |       |      |       |       |       |
| Maize - black gram (Pahenlo Dal) - toria                  | 9250  | 6300  |       |      |       |       |       |
| Mean                                                      | 10078 | 7735  |       |      |       |       |       |
| Narendrapur (Rice equivalent)                             |       |       |       |      |       |       |       |
| Rice (Gobindo bhog)-rice (Satabdi)                        | 3120  | 3050  | 3460  | 3180 | 1940  | 2330  | 2847  |
| Rice (Kanakchur)- sesbania green manure                   | 340   | 530   | 880   | 510  | 920   | 590   | 628   |
| Rice (Dudheswar)- red amaranthus+cucumber                 | 1980  | 1510  | 8610  | 7500 | 7980  | 8160  | 5957  |

|                                                  |       |       |       |       |       |       |       |
|--------------------------------------------------|-------|-------|-------|-------|-------|-------|-------|
| Rice (Satabdi) - veg. pea                        | 6250  | 5250  | 7920  | 7340  | 6630  | 6530  | 6653  |
| Mean                                             | 2923  | 2585  | 5218  | 4633  | 4368  | 4403  |       |
| S.K. Nagar (Groundnut equivalent)                |       |       |       |       |       |       |       |
| Green gram-amaranth – fallow                     | 1979  | 1556  | 2088  | 2228  | 2003  | 1816  | 1945  |
| Green gram -mustard –fallow                      | 1731  | 1413  | 1894  | 1998  | 1747  | 1643  | 1738  |
| Groundnut–lucerne - lucerne continue             | 2848  | 2514  | 2996  | 3272  | 2931  | 2552  | 2852  |
| Mean                                             | 2186  | 1828  | 2326  | 2499  | 2227  | 2004  |       |
| Thiruvananthapuram (Cassava equivalent)          |       |       |       |       |       |       |       |
| Cassava -vegetable cowpea                        | 28385 | 18321 | 16585 | 14447 | 20511 | 21397 | 19941 |
| Cassava -groundnut                               | 24967 | 16710 | 11127 | 11533 | 17991 | 15509 | 16306 |
| Taro -black gram                                 | 6940  | 5518  | 5267  | 4386  | 5331  | 5064  | 5418  |
| Taro -green gram                                 | 8704  | 7376  | 6319  | 7340  | 5702  | 5792  | 6872  |
| Mean                                             | 17249 | 11981 | 9825  | 9426  | 12384 | 11940 |       |
| Udaipur (Maize equivalent)                       |       |       |       |       |       |       |       |
| Maize + blackgram (2:2) – durum wheat – sesbania | 8991  | 8594  | 9255  | 9598  | 9932  | 8182  | 9092  |
| Blackgram – wheat (Triticum aestivum)            | 7476  | 7244  | 7876  | 8243  | 8623  | 6979  | 7740  |
| Sweet corn + blackgram (2:2) – chickpea          | 8965  | 8343  | 9376  | 9678  | 10132 | 7978  | 9079  |
| Greengram – fenugreek                            | 6785  | 6485  | 7272  | 7547  | 8088  | 6286  | 7077  |



### **Influence of organic inorganic and towards organic (integrated) management packages on soil physio-chemical properties and available nutrient status (Table 7.2.3 -7.2.9)**

**Bajaura:** pH, organic carbon, available N, P, K, Mn, Zn, Cu and Fe were estimated. Among all management practices, soil pH under organic management ranged between 6.9-6.93 which is numerically lower than towards organic-I. Organic carbon in ranged between 1.36 to 1.49% under organic management practice which was higher to tune of 21.1% than towards organic-II. Among all the cropping systems, organic carbon recorded highest (1.23%) in okra-pea system and lowest (1.20%) in cauliflower-tomato. Availability of residual N (266.1 kg/ha), phosphorus (79.5 kg/ha) and potassium (256.0 kg/ha) were higher with towards organic-I (integrated) followed by organic production system. Among the cropping systems, okra-pea recorded maximum N availability in the soil whereas P and K was higher in cauliflower-tomato. Availability of micro-nutrients iron, manganese, zinc and copper recorded higher under towards organic-I followed by organic management practice. Organic management resulted in 2.7, 4.6, 4.8 and 19.6% lower availability of Fe, Mn, Zn & Cu than the towards organic-II respectively.

**Bhopal:** Physico-chemical properties of soil in term of electric conductivity, pH, OC, available P & K were estimated. Not much changes were observed among various input practice and cropping systems. Electric conductivity under organic production package ranged between 0.298-0.306 ds/m which is 8.9% lower than towards organic-II. Soil organic carbon under organic management practice ranged between 0.91 to 0.97 which is about 9% higher than towards organic-II. Among the cropping systems, organic carbon resulted in higher in soybean-wheat (duram) system. Availability of P and K in the soil were higher under organic management ranged between 87.0-88.8 and 686-702 kg/ha which were 6.3 and 3.9% higher than the towards organic-II.

**Calicut:** pH, OC, available N, P, K and micronutrients Fe, Mn, Zn & Cu were estimated. In ginger and turmeric, soil pH, organic carbon, nitrogen, phosphorus and potassium iron, manganese and copper were higher under organic management practice. An increase in soil organic carbon found to higher to the tune of 15.4 and 2.5% with organic than towards organic-II in ginger and turmeric respectively. Availability of N, P and K in ginger recorded in ranged 258.9 - 288.0, 23.7 - 48.3 and 251.4 - 290.2 kg/ha respectively which was 5.7, 122.6 and 21.0% higher than the towards organic management practice. In case of turmeric, it ranged between 337.1-345.1, 115.3-158.6 and 546.3-676.6 kg/ha respectively which is 2.4, 22.1 and 8.6% higher than the towards organic-II respectively. Micronutrients such as Fe and Cu recorded higher under organic (100%) practice in while Zn and Mn recorded higher under towards organic in ginger, similarly, in turmeric Fe, Mn and Cu was higher with organic.

**Dharwad:** BD, EC, pH, OC, available N, P, K and micronutrients Fe, Mn, Zn & Cu were estimated. In general, bulk density, electrical conductivity and pH recorded lower value with organic management practices. Among all management practices, organic carbon under organic management ranged between 5.02-5.67 g kg<sup>-1</sup> which is 17.6% & 31.9% higher than towards organic-II and inorganic respectively. Not much variation was observed among all the cropping systems for OC and found to be in ranged from 4.65- 4.97 g kg<sup>-1</sup>. In general availability of residual N (256.0 kg/ha), phosphorus (37.0 kg/ha) and potassium (387.0 kg/ha) were higher with organic management practice (100%). Among the cropping systems, pigeonpea+groundnut system retained better NPK availability in the soil. Organic nutrient management recorded better micronutrients availability (iron, manganese, zinc and copper). Organic management resulted in 13.4, 8.1, 3.7 and 7.3% higher availability of Fe, Mn, Zn & Cu than the towards organic-II respectively.

**Jabalpur:** EC, pH, OC and available N, P, K were estimated. Electrical conductivity under organic management ranged between 0.18- 0.22 ds/m which is 69% higher than the towards organic-II which recorded minimum EC of 0.13 ds/m. Among the management practices, not much variation is recorded for pH, and found to be lowest under organic with 50% organic + NF practices. Under organic management OC ranged from 3.08 to 3.43 g kg<sup>-1</sup> which is 12.7% lower than the towards organic-II. Availability of N, P & K recorded higher under organic either with 100% or 50% organic + practices which is 5.7, 6.8 & 2.7% higher than the towards organic management practice.

**Ludhiana:** In general, electrical conductivity, pH, soil organic carbon, were higher under organic management either with adoption of 50% organic input + NF practice. Soil organic carbon recorded higher to the tune of 10.7% over towards organic management practice. Similarly, basmati rice- wheat- green manure resulted in higher organic carbon 0.68% under organic management practice.

**Modipuram:** Chemical properties of soil such as electrical conductivity, pH, soil organic carbon, available N, P, & K and micronutrients Fe, Mn, Zn & Cu were estimated. Electrical conductivity in the soil recorded lower either with organic or towards organic than the inorganic practice. Soil pH was observed neutral in nature under organic management ranged between 7.63- 7.73. Among all the management practices organic management practice recorded organic carbon ranged from 8.40 to 8.50 g kg<sup>-1</sup> which is 25.7% higher than towards organic-II (25% nutrients through organic +25% nutrients through inorganic source of nutrients + NF practice). Availability of N, P & K under organic management ranged between 133.8- 139 kg/ha, 50.0-50.1 kg/ha, 182.4-192.1 kg/ha respectively. Among the four cropping system black rice-lentil-cowpea system recorded higher available N & P, however, K was higher in finger millet-barley-sesbania system. In general availability of micronutrients (Fe, Mn, Zn & Cu) in the soil recorded higher under organic management system.

**Pantnagar:** Lower EC (0.32 dsm<sup>-1</sup>) was recorded under organic package with 50% organic + NF practices among all nutrient management practice, similarly, basmati rice -wheat and rice-potato system recorded lowest EC (0.38 dsm<sup>-1</sup>). Soil pH varied from 6.71 to 7.96 across the various management practice and cropping systems. At the end of cropping cycle, maximum soil organic carbon recorded under organic package (1.44%) followed by towards organic (1.26%). The significant improvement in soil organic carbon found to be 14.3 % with organic than towards organic. Similarly, availability of N, and P (166.3 and 26.8 kg/ha) in soil was recorded under organic management which is 3.1% higher than towards organic management-II whereas, availability of K was in the soil found to be at par among the various cropping system. Availability of micro nutrients in the soil i.e. Fe, Mn, Zn and Cu did not differ among the nutrients management practice as well as cropping systems.

**Raipur:** Soil organic carbon, available N, P and K were estimated. Among all the management practices, organic carbon content under organic management practices ranged between 0.78 to 0.82% after end of cropping cycle which was about 6.5% higher than towards organic-II. Similarly, soybean-frenchbean recorded highest organic carbon content in the soil of 0.83% among 4 cropping systems. Likewise, available N, P & K under organic management practice ranged between 247.7-247.7, 21.0-22.1 and 380.1-386.6 g/ha respectively where N and P was higher by 8.9 and 24.2% than towards organic-II practice but K was at par to each other.

**Narendrapur:** Physico-chemical properties of soil in term of bulk density, electric conductivity, pH, OC, available N, P & K were estimated. Among the management practices, bulk density, electric conductivity and pH recorded numerically lower with management practice towards organic-II under integrated package followed by organic. Soil organic carbon under organic management package ranged between 0.84-0.89% which is 8.5% higher than towards organic and 20.3% higher than inorganic. Similarly, rice (Gobindobhog)-broccoli-sesbania green manure and rice (Shatabdi) -vegetable pea-sesame system recorded better organic carbon (0.84%) among the systems. Availability of N and P in the soil recorded better under organic management practice whereas, K was better under towards organic management practice.

**Sardarkrushinagar:** In general, lower value of bulk density and electrical conductivity recorded with organic management practices while pH status was improved due to the adoption of 25% organic+ 25% inorganic input +NF practice. Organic carbon content was higher under 100% organic practice (0.38%) which is 11.8% higher than towards organic management-II. Organic carbon among the cropping systems recorded better with groundnut- wheat- green gram system. Available N and K status in the soil at the end of cropping cycle was higher under 100% organic practice followed by integrated (towards organic) while status of available P was better with towards organic. No significant variation was observed among the cropping systems for available N, P & K. Availability of micronutrients in the soil (Mn, Zn and Cu) were higher under 100% organic practice whereas Fe was higher under towards organic.

**Thiruvananthapuram:** EC, pH, OC, available N, P, K and Fe, Zn and Cu were estimated. In general, electrical conductivity and pH recorded lower values towards organic ranged between 0.17-0.23 and 4.49-4.60 respectively. Organic carbon status was improved due to the adoption of 100% organic input to the tune of 18.1% under organic management practice than towards organic-II. Taro followed by black gram and green gram recorded better organic carbon in the soil. Among all the management practice, available N, P and K was in the soil ranged between 270.5-286.2, 48.96-57.58 and 137.5-190.3 kg/ha respectively which is 5.8, 28.0 and 38.3% higher than towards organic management practice with application of 25% nutrients through organic +25% nutrients through inorganic source of nutrients + NF practice.



**Table 7.2.3: Influence of organic, inorganic and integrated package on soil physio-chemical properties (bulk density and electrical conductivity) at the end of cropping cycle at various locations**

| Locations/Treatments         | Bulk Density (g cm <sup>-3</sup> ) |               |      |           |          |      | Electricity Conductivity (ds/m) |               |       |                              |               |       |
|------------------------------|------------------------------------|---------------|------|-----------|----------|------|---------------------------------|---------------|-------|------------------------------|---------------|-------|
|                              | Organic                            |               |      | Inorganic |          |      | Towards organic (Integrated)    |               |       | Towards organic (Integrated) |               |       |
|                              | Organic-ic-I                       | Organic-ic-II |      | Inorganic | SR or FP |      | Organic-ic-I                    | Organic-ic-II |       | Organic-ic-I                 | Organic-ic-II | Mean  |
| Bhopal                       |                                    |               |      |           |          |      |                                 |               |       |                              |               |       |
| Soybean-durum wheat          | -                                  | -             | -    | -         | -        | -    | 0.29                            | 0.286         | 0.325 | 0.265                        | 0.283         | 0.291 |
| Soybean- mustard             | -                                  | -             | -    | -         | -        | -    | 0.297                           | 0.29          | 0.258 | 0.289                        | 0.291         | 0.283 |
| Soybean- chickpea            | -                                  | -             | -    | -         | -        | -    | 0.296                           | 0.29          | 0.262 | 0.292                        | 0.287         | 0.285 |
| Soybean- linseed             | -                                  | -             | -    | -         | -        | -    | 0.284                           | 0.299         | 0.292 | 0.273                        | 0.298         | 0.290 |
| Mean                         |                                    |               |      |           |          |      | 0.293                           | 0.291         | 0.284 | 0.280                        | 0.290         | 0.285 |
| Dharwad                      |                                    |               |      |           |          |      |                                 |               |       |                              |               |       |
| Pigeonpea + green gram (1:2) | 1.33                               | 1.22          | 1.37 | 1.34      | 1.38     | 1.43 | 0.05                            | 0.03          | 0.10  | 0.09                         | 0.07          | 0.06  |
| Pigeonpea + soybean (1:2)    | 1.34                               | 1.42          | 1.38 | 1.26      | 1.42     | 1.45 | 0.05                            | 0.04          | 0.03  | 0.05                         | 0.08          | 0.05  |
| Pigeonpea + groundnut (1:2)  | 1.35                               | 1.26          | 1.40 | 1.33      | 1.52     | 1.27 | 0.04                            | 0.21          | 0.05  | 0.10                         | 0.05          | 0.08  |
| Cotton + green gram (1:2)    | 1.26                               | 1.34          | 1.31 | 1.29      | 1.21     | 1.31 | 0.09                            | 0.09          | 0.09  | 0.06                         | 0.07          | 0.08  |
| Cotton + soybean (1:2)       | 1.19                               | 1.33          | 1.31 | 1.37      | 1.36     | 1.34 | 0.05                            | 0.06          | 0.10  | 0.12                         | 0.09          | 0.08  |
| Mean                         | 1.29                               | 1.31          | 1.35 | 1.318     | 1.38     | 1.36 | 0.06                            | 0.09          | 0.07  | 0.084                        | 0.07          | 0.05  |
| Jabalpur                     |                                    |               |      |           |          |      |                                 |               |       |                              |               |       |
| Soybean- wheat               |                                    |               |      |           |          |      | 0.21                            | 0.20          | 0.21  | 0.23                         | 0.21          | 0.22  |
| Soybean-mustard- greengram   |                                    |               |      |           |          |      | 0.22                            | 0.21          | 0.25  | 0.21                         | 0.22          | 0.22  |
| Soybean-berseem (F & S)      |                                    |               |      |           |          |      | 0.22                            | 0.19          | 0.27  | 0.24                         | 0.24          | 0.24  |
| Soybean- lentil- sorghum (F) |                                    |               |      |           |          |      | 0.20                            | 0.21          | 0.23  | 0.24                         | 0.22          | 0.22  |
| Mean                         |                                    |               |      |           |          |      | 0.21                            | 0.20          | 0.24  | 0.23                         | 0.22          | 0.23  |
| Karjat                       |                                    |               |      |           |          |      |                                 |               |       |                              |               |       |

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**Table 7.2.4: Influence of organic, inorganic and integrated package on soil chemical properties (pH and Organic Carbon) at the end of cropping cycle at various locations**

| Locations/Treatments                    | pH         |             |      |            |                   |          | Organic carbon (%) |             |      |                   |          |                              |
|-----------------------------------------|------------|-------------|------|------------|-------------------|----------|--------------------|-------------|------|-------------------|----------|------------------------------|
|                                         | Organic    |             |      | Inorganic  |                   |          | Organic            |             |      | Inorganic         |          |                              |
|                                         | Organ-ic-I | Organ-ic-II | Mean | Organ-ic-I | Inor-ganic (100%) | SR or FP | Organ-ic-I         | Organ-ic-II | Mean | Inor-ganic (100%) | SR or FP | Towards organic (Integrated) |
|                                         |            |             |      |            |                   |          |                    |             |      |                   |          |                              |
| Bajaura                                 |            |             |      |            |                   |          |                    |             |      |                   |          |                              |
| French bean - cauliflower- french bean  | 7.00       | 6.90        | 6.93 | 7.00       | 6.80              | 7.00     | 6.90               | 7.00        | 6.93 | 0.92              | 1.24     | 1.24                         |
| Cauliflower-tomato                      | 7.10       | 7.00        | 7.00 | 7.00       | 6.80              | 7.10     | 7.00               | 7.00        | 7.00 | 0.86              | 1.16     | 1.24                         |
| Black gram-cauliflower-summer Squash    | 7.10       | 6.90        | 6.97 | 7.00       | 6.80              | 7.00     | 7.00               | 7.00        | 6.97 | 0.86              | 1.16     | 1.26                         |
| Okra-pea                                | 7.00       | 7.00        | 6.98 | 7.00       | 6.90              | 7.10     | 6.90               | 7.00        | 6.98 | 0.89              | 1.14     | 1.24                         |
| Mean                                    | 7.05       | 6.95        | 7.00 | 7.00       | 6.83              | 7.05     | 6.95               | 7.00        | 7.00 | 0.88              | 1.18     | 1.25                         |
| Bhopal                                  |            |             |      |            |                   |          |                    |             |      |                   |          |                              |
| Soybean-durum wheat                     | 7.70       | 7.7         | 7.72 | 7.71       | 7.74              | 7.74     | 7.71               | 7.71        | 7.72 | 0.62              | 0.60     | 0.89                         |
| Soybean- mustard                        | 7.7        | 7.73        | 7.73 | 7.72       | 7.75              | 7.73     | 7.72               | 7.72        | 7.73 | 0.57              | 0.62     | 0.86                         |
| Soybean- chickpea                       | 7.7        | 7.73        | 7.72 | 7.7        | 7.73              | 7.74     | 7.7                | 7.71        | 7.72 | 0.59              | 0.60     | 0.85                         |
| Soybean- linseed                        | 7.71       | 7.67        | 7.71 | 7.72       | 7.74              | 7.72     | 7.72               | 7.72        | 7.71 | 0.60              | 0.60     | 0.86                         |
| Mean                                    | 7.70       | 7.71        | 7.72 | 7.71       | 7.74              | 7.73     | 7.71               | 7.72        | 7.72 | 0.60              | 0.61     | 0.87                         |
| Calicut                                 |            |             |      |            |                   |          |                    |             |      |                   |          |                              |
| Ginger-fallow                           | 6.20       | 6.26        | 6.13 | 5.97       | 6.07              |          | 5.97               | 6.13        | 1.82 | 1.68              | 1.49     | 1.73                         |
| Turmeric-fallow                         | 5.83       | 5.51        | 5.50 | 5.46       | 5.26              |          | 5.46               | 5.50        | 2.6  | 2.5               | 2.26     | 2.38                         |
| Coimbatore                              |            |             |      |            |                   |          |                    |             |      |                   |          |                              |
| Brinjal - pearl millet - green manure   | -          | -           | -    | -          | -                 | -        | -                  | -           | 1.25 | 1.15              | 1.10     |                              |
| Chilli - barnyard millet - green manure | -          | -           | -    | -          | -                 | -        | -                  | -           | 1.33 | 1.20              | 1.35     |                              |
| Tomato - finger millet - green manure   | -          | -           | -    | -          | -                 | -        | -                  | -           | 1.24 | 1.12              | 1.19     |                              |
| Dharwad                                 |            |             |      |            |                   |          |                    |             |      |                   |          |                              |



|                                         |      |      |      |       |      |      |      |                       |      |      |       |      |      |      |
|-----------------------------------------|------|------|------|-------|------|------|------|-----------------------|------|------|-------|------|------|------|
| Pigeonpea + green gram (1:2)            | 6.92 | 7.05 | 6.99 | 6.85  | 6.91 | 6.80 | 6.92 | 0.82                  | 0.77 | 0.52 | 0.53  | 0.78 | 0.69 | 0.69 |
| Pigeonpea + soybean (1:2)               | 6.81 | 7.15 | 6.36 | 7.01  | 6.47 | 6.64 | 6.74 | 0.81                  | 0.78 | 0.51 | 0.61  | 0.74 | 0.76 | 0.70 |
| Pigeonpea + groundnut (1:2)             | 6.81 | 6.99 | 6.71 | 6.62  | 6.65 | 6.76 | 6.76 | 0.85                  | 0.78 | 0.56 | 0.63  | 0.61 | 0.49 | 0.65 |
| Cotton + green gram (1:2)               | 6.77 | 6.96 | 6.81 | 6.91  | 7.07 | 6.95 | 6.91 | 0.82                  | 0.78 | 0.51 | 0.62  | 0.74 | 0.51 | 0.66 |
| Cotton + soybean (1:2)                  | 6.95 | 6.98 | 7.35 | 6.97  | 7.08 | 7.21 | 7.09 | 0.81                  | 0.62 | 0.62 | 0.62  | 0.79 | 0.50 | 0.66 |
| Mean                                    | 6.85 | 7.03 | 6.84 | 6.872 | 6.84 | 6.87 |      | 0.82                  | 0.75 | 0.54 | 0.602 | 0.73 | 0.59 |      |
| Jabalpur                                |      |      |      |       |      |      |      |                       |      |      |       |      |      |      |
| Soybean- wheat                          | 7.21 | 7.19 | 7.27 | 7.30  | 7.20 | 7.19 | 7.23 | 0.72                  | 0.73 | 0.71 | 0.70  | 0.71 | 0.71 | 0.71 |
| Soybean-mustard- greengram              | 7.20 | 7.18 | 7.28 | 7.31  | 7.20 | 7.19 | 7.23 | 0.72                  | 0.73 | 0.70 | 0.71  | 0.72 | 0.72 | 0.72 |
| Soybean-berseem (F & S)                 | 7.20 | 7.19 | 7.27 | 7.26  | 7.21 | 7.20 | 7.22 | 0.73                  | 0.71 | 0.72 | 0.70  | 0.73 | 0.73 | 0.72 |
| Soybean- lentil- sorghum (F)            | 7.21 | 7.19 | 7.28 | 7.28  | 7.20 | 7.19 | 7.23 | 0.73                  | 0.73 | 0.70 | 0.71  | 0.72 | 0.70 | 0.72 |
| Mean                                    | 7.21 | 7.19 | 7.28 | 7.29  | 7.20 | 7.19 |      | 0.73                  | 0.73 | 0.71 | 0.71  | 0.72 | 0.72 |      |
| Karjat                                  |      |      |      |       |      |      |      |                       |      |      |       |      |      |      |
| Rice – brinjal                          | -    | -    | -    | -     | -    | -    | 6.72 | -                     | -    | -    | -     | -    | -    | 1.09 |
| Rice – chick pea                        | -    | -    | -    | -     | -    | -    | 6.66 | -                     | -    | -    | -     | -    | -    | 1.16 |
| Rice – field bean                       | -    | -    | -    | -     | -    | -    | 6.7  | -                     | -    | -    | -     | -    | -    | 1.18 |
| Rice – white onion                      | -    | -    | -    | -     | -    | -    | 6.72 | -                     | -    | -    | -     | -    | -    | 1.13 |
| Mean                                    | 6.68 | 6.72 | 6.73 | 6.71  | 6.64 | 6.73 |      | 1.21                  | 1.19 | 1.14 | 1.05  | 1.16 | 1.11 |      |
| Ludhiana                                |      |      |      |       |      |      |      |                       |      |      |       |      |      |      |
| Basmati rice-chickpea-green manure      | 7.50 | 7.40 | 7.30 | 7.30  | 7.30 | 7.40 | 7.37 | 0.60                  | 0.55 | 0.48 | 0.45  | 0.53 | 0.53 | 0.52 |
| Basmati rice-wheat-green manure         | 7.60 | 7.40 | 7.30 | 7.20  | 7.60 | 7.20 | 7.38 | 0.65                  | 0.64 | 0.46 | 0.45  | 0.56 | 0.55 | 0.55 |
| Kharrif moong-wheat-summer moong        | 7.40 | 7.20 | 7.60 | 7.40  | 7.50 | 7.50 | 7.43 | 0.64                  | 0.63 | 0.42 | 0.43  | 0.60 | 0.58 | 0.55 |
| Sesame-lentil                           | 7.70 | 7.60 | 7.40 | 7.50  | 7.50 | 7.50 | 7.53 | 0.61                  | 0.61 | 0.43 | 0.44  | 0.56 | 0.55 | 0.53 |
| Mean                                    | 7.55 | 7.40 | 7.40 | 7.35  | 7.48 | 7.40 |      | 0.63                  | 0.61 | 0.45 | 0.44  | 0.56 | 0.55 |      |
| Modipuram                               |      |      |      |       |      |      |      | (g kg <sup>-1</sup> ) |      |      |       |      |      |      |
| Sesame –lentil – vegetable cowpea (pod) | 7.67 | 7.87 | 8.00 | 8.06  | 7.95 | 7.93 | 7.91 | 8.24                  | 6.93 | 5.27 | 4.10  | 6.07 | 6.39 | 6.17 |

|                                                            |      |      |      |      |      |      |      |       |       |       |       |       |       |      |
|------------------------------------------------------------|------|------|------|------|------|------|------|-------|-------|-------|-------|-------|-------|------|
| Finger millet – barley – sesbania<br>rostrata green manure | 7.77 | 8.05 | 8.22 | 8.20 | 8.09 | 8.11 | 8.07 | 9.68  | 9.32  | 5.86  | 5.24  | 8.91  | 7.78  | 7.80 |
| Okra – vegetable pea – sesbania<br>aculeata green manure   | 8.11 | 8.05 | 8.13 | 8.13 | 8.10 | 8.13 | 8.11 | 9.58  | 8.97  | 5.43  | 4.98  | 8.18  | 7.11  | 7.38 |
| Black gram – tomato – sunhemp<br>green manure              | 7.56 | 7.98 | 7.90 | 7.84 | 7.92 | 7.87 | 7.85 | 8.68  | 8.46  | 6.05  | 5.35  | 6.82  | 6.67  | 7.01 |
| Mean                                                       | 7.78 | 7.99 | 8.06 | 8.06 | 8.02 | 8.01 |      | 9.05  | 8.42  | 5.65  | 4.92  | 7.50  | 6.99  |      |
| Pantnagar                                                  |      |      |      |      |      |      |      |       |       |       |       |       |       |      |
| Basmati rice - wheat                                       | 7.84 | 7.44 | 7.73 | 7.94 | 6.94 | 7.58 | 7.58 | 1.45  | 1.36  | 0.81  | 0.91  | 1.17  | 1.26  | 1.16 |
| Basmati rice – mustard                                     | 7.13 | 7.13 | 7.67 | 7.90 | 6.95 | 7.45 | 7.37 | 1.47  | 1.32  | 0.85  | 0.9   | 1.19  | 1.25  | 1.16 |
| Basmati rice – vegetable pea +<br>coriander (4:2)          | 7.60 | 7.14 | 7.91 | 7.94 | 6.78 | 7.47 | 7.47 | 1.49  | 1.37  | 0.9   | 0.96  | 1.22  | 1.31  | 1.21 |
| Basmati rice – potato                                      | 7.71 | 7.15 | 7.93 | 7.65 | 7.55 | 6.93 | 7.49 | 1.44  | 1.35  | 0.85  | 0.94  | 1.19  | 1.29  | 1.18 |
| Mean                                                       | 7.57 | 7.22 | 7.81 | 7.86 | 7.06 | 7.36 |      | 1.46  | 1.35  | 0.85  | 0.93  | 1.19  | 1.28  |      |
| Raipur                                                     |      |      |      |      |      |      |      |       |       |       |       |       |       |      |
| Soybean-sweet corn                                         | -    | -    | -    | -    | -    | -    | -    | -     | -     | -     | -     | -     | -     | 0.79 |
| Soybean- field bean                                        | -    | -    | -    | -    | -    | -    | -    | -     | -     | -     | -     | -     | -     | 0.8  |
| Soybean-tomato                                             | -    | -    | -    | -    | -    | -    | -    | -     | -     | -     | -     | -     | -     | 0.78 |
| Soybean-cabbage                                            | -    | -    | -    | -    | -    | -    | -    | -     | -     | -     | -     | -     | -     | 0.76 |
| Mean                                                       |      |      |      |      |      |      |      | 0.81  | 0.75  | 0.79  | 0.8   | 0.8   | 0.74  |      |
| Ranchi                                                     |      |      |      |      |      |      |      |       |       |       |       |       |       |      |
| Rice- wheat                                                | -    | -    | -    | -    | -    | -    | 6.32 | -     | -     | -     | -     | -     | -     | 0.89 |
| Rice - onion                                               | -    | -    | -    | -    | -    | -    | 6.33 | -     | -     | -     | -     | -     | -     | 0.89 |
| Rice - potato                                              | -    | -    | -    | -    | -    | -    | 6.33 | -     | -     | -     | -     | -     | -     | 0.89 |
| Rice - okra                                                | -    | -    | -    | -    | -    | -    | 6.32 | -     | -     | -     | -     | -     | -     | 0.93 |
| Mean                                                       | 6.49 | 6.42 | 6.21 | 6.10 | 6.40 | 6.32 |      | 1.24  | 1.19  | 0.52  | 0.46  | 1.09  | 0.91  |      |
| Ajmer                                                      |      |      |      |      |      |      |      |       |       |       |       |       |       |      |
| Cow pea + maize (4:2) -coriander +<br>cabbage (2:1)        | 8.56 | 8.59 | 8.82 | 8.79 | 8.61 | 8.57 | 8.66 | 0.378 | 0.358 | 0.275 | 0.347 | 0.337 | 0.356 | 0.34 |



|                                                           |      |      |      |      |      |      |      |       |       |       |       |       |       |      |
|-----------------------------------------------------------|------|------|------|------|------|------|------|-------|-------|-------|-------|-------|-------|------|
| Cow pea + maize (4:2)- fennel + cabbage (2:1)             | 8.36 | 8.41 | 8.89 | 8.78 | 8.72 | 8.88 | 8.67 | 0.361 | 0.342 | 0.283 | 0.326 | 0.334 | 0.342 | 0.33 |
| Cow pea (sole)-fennel                                     | 8.55 | 8.57 | 8.81 | 8.7  | 8.59 | 8.55 | 8.63 | 0.361 | 0.366 | 0.274 | 0.343 | 0.342 | 0.345 | 0.34 |
| Cow pea (sole)-coriander                                  | 8.56 | 8.59 | 8.81 | 8.8  | 8.61 | 8.57 | 8.66 | 0.369 | 0.351 | 0.28  | 0.346 | 0.36  | 0.358 | 0.34 |
| Mean                                                      | 8.51 | 8.54 | 8.83 | 8.77 | 8.63 | 8.64 |      | 0.37  | 0.35  | 0.28  | 0.34  | 0.34  | 0.35  |      |
| Almora                                                    |      |      |      |      |      |      |      |       |       |       |       |       |       |      |
| Grain amaranth - wheat + lentil (2:1)                     | 6.47 | 6.37 | 5.82 |      | 6.2  |      | 6.22 | 1.18  | 1.01  | 0.57  |       | 1.05  |       | 0.95 |
| Finger millet + black Soybean (2:1) - wheat + toria (2:1) | 6.47 | 6.38 | 5.67 |      | 6.45 |      | 6.24 | 1.23  | 1.08  | 0.6   |       | 0.95  |       | 0.97 |
| Mean                                                      | 6.47 | 6.38 | 5.75 |      | 6.33 |      |      | 1.21  | 1.05  | 0.59  |       | 1.00  |       |      |
| Narendrapur                                               |      |      |      |      |      |      |      |       |       |       |       |       |       |      |
| Rice (Gobindo bhog)-rice (Satabdi)                        | 7.27 | 7.24 | 7.34 | 7.35 | 7.28 | 7.27 | 7.29 | 0.97  | 0.93  | 0.71  | 0.88  | 0.88  | 0.78  | 0.86 |
| Rice (Kanakchur)- sesbania green manure                   | 7.26 | 7.11 | 7.29 | 7.25 | 7.24 | 7.23 | 7.23 | 0.86  | 0.73  | 0.75  | 0.66  | 0.66  | 0.71  | 0.73 |
| Rice (Dudheswar)- red amaranthus+ cucumber                | 7.12 | 6.97 | 6.94 | 6.96 | 6.97 | 6.95 | 6.98 | 0.96  | 1.06  | 0.94  | 1.07  | 1.07  | 0.97  | 1.01 |
| Rice (Satabdi) - veg. pea                                 | 7.38 | 7.39 | 7.37 | 7.36 | 7.41 | 7.51 | 7.40 | 1.12  | 0.97  | 1.02  | 0.91  | 0.91  | 0.99  | 0.99 |
| Mean                                                      | 7.26 | 7.18 | 7.24 | 7.23 | 7.23 | 7.24 |      | 0.98  | 0.92  | 0.86  | 0.88  | 0.88  | 0.86  |      |
| S.K. Nagar                                                |      |      |      |      |      |      |      |       |       |       |       |       |       |      |
| Green gram-amaranth – fallow                              | 7.64 | 7.45 | 7.36 | 7.52 | 7.40 | 7.51 | 7.48 | 0.40  | 0.37  | 0.26  | 0.37  | 0.38  | 0.36  | 0.36 |
| Green gram -mustard –fallow                               | 7.45 | 7.52 | 7.43 | 7.59 | 7.48 | 7.64 | 7.52 | 0.41  | 0.35  | 0.27  | 0.34  | 0.38  | 0.30  | 0.34 |
| Groundnut-lucerne - lucerne continue                      | 7.33 | 7.47 | 7.43 | 7.35 | 7.41 | 7.48 | 7.41 | 0.39  | 0.34  | 0.25  | 0.31  | 0.37  | 0.35  | 0.33 |
| Mean                                                      | 7.47 | 7.48 | 7.41 | 7.49 | 7.43 | 7.54 |      | 0.40  | 0.35  | 0.26  | 0.34  | 0.38  | 0.34  |      |
| Thiruvananthapuram                                        |      |      |      |      |      |      |      |       |       |       |       |       |       |      |
| Cassava -vegetable cowpea                                 | 4.55 | 4.70 | 4.48 | 4.28 | 4.51 | 4.80 | 4.55 | 0.94  | 0.88  | 0.48  | 0.62  | 0.71  | 0.67  | 0.72 |
| Cassava -groundnut                                        | 4.73 | 4.75 | 4.51 | 4.64 | 4.56 | 4.89 | 4.68 | 0.94  | 0.87  | 0.54  | 0.44  | 0.75  | 0.65  | 0.70 |
| Taro -black gram                                          | 4.97 | 4.99 | 4.49 | 4.76 | 4.85 | 4.89 | 4.83 | 0.96  | 0.88  | 0.50  | 0.44  | 0.64  | 0.64  | 0.68 |
| Taro -green gram                                          | 4.59 | 4.44 | 4.28 | 4.43 | 4.46 | 4.53 | 4.46 | 0.94  | 0.85  | 0.29  | 0.41  | 0.73  | 0.45  | 0.61 |
| Mean                                                      | 4.71 | 4.72 | 4.44 | 4.53 | 4.60 | 4.78 |      | 0.95  | 0.87  | 0.45  | 0.48  | 0.71  | 0.60  |      |

**Table 7.2.5: Influence of organic, inorganic and integrated package on soil available nitrogen at the end of cropping cycle at various locations**

|                                        | Available Nitrogen (kg ha <sup>-1</sup> ) |            |                     |          |                                  |                       |       |
|----------------------------------------|-------------------------------------------|------------|---------------------|----------|----------------------------------|-----------------------|-------|
| Locations/Treatments                   | Organic                                   |            | Inorganic           |          | Towards organic<br>(Integrated ) |                       | Mean  |
|                                        | Organic-I                                 | Organic-II | Inorganic<br>(100%) | SR or FP | Towards<br>organic-I             | Towards<br>Organic-II |       |
| Bajaura                                |                                           |            |                     |          |                                  |                       |       |
| French bean - cauliflower- french bean | 261.8                                     | 255.5      | 248.4               | 263.7    | 261.8                            | 255.5                 | 257.8 |
| Cauliflower-tomato                     | 258.5                                     | 257.7      | 250.3               | 263.7    | 258.5                            | 255.5                 | 257.4 |
| Black gram-cauliflower-summer Squash   | 261.8                                     | 255.5      | 248.4               | 261.8    | 258.5                            | 253.5                 | 256.6 |
| Okra-pea                               | 263.7                                     | 258.5      | 247.5               | 263.7    | 261.8                            | 258.5                 | 259.0 |
| Mean                                   | 261.5                                     | 256.8      | 248.7               | 263.2    | 260.2                            | 255.8                 |       |
| Bhopal                                 |                                           |            |                     |          |                                  |                       |       |
| Soybean-durum wheat                    | 219.5                                     | 192.3      | 177.7               | 175.6    | 196.5                            | 181.9                 | 190.6 |
| Soybean- mustard                       | 209.1                                     | 179.8      | 169.3               | 173.5    | 181.9                            | 163.1                 | 179.5 |
| Soybean- chickpea                      | 196.5                                     | 184.0      | 169.3               | 169.3    | 186.1                            | 179.8                 | 180.8 |
| Soybean- linseed                       | 181.9                                     | 167.3      | 154.7               | 163.1    | 179.8                            | 169.3                 | 169.4 |
| Mean soybean yield                     | 201.8                                     | 180.9      | 167.8               | 170.4    | 186.1                            | 173.5                 |       |
| Calicut                                |                                           |            |                     |          |                                  |                       |       |
| Ginger-fallow                          | 217.8                                     | 212.4      | 201.6               |          | 178.2                            | 207.6                 |       |
| Turmeric-fallow                        | 311.8                                     | 287.3      | 301.1               |          | 273.6                            | 287.5                 |       |
| Dharwad                                |                                           |            |                     |          |                                  |                       |       |
| Pigeonpea + green gram (1:2)           | 267.0                                     | 260.0      | 249.0               | 263.0    | 271.0                            | 232.0                 | 257.0 |
| Pigeonpea + soybean (1:2)              | 278.0                                     | 268.0      | 262.0               | 269.0    | 266.0                            | 234.0                 | 262.8 |
| Pigeonpea + groundnut (1:2)            | 261.0                                     | 273.0      | 231.0               | 262.0    | 262.0                            | 265.0                 | 259.0 |
| Cotton + green gram (1:2)              | 271.0                                     | 265.0      | 239.0               | 220.0    | 239.0                            | 243.0                 | 246.2 |
| Cotton + soybean (1:2)                 | 249.0                                     | 263.0      | 246.0               | 299.0    | 264.0                            | 235.0                 | 259.3 |
| Mean                                   | 265.2                                     | 265.8      | 245.4               | 262.6    | 260.4                            | 241.8                 |       |
| Jabalpur                               |                                           |            |                     |          |                                  |                       |       |
| Soybean- wheat                         | 269.0                                     | 262.0      | 259.0               | 248.0    | 264.0                            | 262.0                 | 260.7 |
| Soybean-mustard- greengram             | 268.0                                     | 266.0      | 262.0               | 253.0    | 266.0                            | 263.0                 | 263.0 |
| Soybean–berseem (F & S)                | 271.0                                     | 263.0      | 260.0               | 251.0    | 264.0                            | 261.0                 | 261.7 |
| Soybean- lentil- sorghum (F)           | 269.0                                     | 261.0      | 256.0               | 251.0    | 262.0                            | 263.0                 | 260.3 |
| Mean                                   | 269.3                                     | 263.0      | 259.3               | 250.8    | 264.0                            | 262.3                 |       |



|                                                         |       |       |       |       |       |       |       |
|---------------------------------------------------------|-------|-------|-------|-------|-------|-------|-------|
| Karjat                                                  |       |       |       |       |       |       |       |
| Rice – brinjal                                          |       |       |       |       |       |       | 254.2 |
| Rice – chick pea                                        |       |       |       |       |       |       | 266.4 |
| Rice – field bean                                       |       |       |       |       |       |       | 267.0 |
| Rice – white onion                                      |       |       |       |       |       |       | 244.8 |
| Mean                                                    | 267.0 | 263.7 | 261.9 | 244.3 | 261.3 | 250.4 |       |
| Ludhiana                                                |       |       |       |       |       |       |       |
| Basmati rice-chickpea-green manure                      | 365.5 | 360.3 | 320.3 | 323.5 | 356.6 | 358.6 | 347.5 |
| Basmati rice-wheat-green manure                         | 360.2 | 357.7 | 350.5 | 352.5 | 355.4 | 356.8 | 355.5 |
| Kharif moong-wheat-summer moong                         | 347.4 | 344.3 | 341.2 | 343.5 | 345.6 | 342.2 | 344.0 |
| Sesame-lentil                                           | 352.2 | 348.4 | 320.3 | 321.7 | 343.5 | 345.5 | 338.6 |
| Mean                                                    | 356.3 | 352.7 | 333.1 | 335.3 | 350.3 | 350.8 |       |
| Modipuram                                               |       |       |       |       |       |       |       |
| Sesame –lentil – vegetable cowpea (pod)                 | 283.8 | 271.2 | 229.4 | 191.3 | 262.9 | 237.8 | 246.1 |
| Finger millet – barley – sesbania rostrata green manure | 301.1 | 309.4 | 261.2 | 204.9 | 267.6 | 259.2 | 267.2 |
| Okra – vegetable pea – sesbania aculeata green manure   | 296.9 | 278.5 | 229.7 | 195.2 | 267.6 | 250.2 | 253.0 |
| Black gram – tomato – sunhemp green manure              | 280.8 | 274.3 | 225.7 | 188.2 | 260.5 | 248.3 | 246.3 |
| Mean                                                    | 290.7 | 283.4 | 236.5 | 194.9 | 264.7 | 248.9 |       |
| Pantnagar                                               |       |       |       |       |       |       |       |
| Basmati rice - wheat                                    | 171.9 | 169.9 | 175.1 | 165.1 | 170.1 | 168.4 | 170.1 |
| Basmati rice – mustard                                  | 170.0 | 171.9 | 171.8 | 169.2 | 173.0 | 164.5 | 170.1 |
| Basmati rice – vegetable pea + coriander (4:2)          | 171.8 | 168.1 | 163.2 | 167.3 | 173.5 | 171.4 | 169.2 |
| Basmati rice – potato                                   | 165.9 | 169.7 | 167.3 | 163.1 | 164.2 | 168.5 | 166.5 |
| Mean                                                    | 169.9 | 169.9 | 169.4 | 166.2 | 170.2 | 168.2 |       |
| Raipur                                                  |       |       |       |       |       |       |       |
| Soybean-sweet corn                                      |       |       |       |       |       |       | 236.8 |
| Soybean- field bean                                     |       |       |       |       |       |       | 240.0 |
| Soybean-tomato                                          |       |       |       |       |       |       | 235.4 |
| Soybean-cabbage                                         |       |       |       |       |       |       | 234.3 |
| Mean                                                    | 243.1 | 229.8 | 238.3 | 245.4 | 236.2 | 226.8 |       |
| Ranchi                                                  |       |       |       |       |       |       |       |
| Rice– wheat                                             |       |       |       |       |       |       | 285.7 |

|                                                  |       |       |       |       |       |       |       |
|--------------------------------------------------|-------|-------|-------|-------|-------|-------|-------|
| Rice - onion                                     |       |       |       |       |       |       | 288.1 |
| Rice - potato                                    |       |       |       |       |       |       | 280.0 |
| Rice - okra                                      |       |       |       |       |       |       | 286.0 |
| Mean                                             | 334.5 | 315.1 | 260.8 | 247.7 | 285.9 | 265.5 |       |
| <b>Ajmer</b>                                     |       |       |       |       |       |       |       |
| Cow pea + maize (4:2) -coriander + cabbage (2:1) | 160.9 | 153.4 | 137.6 | 148.8 | 145.7 | 147.0 | 148.9 |
| Cow pea + maize (4:2)- fennel + cabbage (2:1)    | 149.3 | 143.6 | 136.1 | 141.2 | 138.7 | 137.2 | 141.0 |
| Cow pea (sole)-fennel                            | 145.2 | 164.1 | 149.3 | 143.7 | 154.6 | 148.2 | 150.8 |
| Cow pea (sole)-coriander                         | 160.9 | 153.4 | 137.6 | 148.8 | 145.7 | 147.0 | 148.9 |
| Mean                                             | 154.1 | 153.6 | 140.2 | 145.6 | 146.1 | 144.9 |       |
| <b>S.K. Nagar</b>                                |       |       |       |       |       |       |       |
| Green gram-amaranth – fallow                     | 181.9 | 175.6 | 163.1 | 169.3 | 207.0 | 181.9 | 179.8 |
| Green gram -mustard –fallow                      | 175.6 | 163.1 | 150.5 | 169.3 | 194.4 | 163.1 | 169.3 |
| Groundnut–lucerne - lucerne continue             | 156.8 | 163.1 | 156.8 | 169.3 | 156.8 | 169.3 | 162.0 |
| Mean                                             | 171.4 | 167.3 | 156.8 | 169.3 | 186.1 | 171.4 |       |
| <b>Thiruvananthapuram</b>                        |       |       |       |       |       |       |       |
| Cassava -vegetable cowpea                        | 313.7 | 278.4 | 196.3 | 241.4 | 237.0 | 234.9 | 250.3 |
| Cassava -groundnut                               | 300.3 | 275.7 | 234.6 | 188.2 | 257.5 | 211.0 | 244.5 |
| Taro -black gram                                 | 296.3 | 277.0 | 201.9 | 184.4 | 254.1 | 237.0 | 241.8 |
| Taro -green gram                                 | 321.4 | 286.5 | 176.4 | 169.2 | 245.3 | 220.4 | 236.5 |
| Mean                                             | 307.9 | 279.4 | 202.3 | 195.8 | 248.5 | 225.8 |       |



**Table 7.2.6: Influence of organic, inorganic and integrated management package on soil available phosphorus at the end of cropping cycle at various locations**

|                                        | Available Phosphorus (kg ha <sup>-1</sup> ) |            |                     |             |                                  |                       |      |
|----------------------------------------|---------------------------------------------|------------|---------------------|-------------|----------------------------------|-----------------------|------|
| Locations/Treatments                   | Organic                                     |            | Inorganic           |             | Towards organic<br>(Integrated ) |                       | Mean |
|                                        | Organic-I                                   | Organic-II | Inorganic<br>(100%) | SR or<br>FP | Towards<br>organic-I             | Towards<br>Organic-II |      |
| Bajaura                                |                                             |            |                     |             |                                  |                       |      |
| French bean - cauliflower- french bean | 80.1                                        | 76.6       | 53.4                | 63.7        | 80.6                             | 75.6                  | 71.7 |
| Cauliflower-tomato                     | 81.4                                        | 79.7       | 54.1                | 66.1        | 81.5                             | 77.9                  | 73.5 |
| Black gram-cauliflower-summer Squash   | 80.1                                        | 76.6       | 52.1                | 70.0        | 83.0                             | 73.8                  | 72.6 |
| Okra-pea                               | 76.6                                        | 75.1       | 51.9                | 61.8        | 80.9                             | 74.7                  | 70.2 |
| Mean                                   | 79.6                                        | 77.0       | 52.9                | 65.4        | 81.5                             | 75.5                  |      |
| Bhopal                                 |                                             |            |                     |             |                                  |                       |      |
| Soybean-durum wheat                    | 87.9                                        | 84.0       | 60.4                | 58.9        | 82.6                             | 74.2                  | 74.7 |
| Soybean- mustard                       | 86.0                                        | 83.2       | 59.8                | 57.2        | 81.4                             | 77.5                  | 74.2 |
| Soybean- chickpea                      | 85.3                                        | 83.6       | 57.6                | 55.8        | 79.2                             | 80.1                  | 73.6 |
| Soybean- linseed                       | 84.0                                        | 81.1       | 58.6                | 58.7        | 82.2                             | 80.8                  | 74.2 |
| Mean soybean yield                     | 85.8                                        | 83.0       | 59.1                | 57.7        | 81.4                             | 78.2                  |      |
| Calicut                                |                                             |            |                     |             |                                  |                       |      |
| Ginger-fallow                          | 40.6                                        | 64.0       | 18.9                |             | 17.0                             | 21.7                  |      |
| Turmeric-fallow                        | 135.4                                       | 136.1      | 19.5                |             | 61.9                             | 143.1                 |      |
| Dharwad                                |                                             |            |                     |             |                                  |                       |      |
| Pigeonpea + green gram (1:2)           | 63.0                                        | 51.0       | 56.0                | 59.0        | 36.0                             | 40.0                  | 50.8 |
| Pigeonpea + soybean (1:2)              | 54.0                                        | 38.0       | 59.0                | 70.0        | 49.0                             | 54.0                  | 54.0 |
| Pigeonpea + groundnut (1:2)            | 47.0                                        | 31.0       | 48.0                | 55.0        | 56.0                             | 41.0                  | 46.3 |
| Cotton + green gram (1:2)              | 35.0                                        | 40.0       | 28.0                | 31.0        | 34.0                             | 35.0                  | 33.8 |
| Cotton + soybean (1:2)                 | 36.0                                        | 41.0       | 23.0                | 38.0        | 42.0                             | 27.0                  | 34.5 |
| Mean                                   | 47.0                                        | 40.2       | 42.8                | 50.6        | 43.4                             | 39.4                  |      |
| Jabalpur                               |                                             |            |                     |             |                                  |                       |      |
| Soybean- wheat                         | 12.0                                        | 10.5       | 11.0                | 10.3        | 11.4                             | 11.1                  | 11.1 |
| Soybean-mustard- greengram             | 12.7                                        | 12.9       | 11.4                | 11.5        | 11.9                             | 11.0                  | 11.9 |
| Soybean–berseem (F & S)                | 13.6                                        | 11.6       | 11.8                | 12.0        | 12.3                             | 11.4                  | 12.1 |
| Soybean- lentil- sorghum (F)           | 13.2                                        | 11.3       | 10.9                | 11.1        | 12.2                             | 11.0                  | 11.6 |
| Mean                                   | 12.9                                        | 11.6       | 11.3                | 11.2        | 12.0                             | 11.1                  |      |
| Karjat                                 |                                             |            |                     |             |                                  |                       |      |

|                                                         |      |      |      |      |      |      |      |
|---------------------------------------------------------|------|------|------|------|------|------|------|
| Rice – brinjal                                          |      |      |      |      |      |      | 27.1 |
| Rice – chick pea                                        |      |      |      |      |      |      | 28.4 |
| Rice – field bean                                       |      |      |      |      |      |      | 28.9 |
| Rice – white onion                                      |      |      |      |      |      |      | 26.0 |
| Mean                                                    | 28.5 | 28.2 | 27.8 | 26.1 | 28.3 | 26.7 |      |
| <b>Ludhiana</b>                                         |      |      |      |      |      |      |      |
| Basmati rice-chickpea-green manure                      | 44.3 | 42.5 | 39.5 | 41.3 | 41.6 | 43.6 | 42.1 |
| Basmati rice-wheat-green manure                         | 46.5 | 43.6 | 42.7 | 43.4 | 42.5 | 44.2 | 43.8 |
| Kharif moong-wheat-summer moong                         | 47.3 | 44.4 | 43.7 | 45.7 | 44.1 | 45.5 | 45.1 |
| Sesame-lentil                                           | 45.2 | 42.6 | 43.7 | 44.2 | 41.6 | 43.5 | 43.5 |
| Mean                                                    | 45.8 | 43.3 | 42.4 | 43.7 | 42.5 | 44.2 |      |
| <b>Modipuram</b>                                        |      |      |      |      |      |      |      |
| Sesame –lentil – vegetable cowpea (pod)                 | 66.0 | 56.0 | 39.3 | 38.7 | 45.3 | 51.0 | 49.4 |
| Finger millet – barley – sesbania rostrata green manure | 53.2 | 49.2 | 41.7 | 28.8 | 49.2 | 47.8 | 45.0 |
| Okra – vegetable pea – sesbania aculeata green manure   | 41.0 | 39.7 | 24.1 | 20.0 | 34.2 | 31.2 | 31.7 |
| Black gram – tomato – sunhemp green manure              | 44.7 | 35.4 | 29.1 | 23.1 | 36.1 | 32.4 | 33.5 |
| Mean                                                    | 51.2 | 45.1 | 33.6 | 27.7 | 41.2 | 40.6 |      |
| <b>Pantnagar</b>                                        |      |      |      |      |      |      |      |
| Basmati rice - wheat                                    | 27.1 | 24.9 | 22.1 | 21.6 | 24.9 | 24.8 | 24.2 |
| Basmati rice – mustard                                  | 28.0 | 25.9 | 19.1 | 20.1 | 26.4 | 25.9 | 24.2 |
| Basmati rice – vegetable pea + coriander (4:2)          | 25.0 | 24.9 | 20.1 | 20.1 | 27.4 | 24.7 | 23.7 |
| Basmati rice – potato                                   | 28.8 | 28.4 | 19.9 | 21.9 | 24.3 | 25.9 | 24.9 |
| Mean                                                    | 27.2 | 26.0 | 20.3 | 20.9 | 25.8 | 25.3 |      |
| <b>Raipur</b>                                           |      |      |      |      |      |      |      |
| Soybean-sweet corn                                      |      |      |      |      |      |      | 20.4 |
| Soybean- field bean                                     |      |      |      |      |      |      | 20.4 |
| Soybean-tomato                                          |      |      |      |      |      |      | 20.6 |
| Soybean-cabbage                                         |      |      |      |      |      |      | 19.9 |
| Mean                                                    | 22.0 | 19.9 | 20.8 | 22.5 | 19.0 | 18.2 |      |
| <b>Ranchi</b>                                           |      |      |      |      |      |      |      |
| Rice– wheat                                             |      |      |      |      |      |      | 56.0 |
| Rice - onion                                            |      |      |      |      |      |      | 56.7 |
| Rice - potato                                           |      |      |      |      |      |      | 58.0 |



|                                                  |       |       |       |       |       |       |       |
|--------------------------------------------------|-------|-------|-------|-------|-------|-------|-------|
| Rice - okra                                      |       |       |       |       |       |       | 58.0  |
| Mean                                             | 64.4  | 60.5  | 53.4  | 52.2  | 57.4  | 55.1  |       |
| Ajmer                                            |       |       |       |       |       |       |       |
| Cow pea + maize (4:2) -coriander + cabbage (2:1) | 15.9  | 14.4  | 10.7  | 12.5  | 12.7  | 12.0  | 13.0  |
| Cow pea + maize (4:2)- fennel + cabbage (2:1)    | 13.1  | 11.8  | 10.5  | 10.3  | 10.3  | 10.6  | 11.1  |
| Cow pea (sole)-fennel                            | 15.2  | 13.3  | 10.9  | 11.8  | 11.9  | 11.1  | 12.4  |
| Cow pea (sole)-coriander                         | 15.9  | 14.4  | 10.7  | 12.5  | 12.7  | 12.0  | 13.0  |
| Mean                                             | 15.0  | 13.5  | 10.7  | 11.8  | 11.9  | 11.4  |       |
| Narendrapur                                      |       |       |       |       |       |       |       |
| Rice (Gobindo bhog)-rice (Satabdi)               | 93.3  | 93.7  | 92.8  | 92.4  | 95.9  | 105.1 | 95.5  |
| Rice (Kanakchur)- sesbania green manure          | 93.5  | 94.9  | 93.4  | 96.5  | 98.4  | 101.9 | 96.4  |
| Rice (Dudheswar)- red amaranthus+ cucumber       | 112.8 | 126.4 | 127.8 | 67.1  | 87.8  | 105.0 | 104.5 |
| Rice (Satabdi) - veg. pea                        | 177.5 | 165.6 | 100.9 | 102.8 | 119.0 | 138.4 | 134.0 |
| Mean                                             | 119.3 | 120.1 | 103.7 | 89.7  | 100.3 | 112.6 |       |
| S.K. Nagar                                       |       |       |       |       |       |       |       |
| Green gram-amaranth – fallow                     | 29.0  | 28.4  | 30.7  | 24.8  | 26.6  | 27.8  | 27.9  |
| Green gram -mustard –fallow                      | 30.7  | 24.2  | 34.9  | 33.1  | 24.8  | 25.4  | 28.9  |
| Groundnut–lucerne - lucerne continue             | 21.3  | 20.7  | 20.1  | 27.2  | 18.9  | 20.7  | 21.5  |
| Mean                                             | 27.0  | 24.4  | 28.6  | 28.4  | 23.4  | 24.6  |       |
| Thiruvananthapuram                               |       |       |       |       |       |       |       |
| Cassava -vegetable cowpea                        | 122.4 | 60.9  | 79.9  | 28.6  | 39.2  | 62.2  | 65.5  |
| Cassava -groundnut                               | 87.4  | 98.9  | 23.7  | 22.4  | 114.8 | 57.8  | 67.5  |
| Taro -black gram                                 | 112.6 | 90.9  | 80.8  | 56.9  | 113.1 | 56.9  | 85.2  |
| Taro -green gram                                 | 67.5  | 42.7  | 25.0  | 69.3  | 43.7  | 47.2  | 49.2  |
| Mean                                             | 97.5  | 73.4  | 52.3  | 44.3  | 77.7  | 56.0  |       |

**Table 7.2.7: Influence of organic, inorganic and integrated management package on soil available potassium at the end of cropping cycle at various locations**

|                                        | Available Potassium(kg ha <sup>-1</sup> ) |            |                  |          |                               |                    |       |
|----------------------------------------|-------------------------------------------|------------|------------------|----------|-------------------------------|--------------------|-------|
| Locations/Treatments                   | Organic                                   |            | Inorganic        |          | Towards organic (Integrated ) |                    | Mean  |
|                                        | Organic-I                                 | Organic-II | Inorganic (100%) | SR or FP | Towards organic-I             | Towards Organic-II |       |
| Bajaura                                |                                           |            |                  |          |                               |                    |       |
| French bean - cauliflower- french bean | 252.4                                     | 258.7      | 142.4            | 188.7    | 251.5                         | 254.3              | 224.7 |
| Cauliflower-tomato                     | 254.9                                     | 257.3      | 142.6            | 196.9    | 259.1                         | 257.5              | 228.1 |
| Black gram-cauliflower-summer Squash   | 259.1                                     | 244.4      | 141.6            | 193.3    | 266.7                         | 259.2              | 227.4 |
| Okra-pea                               | 244.2                                     | 240.2      | 137.0            | 194.4    | 252.5                         | 246.1              | 219.1 |
| Mean                                   | 252.7                                     | 250.2      | 140.9            | 193.3    | 257.5                         | 254.3              |       |
| Bhopal                                 |                                           |            |                  |          |                               |                    |       |
| Soybean-durum wheat                    | 722.0                                     | 662.0      | 726.0            | 616.0    | 679.0                         | 616.0              | 670.2 |
| Soybean- mustard                       | 659.0                                     | 694.0      | 642.0            | 643.0    | 684.0                         | 614.0              | 656.0 |
| Soybean- chickpea                      | 709.0                                     | 686.0      | 634.0            | 625.0    | 690.0                         | 645.0              | 664.8 |
| Soybean- linseed                       | 690.0                                     | 653.0      | 696.0            | 698.0    | 716.0                         | 728.0              | 696.8 |
| Mean soybean yield                     | 695.0                                     | 673.8      | 674.5            | 645.5    | 692.3                         | 650.8              |       |
| Calicut                                |                                           |            |                  |          |                               |                    |       |
| Ginger-fallow                          | 380.8                                     | 441.3      | 419.8            |          | 397.8                         | 381.5              |       |
| Turmeric-fallow                        | 462.4                                     | 343.1      | 709.9            |          | 620.5                         | 481.3              |       |
| Dharwad                                |                                           |            |                  |          |                               |                    |       |
| Pigeonpea + green gram (1:2)           | 407.0                                     | 427.0      | 278.0            | 355.0    | 418.0                         | 351.0              | 372.7 |
| Pigeonpea + soybean (1:2)              | 386.0                                     | 397.0      | 386.0            | 422.0    | 424.0                         | 460.0              | 412.5 |
| Pigeonpea + groundnut (1:2)            | 344.0                                     | 369.0      | 377.0            | 338.0    | 387.0                         | 359.0              | 362.3 |
| Cotton + green gram (1:2)              | 611.0                                     | 597.0      | 422.0            | 463.0    | 608.0                         | 434.0              | 522.5 |
| Cotton + soybean (1:2)                 | 559.0                                     | 584.0      | 467.0            | 544.0    | 573.0                         | 424.0              | 525.2 |
| Mean                                   | 461.4                                     | 474.8      | 386.0            | 424.4    | 482.0                         | 405.6              |       |
| Jabalpur                               |                                           |            |                  |          |                               |                    |       |
| Soybean- wheat                         | 296.0                                     | 289.0      | 275.0            | 280.0    | 289.0                         | 288.0              | 286.2 |
| Soybean-mustard- greengram             | 298.0                                     | 294.0      | 286.0            | 272.0    | 289.0                         | 290.0              | 288.2 |
| Soybean–berseem (F & S)                | 295.0                                     | 291.0      | 286.0            | 282.0    | 291.0                         | 288.0              | 288.8 |
| Soybean- lentil- sorghum (F)           | 299.0                                     | 293.0      | 278.0            | 271.0    | 289.0                         | 284.0              | 285.7 |
| Mean                                   | 297.0                                     | 291.8      | 281.3            | 276.3    | 289.5                         | 287.5              |       |
| Karjat                                 |                                           |            |                  |          |                               |                    |       |



|                                                         |       |       |       |       |       |       |       |
|---------------------------------------------------------|-------|-------|-------|-------|-------|-------|-------|
| Rice – brinjal                                          |       |       |       |       |       |       | 343.9 |
| Rice – chick pea                                        |       |       |       |       |       |       | 353.1 |
| Rice – field bean                                       |       |       |       |       |       |       | 357.2 |
| Rice – white onion                                      |       |       |       |       |       |       | 349.2 |
| Mean                                                    | 363.4 | 361.0 | 359.9 | 324.7 | 355.3 | 340.8 |       |
| <b>Ludhiana</b>                                         |       |       |       |       |       |       |       |
| Basmati rice-chickpea-green manure                      | 157.5 | 154.4 | 144.3 | 146.7 | 147.5 | 145.5 | 149.3 |
| Basmati rice-wheat-green manure                         | 160.5 | 157.4 | 149.5 | 150.5 | 151.6 | 151.1 | 153.4 |
| Kharif moong-wheat-summer moong                         | 155.6 | 149.4 | 145.3 | 148.5 | 148.8 | 147.2 | 149.1 |
| Sesame-lentil                                           | 151.6 | 150.2 | 143.3 | 142.6 | 147.3 | 146.3 | 146.9 |
| Mean                                                    | 156.3 | 152.9 | 145.6 | 147.1 | 148.8 | 147.5 |       |
| <b>Modipuram</b>                                        |       |       |       |       |       |       |       |
| Sesame –lentil – vegetable cowpea (pod)                 | 275.4 | 234.3 | 209.6 | 164.4 | 246.0 | 173.6 | 217.2 |
| Finger millet – barley – sesbania rostrata green manure | 257.3 | 229.1 | 220.1 | 153.6 | 222.5 | 203.0 | 214.3 |
| Okra – vegetable pea – sesbania aculeata green manure   | 295.9 | 270.5 | 239.6 | 234.8 | 273.8 | 226.4 | 256.8 |
| Black gram – tomato – sunhemp green manure              | 279.3 | 282.4 | 198.5 | 180.2 | 269.2 | 240.8 | 241.7 |
| Mean                                                    | 277.0 | 254.1 | 217.0 | 183.3 | 252.9 | 211.0 |       |
| <b>Pantnagar</b>                                        |       |       |       |       |       |       |       |
| Basmati rice - wheat                                    | 237.8 | 236.9 | 234.1 | 233.8 | 237.6 | 237.9 | 236.4 |
| Basmati rice – mustard                                  | 240.2 | 234.9 | 236.0 | 234.9 | 239.9 | 235.9 | 237.0 |
| Basmati rice – vegetable pea + coriander (4:2)          | 238.9 | 233.6 | 236.7 | 233.1 | 240.8 | 230.7 | 235.6 |
| Basmati rice – potato                                   | 241.8 | 233.9 | 234.9 | 234.1 | 241.9 | 236.9 | 237.3 |
| Mean                                                    | 239.7 | 234.8 | 235.4 | 234.0 | 240.1 | 235.4 |       |
| <b>Raipur</b>                                           |       |       |       |       |       |       |       |
| Soybean-sweet corn                                      |       |       |       |       |       |       | 86.0  |
| Soybean- field bean                                     |       |       |       |       |       |       | 87.0  |
| Soybean-tomato                                          |       |       |       |       |       |       | 85.6  |
| Soybean-cabbage                                         |       |       |       |       |       |       | 85.0  |
| Mean                                                    | 377.4 | 383.9 | 379.6 | 376.3 | 379.9 | 381.5 |       |
| <b>Ranchi</b>                                           |       |       |       |       |       |       |       |
| Rice– wheat                                             |       |       |       |       |       |       | 303.1 |
| Rice - onion                                            |       |       |       |       |       |       | 298.8 |
| Rice - potato                                           |       |       |       |       |       |       | 306.4 |

|                                                  |       |       |       |       |       |       |       |
|--------------------------------------------------|-------|-------|-------|-------|-------|-------|-------|
| Rice - okra                                      |       |       |       |       |       |       | 301.3 |
| Mean                                             | 323.4 | 317.8 | 298.0 | 277.3 | 294.6 | 303.2 |       |
| Ajmer                                            |       |       |       |       |       |       |       |
| Cow pea + maize (4:2) -coriander + cabbage (2:1) | 304.0 | 305.8 | 287.4 | 307.9 | 295.7 | 293.3 | 299.0 |
| Cow pea + maize (4:2)- fennel + cabbage (2:1)    | 295.0 | 283.5 | 285.9 | 281.8 | 300.7 | 296.4 | 290.5 |
| Cow pea (sole)-fennel                            | 287.1 | 291.5 | 271.4 | 295.9 | 278.5 | 275.8 | 283.4 |
| Cow pea (sole)-coriander                         | 304.0 | 305.8 | 287.4 | 307.9 | 295.7 | 293.3 | 299.0 |
| Mean                                             | 297.5 | 296.7 | 283.0 | 298.3 | 292.7 | 289.7 |       |
| Narendrapur                                      |       |       |       |       |       |       |       |
| Rice (Gobindo bhog)-rice (Satabdi)               | 432.5 | 399.5 | 450.5 | 399.8 | 367.9 | 453.2 | 417.2 |
| Rice (Kanakchur)- sesbania green manure          | 316.1 | 292.7 | 421.4 | 342.3 | 340.5 | 364.1 | 346.2 |
| Rice (Dudheswar)- red amaranthus+ cucumber       | 283.7 | 296.8 | 291.9 | 295.7 | 305.4 | 256.9 | 288.4 |
| Rice (Satabdi) - veg. pea                        | 371.1 | 361.0 | 430.5 | 417.9 | 419.5 | 404.8 | 400.8 |
| Mean                                             | 350.9 | 337.5 | 398.6 | 363.9 | 358.3 | 369.7 |       |
| S.K. Nagar                                       |       |       |       |       |       |       |       |
| Green gram-amaranth – fallow                     | 172.5 | 131.0 | 161.3 | 142.2 | 154.6 | 161.3 | 153.8 |
| Green gram -mustard –fallow                      | 183.7 | 169.1 | 173.6 | 181.4 | 188.2 | 166.9 | 177.2 |
| Groundnut–lucerne - lucerne continue             | 159.0 | 150.1 | 161.3 | 155.7 | 164.6 | 164.6 | 159.2 |
| Mean                                             | 171.7 | 150.1 | 165.4 | 159.8 | 169.1 | 164.3 |       |
| Thiruvananthapuram                               |       |       |       |       |       |       |       |
| Cassava -vegetable cowpea                        | 217.7 | 131.9 | 148.7 | 107.1 | 179.7 | 170.7 | 159.3 |
| Cassava -groundnut                               | 89.4  | 124.8 | 130.8 | 102.1 | 146.3 | 136.2 | 121.6 |
| Taro -black gram                                 | 78.0  | 174.3 | 119.2 | 113.8 | 151.2 | 173.4 | 135.0 |
| Taro -green gram                                 | 167.1 | 114.7 | 101.7 | 101.7 | 64.3  | 147.4 | 116.1 |
| Mean                                             | 138.0 | 136.4 | 125.1 | 106.2 | 135.4 | 156.9 |       |



**Table 7.2.8: Influence of methods of organic, inorganic and integrated management practice on soil available micronutrients (Fe & Mn) at the end of cropping cycle at different locations**

| Locations/Treatments                   | Soil Available Iron (ppm) |               |                  |           |                      |                       | Soil Available Manganese (ppm) |               |                  |          |                      |                       |
|----------------------------------------|---------------------------|---------------|------------------|-----------|----------------------|-----------------------|--------------------------------|---------------|------------------|----------|----------------------|-----------------------|
|                                        | Organic                   |               |                  | Inorganic |                      |                       | Towards organic (Integrated)   |               |                  | Organic  |                      |                       |
|                                        | Organic-ic-I              | Organic-ic-II | Inorganic (100%) | SR or FP  | Towards organic-ic-I | Towards organic-ic-II | Organic-ic-I                   | Organic-ic-II | Inorganic (100%) | SR or FP | Towards organic-ic-I | Towards organic-ic-II |
|                                        |                           |               |                  |           |                      |                       |                                |               |                  |          |                      |                       |
| Bajaura                                |                           |               |                  |           |                      |                       |                                |               |                  |          |                      |                       |
| French bean - cauliflower- french bean | 16.90                     | 15.10         | 10.60            | 11.90     | 15.20                | 13.00                 | 12.20                          | 11.40         | 8.40             | 9.60     | 13.90                | 11.20                 |
| Cauliflower-tomato                     | 16.80                     | 14.20         | 11.90            | 12.70     | 15.50                | 13.60                 | 13.10                          | 11.20         | 8.70             | 10.30    | 13.70                | 11.50                 |
| Black gram-cauliflower-summer Squash   | 17.80                     | 15.70         | 10.60            | 13.80     | 17.50                | 16.10                 | 12.20                          | 9.60          | 8.40             | 9.40     | 12.30                | 11.50                 |
| Okra-pea                               | 15.70                     | 15.30         | 11.90            | 12.00     | 17.80                | 15.70                 | 12.60                          | 11.40         | 8.60             | 10.40    | 12.40                | 11.20                 |
| Mean                                   | 16.80                     | 15.08         | 11.25            | 12.60     | 16.50                | 14.60                 | 12.53                          | 10.90         | 8.53             | 9.93     | 13.08                | 11.35                 |
| Calicut                                |                           |               |                  |           |                      |                       |                                |               |                  |          |                      |                       |
| Ginger-fallow                          | 29.04                     | 21.53         | 19.71            |           | 17.77                | 17.79                 | 27.64                          | 25.95         | 24.86            |          | 25.62                | 26.52                 |
| Turmeric-fallow                        | 46.6                      | 42.7          | 38.1             |           | 42.9                 | 51.2                  | 25.90                          | 22.8          | 26.9             |          | 18.7                 | 24.0                  |
| Dharwad                                |                           |               |                  |           |                      |                       |                                |               |                  |          |                      |                       |
| Pigeonpea + green gram (1:2)           | 7.40                      | 6.50          | 10.70            | 10.90     | 10.50                | 12.30                 | 18.50                          | 19.10         | 15.40            | 16.60    | 18.30                | 17.30                 |
| Pigeonpea + soybean (1:2)              | 6.50                      | 7.60          | 16.30            | 8.00      | 13.00                | 10.90                 | 18.00                          | 19.30         | 16.50            | 18.50    | 19.50                | 19.10                 |
| Pigeonpea + groundnut (1:2)            | 7.70                      | 7.90          | 14.40            | 11.80     | 13.40                | 12.20                 | 19.40                          | 18.80         | 18.30            | 16.30    | 18.50                | 16.10                 |
| Cotton + green gram (1:2)              | 10.50                     | 9.70          | 11.50            | 10.00     | 10.10                | 10.00                 | 18.00                          | 15.80         | 16.20            | 16.70    | 16.10                | 17.00                 |
| Cotton + soybean (1:2)                 | 9.70                      | 8.80          | 9.30             | 10.20     | 9.90                 | 8.70                  | 16.50                          | 17.40         | 15.90            | 15.90    | 16.10                | 14.80                 |
| Mean                                   | 8.36                      | 8.10          | 12.44            | 10.18     | 11.38                | 10.82                 | 18.08                          | 18.08         | 16.46            | 16.80    | 17.70                | 16.86                 |
| Pantnagar                              |                           |               |                  |           |                      |                       |                                |               |                  |          |                      |                       |
| Basmati rice - wheat                   | 32.72                     | 32.69         | 32.68            | 32.63     | 32.69                | 32.70                 | 8.30                           | 8.29          | 8.25             | 8.26     | 8.29                 | 8.28                  |
| Basmati rice – mustard                 | 32.76                     | 32.87         | 32.64            | 32.64     | 32.70                | 32.76                 | 8.27                           | 8.26          | 8.23             | 8.25     | 8.28                 | 8.25                  |

|                                                |       |       |       |       |       |       |       |      |      |      |      |      |      |      |
|------------------------------------------------|-------|-------|-------|-------|-------|-------|-------|------|------|------|------|------|------|------|
| Basmati rice – vegetable pea + coriander (4:2) | 32.74 | 32.67 | 32.65 | 32.62 | 32.66 | 32.76 | 32.68 | 8.35 | 8.22 | 8.23 | 8.26 | 8.25 | 8.27 | 8.26 |
| Basmati rice – potato                          | 32.89 | 32.68 | 32.67 | 32.85 | 32.68 | 32.65 | 32.74 | 8.25 | 8.28 | 8.20 | 8.24 | 8.27 | 8.26 | 8.25 |
| Mean                                           | 32.78 | 32.73 | 32.66 | 32.69 | 32.68 | 32.72 |       | 8.29 | 8.26 | 8.23 | 8.25 | 8.27 | 8.27 |      |
| S.K. Nagar                                     |       |       |       |       |       |       |       |      |      |      |      |      |      |      |
| Green gram-amaranth – fallow                   | 2.48  | 2.52  | 2.12  | 3.09  | 2.20  | 2.20  | 2.44  | 7.24 | 5.94 | 9.3  | 5.95 | 7.01 | 6.65 | 7.02 |
| Green gram -mustard –fallow                    | 1.70  | 1.78  | 2.01  | 1.91  | 2.02  | 1.86  | 1.88  | 5.51 | 6.92 | 7.24 | 6.77 | 7.22 | 6.22 | 6.65 |
| Groundnut–lucerne - lucerne continue           | 1.80  | 2.04  | 1.46  | 2.22  | 2.27  | 2.10  | 1.98  | 5.81 | 5.42 | 4.95 | 6.68 | 6.02 | 4.94 | 5.64 |
| Mean                                           | 1.99  | 2.11  | 1.86  | 2.41  | 2.16  | 2.05  |       | 6.19 | 6.09 | 7.16 | 6.47 | 6.75 | 5.94 |      |
| Thiruvananthapuram                             |       |       |       |       |       |       |       |      |      |      |      |      |      |      |
| Cassava -vegetable cowpea                      | 76.79 | 82.32 | 89.26 | 75.06 | 83.44 | 85.58 | 82.08 |      |      |      |      |      |      |      |
| Cassava -groundnut                             | 66.97 | 69.88 | 25.57 | 67.25 | 67.91 | 77.09 | 62.45 |      |      |      |      |      |      |      |
| Taro -black gram                               | 62.48 | 63.35 | 50.52 | 52.04 | 62.58 | 65.82 | 59.47 |      |      |      |      |      |      |      |
| Taro -green gram                               | 58.24 | 53.8  | 63.52 | 51.52 | 49.75 | 57.62 | 55.74 |      |      |      |      |      |      |      |
| Mean                                           | 66.12 | 67.34 | 57.22 | 61.47 | 65.92 | 71.53 |       |      |      |      |      |      |      |      |



Table 7.2.9: Influence of methods of organic, inorganic and integrated management practice on soil available micronutrients (Zn & Cu) at the end of cropping cycle

| Locations/Treatments                           | Zinc (ppm)                   |             |      |                              |             |      | Copper (ppm)                 |             |      |                              |             |      |
|------------------------------------------------|------------------------------|-------------|------|------------------------------|-------------|------|------------------------------|-------------|------|------------------------------|-------------|------|
|                                                | Organic                      |             |      | Inorganic                    |             |      | Organic                      |             |      | Inorganic                    |             |      |
|                                                | Towards organic (Integrated) |             |      | Towards organic (Integrated) |             |      | Towards organic (Integrated) |             |      | Towards organic (Integrated) |             |      |
|                                                | Organ-ic-I                   | Organ-ic-II | Mean | Organ-ic-I                   | Organ-ic-II | Mean | Organ-ic-I                   | Organ-ic-II | Mean | Organ-ic-I                   | Organ-ic-II | Mean |
| Bajaura                                        |                              |             |      |                              |             |      |                              |             |      |                              |             |      |
| French bean - cauliflower- french bean         | 4.11                         | 3.07        | 3.0  | 2.01                         | 2.16        | 3.09 | 2.27                         | 1.84        | 1.13 | 1.67                         | 2.47        | 1.9  |
| Cauliflower-tomato                             | 3.59                         | 3.06        | 2.9  | 1.87                         | 2.37        | 3.05 | 3.28                         | 1.98        | 1.18 | 1.81                         | 3.84        | 2.4  |
| Black gram-cauliflower-summer Squash           | 3.88                         | 3.30        | 3.0  | 1.96                         | 2.99        | 2.97 | 1.53                         | 1.34        | 1.15 | 1.23                         | 1.90        | 1.5  |
| Okra-pea                                       | 3.70                         | 2.83        | 2.9  | 2.03                         | 2.62        | 3.05 | 3.57                         | 2.27        | 1.15 | 1.63                         | 3.97        | 2.5  |
| Mean                                           | 3.82                         | 3.07        |      | 1.97                         | 2.54        | 3.04 | 2.66                         | 1.86        | 1.15 | 1.59                         | 3.05        |      |
| Calicut                                        |                              |             |      |                              |             |      |                              |             |      |                              |             |      |
| Ginger-fallow                                  | 6.73                         | 4.58        |      | 2.45                         | 2.11        | 2.03 | 2.31                         | 1.65        | 1.61 |                              | 1.37        | 1.54 |
| Turneric-fallow                                | 9.30                         | 9.422       |      | 8.944                        | 8.1         | 8.7  | 4.14                         | 3.89        | 0.72 |                              | 1.58        | 2.95 |
| Dharwad                                        |                              |             |      |                              |             |      |                              |             |      |                              |             |      |
| Pigeonpea + green gram (1:2)                   | 1.37                         | 1.36        | 0.81 | 0.44                         | 0.40        | 0.49 | 2.10                         | 1.88        | 1.84 | 1.86                         | 1.80        | 1.91 |
| Pigeonpea + soybean (1:2)                      | 1.35                         | 1.23        | 0.79 | 0.37                         | 0.48        | 0.52 | 2.08                         | 2.11        | 2.77 | 1.86                         | 1.97        | 2.10 |
| Pigeonpea + groundnut (1:2)                    | 1.41                         | 1.22        | 0.74 | 0.41                         | 0.45        | 0.50 | 1.91                         | 2.12        | 2.09 | 1.99                         | 2.18        | 2.06 |
| Cotton + green gram (1:2)                      | 0.61                         | 1.18        | 0.68 | 0.68                         | 0.68        | 0.51 | 1.72                         | 1.97        | 2.00 | 1.95                         | 1.97        | 1.94 |
| Cotton + soybean (1:2)                         | 0.84                         | 1.32        | 0.91 | 1.18                         | 0.87        | 0.57 | 1.73                         | 1.60        | 2.00 | 2.28                         | 1.92        | 1.90 |
| Mean                                           | 1.12                         | 1.26        |      | 0.62                         | 0.58        | 0.52 | 1.91                         | 1.94        | 2.14 | 1.99                         | 1.97        |      |
| Pantnagar                                      |                              |             |      |                              |             |      |                              |             |      |                              |             |      |
| Basmati rice - wheat                           | 1.12                         | 1.09        | 1.10 | 1.10                         | 1.10        | 1.10 | 4.02                         | 4.00        | 3.98 | 3.99                         | 4.02        | 4.00 |
| Basmati rice – mustard                         | 1.11                         | 1.13        | 1.10 | 1.08                         | 1.12        | 1.10 | 4.01                         | 4.04        | 3.97 | 3.98                         | 3.99        | 4.00 |
| Basmati rice – vegetable pea + coriander (4:2) | 1.09                         | 1.12        | 1.10 | 1.10                         | 1.10        | 1.10 | 4.02                         | 3.99        | 3.97 | 3.96                         | 4.01        | 4.00 |

|                                      |      |      |      |      |      |      |      |       |       |       |       |       |       |      |      |
|--------------------------------------|------|------|------|------|------|------|------|-------|-------|-------|-------|-------|-------|------|------|
| Basmati rice – potato                | 1.11 | 1.15 | 1.08 | 1.10 | 1.10 | 1.10 | 1.11 | 1.11  | 4.04  | 4.01  | 3.97  | 3.95  | 4.03  | 3.99 | 4.00 |
| Mean                                 | 1.11 | 1.12 | 1.09 | 1.11 | 1.09 | 1.10 | 1.10 | 1.10  | 4.02  | 4.01  | 3.97  | 3.97  | 4.00  | 4.01 |      |
| S.K. Nagar                           |      |      |      |      |      |      |      |       |       |       |       |       |       |      |      |
| Green gram-amaranth – fallow         | 0.63 | 0.75 | 0.45 | 0.30 | 1.54 | 0.82 | 0.75 | 0.48  | 0.47  | 0.389 | 0.46  | 0.49  | 0.50  | 0.46 |      |
| Green gram -mustard –fallow          | 1.81 | 0.37 | 1.84 | 0.26 | 1.18 | 0.53 | 1.00 | 0.37  | 0.366 | 0.456 | 0.41  | 0.366 | 0.347 | 0.39 |      |
| Groundnut-lucerne - lucerne continue | 0.43 | 0.21 | 0.29 | 0.25 | 1.65 | 0.43 | 0.54 | 0.325 | 0.436 | 0.328 | 0.405 | 0.395 | 0.379 | 0.38 |      |
| Mean                                 | 0.96 | 0.44 | 0.86 | 0.27 | 1.46 | 0.59 |      | 0.39  | 0.42  | 0.39  | 0.42  | 0.42  | 0.41  |      |      |
| Thiruvananthapuram                   |      |      |      |      |      |      |      |       |       |       |       |       |       |      |      |
| Cassava -vegetable cowpea            | 7.96 | 3.85 | 5.83 | 7.24 | 4.39 | 5.34 | 5.77 | 1.79  | 1.89  | 1.91  | 1.88  | 1.92  | 2.85  | 2.04 |      |
| Cassava -groundnut                   | 3.1  | 5.58 | 4.37 | 5.84 | 3.07 | 3.56 | 4.25 | 1.47  | 1.83  | 2.06  | 2.11  | 1.74  | 1.81  | 1.84 |      |
| Taro -black gram                     | 2.86 | 2.56 | 1.93 | 2.09 | 2.81 | 4.14 | 2.73 | 1.58  | 1.92  | 1.72  | 1.33  | 1.58  | 1.64  | 1.63 |      |
| Taro -green gram                     | 3.89 | 2.77 | 1.96 | 2.38 | 2.63 | 3.91 | 2.92 | 1.46  | 1.47  | 2.02  | 1.47  | 1.29  | 1.42  | 1.52 |      |
| Mean                                 | 4.45 | 3.69 | 3.52 | 4.39 | 3.23 | 4.24 |      | 1.58  | 1.78  | 1.93  | 1.70  | 1.63  | 1.93  |      |      |



### Soil microbial population as influenced by the different management practices (Table 7.2.10 and 7.2.11)

**Bajaura:** In general, the organic management practice improved soil microbial properties across the cropping systems compare to inorganic and towards organic practice. At the end of cropping cycle, microbial bacteria count ranged 22.2-27.0 log cfu/g, fungi 20.2-24.6 log cfu/g, actinomycetes 21.1-24.5 log cfu/g and PSB 24.6-26.2 log cfu/g under organic management which is 10.7, 2.1, 3.8 and 4.4% higher than then towards organic-II. Among the cropping systems, bacteria and actinomycetes count recorded better in cauliflower-tomato while fungi and PSB count recoded better in black gram-cauliflower- summer squash.

**Dharwad:** Among all the management practices, bacteria, fungi, actinomycetes and PSB recorded higher under organic management practice and population of bacteria, fungi, actinomycetes and PSB found to be ranged between 93.3-104.3, 14.5-15.30, 30.6-37.1 and 35.5-38.4 log cfu/g. The difference from organic to towards organic is 86.7, 82.1, 64.9 and 48.3% respectively. Among the cropping systems, population of bacteria, fungi and PSB recorded higher in pigeonpea +soybean system whereas actinomycetes recorded higher in pigeonpea +groundnut system

**Jabalpur:** Among all the management practices, bacteria and actinomycetes recorded higher under organic management practice while, fungi recorded higher population under towards organic practice. Population of bacteria, fungi and actinomycetes ranged in 41.26-41.43, 42.13-42.4 and 12.71-12.84 log cfu/g respectively. Cropping systems did not varied significantly for bacteria, fungi and actinomycetes.

**Narendrapur:** Application of organic nutrient consisting of 25% organic+25% inorganic +NF practice (towards organic) resulted in higher microbial population in the soil viz bacteria and actinomycetes. Population of bacteria ( $15.19 (10^{12} \text{ CFU/g})$ ), and actinomycetes ( $23.33 10^{12} \text{ cfu/g}$ ) recorded with towards organic-II which is only 1.3 and 6.0% lower with the organic management practice. Population of fungi ranged between 14.8-16.8 and found to be higher by 11.5% over towards organic-II. Among the cropping systems, basmati rice–broccoli – sesbania recorded higher population of fungi and actinomycetes (15.3 and 20.4 log cfu/g respectively) whereas maximum count of bacteria recorded in rice –veg. pea – sesame at the end of crop cycle in the soil.

**Sardarkrushinagar:** It is evident from the data outlined in table that population bacterial, fungi and actinomycetes recorded higher under organic input package in all three cropping systems at the end of cropping cycle. Population of bacteria, fungi and actinomycetes found ranged from 172.96-228.5, 19.27-24.88 and 46.26-58.55 log cfu/g respectively which were 135.9, 173.4 and 186.2% higher than the towards organic-II. Among the cropping systems, population count of bacteria, fungi and actinomycetes was higher in green gram - fennel – continue system.

**Thiruvananthapuram:** Among the management practices, bacterial count ranged in 105.0-125.3 log cfu/g which is 15.0% lower than the towards organic-II. Similarly, population count of fungi and actinomycetes was ranged in 6.83-15.67 and 3.83-5.58 log cfu/g recorded under organic management practice which is 2.8 and 28.6% higher than towards organic-II. Among the cropping systems, cassava-veg cowpea cropping system found higher bacterial and fungi population whereas actinomycetes count was higher in cassava-groundnut system.

### Effect of different management practices (organic, inorganic and towards) on quality aspects of produce (Table 7.2.12)

**Bajaura:** Quality parameters protein, TSS (%brix) and vitamin C in different vegetable crops namely frenchbean, black gram, tomato, pea and cauliflower were estimated. In general, quality parameters among the various input practice observed slightly numerically higher towards organic nutrient management-II. Protein content in french bean and black gram recorded in ranged between 14.0-14.2% under organic management practice. TSS (%brix) in tomato recorded maximum TSS content with integrated consisting of 75% organic + 25% inorganic practice. Whereas, In Pea highest TSS recorded in ranged between 5.2 -5.4 (%brix) while in pea it is ranged between 14.0-14.4 under organic input practice. Vitamin C content in

tomato fruits is recorded in ranged from 33.8-34.2 mg/100g whereas, in cauliflower, it is 45.1-47.0 mg/100g under organic management practice.

**Bhopal:** In general, nutritional quality constituents in soybean recorded numerically higher with organic management viz. oil, protein, methionine and tryptophan content. Under organic nutrient management practice, oil content ranged between 18.07-18.09%, protein 35.2-35.9, methionine 1.76-1.78 (g/16gN) and tryptophan 1.83-1.85 (g/16gN).

**Calicut:** Nutritional quality in ginger recorded marginally higher with organic (100%) whereas in turmeric, curcumin, oleoresin and oil content was higher with towards organic management-II. Under organic management practice, oil, oleoresin and curcumin content percent in turmeric is 7.0, 9.1 and 10.6% lower than the towards organic-II.

**Coimbatore:** All the quality parameter of brinjal, chilli and tomato did not differ significantly due to various input management package but in general, all quality parameter was higher with organic management followed by towards organic. Titrable acidity (%) and ascorbic acid in brinjal recorded higher by 13.3 and 4.8% respectively. TSS and ascorbic acid in chilli is better under organic input practice which is 5.4 and only about 1.2% higher under organic than the towards organic-II. TSS, titrable acidity (%) and ascorbic acid in tomato recorded higher under organic practice and ranged between 5.57-5.61, 0.68-0.70 and 34.51-34.70 respectively.

**Ranchi:** Nutritional quality constituents such as protein and moisture did not significantly differ due to production practice. Protein and moisture in rice was higher in organic production management either with 100% organic or with 50% organic + NF practice compared to towards organic and inorganic. In case of wheat, reverse was recorded wherein protein and moisture was found to be higher in towards organic.

### **Influence of organic, inorganic and integrated management packages on economics of different crops and cropping systems Table (7.2.13 and 7.2.14)**

**Bajaura:** Among all the management practices evaluated, the cost of cultivation under organic management ranged between 2.15 to 2.22 lakhs which is only about 2% higher than the towards organic with application integrated (25% each organic & inorganic nutrients +NF practice). Similarly, okra-pea system recorded lower cost of cultivation. In term of net return and net return per rupee invested, organic management-II recorded higher while black gram-cauliflower-summer squash recorded maximum net return. In term of NRPRI, okra-pea recorded higher value of 1.58.

**Bhopal:** Among the management practices evaluated, cost of cultivation under organic management practice ranged between Rs. 56,147 to 58,391 which is 6 and 2.3% higher respectively than towards organic-II. Among the cropping systems, soybean chickpea recorded lowest cost of cultivation. In term of net return and net return per rupee invested, organic management practice recorded higher while, soybean-linseed system recorded maximum net return and NRPRI as well.

**Calicut:** Cost of cultivation for ginger was recorded in ranged between Rs. 1.84 to 1.91 lakhs which is 4.6 and 8.2% higher than towards organic II. Similarly, turmeric production cost was also higher with organic management practice which is 5.4% higher than towards organic. Net return for ginger and turmeric under organic practice recorded of Rs.1.75 and 2.26 lakh/ha which is 12.4 and 16.2% lower than towards organic respectively. Similar trend was observed for net return per rupee invested for both the crop.

**Coimbatore:** Among the management practices evaluated, cost of cultivation under organic management ranged between Rs. 1.87 to 2.16 lakh which is 21.0 and 5.1 higher respectively than towards organic-II. Among the cropping systems, brinjal-pearl millet-green manure recorded lowest cost of cultivation. In term of net return and net return per rupee invested, organic management practice recorded higher while, brinjal-pearl millet-green manure system recorded maximum net return and NRPRI value as well.



**Dharwad:** Among all the management practices, cost of cultivation under organic management ranged between Rs. 34,444 to 38,128 /ha which is 7.6% higher than towards organic-II. Similarly, pigeon pea + green gram (2:4) intercropping system recorded lower cost of cultivation. In term of net return, organic management recorded ranged between Rs. 29643 to 33275/ha which is 20.2% lower than towards organic-II among the different production practices respectively. Similarly, pigeon pea +groundnut (2:4) intercropping system recorded highest net return of Rs. 50047/ha among the cropping systems. Net return per rupees invested observed the similar trend.

**Jabalpur:** Among the production management practices, organic management practices ranged between of Rs. 89033 to 91460/ha which is about 4% higher than towards organic management practices –II. Likewise, soybean-wheat resulted in lower cost of cultivation of Rs. 75685/ha among the systems. In term of net return and NRPRI organic (100%) recorded better which was 16 and 11.0% higher than towards organic II respectively. Among the cropping systems, soybean-berseem (fodder and seed) resulted in better net return and NRPRI of 1.63 lakh/ha and 1.94 respectively.

**Karjat:** On comparing the input management practices, organic management practices ranged between of Rs. 1.79 to 2.13 lakh which is 24.7% higher than towards organic management practices –II. Likewise, rice-chickpea resulted in lower cost of cultivation of Rs. 1.22 lakh/ha among the systems. In term of net return and NRPRI, organic (100%) production package recorded better which is 73.4 and 41.5% higher than towards organic II respectively. Among the cropping systems, rice-brinjal resulted in better net return and NRPRI of 2.83 lakh/ha and 1.16 respectively.

**Ludhiana:** Among all the management practices evaluated, the cost of cultivation under organic management ranged between Rs. 0.96 to 1.0 lakhs which is 17% higher than the towards organic with integrated (25% each organic & inorganic nutrients +NF practice). Similarly, sesame-lentil system recorded lower cost of cultivation of Rs. 57521/ha. In term of net return and net return per rupee invested, organic management (100%) recorded about 18.1 and 3.0% better while basmati rice-wheat-green manure recorded maximum net return and NRPRI among the systems.

**Modipuram:** Among the management practices, cost of cultivation under organic management ranged between Rs.89920 to 96031/ha which is 5.6% higher than towards organic II. Similarly, finger millet–barley–sesbania recorded lower cost of cultivation. In term of net return and NRPRI, organic management (100%) recorded better which is 134 and 155% higher than towards organic-II respectively. Among the cropping systems, black gram–tomato–sunhemp resulted better net return and NRPRI.

**Pantnagar:** Among all the management practices evaluated, the cost of cultivation under organic management ranged between 84305 to 88386 Rs/ha which is 8.6% higher than the towards organic II. Similarly, basmati rice-mustard system recorded lower cost of cultivation. In case of net return and NRPRI, organic management 100% resulted in better which is 54.4 and 39.4% higher than the towards organic-II respectively. Among the cropping systems, though net return is higher with basmati rice – vegetable pea (4 rows vegetable pea + 2 rows coriander) while, basmati rice – mustard recorded higher value (3.3) of NRPRI.

**Raipur:** Among all the management practices evaluated, the cost of cultivation under organic management ranged between 1.26 to Rs 1.31 lakh/ha which is 12.2% higher than the towards organic-II. Similarly, soybean-french bean system recorded lower cost of cultivation. In case of net return and NRPRI, organic management package 100% recorded better which is 88.7 and 70.4% than the towards organic-II respectively. Among the cropping systems, soybean-cabbage recorded better net return and NRPRI.

**Ranchi:** Among all the management practices evaluated, the cost of cultivation under organic management ranged from Rs. 1.06 to 1.18 lakh/ha. Similarly, rice-wheat recorded lower cost of cultivation among the systems of Rs. 0.66 lakh/ha. In case of net return and net return per rupee invested, organic management practice (organic I & II) recorded better which is 178.4 and 86.4% higher than the towards organic respectively. Among the cropping systems, net return and NRPRI recoded better with rice-onion system.

**Umiam:** Among all the management practices evaluated, the cost of cultivation under organic management ranged between Rs. 2.15 to 2.40 lakh/ha which is 18.5% higher than the towards organic-I. Similarly, okra-french bean system recorded lower cost of cultivation among the systems. In term of net return and NRPRI, organic management-II recorded better which is 11.4 and 6.3% higher than towards organic-I respectively. Among the cropping systems, okra-potato system recorded higher net return and NRPRI.

**Ajmer:** Among all the management practices evaluated, the cost of cultivation under organic management ranged between Rs. 2.15 to 2.40 lakh/ha which is 18.5% higher than the towards organic-I. Similarly, cow pea + maize- coriander + cabbage and cowpea - coriander system recorded lower cost of cultivation among the systems. In case of net return and NRPRI, organic management (organic -I & II) recorded lower net return and NRPRI which is 35.2 and 57.3% lower than towards organic-II respectively. Among the cropping systems, cowpea + maize - fennel + cabbage system recorded better net return and NRPRI.

**Almora:** Among all the management practices evaluated, the cost of cultivation ranged between 0.81 to 0.88 lakh/ha which is 29.1% higher than the towards organic-I. Similarly, Finger millet + black soybean-wheat + toria system recorded lower cost of cultivation. In case of net return and NRPRI, organic nutrient management (100%) recorded better net return and NRPRI which is 63.5 and 25.5% higher than the towards organic-I respectively. among the two cropping systems, grain amaranth-wheat + lentil system recorded higher net return and NRPRI which is found to be 34.3 and 31.1% higher than finger millet + black soybean-wheat + toria.

**Narendrapur:** Among all the management practices evaluated, the cost of cultivation under organic management ranged between Rs. 1.06 to 1.26 lakh/ha which is 31.1% higher than the towards organic II. Similarly, rice (Gobindobhog)-broccoli-sesbania green manure recorded lower cost of cultivation. In case of net return and NRPRI, organic management-II resulted in better which is 93.6 and 79.7% higher than the towards organic-II respectively. Among the cropping systems, rice (Shatabdi) -frenchbean-green gram system recorded better net return and NRPRI.

**Sardarkrushinagar:** Among all the input management practices, the cost of cultivation under organic management ranged between 0.84 – 0.90 lakh/ha which is 9.4% higher than the towards organic-II. Similarly, green gram-fennel-fennel recorded lowest cost of cultivation. Likewise, net return and net return per rupee invested (NRPRI) also resulted in better with organic management practices and found to be higher to the tune of 135.4 78.4% respectively. Though, groundnut- wheat- green gram recorded better net return of Rs 0.96 lakh/ha but green gram-fennel-fennel system recorded higher value of 1.14 among the cropping system.

**Thiruvananthapuram:** Among the various management practices evaluated, the cost of cultivation under organic management ranged between 4.25-4.29 lakh/ha which is at par with towards organic-II. Similarly, cassava-groundnut system recorded lower cost of cultivation. In case of net return, organic management recorded in ranged between 1.62 to 1.81 lakh/ha which is 108.1% higher than the towards organic-II. NRPRI followed the same trend. Cassava-ground nut recorded better net return and net return per rupees invested due to lower cost of cultivation among the cropping system.

**Udaipur:** Among all the management practices evaluated, the cost of cultivation under organic management ranged between Rs. 0.89 to 0.92 lakhs which is 23.5% higher than the towards organic with integrated (25% each organic & inorganic nutrients +NF practice). Similarly, black gram – wheat (*Triticum aestivum*) system recorded lower cost of cultivation of Rs. 57118/ha. In term of net return, organic management-II recorded remarkable higher by 153.3 while NRPRI recorded by only about 1.4% higher than the towards organic-II. Among the cropping systems, basmati rice-wheat-green manure recorded maximum net return and NRPRI among the systems, black gram – wheat (*Triticum aestivum*) system recorded maximum net return and NRPRI owing to lower cost of cultivation.



Table 7.2.10: Population of bacteria and fungi in rhizosphere soil as influenced by the different nutrient management practices and cropping systems

| Locations/Treatments                   | Bacteria (log cfu/g)                |            |           |          |                              |                    | Fungi (log cfu/g)                   |            |                  |          |                              |                    |
|----------------------------------------|-------------------------------------|------------|-----------|----------|------------------------------|--------------------|-------------------------------------|------------|------------------|----------|------------------------------|--------------------|
|                                        | Organic                             |            | Inorganic |          | Towards organic (Integrated) |                    | Organic                             |            | Inorganic        |          | Towards organic (Integrated) |                    |
|                                        | Organic-I                           | Organic-II | Inorganic | SR or FP | Towards organic-I            | Towards organic-II | Organic-I                           | Organic-II | Inorganic (100%) | SR or FP | Towards organic-I            | Towards organic-II |
| Bajaura                                |                                     |            |           |          |                              |                    |                                     |            |                  |          |                              |                    |
| French bean - cauliflower- french bean | 24.3                                | 26.7       | 14.9      | 19.1     | 20.6                         | 24.4               | 23.0                                | 25.5       | 17.9             | 21.8     | 21.3                         | 24.8               |
| Cauliflower-tomato                     | 23.7                                | 27.4       | 14.7      | 19.4     | 21.8                         | 27.5               | 21.3                                | 26.9       | 17.5             | 21.9     | 21.0                         | 23.6               |
| Black gram-cauliflower-summer Squash   | 22.5                                | 27.6       | 14.9      | 19.3     | 20.5                         | 23.8               | 21.7                                | 26.4       | 17.3             | 21.9     | 21.8                         | 26.7               |
| Okra-pea                               | 24.6                                | 26.9       | 15.0      | 19.3     | 20.6                         | 24.1               | 23.2                                | 25.6       | 18.0             | 22.0     | 21.1                         | 25.5               |
| Mean                                   | 23.8                                | 27.2       | 14.9      | 19.3     | 20.9                         | 25.0               | 22.3                                | 26.1       | 17.7             | 21.9     | 21.3                         | 25.2               |
| Dharwad                                | CFU x 10 <sup>6</sup>               |            |           |          |                              |                    | CFU x 10 <sup>4</sup>               |            |                  |          |                              |                    |
| Pigeonpea + green gram (1:2)           | 85.5                                | 95.0       | 85.5      | 89.0     | 58.0                         | 63.0               | 6.0                                 | 6.0        | 4.5              | 11.5     | 9.5                          | 7.5                |
| Pigeonpea + soybean (1:2)              | 75.5                                | 83.0       | 74.0      | 54.5     | 95.5                         | 96.5               | 7.0                                 | 3.5        | 9.0              | 9.0      | 14.5                         | 9.5                |
| Pigeonpea + groundnut (1:2)            | 69.5                                | 54.5       | 94.5      | 83.0     | 75.5                         | 81.0               | 5.0                                 | 9.0        | 6.0              | 10.0     | 10.5                         | 6.5                |
| Cotton + green gram (1:2)              | 91.5                                | 75.0       | 80.5      | 79.0     | 90.0                         | 85.0               | 6.0                                 | 6.0        | 8.5              | 7.0      | 8.5                          | 7.0                |
| Cotton + soybean (1:2)                 | 71.0                                | 53.5       | 84.5      | 75.5     | 88.5                         | 71.5               | 6.0                                 | 8.0        | 6.0              | 8.5      | 11.0                         | 6.5                |
| Mean                                   | 78.6                                | 72.2       | 83.8      | 76.2     | 81.5                         | 79.4               | 6.0                                 | 6.5        | 6.8              | 9.2      | 10.8                         | 7.4                |
| Jabalpur                               | CFUx10 <sup>6</sup> g <sup>-1</sup> |            |           |          |                              |                    | CFUx10 <sup>3</sup> g <sup>-1</sup> |            |                  |          |                              |                    |
| Soybean- wheat                         | 46.6                                | 43.3       | 41.3      | 40.4     | 42.4                         | 42.2               | 30.8                                | 30.2       | 30.2             | 30.8     | 31.0                         | 29.7               |
| Soybean-mustard- greengram             | 47.0                                | 42.5       | 42.2      | 40.0     | 42.8                         | 42.7               | 30.9                                | 30.8       | 31.0             | 30.4     | 30.8                         | 30.8               |
| Soybean-berseem (F & S)                | 48.6                                | 46.0       | 40.4      | 41.4     | 43.6                         | 43.8               | 30.4                                | 30.8       | 29.8             | 30.8     | 31.5                         | 30.9               |
| Soybean- lentil- sorghum (F)           | 46.6                                | 45.6       | 41.2      | 40.8     | 43.1                         | 42.3               | 31.4                                | 31.3       | 30.4             | 29.8     | 30.6                         | 30.7               |
| Mean                                   | 47.2                                | 44.4       | 41.3      | 40.7     | 43.0                         | 42.8               | 30.9                                | 30.8       | 30.4             | 30.5     | 31.0                         | 30.5               |
| Karjat                                 | CFUx10 <sup>6</sup> g <sup>-1</sup> |            |           |          |                              |                    | CFUx10 <sup>3</sup> g <sup>-1</sup> |            |                  |          |                              |                    |
| Rice – brinjal                         |                                     |            |           |          |                              |                    |                                     |            |                  |          |                              | 12.8               |
| Rice – chick pea                       |                                     |            |           |          |                              |                    |                                     |            |                  |          |                              | 11.6               |
| Rice – field bean                      |                                     |            |           |          |                              |                    |                                     |            |                  |          |                              | 12.0               |

[illegible]



**Table 7.2.11: Population of actinomycetes and phosphorus solubilizing bacteria in rhizosphere soil as influenced by the different nutrient practices and cropping systems**

| Locations/Treatments                   |  | Soil actinomycetes (log cfu/g)      |             |                   |          |                               |                      | Phosphate solubilizing bacteria (log cfu/g) |                                                           |             |                   |          |                               |                      |      |  |
|----------------------------------------|--|-------------------------------------|-------------|-------------------|----------|-------------------------------|----------------------|---------------------------------------------|-----------------------------------------------------------|-------------|-------------------|----------|-------------------------------|----------------------|------|--|
|                                        |  | Organic                             |             | Inorganic         |          | Towards organ-ic (Integrated) |                      | Mean                                        | Organic                                                   |             | Inorganic         |          | Towards organ-ic (Integrated) |                      | Mean |  |
|                                        |  | Organ-ic-I                          | Organ-ic-II | Inor-ganic (100%) | SR or FP | To-wards organ-ic-I           | To-wards Organ-ic-II |                                             | Organ-ic-I                                                | Organ-ic-II | Inor-ganic (100%) | SR or FP | To-wards organ-ic-I           | To-wards Organ-ic-II |      |  |
| Bajaura                                |  |                                     |             |                   |          |                               |                      |                                             | Phosphatase (µg/g/hr)                                     |             |                   |          |                               |                      |      |  |
| French bean - cauliflower- french bean |  | 26.2                                | 29.0        | 20.1              | 24.8     | 25.4                          | 27.8                 | 25.6                                        | 24.4                                                      | 26.5        | 15.8              | 21.6     | 22.1                          | 26.1                 | 22.8 |  |
| Cauliflower-tomato                     |  | 27.0                                | 28.5        | 19.5              | 25.1     | 25.4                          | 28.9                 | 25.7                                        | 23.5                                                      | 28.2        | 15.9              | 21.5     | 22.0                          | 26.6                 | 23.0 |  |
| Black gram-cauliflower-summer Squash   |  | 29.0                                | 29.6        | 20.2              | 24.2     | 24.5                          | 29.0                 | 26.1                                        | 25.5                                                      | 25.7        | 14.9              | 22.2     | 23.5                          | 23.7                 | 22.6 |  |
| Okra-pea                               |  | 26.6                                | 29.5        | 19.9              | 24.3     | 25.4                          | 27.3                 | 25.5                                        | 24.5                                                      | 26.5        | 15.9              | 21.1     | 22.1                          | 25.5                 | 22.6 |  |
| Mean                                   |  | 27.2                                | 29.2        | 19.9              | 24.6     | 25.2                          | 28.3                 |                                             | 24.5                                                      | 26.7        | 15.6              | 21.6     | 22.4                          | 25.5                 |      |  |
| Dharwad                                |  |                                     |             |                   |          |                               |                      |                                             | Total P solubilizing microorganisms CFU x 10 <sup>4</sup> |             |                   |          |                               |                      |      |  |
| Pigeonpea + green gram (1:2)           |  | -                                   | -           | -                 | -        | -                             | -                    | -                                           | 25.5                                                      | 36.5        | 57.5              | 34.0     | 39.5                          | 45.5                 | 39.8 |  |
| Pigeonpea + soybean (1:2)              |  | -                                   | -           | -                 | -        | -                             | -                    | -                                           | 41.0                                                      | 49.0        | 50.5              | 31.0     | 32.0                          | 58.5                 | 43.7 |  |
| Pigeonpea + groundnut (1:2)            |  | -                                   | -           | -                 | -        | -                             | -                    | -                                           | 50.5                                                      | 65.0        | 55.0              | 23.5     | 63.0                          | 42.5                 | 49.9 |  |
| Cotton + green gram (1:2)              |  | -                                   | -           | -                 | -        | -                             | -                    | -                                           | 57.5                                                      | 39.5        | 29.5              | 44.0     | 38.0                          | 44.5                 | 42.2 |  |
| Cotton + soybean (1:2)                 |  | -                                   | -           | -                 | -        | -                             | -                    | -                                           | 56.0                                                      | 52.0        | 43.5              | 24.0     | 48.0                          | 53.5                 | 46.2 |  |
| Mean                                   |  |                                     |             |                   |          |                               |                      |                                             | 46.1                                                      | 48.4        | 47.2              | 31.3     | 44.1                          | 48.9                 |      |  |
| Jabalpur                               |  | CFUx10 <sup>4</sup> g <sup>-1</sup> |             |                   |          |                               |                      |                                             |                                                           |             |                   |          |                               |                      |      |  |
| Soybean- wheat                         |  | 11.4                                | 11.2        | 10.6              | 10.3     | 11.1                          | 12.0                 | 11.1                                        | -                                                         | -           | -                 | -        | -                             | -                    |      |  |
| Soybean-mustard- greengram             |  | 11.2                                | 11.0        | 11.0              | 10.0     | 11.5                          | 11.4                 | 11.0                                        | -                                                         | -           | -                 | -        | -                             | -                    |      |  |
| Soybean-berseem (F & S)                |  | 12.2                                | 11.3        | 10.8              | 10.3     | 11.6                          | 11.6                 | 11.3                                        | -                                                         | -           | -                 | -        | -                             | -                    |      |  |
| Soybean- lentil- sorghum (F)           |  | 11.6                                | 11.0        | 10.9              | 10.3     | 10.9                          | 11.1                 | 11.0                                        | -                                                         | -           | -                 | -        | -                             | -                    |      |  |
| Mean                                   |  | 11.6                                | 11.1        | 10.8              | 10.2     | 11.3                          | 11.5                 |                                             | -                                                         | -           | -                 | -        | -                             | -                    |      |  |
| Karjat                                 |  | CFUx10 <sup>4</sup> g <sup>-1</sup> |             |                   |          |                               |                      |                                             |                                                           |             |                   |          |                               |                      |      |  |
| Rice – brinjal                         |  |                                     |             |                   |          |                               |                      | 43.8                                        |                                                           |             |                   |          |                               |                      |      |  |
| Rice – chick pea                       |  |                                     |             |                   |          |                               |                      | 39.1                                        |                                                           |             |                   |          |                               |                      |      |  |
| Rice – field bean                      |  |                                     |             |                   |          |                               |                      | 41.1                                        |                                                           |             |                   |          |                               |                      |      |  |

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**Table 7.2.12: Influence of organic, inorganic and integrated management package on quality of crops at different locations**

| Locations  | Crops             | Quality parameter         | Organic   |            | Inorganic        |          | Towards organic (Integrated) |                    |
|------------|-------------------|---------------------------|-----------|------------|------------------|----------|------------------------------|--------------------|
|            |                   |                           | Organic-I | Organic-II | Inorganic (100%) | SR or FP | Towards organic-I            | Towards Organic-II |
| Bajaura    | Frenchbean kharif | Protein (%)               | 9.0       | 8.9        | 8.7              | 9.1      | 9.2                          | 9.3                |
|            | Frenchbean Summer |                           | 9.5       | 9.4        | 8.8              | 9.4      | 9.4                          | 9.4                |
|            | Black gram        |                           | 13.1      | 13.1       | 12.7             | 13.9     | 12.4                         | 12.7               |
|            | Pea               |                           | 13.0      | 12.9       | 12.9             | 13.3     | 13.2                         | 13.1               |
|            | Tomato            | TSS (°Brix)               | 5.4       | 5.2        | 4.6              | 5.4      | 5.4                          | 5.2                |
|            | Pea               |                           | 14.2      | 14.0       | 13.0             | 14.0     | 14.2                         | 14.2               |
|            | Tomato            | Vitamin C (mg/100g)       | 34.5      | 33.8       | 30.0             | 33.2     | 34.4                         | 34.2               |
|            | Cauliflower       |                           | 46.7      | 45.3       | 42.2             | 45.2     | 45.7                         | 45.5               |
| Bhopal     | Soybean           | Protien (%)               | 36.1      | 35.3       | 36.0             | 36.0     | 36.1                         | 35.3               |
|            |                   | Methionine (g/16 g N)     | 1.8       | 1.8        | 1.8              | 1.8      | 1.8                          | 1.7                |
|            |                   | Tryptophan(g/16 g N)      | 1.9       | 1.8        | 1.8              | 1.8      | 1.9                          | 1.8                |
|            |                   | Oil (%)                   | 18.2      | 18.2       | 18.2             | 18.2     | 18.2                         | 18.2               |
| Calicut    | Ginger            | Oil content (%)           | 2.2       | 1.8        | 2.1              |          | 1.8                          | 1.8                |
|            |                   | Oleoresin content (%)     | 5.1       | 4.6        | 4.9              |          | 4.3                          | 4.7                |
| Coimbatore | Brinjal           | Titration Acidity (%)     | 0.4       | 0.3        | 0.3              | 0.3      | 0.3                          | 0.3                |
|            |                   | Ascorbic acid (mg/100g)   | 17.1      | 15.9       | 14.5             | 15.1     | 14.8                         | 14.5               |
|            | Chilli            | TSS (°Brix)               | 6.0       | 5.8        | 4.8              | 5.3      | 5.5                          | 5.6                |
|            |                   | Ascorbic acid (mg/100g)   | 126.8     | 129.1      | 119.2            | 124.0    | 122.9                        | 124.2              |
|            | Tomato            | TSS (°Brix)               | 4.4       | 4.3        | 3.8              | 4.0      | 3.9                          | 4.2                |
|            |                   | Titration acidity (%)     | 1.3       | 1.2        | 0.9              | 1.0      | 1.1                          | 1.2                |
|            |                   | Ascorbic acid (mg /100g ) | 27.1      | 26.2       | 21.9             | 25.1     | 23.4                         | 24.8               |
|            |                   |                           |           |            |                  |          |                              |                    |

**Table 7.2.13. Gross return and cost of cultivation of different crops and cropping system as influence by organic, inorganic and integrated production systems at various locations**

| Location/cropping systems               | Gross returns (Rs/ha) |            |          |                  |          |                    | Cost of cultivation (Rs/ha) |            |          |                  |          |                    |
|-----------------------------------------|-----------------------|------------|----------|------------------|----------|--------------------|-----------------------------|------------|----------|------------------|----------|--------------------|
|                                         | Organic               |            |          | Inorganic        |          |                    | Organic                     |            |          | Inorganic        |          |                    |
|                                         | Organic-I             | Organic-II |          | Inorganic (100%) | SR or FP | Towards organic-I  | Organic-I                   | Organic-II |          | Inorganic (100%) | SR or FP | Towards organic-I  |
|                                         |                       |            |          |                  |          | Towards organic-II |                             |            |          |                  |          | Towards organic-II |
|                                         |                       |            |          |                  |          |                    |                             |            |          |                  |          |                    |
| Bajaura                                 |                       |            |          |                  |          |                    |                             |            |          |                  |          |                    |
| French bean - cauliflower- french bean  | 6,37,576              | 5,98,763   | 3,64,048 | 6,98,720         | 5,83,037 | 5,23,911           | 4,43,525                    | 3,82,899   | 2,95,369 | 5,24,101         | 3,77,107 | 3,49,038           |
| Cauliflower-tomato                      | 11,52,822             | 10,43,586  | 6,05,743 | 10,97,608        | 9,83,693 | 9,30,939           | 3,98,376                    | 3,13,283   | 2,09,572 | 3,67,898         | 3,10,650 | 2,69,123           |
| Black gram-cauliflower-summer Squash    | 7,83,463              | 7,37,100   | 4,41,036 | 7,30,323         | 6,64,350 | 6,29,941           | 4,51,353                    | 3,83,256   | 2,83,833 | 4,42,550         | 3,75,244 | 3,44,547           |
| Okra-pea                                | 5,66,722              | 5,22,407   | 3,31,890 | 5,22,702         | 4,83,098 | 4,52,262           | 2,20,596                    | 1,98,766   | 1,53,372 | 2,58,782         | 1,84,118 | 1,84,852           |
| Mean                                    | 7,85,146              | 7,25,464   | 4,35,679 | 7,62,338         | 6,78,545 | 6,34,263           | 3,78,463                    | 3,19,551   | 2,35,537 | 3,98,333         | 3,11,780 | 2,86,890           |
| Bhopal                                  |                       |            |          |                  |          |                    |                             |            |          |                  |          |                    |
| Soybean-durum wheat                     | 1,20,998              | 1,00,779   | 1,16,680 | 1,15,213         | 1,26,435 | 95,038             | 59,026                      | 56,263     | 58,385   | 58,267           | 59,086   | 54,629             |
| Soybean- mustard                        | 1,12,391              | 92,556     | 1,01,298 | 1,02,268         | 1,21,648 | 81,142             | 51,656                      | 50,588     | 51,910   | 51,661           | 52,169   | 49,913             |
| Soybean- chickpea                       | 1,17,353              | 92,772     | 98,248   | 1,06,316         | 1,23,983 | 86,927             | 52,006                      | 50,803     | 51,838   | 52,106           | 52,670   | 50,151             |
| Soybean- linseed                        | 1,01,579              | 87,595     | 1,07,334 | 1,05,287         | 1,07,427 | 81,201             | 51,418                      | 50,149     | 51,708   | 51,554           | 51,751   | 49,674             |
| Mean                                    | 1,13,080              | 93,426     | 1,05,890 | 1,07,271         | 1,19,873 | 86,077             | 53,527                      | 51,951     | 53,460   | 53,397           | 53,919   | 51,092             |
| Calicut                                 |                       |            |          |                  |          |                    |                             |            |          |                  |          |                    |
| Turmeric                                | 841,400               | 537,600    | 859,600  |                  | 830,200  | 848,400            | 182,499                     | 171,712    | 148,208  |                  | 163,989  | 173,109            |
| Coimbatore                              |                       |            |          |                  |          |                    |                             |            |          |                  |          |                    |
| Brinjal - pearl millet - green manure   | 4,52,829              | 3,90,659   | 3,32,202 | 4,49,071         | 3,89,275 | 3,29,666           | 2,26,942                    | 2,18,863   | 2,24,511 | 2,43,314         | 2,23,173 | 2,29,359           |
| Chilli - barnyard millet - green manure | 4,30,422              | 3,81,276   | 3,52,932 | 4,14,446         | 3,64,962 | 3,35,055           | 2,29,374                    | 2,21,552   | 1,90,219 | 2,52,978         | 2,09,256 | 2,09,678           |
| Tomato - finger millet - green manure   | 4,20,954              | 3,65,073   | 3,32,479 | 4,42,548         | 3,75,252 | 3,15,640           | 2,72,435                    | 2,58,792   | 2,11,408 | 2,75,239         | 2,49,104 | 2,40,854           |
| Mean                                    | 4,34,735              | 3,79,003   | 3,39,204 | 4,35,355         | 3,76,496 | 3,26,787           | 2,42,917                    | 2,33,069   | 2,08,713 | 2,57,177         | 2,27,178 | 2,26,630           |
| Dharwad                                 |                       |            |          |                  |          |                    |                             |            |          |                  |          |                    |
| Pigeonpea + green gram (1:2)            | 45,571                | 43,405     | 39,522   | 44,857           | 41,438   | 35,310             | 32,714                      | 29,915     | 26,280   | 30,460           | 28,640   | 25,752             |
| Pigeonpea + soybean (1:2)               | 1,25,724              | 1,18,252   | 1,19,065 | 1,34,141         | 1,26,691 | 1,09,100           | 34,714                      | 31,915     | 28,280   | 32,460           | 30,640   | 27,752             |
| Pigeonpea + groundnut (1:2)             | 75,538                | 70,566     | 76,866   | 75,341           | 73,572   | 66,551             | 38,714                      | 35,915     | 28,587   | 35,330           | 32,280   | 36,460             |
| Cotton + green gram (1:2)               | 45,708                | 43,185     | 41,396   | 48,127           | 45,446   | 41,182             | 40,250                      | 35,237     | 25,816   | 36,852           | 33,962   | 33,288             |
|                                         |                       |            |          |                  |          |                    |                             |            |          |                  |          | 34,234             |



|                                                         |          |          |          |          |          |          |          |          |          |          |          |          |          |          |
|---------------------------------------------------------|----------|----------|----------|----------|----------|----------|----------|----------|----------|----------|----------|----------|----------|----------|
| Cotton + soybean (1:2)                                  | 1,25,919 | 1,14,852 | 1,18,767 | 1,32,662 | 1,22,997 | 1,12,636 | 1,21,306 | 44,250   | 39,237   | 29,816   | 40,852   | 37,962   | 37,288   | 38,234   |
| Mean                                                    | 83,692   | 78,052   | 79,123   | 87,026   | 82,029   | 72,956   |          | 38,128   | 34,444   | 27,756   | 35,191   | 32,697   | 32,108   |          |
| Jabalpur                                                |          |          |          |          |          |          |          |          |          |          |          |          |          |          |
| Soybean- wheat                                          | 91,432   | 92,169   | 1,38,485 | 79,494   | 1,05,727 | 1,07,853 | 1,02,527 | 90,454   | 71,600   | 56,014   | 48,969   | 69,282   | 59,423   | 65,957   |
| Soybean-mustard- greengram                              | 81,467   | 95,458   | 1,46,749 | 84,138   | 1,00,568 | 69,438   | 96,303   | 99,444   | 86,110   | 72,853   | 61,600   | 81,318   | 72,005   | 78,888   |
| Soybean-berseem (F & S)                                 | 1,85,316 | 1,64,525 | 2,08,586 | 1,53,656 | 1,83,205 | 1,85,010 | 1,80,050 | 81,564   | 77,080   | 71,349   | 64,610   | 73,457   | 69,538   | 72,933   |
| Soybean- lentil- sorghum (F)                            | 74,276   | 67,603   | 64,060   | 44,327   | 51,214   | 66,455   | 61,323   | 96,654   | 89,080   | 83,687   | 73,329   | 85,224   | 78,543   | 84,420   |
| Mean                                                    | 1,08,123 | 1,04,939 | 1,39,470 | 90,404   | 1,10,179 | 1,07,189 |          | 92,029   | 80,968   | 70,976   | 62,127   | 77,320   | 69,877   |          |
| Karjat                                                  |          |          |          |          |          |          |          |          |          |          |          |          |          |          |
| Rice – brinjal                                          | 6,59,397 | 5,64,379 | 5,96,945 | 3,68,226 | 5,44,836 | 4,79,716 | 5,35,583 | 3,02,608 | 2,67,858 | 2,18,102 | 2,13,958 | 2,61,583 | 2,48,256 | 2,52,061 |
| Rice – chick pea                                        | 2,36,979 | 1,98,904 | 1,71,267 | 1,51,955 | 1,90,079 | 1,71,636 | 1,86,803 | 1,48,679 | 1,36,682 | 1,13,170 | 1,10,543 | 1,32,070 | 1,26,150 | 1,27,882 |
| Rice – field bean                                       | 2,52,065 | 2,19,925 | 1,89,225 | 1,63,603 | 2,01,548 | 1,76,694 | 2,00,510 | 1,58,995 | 1,47,236 | 1,23,724 | 1,21,573 | 1,42,148 | 1,37,180 | 1,38,476 |
| Rice – white onion                                      | 6,51,660 | 4,58,574 | 4,71,944 | 3,56,104 | 5,43,689 | 4,18,744 | 4,83,453 | 2,67,016 | 2,32,980 | 1,83,932 | 1,80,386 | 2,25,393 | 2,11,828 | 2,16,923 |
| Mean                                                    | 4,50,025 | 3,60,446 | 3,57,345 | 2,59,972 | 3,70,038 | 3,11,698 |          | 2,19,325 | 1,96,189 | 1,59,732 | 1,56,615 | 1,90,299 | 1,80,854 |          |
| Ludhiana                                                |          |          |          |          |          |          |          |          |          |          |          |          |          |          |
| Basmati rice-chickpea-green manure                      | 2,92,904 | 2,73,197 | 2,08,052 | 2,13,697 | 2,26,319 | 2,36,956 | 2,41,854 | 1,01,273 | 1,08,175 | 1,01,866 | 1,04,166 | 1,10,420 | 1,03,734 | 1,04,939 |
| Basmati rice-wheat-green manure                         | 3,37,118 | 3,26,396 | 2,98,846 | 3,05,019 | 2,72,797 | 2,90,845 | 3,05,170 | 97,973   | 1,03,364 | 99,134   | 1,01,334 | 1,05,512 | 1,00,526 | 1,01,307 |
| Khairif moong-wheat-summer moong                        | 3,19,936 | 2,89,195 | 2,44,355 | 2,49,775 | 2,49,605 | 2,75,414 | 2,71,380 | 94,778   | 1,01,976 | 96,298   | 95,748   | 1,02,003 | 95,125   | 97,655   |
| Sesame-lentil                                           | 1,85,889 | 1,63,750 | 1,57,248 | 1,49,072 | 1,39,866 | 1,63,775 | 1,59,933 | 64,817   | 68,845   | 63,597   | 63,697   | 68,436   | 64,256   | 65,608   |
| Mean                                                    | 2,83,962 | 2,63,135 | 2,27,125 | 2,29,391 | 2,22,147 | 2,41,748 |          | 89,710   | 95,590   | 90,224   | 91,236   | 96,593   | 90,910   |          |
| Modipuram                                               |          |          |          |          |          |          |          |          |          |          |          |          |          |          |
| Sesame –lentil – vegetable cowpea (pod)                 | 1,22,273 | 1,22,531 | 1,18,903 | 1,27,683 | 1,13,263 | 1,25,723 | 1,21,729 | 63,308   | 81,444   | 63,839   | 63,524   | 60,169   | 78,376   | 68,443   |
| Finger millet – barley – sesbania rostrata green manure | 1,15,675 | 95,267   | 1,33,955 | 1,41,240 | 1,19,952 | 1,24,404 | 1,21,749 | 80,350   | 84,280   | 61,157   | 67,724   | 70,006   | 78,658   | 73,696   |
| Okra – vegetable pea – sesbania aculeata green manure   | 2,65,003 | 2,51,991 | 2,52,031 | 2,28,253 | 2,65,183 | 2,50,353 | 2,52,136 | 90,900   | 94,530   | 76,165   | 86,072   | 80,445   | 88,403   | 86,086   |
| Black gram – tomato – sunhemp green manure              | 3,06,219 | 2,74,475 | 3,12,496 | 3,31,504 | 3,13,900 | 3,11,796 | 3,08,398 | 1,19,350 | 1,19,780 | 98,419   | 1,09,765 | 1,05,821 | 1,11,516 | 1,10,775 |
| Mean                                                    | 2,02,293 | 1,86,066 | 2,04,346 | 2,07,170 | 2,03,075 | 2,03,069 |          | 88,477   | 95,009   | 74,895   | 81,771   | 79,110   | 89,238   |          |
| Pantnagar                                               |          |          |          |          |          |          |          |          |          |          |          |          |          |          |
| Basmati rice - wheat                                    | 3,60,206 | 3,15,369 | 2,87,486 | 3,02,336 | 3,24,119 | 2,65,962 | 3,09,246 | 82,323   | 75,573   | 68,225   | 71,975   | 88,635   | 77,354   | 77,348   |
| Basmati rice – mustard                                  | 3,52,748 | 3,33,697 | 2,95,346 | 2,93,768 | 3,20,477 | 2,79,597 | 3,12,606 | 74,991   | 67,741   | 59,400   | 63,150   | 82,527   | 73,256   | 70,178   |

|                                                  |          |          |          |          |          |          |          |          |          |          |          |          |          |          |
|--------------------------------------------------|----------|----------|----------|----------|----------|----------|----------|----------|----------|----------|----------|----------|----------|----------|
| Basmati rice – vegetable pea + coriander (4:2)   | 3,76,284 | 3,04,583 | 2,48,247 | 2,49,363 | 2,62,843 | 2,48,210 | 2,81,588 | 79,701   | 75,481   | 68,946   | 72,696   | 83,379   | 77,300   | 76,251   |
| Basmati rice – potato                            | 3,42,147 | 3,06,130 | 2,38,196 | 2,42,977 | 2,59,266 | 2,42,002 | 2,71,786 | 80,775   | 73,725   | 72,288   | 76,038   | 83,622   | 76,529   | 77,163   |
| Mean                                             | 3,57,846 | 3,14,945 | 2,67,319 | 2,72,111 | 2,91,676 | 2,58,943 |          | 79,448   | 73,130   | 67,215   | 70,965   | 84,541   | 76,110   |          |
| Raipur                                           |          |          |          |          |          |          |          |          |          |          |          |          |          |          |
| Soybean-sweet corn                               | 6,18,122 | 3,97,382 | 4,43,637 | 5,92,064 | 4,15,990 | 3,46,025 | 4,68,870 | 1,54,777 | 1,93,181 | 1,12,021 | 1,14,263 | 1,33,408 | 1,36,578 | 1,40,705 |
| Soybean- field bean                              | 2,99,473 | 2,06,451 | 2,20,890 | 2,56,394 | 1,84,043 | 1,64,154 | 2,21,901 | 76,725   | 86,717   | 67,514   | 69,754   | 72,138   | 84,393   | 76,207   |
| Soybean-tomato                                   | 8,64,402 | 6,01,243 | 6,80,084 | 7,04,523 | 6,17,933 | 5,69,330 | 6,72,919 | 1,87,884 | 1,74,866 | 1,38,258 | 1,40,500 | 1,63,083 | 1,62,447 | 1,61,173 |
| Soybean-cabbage                                  | 6,91,463 | 5,39,426 | 5,08,224 | 5,82,722 | 4,93,055 | 4,68,286 | 5,47,196 | 1,44,832 | 1,31,814 | 94,375   | 96,617   | 1,19,615 | 1,19,187 | 1,17,740 |
| Mean                                             | 6,18,365 | 4,36,126 | 4,63,209 | 5,33,926 | 4,27,755 | 3,86,949 |          | 1,41,055 | 1,46,645 | 1,03,042 | 1,05,284 | 1,22,061 | 1,25,651 |          |
| Ranchi                                           |          |          |          |          |          |          |          |          |          |          |          |          |          |          |
| Rice- wheat                                      | 1,81,344 | 1,92,536 | 1,38,427 | 89,849   | 1,36,107 | 1,52,125 | 1,48,398 | 1,01,076 | 91,372   | 66,288   | 60,728   | 80,602   | 89,194   | 81,543   |
| Rice - onion                                     | 3,28,878 | 3,12,412 | 1,96,301 | 1,48,733 | 2,50,542 | 2,70,768 | 2,51,272 | 1,07,025 | 90,372   | 55,859   | 52,879   | 86,956   | 84,413   | 79,584   |
| Rice - potato                                    | 4,59,445 | 4,25,132 | 2,27,407 | 1,55,563 | 2,65,964 | 2,97,756 | 3,05,211 | 1,18,282 | 1,03,471 | 71,461   | 72,845   | 1,04,083 | 1,00,690 | 95,139   |
| Rice - okra                                      | 3,16,958 | 3,12,848 | 2,07,056 | 1,43,826 | 2,09,541 | 2,52,712 | 2,40,490 | 1,06,008 | 89,355   | 55,872   | 51,862   | 85,939   | 83,396   | 78,739   |
| Mean                                             | 3,21,656 | 3,10,732 | 1,92,298 | 1,34,493 | 2,15,539 | 2,43,340 |          | 1,08,098 | 93,643   | 62,370   | 59,579   | 89,395   | 89,423   |          |
| Uniam                                            |          |          |          |          |          |          |          |          |          |          |          |          |          |          |
| Rice-vegetables (in raised beds)                 |          |          |          |          |          |          |          |          |          |          |          |          |          |          |
| Okra - carrot                                    |          |          |          |          |          |          |          | 65,765   | 51,115   | 56,860   |          | 61,311   |          | 58,763   |
| Okra - potato                                    |          |          |          |          |          |          |          | 1,24,565 | 1,09,915 | 1,15,660 |          | 1,20,111 |          | 1,17,563 |
| Okra - french bean                               |          |          |          |          |          |          |          | 65,415   | 53,365   | 65,401   |          | 65,406   |          | 62,397   |
| Okra - tomato                                    |          |          |          |          |          |          |          | 63,465   | 49,465   | 65,813   |          | 65,638   |          | 61,095   |
| Mean okra                                        |          |          |          |          |          |          |          | 79,803   | 65,965   | 75,934   |          | 78,117   |          |          |
| Ajmer                                            |          |          |          |          |          |          |          |          |          |          |          |          |          |          |
| Cow pea + maize (4:2) -coriander + cabbage (2:1) |          |          |          |          |          |          |          | 65,175   | 51,515   | 53,546   | 45,681   | 41,588   | 54,088   | 51,932   |
| Cow pea + maize (4:2)- fennel + cabbage (2:1)    |          |          |          |          |          |          |          | 82,711   | 61,551   | 64,558   | 52,497   | 46,162   | 58,662   | 61,024   |
| Cow pea (sole)-fennel                            |          |          |          |          |          |          |          | 82,419   | 61,259   | 64,266   | 52,205   | 45,870   | 58,370   | 60,732   |
| Cow pea (sole)-coriander                         |          |          |          |          |          |          |          | 65,019   | 51,359   | 53,390   | 45,525   | 41,432   | 53,932   | 51,776   |
| Mean                                             |          |          |          |          |          |          |          | 73,831   | 56,421   | 58,940   | 48,977   | 43,763   | 56,263   |          |
| Almora                                           |          |          |          |          |          |          |          |          |          |          |          |          |          |          |



वार्षिक प्रतिवेदन 2024-25

**Table 7.2.14. Net return and net return per rupee invested of different crops and cropping system as influence by organic, inorganic and integrated production systems at different locations**

| Location/cropping systems               | Net returns (Rs/ha) |             |                      |           |                       |          | NRPRI      |             |                   |          |                      |                       |
|-----------------------------------------|---------------------|-------------|----------------------|-----------|-----------------------|----------|------------|-------------|-------------------|----------|----------------------|-----------------------|
|                                         | Organic             |             |                      | Inorganic |                       |          | Mean       |             |                   | Organic  |                      |                       |
|                                         | Organ-ic-I          | Organ-ic-II | Towards organic-ic-I | SR or FP  | Towards organic-ic-II | Mean     | Organ-ic-I | Organ-ic-II | Inor-ganic (100%) | SR or FP | Towards organic-ic-I | Towards organic-ic-II |
|                                         |                     |             |                      |           |                       |          |            |             |                   |          |                      |                       |
| Bajaura                                 |                     |             |                      |           |                       |          |            |             |                   |          |                      |                       |
| French bean - cauliflower- french bean  | 1,94,051            | 2,15,864    | 68,680               | 1,74,619  | 2,05,931              | 1,74,874 | 0.44       | 0.56        | 0.23              | 0.33     | 0.55                 | 0.50                  |
| Cauliflower-tomato                      | 7,54,446            | 7,30,302    | 3,96,171             | 7,29,709  | 6,73,043              | 6,57,581 | 1.89       | 2.33        | 1.89              | 1.98     | 2.17                 | 2.46                  |
| Black gram-cauliflower-summer Squash    | 3,32,110            | 3,53,845    | 1,57,203             | 2,87,773  | 2,89,107              | 2,85,394 | 0.74       | 0.92        | 0.55              | 0.65     | 0.77                 | 0.83                  |
| Okra-pea                                | 3,46,126            | 3,23,641    | 1,78,518             | 2,63,920  | 2,98,980              | 2,67,410 | 1.57       | 1.63        | 1.16              | 1.02     | 1.62                 | 1.45                  |
| Mean                                    | 4,06,683            | 4,05,913    | 2,00,143             | 3,64,005  | 3,66,765              | 3,47,374 | 1.16       | 1.36        | 0.96              | 1.00     | 1.28                 | 1.31                  |
| Bhopal                                  |                     |             |                      |           |                       |          |            |             |                   |          |                      |                       |
| Soybean-durum wheat                     | 61,972              | 44,516      | 58,295               | 56,946    | 67,349                | 40,409   | 1.05       | 0.79        | 1.00              | 0.98     | 1.14                 | 0.74                  |
| Soybean- mustard                        | 60,735              | 41,968      | 49,388               | 50,607    | 69,479                | 31,229   | 1.18       | 0.83        | 0.95              | 0.98     | 1.33                 | 0.63                  |
| Soybean- chickpea                       | 65,347              | 41,969      | 46,410               | 54,210    | 71,313                | 36,776   | 1.26       | 0.83        | 0.90              | 1.04     | 1.35                 | 0.73                  |
| Soybean- linseed                        | 50,161              | 37,446      | 55,626               | 53,733    | 55,676                | 31,527   | 0.98       | 0.75        | 1.08              | 1.04     | 1.08                 | 0.63                  |
| Mean                                    | 59,554              | 41,475      | 52,430               | 53,874    | 65,954                | 34,985   | 1.11       | 0.80        | 0.98              | 1.01     | 1.23                 | 0.68                  |
| Calicut                                 |                     |             |                      |           |                       |          |            |             |                   |          |                      |                       |
| Turmeric                                | 658901              | 365888      | 711392               |           | 666211                | 675291   | 3.61       | 2.13        | 4.80              |          | 4.06                 | 3.90                  |
| Coimbatore                              |                     |             |                      |           |                       |          |            |             |                   |          |                      |                       |
| Brinjal - peard millet - green manure   | 2,25,887            | 1,71,796    | 1,07,691             | 2,05,757  | 1,66,102              | 1,00,307 | 1.00       | 0.78        | 0.48              | 0.85     | 0.74                 | 0.44                  |
| Chilli - barnyard millet - green manure | 2,01,048            | 1,59,724    | 1,62,713             | 1,61,468  | 1,55,706              | 1,25,377 | 0.88       | 0.72        | 0.86              | 0.64     | 0.74                 | 0.60                  |
| Tomato - finger millet - green manure   | 1,48,519            | 1,06,281    | 1,21,071             | 1,67,309  | 1,26,148              | 74,786   | 0.55       | 0.41        | 0.57              | 0.61     | 0.51                 | 0.31                  |
| Mean                                    | 1,91,818            | 1,45,934    | 1,30,492             | 1,78,178  | 1,49,319              | 1,00,157 | 0.81       | 0.64        | 0.64              | 0.70     | 0.66                 | 0.45                  |
| Dharwad                                 |                     |             |                      |           |                       |          |            |             |                   |          |                      |                       |
| Pigeonpea + green gram (1:2)            | 12,857              | 13,490      | 13,242               | 14,397    | 14,242                | 9,558    | 0.39       | 0.45        | 0.50              | 0.47     | 0.50                 | 0.37                  |
| Pigeonpea + soybean (1:2)               | 91,010              | 86,337      | 90,785               | 1,01,681  | 97,495                | 81,348   | 2.62       | 2.71        | 3.21              | 3.13     | 3.18                 | 2.93                  |
| Pigeonpea + groundnut (1:2)             | 36,824              | 34,651      | 44,586               | 38,881    | 40,376                | 34,799   | 0.95       | 0.96        | 1.56              | 1.10     | 1.25                 | 0.95                  |
| Cotton + green gram (1:2)               | 5,458               | 7,948       | 15,580               | 11,275    | 11,821                | 7,894    | 0.14       | 0.23        | 0.60              | 0.31     | 0.35                 | 0.24                  |



|                                                         |          |          |          |          |          |          |          |       |       |       |       |       |       |       |
|---------------------------------------------------------|----------|----------|----------|----------|----------|----------|----------|-------|-------|-------|-------|-------|-------|-------|
| Cotton + soybean (1:2)                                  | 6,615    | 10,158   | 26,295   | 21,547   | 26,939   | 6,696    | 16,375   | 0.15  | 0.26  | 0.88  | 0.53  | 0.71  | 0.18  | 0.45  |
| Mean                                                    | 30,553   | 30,517   | 38,098   | 37,556   | 38,175   | 28,059   |          | 0.85  | 0.92  | 1.35  | 1.11  | 1.20  | 0.93  |       |
| Jabalpur                                                |          |          |          |          |          |          |          |       |       |       |       |       |       |       |
| Soybean- wheat                                          | 978      | 20,569   | 82,471   | 30,525   | 36,445   | 48,430   | 36,570   | 0.01  | 0.29  | 1.47  | 0.62  | 0.53  | 0.82  | 0.62  |
| Soybean-mustard- greengram                              | -17,977  | 9,348    | 73,896   | 22,538   | 19,250   | -2,567   | 17,415   | -0.18 | 0.11  | 1.01  | 0.37  | 0.24  | -0.04 | 0.25  |
| Soybean-berseem (F & S)                                 | 1,03,752 | 87,445   | 1,37,237 | 89,046   | 1,09,748 | 1,15,472 | 1,07,117 | 1.27  | 1.13  | 1.92  | 1.38  | 1.49  | 1.66  | 1.48  |
| Soybean- lentil- sorghum (F)                            | -22,378  | -21,477  | -19,627  | -29,002  | -34,010  | -12,088  | -23,097  | -0.23 | -0.24 | -0.23 | -0.40 | -0.40 | -0.15 | -0.28 |
| Mean                                                    | 16,094   | 23,971   | 68,494   | 28,277   | 32,858   | 37,312   |          | 0.22  | 0.32  | 1.04  | 0.49  | 0.46  | 0.57  |       |
| Karjat                                                  |          |          |          |          |          |          |          |       |       |       |       |       |       |       |
| Rice – brinjal                                          | 3,56,789 | 2,96,521 | 3,78,843 | 1,54,268 | 2,83,253 | 2,31,460 | 2,83,522 | 1.18  | 1.11  | 1.74  | 0.72  | 1.08  | 0.93  | 1.13  |
| Rice – chick pea                                        | 88,300   | 62,222   | 58,097   | 41,412   | 58,009   | 45,486   | 58,921   | 0.59  | 0.46  | 0.51  | 0.37  | 0.44  | 0.36  | 0.46  |
| Rice – field bean                                       | 93,070   | 72,689   | 65,501   | 42,030   | 59,400   | 39,514   | 62,034   | 0.59  | 0.49  | 0.53  | 0.35  | 0.42  | 0.29  | 0.44  |
| Rice – white onion                                      | 3,84,644 | 2,25,594 | 2,88,012 | 1,75,718 | 3,18,296 | 2,06,916 | 2,66,530 | 1.44  | 0.97  | 1.57  | 0.97  | 1.41  | 0.98  | 1.22  |
| Mean                                                    | 2,30,701 | 1,64,257 | 1,97,613 | 1,03,357 | 1,79,740 | 1,30,844 |          | 0.95  | 0.76  | 1.09  | 0.60  | 0.84  | 0.64  |       |
| Ludhiana                                                |          |          |          |          |          |          |          |       |       |       |       |       |       |       |
| Basmati rice-chickpea-green manure                      | 1,91,632 | 1,65,021 | 1,06,186 | 1,09,530 | 1,15,899 | 1,33,222 | 1,36,915 | 1.89  | 1.53  | 1.04  | 1.05  | 1.05  | 1.28  | 1.31  |
| Basmati rice-wheat-green manure                         | 2,39,145 | 2,23,032 | 1,99,712 | 2,03,685 | 1,67,284 | 1,90,319 | 2,03,863 | 2.44  | 2.16  | 2.01  | 2.01  | 1.59  | 1.89  | 2.02  |
| Khariif moong-wheat-summer moong                        | 2,25,158 | 1,87,219 | 1,48,056 | 1,54,027 | 1,47,602 | 1,80,290 | 1,73,725 | 2.38  | 1.84  | 1.54  | 1.61  | 1.45  | 1.90  | 1.78  |
| Sesame-lentil                                           | 1,21,072 | 94,905   | 93,651   | 85,375   | 71,430   | 99,518   | 94,325   | 1.87  | 1.38  | 1.47  | 1.34  | 1.04  | 1.55  | 1.44  |
| Mean                                                    | 1,94,252 | 1,67,544 | 1,36,901 | 1,38,154 | 1,25,554 | 1,50,837 |          | 2.14  | 1.72  | 1.52  | 1.50  | 1.28  | 1.66  |       |
| Modipuram                                               |          |          |          |          |          |          |          |       |       |       |       |       |       |       |
| Sesame –lentil – vegetable cowpea (pod)                 | 58,965   | 41,087   | 55,064   | 64,159   | 53,094   | 47,347   | 53,286   | 0.93  | 0.50  | 0.86  | 1.01  | 0.88  | 0.60  | 0.80  |
| Finger millet – barley – sesbania rostrata green manure | 35,325   | 10,987   | 72,798   | 73,516   | 49,946   | 45,746   | 48,053   | 0.44  | 0.13  | 1.19  | 1.09  | 0.71  | 0.58  | 0.69  |
| Okra – vegetable pea – sesbania aculeata green manure   | 1,74,103 | 1,57,461 | 1,75,866 | 1,42,181 | 1,84,738 | 1,61,950 | 1,66,050 | 1.92  | 1.67  | 2.31  | 1.65  | 2.30  | 1.83  | 1.95  |
| Black gram – tomato – sunhemp green manure              | 1,86,869 | 1,54,695 | 2,14,077 | 2,21,739 | 2,08,079 | 2,00,280 | 1,97,623 | 1.57  | 1.29  | 2.18  | 2.02  | 1.97  | 1.80  | 1.80  |
| Mean                                                    | 1,13,816 | 91,058   | 1,29,451 | 1,25,399 | 1,23,964 | 1,13,831 |          | 1.21  | 0.90  | 1.63  | 1.44  | 1.46  | 1.20  |       |
| Partnagar                                               |          |          |          |          |          |          |          |       |       |       |       |       |       |       |
| Basmati rice - wheat                                    | 2,77,883 | 2,39,796 | 2,19,261 | 2,30,361 | 2,35,484 | 1,88,608 | 2,31,899 | 3.38  | 3.17  | 3.21  | 3.20  | 2.66  | 2.44  | 3.01  |
| Basmati rice – mustard                                  | 2,77,757 | 2,65,956 | 2,35,946 | 2,30,618 | 2,37,950 | 2,06,341 | 2,42,428 | 3.70  | 3.93  | 3.97  | 3.65  | 2.88  | 2.82  | 3.49  |

|                                                  |          |          |          |          |          |          |          |      |      |      |      |      |      |      |
|--------------------------------------------------|----------|----------|----------|----------|----------|----------|----------|------|------|------|------|------|------|------|
| Basmati rice – vegetable pea + coriander (4:2)   | 2,96,583 | 2,29,102 | 1,79,301 | 1,76,667 | 1,79,464 | 1,70,910 | 2,05,338 | 3,72 | 3,04 | 2,60 | 2,43 | 2,15 | 2,21 | 2,69 |
| Basmati rice – potato                            | 2,61,372 | 2,32,405 | 1,65,908 | 1,66,939 | 1,75,644 | 1,65,473 | 1,94,624 | 3,24 | 3,15 | 2,30 | 2,20 | 2,10 | 2,16 | 2,52 |
| Mean                                             | 2,78,999 | 2,41,815 | 2,00,104 | 2,01,146 | 2,07,136 | 1,82,833 |          | 3,51 | 3,32 | 3,02 | 2,87 | 2,45 | 2,41 |      |
| Raipur                                           |          |          |          |          |          |          |          |      |      |      |      |      |      |      |
| Soybean-sweet corn                               | 4,63,345 | 2,04,201 | 3,31,616 | 4,77,801 | 2,82,582 | 2,09,447 | 3,28,165 | 2,99 | 1,06 | 2,96 | 4,18 | 2,12 | 1,53 | 2,47 |
| Soybean- field bean                              | 2,22,748 | 1,19,734 | 1,53,376 | 1,86,640 | 1,11,905 | 79,761   | 1,45,694 | 2,90 | 1,38 | 2,27 | 2,68 | 1,55 | 0,95 | 1,95 |
| Soybean-tomato                                   | 6,76,518 | 4,26,377 | 5,41,826 | 5,64,023 | 4,54,850 | 4,06,883 | 5,11,746 | 3,60 | 2,44 | 3,92 | 4,01 | 2,79 | 2,50 | 3,21 |
| Soybean-cabbage                                  | 5,46,631 | 4,07,612 | 4,13,849 | 4,86,105 | 3,73,440 | 3,49,099 | 4,29,456 | 3,77 | 3,09 | 4,39 | 5,03 | 3,12 | 2,93 | 3,72 |
| Mean                                             | 4,77,311 | 2,89,481 | 3,60,167 | 4,28,642 | 3,05,694 | 2,61,298 |          | 3,32 | 1,99 | 3,38 | 3,98 | 2,40 | 1,98 |      |
| Ranchi                                           |          |          |          |          |          |          |          |      |      |      |      |      |      |      |
| Rice- wheat                                      | 80,268   | 1,01,164 | 72,139   | 29,121   | 55,505   | 62,931   | 66,855   | 0,79 | 1,11 | 1,09 | 0,48 | 0,69 | 0,71 | 0,81 |
| Rice - onion                                     | 2,21,853 | 2,22,040 | 1,40,442 | 95,854   | 1,63,586 | 1,86,355 | 1,71,688 | 2,07 | 2,46 | 2,51 | 1,81 | 1,88 | 2,21 | 2,16 |
| Rice - potato                                    | 3,41,163 | 3,21,661 | 1,55,946 | 82,718   | 1,61,881 | 1,97,066 | 2,10,073 | 2,88 | 3,11 | 2,18 | 1,14 | 1,56 | 1,96 | 2,14 |
| Rice - okra                                      | 2,10,950 | 2,23,493 | 1,51,184 | 91,964   | 1,23,602 | 1,69,316 | 1,61,752 | 1,99 | 2,50 | 2,71 | 1,77 | 1,44 | 2,03 | 2,07 |
| Mean                                             | 2,13,559 | 2,17,090 | 1,29,928 | 74,914   | 1,26,144 | 1,53,917 |          | 1,94 | 2,29 | 2,12 | 1,30 | 1,39 | 1,73 |      |
| Umiam                                            |          |          |          |          |          |          |          |      |      |      |      |      |      |      |
| Rice-vegetables (in raised beds)                 |          |          |          |          |          |          |          |      |      |      |      |      |      |      |
| Okra - carrot                                    | 4,65,436 | 2,90,219 | 4,05,807 |          | 4,58,223 |          | 4,04,921 | 7,08 | 5,68 | 7,14 |      | 7,47 |      | 6,84 |
| Okra - potato                                    | 3,44,602 | 2,43,586 | 2,45,674 |          | 3,20,223 |          | 2,88,521 | 2,77 | 2,22 | 2,12 |      | 2,67 |      | 2,44 |
| Okra - french bean                               | 1,99,919 | 1,97,302 | 2,30,600 |          | 2,44,761 |          | 2,18,146 | 3,06 | 3,70 | 3,53 |      | 3,74 |      | 3,51 |
| Okra - tomato                                    | 4,48,736 | 3,57,202 | 3,54,854 |          | 4,86,696 |          | 4,11,872 | 7,07 | 7,22 | 5,39 |      | 7,41 |      | 6,77 |
| Mean okra                                        | 3,64,673 | 2,72,077 | 3,09,234 |          | 3,77,476 |          |          | 4,99 | 4,70 | 4,54 |      | 5,32 |      |      |
| Ajmer                                            |          |          |          |          |          |          |          |      |      |      |      |      |      |      |
| Cow pea + maize (4:2) -coriander + cabbage (2:1) | 69,710   | 1,03,310 | 94,508   | 1,01,196 | 1,03,123 | 1,26,380 | 99,705   | 1,07 | 2,01 | 1,76 | 2,22 | 2,48 | 2,34 | 1,98 |
| Cow pea + maize (4:2)- fennel + cabbage (2:1)    | 1,76,644 | 1,70,682 | 2,08,989 | 1,87,892 | 1,86,904 | 2,40,403 | 1,95,252 | 2,14 | 2,77 | 3,24 | 3,58 | 4,05 | 4,10 | 3,31 |
| Cow pea (sole)-fennel                            | 47,393   | 78,491   | 86,730   | 70,617   | 87,109   | 1,04,170 | 79,085   | 0,58 | 1,28 | 1,35 | 1,35 | 1,90 | 1,78 | 1,37 |
| Cow pea (sole)-coriander                         | 36,996   | 48,938   | 58,108   | 51,918   | 48,110   | 65,450   | 51,587   | 0,57 | 0,95 | 1,09 | 1,14 | 1,16 | 1,21 | 1,02 |
| Mean                                             | 82,686   | 1,00,355 | 1,12,084 | 1,02,906 | 1,06,312 | 1,34,101 |          | 1,09 | 1,75 | 1,86 | 2,07 | 2,40 | 2,36 |      |
| Almora                                           |          |          |          |          |          |          |          |      |      |      |      |      |      |      |



|                                                           |          |           |          |          |           |           |          |      |       |      |       |       |       |
|-----------------------------------------------------------|----------|-----------|----------|----------|-----------|-----------|----------|------|-------|------|-------|-------|-------|
| Grain amaranth - wheat + lentil (2:1)                     | 39126    | 25094     | -3490    | 10073    |           | 17701     | 0.61     | 0.36 | -0.08 |      | 0.18  |       | 0.27  |
| Finger millet + black Soybean (2:1) - wheat + toria (2:1) | 33441    | 15648     | -1133    | 11960    |           | 14979     | 0.46     | 0.20 | -0.02 |      | 0.19  |       | 0.21  |
| Gangtok                                                   |          |           |          |          |           |           |          |      |       |      |       |       |       |
| Maize + ginger (1:1) - french bean                        | 351464   | 344742    |          |          |           |           | 2.40     | 2.29 |       |      |       |       |       |
| Maize - soybean - buckwheat                               | 132940   | 114430    |          |          |           |           | 1.73     | 1.45 |       |      |       |       |       |
| Maize + turmeric (1:1) - rajmash                          | 304453   | 312519    |          |          |           |           | 2.43     | 2.42 |       |      |       |       |       |
| Maize - black gram (Pahenlo Dal) - toria                  | 123693   | 120968    |          |          |           |           | 1.48     | 1.44 |       |      |       |       |       |
| Mean                                                      | 228138   | 223165    |          |          |           |           | 2.01     | 1.90 |       |      |       |       |       |
| Narendrapur                                               |          |           |          |          |           |           |          |      |       |      |       |       |       |
| Rice (Gobindo bhog)-rice (Satabdi)                        | 38,000   | 67,000    | 49,000   | 38,000   | -42,000   | -8,000    | 23,667   | 1.25 | 1.58  | 1.54 | 1.42  | 0.65  | 0.92  |
| Rice (Kanakchur)- sesbania green manure                   | -50,000  | -25,000   | 1,000    | -19,000  | -8,000    | -19,000   | -20,000  | 0.29 | 0.56  | 1.03 | 0.6   | 0.86  | 0.63  |
| Rice (Dudheswar)- red amaranthus+ cucumber                | -6,000   | -8,000    | 69,000   | 48,000   | 5,000     | 38,000    | 24,333   | 0.91 | 0.86  | 2.08 | 1.82  | 1.06  | 1.5   |
| Rice (Satabdi) - veg. pea                                 | 80,000   | 74,000    | 95,000   | 82,000   | 44,000    | 57,000    | 72,000   | 1.64 | 1.75  | 2.18 | 2.02  | 1.43  | 1.65  |
| Mean                                                      | 15,500   | 27,000    | 53,500   | 37,250   | -250      | 17,000    |          | 1.02 | 1.19  | 1.71 | 1.47  | 1.00  | 1.18  |
| S.K. Nagar                                                |          |           |          |          |           |           |          |      |       |      |       |       |       |
| Green gram-amaranth - fallow                              | 32,339   | 18,409    | 54,505   | 30,555   | 41,562    | 36,724    | 35,682   | 0.42 | 0.27  | 0.90 | 0.33  | 0.60  | 0.58  |
| Green gram -mustard -fallow                               | 25,483   | 14,485    | 44,663   | 18,716   | 31,270    | 29,645    | 27,377   | 0.36 | 0.23  | 0.74 | 0.20  | 0.48  | 0.48  |
| Groundnut-lucerne - lucerne continue                      | 72,680   | 58,606    | 87,451   | 71,025   | 80,424    | 62,272    | 72,076   | 0.71 | 0.59  | 0.90 | 0.57  | 0.81  | 0.64  |
| Mean                                                      | 43,501   | 30,500    | 62,206   | 40,099   | 51,085    | 42,880    |          | 0.50 | 0.36  | 0.85 | 0.37  | 0.63  | 0.57  |
| Thiruvananthapuram                                        |          |           |          |          |           |           |          |      |       |      |       |       |       |
| Cassava-vegetable cowpea/groundnut                        | 6,60,500 | 5,57,350  | 8,28,630 | 8,69,034 | 7,84,807  | 7,01,793  | 7,33,686 | 2.66 | 2.37  | 4.01 | 4.16  | 3.01  | 2.46  |
| Taro-blackgram/green gram                                 | 96,200   | -1,30,470 | 17,765   | -95,821  | -1,49,005 | -1,17,330 | -63,110  | 0.26 | -0.38 | 0.07 | -0.35 | -0.47 | -0.35 |
| Udaipur                                                   |          |           |          |          |           |           |          |      |       |      |       |       |       |
| Maize + blackgram (2:2) - durum wheat - sesbania (GM)     | 1,35,867 | 1,41,470  | 1,91,024 | 1,88,990 | 1,84,325  | 1,55,902  | 1,66,263 | 1.31 | 1.59  | 3.44 | 2.89  | 2.32  | 2.44  |
| Blackgram - wheat (Triticum aestivum)                     | 1,18,397 | 1,14,553  | 1,54,185 | 1,52,207 | 1,58,030  | 1,27,186  | 1,37,426 | 1.68 | 1.69  | 3.41 | 2.75  | 2.73  | 2.61  |
| Sweet corn + blackgram (2:2) - chickpea                   | 1,13,269 | 1,03,962  | 1,53,291 | 1,51,232 | 1,56,969  | 1,15,700  | 1,32,404 | 1.10 | 1.06  | 2.11 | 1.83  | 1.79  | 1.49  |
| Greengram - fenugreek                                     | 98,867   | 88,998    | 1,24,281 | 1,20,491 | 1,34,923  | 1,00,573  | 1,11,356 | 1.76 | 1.50  | 3.00 | 2.34  | 2.76  | 2.35  |

## 7.2.2 Evaluation of response of different varieties of major crops for organic farming

### Objectives

- To evaluate the response of varied duration and nutrient requiring varieties of major crops to organic production system
- To identify the suitable varieties of crops for organic management practices

Three to four groups of varieties based on crop duration, nutrient and water requirement and insect/disease tolerance was selected for evaluation. Two major varieties grown by the farmers in the region was also included. About 10-12 different varieties/ hybrids, which are popular in farmers or recommended by institutions were evaluated for potential cropping system of organic farming in 3 replications in RBD having the minimum Plot size 20 m<sup>2</sup>. All the centers have taken up this experiment as it is especially important to identify the varieties which form the core of organic farming package.

**Year of start:** 2013-14

**Locations:** All the 20 centers in different ecosystem as mentioned in section 7.1 have conducted the experiments including 7 new centers started experimentation from 2015-16. Almora and Narendrapur not conducted the experiments.

### Results

Result for each centre are presented and discussed

#### Bajaura

**Performance of maize varieties:** Six varieties of maize were evaluated during *kharif* for their suitability under organic conditions. Significant differences among the varieties for all the traits were observed except number of cobs/ha, cob diameter and no. of rows/cob. The variety Bajaura Makka recorded significantly maximum plant height (259.8cm), cob length (21.4cm), cob diameter (5 cm) and number of rows per cob (17.3) resulted in higher grain yield (4248 kg/ha), followed by Girija, and Palampur Sankar Makka-II which is statistically at par. Further, the maximum net returns (32985 Rs./ha) and B:C (1.31) was also found in variety Bajaura Makka. Lower-performing varieties like Early Composite, L-315, and L-317 showed lower yields, net returns, and B:C ratios, hence are less preferable under the tested conditions. (Table 7.2.2.1).

**Performance of wheat varieties:** Six varieties of wheat were evaluated for their performance under organic conditions during *Rabi*. All the varieties showed significant differences for the different traits. The variety HPW-368 recorded significantly higher plant height (94.8 cm), number of tillers/ meter row (68.7) grain yield (3732 kg/ha) followed by HPW-373 (3524 kg/ha), HPW-349 (3518 kg/ha). likewise, the maximum net returns (Rs. 59068/ha) and B:C (1.56) was found maximum in variety HPW-368. Whereas HS-562 and HPW-360 were the least efficient, showing significantly lower grain yield, and economic benefit. (Table 7.2.2.2)

**Table 7.2.2.1: Yield attributes and yield of maize under organic condition at Bajaura**

| Variety/ hybrid          | Plant height (cm) | Cob length (cm) | Cob diameter (cm) | No. of rows/ cob | 1000 grain weight (g) | Grain yield (kg/ha) | Stover yield (kg/ha) | Net returns (Rs/ha) | B:C ratio |
|--------------------------|-------------------|-----------------|-------------------|------------------|-----------------------|---------------------|----------------------|---------------------|-----------|
| Early composite          | 172.5             | 16.5            | 4.6               | 13.3             | 215                   | 3261                | 4470                 | 1660                | 1.02      |
| Girija                   | 244.3             | 21.0            | 4.8               | 16.7             | 322                   | 4036                | 5332                 | 26700               | 1.25      |
| Bajaura makka            | 259.8             | 21.4            | 5.0               | 17.3             | 315                   | 4248                | 5370                 | 32985               | 1.31      |
| Palampur Sankar makka II | 245.4             | 19.1            | 4.9               | 15.3             | 294                   | 4004                | 5046                 | 24236               | 1.23      |



|             |       |      |     |      |     |      |      |       |      |
|-------------|-------|------|-----|------|-----|------|------|-------|------|
| L-317       | 223.8 | 19.8 | 4.7 | 15.3 | 269 | 3554 | 4997 | 11592 | 1.11 |
| L-315       | 199.2 | 20.0 | 4.6 | 14.7 | 298 | 3508 | 4856 | 9824  | 1.09 |
| CD (P=0.05) | NS    | 2.4  | NS  | NS   | 19  | 568  | NS   | 13278 | 0.17 |

**Table 7.2.2..2. Yield attributes and yield of wheat (*rabi*) under organic condition at Bajaura**

| Variety     | Plant height (cm) | Number of tillers/meter row | 1000 Grain weight (g) | Grain Yield (kg/ha) | Straw yield (kg/ha) | Net Returns (RS. /ha) | B:C  |
|-------------|-------------------|-----------------------------|-----------------------|---------------------|---------------------|-----------------------|------|
| HPW-368     | 94.8              | 68.7                        | 44.9                  | 3732                | 5192                | 59068                 | 1.56 |
| HS-507      | 89.6              | 56.3                        | 41.8                  | 3031                | 4861                | 30034                 | 1.28 |
| HS-562      | 84.8              | 54.0                        | 38.4                  | 2978                | 4646                | 27271                 | 1.26 |
| HPW-349     | 92.2              | 62.0                        | 43.1                  | 3518                | 5135                | 50338                 | 1.48 |
| HPW-373     | 93.0              | 66.0                        | 45.3                  | 3524                | 5217                | 50822                 | 1.48 |
| HPW-360     | 82.3              | 60.0                        | 34.4                  | 3006                | 4882                | 29097                 | 1.28 |
| CD (P=0.05) | NS                | 8.7                         | 5.7                   | 530                 | NS                  | 24156                 | 0.23 |



Best performing maize variety Bajaura Makka and Girija



Best performing variety of wheat HPW-368 and HPW-373

## Bhopal

Different varieties of groundnut and mustard was evaluated for their yield response to screen out as promising varieties for organic management practices for central India. Twelve varieties for each groundnut and mustard grown by the farmers in the region were evaluated.

**Performance of groundnut varieties:** Among the twelve varieties of groundnut grown under similar organic nutrient source and doses, the cultivar GPBD-5 performed best in terms of plant height (42.7cm), pods/plant (36.2), seed yield 2111kg/ha, and total biomass yield (4850 kg/ha) which is statically at par with GJG-17 and DH-256. Whereas DH-86, DH-245, and GG-20 were the least efficient, showing significantly lower seed yield and total biomass yield (Table 7.2.2.3).

**Performance of mustard varieties:** Performance of twelve different varieties of mustard was evaluated for their yield response to screen out promising varieties for organic management practices for central India. Maximum plant height (160 cm), seed yield (1330 kg/ha) and total biomass yield (4398 kg/ha) found in ARAVALI variety Which is Statistically at par with CS-52, however seeds/ silique and silique/ pant of different varieties were not significantly affected under similar nutrient management under organic farming. Whereas RH-749 and NRCHB-101 showed the lowest seed yields and poor biomass production (Table 7.2.2.4).

**Table 7.2.2.3: Performance of different varieties of groundnut in terms yield and yield attributes at Bhopal**

| Variety       | Plant height (cm) | Pods/plant | Seeds/pod | Seed yield (kg ha <sup>-1</sup> ) | Total biomass yield (kg ha <sup>-1</sup> ) |
|---------------|-------------------|------------|-----------|-----------------------------------|--------------------------------------------|
| ICGV-16697    | 38.5              | 24.8       | 2.0       | 1614                              | 3213                                       |
| GJG-17        | 40.0              | 32.7       | 2.3       | 1987                              | 4663                                       |
| DH-256        | 41.1              | 30.9       | 3.0       | 1964                              | 4593                                       |
| GJGHPS-1      | 38.7              | 22.5       | 2.0       | 1592                              | 3695                                       |
| GG-20         | 40.4              | 25.3       | 2.0       | 1133                              | 3128                                       |
| ICGV-16690    | 39.9              | 25.9       | 2.3       | 1911                              | 4045                                       |
| DH-86         | 33.7              | 26.5       | 2.3       | 998                               | 2352                                       |
| DH-101        | 36.2              | 22.3       | 2.0       | 1196                              | 2593                                       |
| GPBD-5        | 42.7              | 36.2       | 3.0       | 2111                              | 4850                                       |
| JL-24         | 37.1              | 30.1       | 2.3       | 1467                              | 3084                                       |
| DH-245        | 33.4              | 22.9       | 2.0       | 1036                              | 3122                                       |
| DH-232        | 34.2              | 25.9       | 2.3       | 1339                              | 3385                                       |
| CD ( P= 0.05) | 3.4               | 4.5        | NS        | 170                               | 362                                        |

**Table 7.2.2.4: Yield attributes and yield of different mustard varieties/hybrids under organic cultivation at Bhopal**

| Variety      | Plant height (cm) | Siliqua/plant | Seeds/ siliqua | Test weight (g) | Seed yield (kg ha <sup>-1</sup> ) | Total biomass yield (kg ha <sup>-1</sup> ) |
|--------------|-------------------|---------------|----------------|-----------------|-----------------------------------|--------------------------------------------|
| DRMR-IJ - 31 | 155               | 230           | 10.3           | 6.3             | 983                               | 3442                                       |
| NRCDR-2      | 148               | 225           | 10.8           | 5.6             | 1130                              | 3876                                       |
| NRCHB-101    | 140               | 198           | 10.3           | 5.8             | 813                               | 3336                                       |
| DRMR-150-35  | 154               | 219           | 11.5           | 5.8             | 1110                              | 3749                                       |
| NRCDR-601    | 150               | 210           | 10.4           | 5.7             | 906                               | 3670                                       |
| RH-749       | 138               | 222           | 9.5            | 6.3             | 807                               | 3045                                       |
| ARAVALI      | 160               | 245           | 12.8           | 6.4             | 1330                              | 4398                                       |
| PUSA MAHAK   | 156               | 226           | 10.9           | 6.2             | 970                               | 3821                                       |
| CS-52        | 157               | 236           | 12.5           | 6.3             | 1223                              | 4156                                       |
| MAYA         | 152               | 228           | 11.2           | 5.8             | 1137                              | 3941                                       |



|               |     |     |      |     |      |      |
|---------------|-----|-----|------|-----|------|------|
| PM-22         | 149 | 226 | 43.9 | 5.6 | 1070 | 3761 |
| PGN-229       | 146 | 233 | 10.8 | 6.2 | 1083 | 3992 |
| CD ( P= 0.05) | 6.0 | NS  | NS   | 0.4 | 153  | 375  |

### Calicut

Six varieties of turmeric were evaluated for their performance under organic conditions which were observed significant different among all the traits. the variety Sudarsana (60.1 t/ha) recorded significantly higher yield followed by Sugna (54.9 t/ha). Whereas the lowest yield was found in Pratibha variety (26.6 t/ha). (Table 7.2.2.5)

**Table 7.2.2.5: Response of turmeric varieties at Calicut**

| Varieties       | Yield (t/ha) |
|-----------------|--------------|
| Prathibha       | 26.6         |
| Alaphey supreme | 27.0         |
| Sugna           | 54.9         |
| Sudarsana       | 60.1         |
| Pragati         | 46.1         |
| Mean            | 42.9         |
| CD (P=0.05)     | 3.03         |

### Coimbatore

Twelve rice varieties were evaluated for their performance of suitability under organic production system

**Performance of rice:** The evaluation of twelve traditional rice varieties revealed considerable variability in growth and yield-related parameters. Plant height ranged from 90.3 cm (Anaikomban) to 106.3 cm (Kuzhiadichan). The number of productive tillers per hill varied between 7 (Milagu samba, Kuzhiadichan, Kullakar, Thulasi vasa samba) and 15 (Poonkar), while total tillers per hill ranged from 11 (Anaikomban) to 19 (Illuppaipoo samba). Panicle length showed variation from 20.9 cm (Garudan samba) to 26.2 cm (Kuzhiadichan). Based on these yield-contributing traits, Poonkar emerged as one of the best-performing varieties, recording the highest number of productive tillers per hill (15), along with good plant height (101.3 cm), panicle length (22.3 cm), and total tillers (16), indicating higher yield potential. Illuppaipoo samba was identified as the second-best performer, with the highest total tillers per hill (19), a high panicle length (23.7 cm), and a good number of productive tillers (12), suggesting its suitability for higher yields under similar conditions. (Table 7.2.2.6)

**Performance of green gram:** Among the ten varieties of green gram the maximum plant height (56.7 cm), pod length (8.32 cm), No of seeds per pod (11.7), yield (972 kg/ha) and net return (36871 Rs./ha) was found in variety VBN-4 which is statistically at par with VBN-2 and CO-7. Whereas the variety VGG-15-013 and VGG-18-002 are least productive and economically unviable. (Table 7.2.2.7)

**Table 7.2.2.6: Response of rice varieties suitable for organic farming at Coimbatore**

| Varieties           | Plant height (cm) | Productive tillers hill <sup>-1</sup> (Nos.) | Panicle length (cm) | Tillers/hill (Nos.) |
|---------------------|-------------------|----------------------------------------------|---------------------|---------------------|
| Athur Kichili samba | 106.1             | 14                                           | 21.8                | 16                  |
| Garudan samba       | 105.6             | 13                                           | 20.9                | 14                  |
| Illuppaipoo samba   | 96.7              | 12                                           | 23.7                | 19                  |
| Milagu samba        | 95.4              | 7                                            | 22.6                | 15                  |

| Varieties           | Plant height (cm) | Productive tillers hill <sup>-1</sup> (Nos.) | Panicle length (cm) | Tillers/hill (Nos.) |
|---------------------|-------------------|----------------------------------------------|---------------------|---------------------|
| Poonkar             | 101.3             | 15                                           | 22.3                | 16                  |
| Sorna masuri        | 102.4             | 9                                            | 21.5                | 16                  |
| Thuaiya malli samba | 96.1              | 11                                           | 23.2                | 14                  |
| Thanga samba        | 93.1              | 12                                           | 21.3                | 16                  |
| Kuzhiadichan        | 106.3             | 7                                            | 26.2                | 12                  |
| Kullakar            | 101.6             | 7                                            | 23.2                | 17                  |
| Anaikomban          | 90.3              | 11                                           | 21.3                | 11                  |
| Thulasi vasa samba  | 102.9             | 7                                            | 24.9                | 17                  |
| CD (P=0.05)         | 1.23              | 0.73                                         | 0.37                | 0.76                |

\* Due to wild boar damage during maturity stage, yield of rice were not recorded

**Table 7.2.2.7: Response of green gram varieties suitable for organic farming at Coimbatore grown organically**

| Treatments  | Plant height (cm) | Number of branches/plant | Number of pods / plant | Pod length (cm) | No. of seeds / pod | Yield (Kg/ha) | Cost of cultivation (Rs./ha) | Net return (Rs./ha) |
|-------------|-------------------|--------------------------|------------------------|-----------------|--------------------|---------------|------------------------------|---------------------|
| CO 7        | 53.8              | 3.3                      | 37                     | 8.21            | 10.4               | 874           | 34564                        | 27903               |
| CO 8        | 51.9              | 3.0                      | 35                     | 7.83            | 10.3               | 821           | 34564                        | 24227               |
| COGG-13-19  | 45.8              | 3.0                      | 32                     | 7.34            | 9.6                | 734           | 34564                        | 19781               |
| COGG-13-39  | 48.6              | 3.0                      | 34                     | 7.7             | 10.3               | 792           | 34564                        | 21778               |
| VBN 2       | 54.8              | 4.7                      | 39                     | 8.23            | 11.3               | 942           | 34564                        | 35281               |
| VBN 3       | 53.0              | 3.7                      | 27                     | 7.7             | 9.8                | 846           | 34564                        | 26709               |
| VBN 4       | 56.7              | 4.0                      | 38                     | 8.32            | 11.7               | 972           | 34564                        | 36871               |
| VGG-18-002  | 47.0              | 3.0                      | 23                     | 8.13            | 10.5               | 693           | 34564                        | 15412               |
| VGG-15-013  | 46.6              | 2.7                      | 26                     | 7.44            | 9.2                | 652           | 34564                        | 12999               |
| ADT 3       | 47.2              | 3.7                      | 28                     | 7.15            | 9.6                | 719           | 34564                        | 18290               |
| CD (P=0.05) | 2.38              | 1.27                     | 3.42                   | 0.18            | 0.48               | 40.4          | -                            | -                   |



Field view of rice and green gram varietal evaluation at Coimbatore



## Dharwad

Soybean-wheat and groundnut and sorghum was undertaken to test the suitability under organic farming.

**Performance of soybean, wheat and ground nut:** A field evaluation of different crop varieties revealed significant variation in yield performance across soybean, wheat, and groundnut. The grain yield of soybean varieties ranged from 2362 to 3874 kg/ha. Among the five tested varieties, DSb-23 recorded the highest yield (3874 kg/ha), followed by DSb-21 (3533 kg/ha), indicating their superior performance under the given agro-climatic conditions. Wheat varieties showed a yield range of 1701 to 2903 kg/ha. The variety UAS-347 outperformed others with the highest yield (2903 kg/ha), followed by UAS BW-11587 (2109 kg/ha), making them the top-performing wheat genotypes in this trial. The yield of groundnut varieties ranged from 2083 to 2707 kg/ha. The variety Dh-256 yielded the highest (2707 kg/ha), followed closely by DBG-3 (2397 kg/ha), indicating their potential for better productivity (Table 7.2.2.8).

**Table 7.2.2.8: Yield of soybean and wheat cultivars under organic condition at Dharwad**

| Soybean     |               | Wheat        |               | Groundnut |               |
|-------------|---------------|--------------|---------------|-----------|---------------|
| Varieties   | Yield (kg/ha) | Varieties    | Yield (kg/ha) | Varieties | Yield (kg/ha) |
| DSb-21      | 3533          | UAS-347      | 2903          | Dh-256    | 2707          |
| JS-93-05    | 2698          | UAS BW-11421 | 1868          | DBG-3     | 2397          |
| MACS 1188   | 2362          | UAS BW-11587 | 2109          | DBG-4     | 2083          |
| DSb-23      | 3874          | UAS DW-30337 | 2021          | Dh-245    | 2364          |
| DSb-34      | 3257          | UAS DW-30508 | 1701          |           |               |
| CD (P=0.05) | 193.4         |              | 303.7         |           | 184.7         |



Best performing variety of Soybean and groundnut Dh- 256 at Dharwad

## Jabalpur

Twelve varieties of soybean and chickpea in system mode were evaluated for their performance and suitability under organic nutrient management (Table 7.2.2.9).

**Performance of soybean varieties:** Maximum seed yield of soybean was recorded with variety JS 20-69 (902 Kg/ha) which was significantly higher than the rest of the varieties whereas the lowest seed yield was found in variety RSC 11-42.

**Performance of chickpea varieties:** Maximum seed yield of chickpea (1299 kg ha<sup>-1</sup>) was recorded with the variety JG 322 which was statistically at par with JG 12 and closely followed by JG 16. Whereas variety JG 30 recorded lowest seed yield.

**Table 7.2.2.9: Yield of soybean and chickpea varieties under organic farming at Jabalpur**

| Soybean     |                 |                    | Chickpea     |                    |
|-------------|-----------------|--------------------|--------------|--------------------|
| Varieties   | Duration (Days) | Seed Yield (kg/ha) | Varieties    | Seed Yield (kg/ha) |
| JS 20-94    | 101             | 744                | JG 218       | 1150               |
| JS 335      | 100             | 727                | JG 11        | 1093               |
| JS 20-29    | 96              | 581                | JG 12        | 1250               |
| JS 20-34    | 90              | 625                | JG 14        | 1178               |
| JS 20-69    | 94              | <b>972</b>         | JG 16        | 1214               |
| JS 20-98    | 100             | 737                | JG 24        | 1112               |
| JS 20-116   | 102             | 644                | JG 36        | 1143               |
| JS 95-60    | 88              | 733                | JG 63        | 1042               |
| RSC 11-42   | 103             | 550                | JG 30        | 1014               |
| JS 93-05    | 106             | 605                | Indira chana | 1124               |
| NRC 86      | 97              | 572                | JG 322       | 1299               |
| NRC 138     | 100             | 645                | JAKI 9218    | 1156               |
| CD (P=0.05) |                 | 68.89              |              | 48.21              |

### Karjat

Fifteen varieties of rice and cowpea each were evaluated for their suitability under organic farming in the system mode with same level and sources of nutrients (Table 7.2.2.10).

**Performance of rice varieties:** Fifteen varieties of rice during *Kharif* including early, mid-late and late maturity category (4 varieties in each) including 3 popular among the farmers were evaluated for their suitability under organic condition. Among the rice varieties Sahyadri-3 was found maximum grain yield (4599 kg/ha) and straw yield (6349 kg/ha) which is statistically at par with variety Ratnagiri-8 and Sahyadri-4 and the least grain yield was recorded in variety Ratnagiri – 1.

**Performance of cowpea varieties:** Fifteen varieties of cowpea during *Rabi* was grown in which the significantly higher seed yield was found in variety Konkan Sadabahar (1386 kg/ha) which was significantly at par with variety Phule Pandhari, Phule sonali and Dalkhan Local. Whereas Panvel Red produced lower yield among the varieties.

**Table 7.2.2.10: Performance of different varieties of rice and cowpea at Karjat under organic cultivation**

| Kharif         |             |                                    |                                    | Rabi             |                                   |                                     |
|----------------|-------------|------------------------------------|------------------------------------|------------------|-----------------------------------|-------------------------------------|
| Rice varieties |             | Grain yield (kg ha <sup>-1</sup> ) | Straw yield (kg ha <sup>-1</sup> ) | Cowpea varieties | Seed yield (kg ha <sup>-1</sup> ) | Stover yield (kg ha <sup>-1</sup> ) |
| Early          | Karjat - 4  | 3212                               | 4404                               | GC-2             | 915                               | 1364                                |
|                | Karjat-7    | 3322                               | 4585                               | GC-3             | 895                               | 1784                                |
|                | Ratnagiri-1 | 3105                               | 4390                               | GC-4             | 1145                              | 1381                                |
|                | Sahyadri-4  | 4366                               | 6110                               | GC-5             | 1309                              | 2156                                |
| Mid-late       | Karjat-5    | 3671                               | 4941                               | GC-6             | 1196                              | 1622                                |
|                | Karjat-6    | 3351                               | 4278                               | Phule Pandhari   | 1328                              | 2080                                |
|                | Palghar-1   | 3480                               | 4626                               | Phule Vithai     | 1248                              | 2098                                |
|                | Sahyadri-3  | 4599                               | 6349                               | Phule Sonali     | 1314                              | 2129                                |
| Late           | Ratnagiri-2 | 3642                               | 5111                               | Pusa Falguni     | 887                               | 1279                                |
|                | Ratnagiri-3 | 3585                               | 4924                               | PCP-1131         | 1055                              | 1718                                |



|                  |             |       |       |                  |      |       |
|------------------|-------------|-------|-------|------------------|------|-------|
|                  | Karjat-8    | 3537  | 4312  | Dalkhan Local    | 1335 | 1704  |
|                  | Ratnagiri 8 | 4492  | 6117  | Konkan Sadabahar | 1386 | 1508  |
| Grown by Farmers | Karjat-3    | 4262  | 5419  | Konkan Safed     | 1221 | 2049  |
|                  | Jaya        | 3358  | 4483  | Panvel Local     | 939  | 1510  |
|                  | Karjat-2    | 3422  | 4446  | Panvel Red       | 792  | 2376  |
| CD (P=0.05)      |             | 139.0 | 272.0 | CD (P=0.05)      | 81.0 | 159.0 |

**System equivalent yield and economics of rice-cowpea system** Significantly higher rice equivalent yield (REY 109423 kg/ha), net return (124829 Rs/ha) and benefit cost ratio (1.78) were recorded with Ratnagiri- 8 (rice) in *kharif* and Konkan Sadabahar (cowpea) in *rabi* compared to other varieties evaluated in the system. Lowest system equivalent yield and net return was recorded in rice (karjat-2) – cowpea (Panvel red). (Table 7.2.2.11)

**Table 7.2.2.11. System equivalent yield and economics of rice-cowpea system under organic management at Karjat**

| Rice        | Cowpea           | System's equivalent yield (kg ha <sup>-1</sup> ) | Gross returns (Rs. ha <sup>-1</sup> ) | Net returns (Rs. ha <sup>-1</sup> ) | B:C ratio |
|-------------|------------------|--------------------------------------------------|---------------------------------------|-------------------------------------|-----------|
| Karjat - 4  | GC-2             | 7202                                             | 196539                                | 36919                               | 1.23      |
| Karjat-7    | GC-3             | 7299                                             | 199194                                | 39574                               | 1.25      |
| Ratnagiri-1 | GC-4             | 7911                                             | 215901                                | 56001                               | 1.35      |
| Sahyadri-4  | GC-5             | 10070                                            | 274823                                | 113163                              | 1.70      |
| Karjat-5    | GC-6             | 8744                                             | 238621                                | 78721                               | 1.49      |
| Karjat-6    | Phule Pandhari   | 8908                                             | 243087                                | 83467                               | 1.52      |
| Palghar-1   | Phule Vithai     | 8787                                             | 239788                                | 80168                               | 1.50      |
| Sahyadri-3  | Phule Sonali     | 10349                                            | 282436                                | 120776                              | 1.75      |
| Ratnagiri-2 | Pusa Falguni     | 7573                                             | 206655                                | 46755                               | 1.29      |
| Ratnagiri-3 | PCP-1131         | 8183                                             | 223323                                | 63703                               | 1.40      |
| Karjat-8    | Dalkhan Local    | 9092                                             | 248127                                | 88507                               | 1.55      |
| Ratnagiri-8 | Konkan Sadabahar | 10423                                            | 284449                                | 124829                              | 1.78      |
| Karjat-3    | Konkan Safed     | 9519                                             | 259770                                | 99870                               | 1.62      |
| Jaya        | Panvel Local     | 7432                                             | 202808                                | 42908                               | 1.27      |
| Karjat-2    | Panvel Red       | 7060                                             | 192681                                | 33061                               | 1.21      |
| CD (P=0.05) |                  | 383.0                                            |                                       |                                     |           |



Varietal performance of rice at Karjat



## Ludhiana

Sixteen varieties of rice and twelve varieties of wheat were evaluated in rice-wheat system for their suitability under organic management. The field was green manured with sun hemp before transplanting whereas wheat field was prepared by applying farmyard manure (FYM) to supply equivalent to 125 kg N/ha.

**Performance of rice varieties:** Basmati rice variety Basmati 386 attained the highest plant height (163.1 cm) which was significantly higher than rest of the varieties. The lowest plant height was observed in Pusa Basmati- 1509. The maximum number of effective tillers/m<sup>2</sup> (370), panicle length (31.5 cm), Grains/ panicle (66.4), grain yield (4030 kg/ha) and straw yield (7120 kg/ha) in variety Punjab Basmati- 7 which is statistically at par with Pusa Basmati- 1718, Pusa Basmati- 1637 and Pusa Basmati- 1718. Whereas the Basmati- 386 and Basmati-370 are least productive and less suitable for high-yield targets. (Table 7.2.2.12)

**Performance of wheat varieties** Significant differences were observed among the varieties for plant height, effective tillers and grain yield. The highest plant height (123.5 cm) was observed in wheat variety C-306 which was significantly higher than all the other wheat varieties. The lowest plant height was observed in Punjab Shingar and it was significantly lower than all the other wheat varieties. The maximum number of effective tillers per m<sup>2</sup> (354.3), Grain per spike (46.1), 1000 grain weight (43.7 g), grain yield 4570 (kg/ha) and straw yield (6280 kg/ha) was recorded in variety Unnat PBW 550 which was statistically at par with variety BWL 3498 in terms of yield. Among which the maximum grains/ panicle (66.4) was also found in treatment Pusa Basmati-7 which was non-significant. Whereas the Kandi Area Landmark, Bansi Gold, and Punjab Shingar are least productive (Table 7.2.2.13)

**Table 7.2.2.12: Performance of basmati rice varieties under organic management at Ludhiana**

| Varieties        | Plant height (cm) | Effective tillers/m <sup>2</sup> | Panicle length (cm) | Grains/ panicle | 1000 grain weight (g) | Grain yield (kg/ha) | Straw yield (kg/ha) |
|------------------|-------------------|----------------------------------|---------------------|-----------------|-----------------------|---------------------|---------------------|
| Punjab Basmati 7 | 113.8             | 349.5                            | 31.5                | 66.4            | 26.4                  | 4030                | 7120                |
| Punjab Basmati 5 | 111.3             | 330.3                            | 28.6                | 61.9            | 25.8                  | 3600                | 6730                |
| Punjab Basmati 4 | 98.4              | 335.8                            | 30.3                | 63.5            | 26.3                  | 3800                | 6840                |
| Punjab Basmati 3 | 110.4             | 332.5                            | 28.4                | 62.3            | 26.6                  | 3720                | 6920                |
| Punjab Basmati 2 | 121.8             | 319.4                            | 27.5                | 58.7            | 26.3                  | 3200                | 6330                |
| Basmati 386      | 163.1             | 285.7                            | 26.3                | 57.7            | 25.6                  | 2220                | 6120                |



|                   |       |       |      |      |      |      |      |
|-------------------|-------|-------|------|------|------|------|------|
| Basmati 370       | 159.5 | 291.5 | 26.6 | 58.2 | 25.7 | 2380 | 6200 |
| CSR 30            | 137.1 | 315.2 | 26.9 | 59.6 | 25.4 | 2690 | 6370 |
| Pusa Basmati 1121 | 118.8 | 328.6 | 27.4 | 61.7 | 26.5 | 3350 | 6390 |
| Pusa Basmati 1509 | 95.8  | 339.7 | 30.0 | 64.2 | 27.3 | 3900 | 6910 |
| Pusa Basmati 1718 | 119.7 | 340.5 | 30.6 | 64.8 | 27.5 | 3950 | 6950 |
| Pusa Basmati 1637 | 110.5 | 339.2 | 30.3 | 64.4 | 27.3 | 3920 | 6930 |
| CD (P=0.05)       | 3.8   | 11.5  | 2.3  | 2.2  | 0.52 | 160  | 220  |

**Table 7.2.2.13: Performance of wheat varieties under organic management at Ludhiana**

| Varieties                  | Plant height (cm) | Effective tillers /m <sup>2</sup> | Spike length (cm) | Grains per spike | 1000 grain weight (g) | Grain yield (kg/ha) | Straw yield (kg/ha) |
|----------------------------|-------------------|-----------------------------------|-------------------|------------------|-----------------------|---------------------|---------------------|
| <i>Unnat</i> PBW 550       | 94.4              | 354.3                             | 10.2              | 46.1             | 43.7                  | 4570                | 6280                |
| <i>Unnat</i> PBW 343       | 96.5              | 337.5                             | 9.8               | 41.8             | 41.7                  | 4050                | 5870                |
| PBW 660                    | 98.8              | 340.6                             | 9.8               | 42.6             | 41.5                  | 4200                | 5960                |
| PBW 1 Zn                   | 105.5             | 311.3                             | 9.7               | 39.3             | 37.6                  | 3490                | 5440                |
| PBW 175                    | 101.3             | 275.5                             | 9.5               | 40.5             | 40.5                  | 2770                | 4580                |
| PBW 1 <i>Chapati</i>       | 98.7              | 296.4                             | 9.6               | 40.1             | 40.6                  | 3150                | 5050                |
| BWL 3500                   | 99.4              | 323.2                             | 9.5               | 40.6             | 40.5                  | 3790                | 5760                |
| BWL 3498                   | 105.6             | 345.2                             | 9.7               | 41.7             | 41.5                  | 4300                | 6140                |
| C-306                      | 123.5             | 260.5                             | 9.4               | 39.8             | 41.3                  | 2750                | 4540                |
| <i>Bansi</i> Gold          | 99.7              | 259.6                             | 9.6               | 36.4             | 37.7                  | 2610                | 4330                |
| <i>Punjab Shingar</i>      | 93.2              | 260.4                             | 9.4               | 45.4             | 34.3                  | 2720                | 4530                |
| <i>Kandi</i> Area Landmark | 96.4              | 254.4                             | 9.6               | 44.9             | 35.8                  | 2420                | 4310                |
| CD (p=0.05)                | 3.6               | 14.5                              | NS                | 1.5              | 2.2                   | 290                 | 310                 |

## Modipuram

Nine promising varieties of Brinjal and Veg. pea in brinjal-veg. pea system were evaluated with similar nutrient source and doses under organic condition.

**Performance of brinjal varieties:** Among the tested varieties of brinjal, highest yield (17111 kg/ha), net return (232383 Rs/ha) B:C ratio (3.60) was recorded under Pragati variety and least by Kashi Uttam variety which was higher than rest of the varieties. Cost of cultivation was similar among different varieties. (Table 7.2.2.14)

**Table 7.2.2.14: Yield and economics of different brinjal varieties under organic farming at Modipuram**

| Maize varieties/ hybrids | Yield (kg/ha) | Cost of cultivation (Rs/ha) | Net return (Rs/ha) | B:C ratio |
|--------------------------|---------------|-----------------------------|--------------------|-----------|
| Hybrid 992               | 14612         | 89299                       | 185411             | 3.08      |
| Pragati                  | 17111         | 89299                       | 232383             | 3.60      |
| Navkiran                 | 11344         | 89299                       | 123959             | 2.39      |
| Hybrid 143               | 11964         | 89299                       | 135626             | 2.52      |
| Pant Rituraj             | 16300         | 89299                       | 217141             | 3.43      |

|               |       |       |        |      |
|---------------|-------|-------|--------|------|
| Krishna       | 16173 | 89299 | 214746 | 3.40 |
| Seema 2       | 14612 | 89299 | 185414 | 3.08 |
| Kashi Uttam   | 7848  | 89299 | 58243  | 1.65 |
| Kashi Sandesh | 12821 | 89299 | 151734 | 2.70 |

**Performance of vegetable pea varieties:** Among the tested varieties of vegetable pea, highest yield (6204 kg/ha), highest net return (112793 Rs/ha) and B:C ratio (3.67) was recorded under Vasundhara which was higher than rest of the varieties. Cost of cultivation was similar among different varieties and the least yield, net return and B:C ratio was recorded in variety PB- 89 (Table 7.2.2.15).

**Table 7.2.2.15 Performance and economics of vegetable pea varieties/hybrids under organic farming**

| Varieties   | Yield (kg/ha) | Cost of cultivation (Rs./ha) | Net return (Rs./ha) | B:C ratio |
|-------------|---------------|------------------------------|---------------------|-----------|
| PS-1100     | 3802          | 42300                        | 52746               | 2.25      |
| NF-10       | 5124          | 42300                        | 85802               | 3.03      |
| Vasundhara  | 6204          | 42300                        | 112793              | 3.67      |
| Maxima 3636 | 5241          | 42300                        | 88719               | 3.10      |
| PS-10       | 3750          | 42300                        | 51450               | 2.22      |
| KS-10       | 3722          | 42300                        | 50756               | 2.20      |
| PB-89       | 3500          | 42300                        | 45200               | 2.07      |



Field view of brinjal and vegetable pea varieties at Modipuram under organic cultivation

### Pant Nagar

Total twelve varieties of rice varieties during *kharif* and twelve varieties of wheat in *rabi* were evaluated under organic mode of cultivation.

**Performance of different rice varieties** Significant variation was observed among the rice varieties for all the traits. Plant height of different rice varies from 101 to 147 cm. hansraj reported tallest plant height (147.0 cm) which is statistically at par with Kalanamak rice and the least height was found in variety CGZR-1. Among all varieties, PD-24 under HYVs recorded the highest Effective tillers/m<sup>2</sup> (255) grain wt./ panicle (2.44 g), 1000 grain wt. (27.2 g), grain yield (5719 kg/ha), Net return (Rs.1,72,640/ha) and B:C ratio (3.63) which was significantly superior to most traditional and medicinal/special quality varieties which is statically at par with Other HYVs such as HKR-47 PR-121. Whereas Kesho Pohu showed the lowest grain yield, significantly lower than the top HYVs and medicinal lines. (Table7.2.2.16)



**Performance of wheat varieties** Plant height at harvest of different wheat varieties ranged from 83 to 105 cm, tallest variety was being Sonalika, (105 cm) followed by UP- 2565 (97 cm) while smallest was recorded with WH-1105 (83.3 cm). Spikes/ m<sup>2</sup> of wheat varieties were non-significant. Test weight (1000-grains weight) of different wheat varieties recorded in range from 23.5 to 35.3 g. The highest grain yield (5032 kg/ha), straw yield (5754 kg/ha), net return 88521 (Rs/ha) and B:C ratio (2.55) was noticed in HD-2903 which was at par with WH 1142, UP2 855 and UP 2565. Whereas the lowest yield was recorded with UP 262. (Table 7.2.2.17)

**Table 7.2.2.16. Yield attributes and yield of rice varieties under organic cultivation at Pantnagar**

| Groups                                 | Varieties   | Plant height (cm) | Effective tillers/ m <sup>2</sup> | Grains wt./ panicle (g) | 1000-grain wt. (g) | Grain yield (kg/ha) | Straw yield (kg/ha) | Harvest Index | Net returns (Rs/ha) | B:C ratio |
|----------------------------------------|-------------|-------------------|-----------------------------------|-------------------------|--------------------|---------------------|---------------------|---------------|---------------------|-----------|
| Traditional Varieties<br>Tilak Chandan |             | 115.7             | 251                               | 1.85                    | 21.1               | 3618                | 5122                | 0.41          | 91723               | 1.93      |
|                                        | Hansraj     | 147.0             | 250                               | 1.70                    | 21.4               | 3389                | 6445                | 0.35          | 82902               | 1.74      |
|                                        | Kalanamak   | 142.0             | 270                               | 1.65                    | 15.3               | 3588                | 5612                | 0.39          | 90583               | 1.90      |
|                                        | Kesho Pohnu | 118.7             | 249                               | 1.57                    | 24.7               | 3238                | 4557                | 0.42          | 77122               | 1.62      |
| High Yielding Varieties                | HKR-47      | 115.7             | 270                               | 2.40                    | 26.2               | 5649                | 6118                | 0.48          | 169940              | 3.57      |
|                                        | PR-121      | 117.3             | 271                               | 2.33                    | 25.0               | 5373                | 6064                | 0.47          | 159293              | 3.35      |
|                                        | PD-24       | 124.7             | 255                               | 2.44                    | 27.2               | 5719                | 6622                | 0.46          | 172640              | 3.63      |
|                                        | NDR-359     | 117.3             | 255                               | 2.37                    | 23.4               | 5341                | 5952                | 0.47          | 158077              | 3.32      |
| Medicinal/ Special Quality Varieties   | PSD-25      | 138.3             | 271                               | 1.88                    | 23.3               | 4368                | 4631                | 0.49          | 120584              | 2.54      |
|                                        | PSD-27      | 108.0             | 227                               | 1.89                    | 23.7               | 5235                | 5674                | 0.48          | 153970              | 3.24      |
|                                        | CGZR-1      | 101.7             | 271                               | 1.84                    | 22.1               | 4586                | 5312                | 0.46          | 129026              | 2.71      |
|                                        | Zinco Rice  | 117.7             | 264                               | 1.63                    | 21.6               | 3527                | 4130                | 0.46          | 88225               | 1.85      |
|                                        | CD(p=0.05)  | 8.49              | 28.89                             | 0.23                    | 0.421              | 722.1               | 1100.7              | 0.03          |                     |           |

**Table 7.2.2.17: Response for yield attributes and yields of wheat varieties under organic management at Pantnagar**

| Groups                     | Varieties   | Plant height (cm) | Spikes/ m <sup>2</sup> | 1000-grain wt. (g) | Grain yield (kg/ha) | Straw yield (kg/ha) | Harvest Index | Net returns (Rs/ha) | B:C ratio |
|----------------------------|-------------|-------------------|------------------------|--------------------|---------------------|---------------------|---------------|---------------------|-----------|
| High yield Varieties       | UP 2855     | 87.0              | 300                    | 29.1               | 4777                | 5315                | 0.47          | 82278               | 2.37      |
|                            | HD2967      | 96.0              | 312                    | 33.7               | 4035                | 4562                | 0.47          | 64100               | 1.84      |
|                            | UP 2565     | 97.7              | 291                    | 30.9               | 4468                | 5045                | 0.47          | 74701               | 2.15      |
|                            | DBW 62150   | 91.3              | 294                    | 34.7               | 4285                | 5053                | 0.46          | 70225               | 2.02      |
|                            | UP 2903     | 96.7              | 347                    | 28.3               | 5032                | 5745                | 0.47          | 88521               | 2.55      |
|                            | WH 1142     | 96.7              | 322                    | 35.3               | 4982                | 5692                | 0.47          | 87304               | 2.51      |
|                            | WH 1105     | 83.3              | 340                    | 32.5               | 3998                | 4748                | 0.46          | 63197               | 1.82      |
| Traditional                | Black wheat | 94.3              | 334                    | 33.0               | 4131                | 4934                | 0.46          | 66456               | 1.91      |
|                            | Sonalika    | 105.0             | 344                    | 34.2               | 4067                | 4717                | 0.46          | 64885               | 1.87      |
|                            | C-306       | 96.0              | 337                    | 28.1               | 3673                | 4375                | 0.46          | 55227               | 1.59      |
| Medicinal/ Special Quality | UP-262      | 97.0              | 350                    | 34.4               | 4242                | 4952                | 0.46          | 69165               | 1.99      |
|                            | WB-2        | 95.7              | 355                    | 34.5               | 4963                | 5602                | 0.47          | 86833               | 2.50      |
|                            | CD(p=0.05)  | 5.89              | NS                     | 0.336              | 719.4               | NS                  | NS            |                     |           |

|                                                                                   |                                                                                    |                                                                                     |
|-----------------------------------------------------------------------------------|------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------|
|  |  |  |
| Rice variety PD 24                                                                | Rice variety HKR 47                                                                | Rice variety PR 121                                                                 |
|  |  |  |
| Wheat variety UP 2903                                                             | Wheat variety WH 1142                                                              | Wheat variety WB 2                                                                  |

Best performing rice and wheat varieties at Pantnagar under organic farming

## Raipur

To assess the response of rice varieties including traditional and improved scented rice and improved chickpea varieties were evaluated under organic production system.

**Performance of rice varieties** Among all the rice varieties tested, the traditional scented variety Indira Sugandhit Dhan 1 recorded the highest grain yield (2895 kg/ha), Straw yield 8272 (kg/ha), gross return (88655 Rs/ha), net return (46515 Rs/ha) and B:C ratio (2.04) which was significantly superior to most other varieties. This was followed closely by C.G. Sugandhit Bhog and CG Devbhog, both of which were statistically at par. Whereas the least grain yield was observed in Chinni Kapoor, a traditional scented variety. (Table 7.2.2.18)

**Performance of chickpea varieties** The highest number of pods per plant was recorded in Vikash (32.74), which was significantly superior to most other varieties, followed closely by Subhra (31.76) and Ambika (31.73). These values were statistically at par with each other. The lowest pod number was observed in PeasTSx10 (25.42), followed by Adarsh (25.99), both significantly inferior to the top performers. Vikash produced the highest seed yield (1276 kg/ha), significantly outperforming other varieties. Subhra (1256 kg/ha) and Ambika (1256 kg/ha) were statistically at par with Vikash, while Amar (1238 kg/ha) also performed well. The least seed yield was recorded in PeasTSx10 (1024 kg/ha) and Adarsh (1025 kg/ha). In terms of profitability, Vikash again topped the chart with the highest net return (Rs 22,159/ha). It was followed by Subhra (Rs 21,464/ha), Ambika (Rs 21,508/ha), and Amar (Rs 20,894/ha) These were statistically at par. The lowest net return was recorded in PeasTSx10 (Rs 13,633/ha) and Adarsh (Rs 13,682/ha). Subhra recorded the highest B:C ratio (3.18), closely followed by Vikash (3.05) and Pea Bliss-201 (3.12). These values were significantly higher than those of other varieties, indicating better economic viability. The lowest B:C ratio was seen in PeasTSx10 (2.25), making it the least economically efficient. In terms of stability index the most stable variety was Vikash (0.79), followed by Pea Bliss-201 (0.75) and Amar (0.75), suggesting these varieties performed consistently across conditions. The least stable variety was Paras (0.53). (Table 7.2.2.19)



**Table 7.2.2.18: Response of different traditional and improved scented varieties of rice under organic production system**

| Varieties                                 | Grain yield (kg/ha) | Straw yield (kg/ha) | Gross return (Rs ha <sup>-1</sup> ) | Net return (Rs ha <sup>-1</sup> ) | B:C ratio |
|-------------------------------------------|---------------------|---------------------|-------------------------------------|-----------------------------------|-----------|
| <i>Traditional Scented rice varieties</i> |                     |                     |                                     |                                   |           |
| Chinni Kapoor                             | 1807                | 5162                | 56916                               | 14774                             | 1.32      |
| Lokti Machhi                              | 2089                | 5968                | 64625                               | 22483                             | 1.49      |
| Tulsi Manjiri                             | 1964                | 5611                | 61303                               | 19161                             | 1.42      |
| Amrit Bhog                                | 1837                | 5247                | 57474                               | 15332                             | 1.33      |
| Samund Chini                              | 2344                | 6696                | 72058                               | 29916                             | 1.67      |
| Lohandi                                   | 2280                | 6515                | 70554                               | 28412                             | 1.63      |
| Aatma Sheetal                             | 2083                | 5950                | 64039                               | 21897                             | 1.48      |
| <i>Improved scented rice varieties</i>    |                     |                     |                                     |                                   |           |
| Tarunbhog Selection 1                     | 2293                | 6551                | 71279                               | 29137                             | 1.64      |
| C.G. Sugandhit bhog                       | 2762                | 7891                | 83920                               | 41778                             | 1.93      |
| Indira Sugandhit Dhan 1                   | 2895                | 8272                | 88655                               | 46513                             | 2.04      |
| CG Devbhog                                | 2778                | 7938                | 83974                               | 41832                             | 1.94      |
| Sugandhmati                               | 2063                | 5893                | 65112                               | 22970                             | 1.5       |
| <i>Fortified rice varieties</i>           |                     |                     |                                     |                                   |           |
| Zinco rice MS                             | 2549                | 7282                | 77705                               | 35563                             | 1.79      |
| Protezin                                  | 2742                | 7834                | 83542                               | 41400                             | 1.92      |
| CG Madhuraj 55                            | 2578                | 7365                | 79549                               | 37407                             | 1.83      |
| CD (P = 0.05)                             | 333                 | 272                 | -                                   | -                                 | -         |

**Table: 7.2.2.19 Response of different improved varieties of chickpea under organic production system at Raipur**

| Variety        | No. of pods plant <sup>-1</sup> | Seed yield (kg/ha) | Net return (Rs ha <sup>-1</sup> ) | B:C ratio | Yield stability index |
|----------------|---------------------------------|--------------------|-----------------------------------|-----------|-----------------------|
| Amar           | 30.74                           | 1238               | 20894                             | 2.67      | 0.75                  |
| KPMR-400       | 27.58                           | 1088               | 15813                             | 2.36      | 0.65                  |
| Adarsh         | 25.99                           | 1025               | 13682                             | 2.58      | 0.62                  |
| Ambika         | 31.73                           | 1256               | 21508                             | 2.94      | 0.68                  |
| Prakash        | 29.15                           | 1174               | 18719                             | 2.54      | 0.70                  |
| Paras          | 27.38                           | 1084               | 15670                             | 2.61      | 0.53                  |
| Indira Matar-1 | 28.58                           | 1123               | 16997                             | 2.60      | 0.64                  |
| Vikash         | 32.74                           | 1276               | 22159                             | 3.05      | 0.79                  |
| Subhra         | 31.76                           | 1256               | 21464                             | 3.18      | 0.65                  |
| PeasTSx10      | 25.42                           | 1024               | 13633                             | 2.25      | 0.64                  |
| Pea Bliss-201  | 29.55                           | 1199               | 19570                             | 3.12      | 0.75                  |
| CD (P = 0.05)  | 0.98                            | 20.15              | 695.00                            | 0.13      | 0.14                  |

## Ranchi

Eleven varieties of rice and ten of wheat were evaluated for their suitability under organic farming in the system mode.

**Performance of rice varieties:** The highest rice yield was recorded in MTU1010 (4084 kg/ha), followed by Lalat (3962 kg/ha) and Naveen (3726 kg/ha) which are statistically at par. The lowest grain yield was observed in Kalazeera (2445 kg/ha), followed by BVD 203 (2506 kg/ha) and Badshah Bhog (2642 kg/ha). In terms of profitability, MTU1010 gave the maximum net return (Rs 63,332/ha), followed by Lalat (Rs 60,013/ha) and Naveen (Rs 53,548/ha). These values were significantly higher and also statistically at par. The least net return was recorded in Kalazeera (Rs 16,198/ha), followed by BVD 203 (Rs 18,006/ha) and Badshah Bhog (Rs 22,109/ha). The highest B:C ratio was noted in MTU1010 (1.17), followed by Lalat (1.11) and Naveen (0.99), showing better profitability. The lowest B:C ratio was found in Kalazeera (0.30), with Badshah Bhog (0.41) and BVD 203 (0.33) also showing poor economic efficiency. (Table 7.2.2.20)

**Performance of wheat varieties** The highest wheat yield was recorded in K-1008 (3179 kg/ha), followed by HD-2967, HI-1563 and DBW- 107 these were statistically at par with each other. The lowest yield was recorded in Govind Bhog. In terms of profitability DBW-107 (Rs 31,441/ha) and HI-1563 (Rs 32,071/ha) showed the highest net returns, followed by JKW-261 (Rs 26,606/ha). These were statistically at par. The least net return was observed in K-1008 recorded the highest wheat net return (39535 Rs/ha) and B:C ratio (0.71), followed by HD-2967, HI- 1563 and DBW- 107 lowest profitability was recorded in Govind Bhog. (Table 7.2.2.20):

**Table 7.2.2.20: Yield of rice and wheat varieties at Ranchi under organic farming**

| Rice         |               |                    |           | Wheat     |               |            |           |
|--------------|---------------|--------------------|-----------|-----------|---------------|------------|-----------|
| Varieties    | Yield (Kg/ha) | Net Return (Rs/ha) | B:C ratio | Varieties | Yield (Kg/ha) | Net Return | B:C ratio |
| BVS-1        | 3269          | 40449              | 0.75      | K-1006    | 3179          | 39535      | 0.71      |
| Govind Bhog  | 2716          | 24799              | 0.46      | DBW-187   | 2422          | 18585      | 0.33      |
| Badshah Bhog | 2642          | 22109              | 0.41      | DBW-14    | 2556          | 22462      | 0.40      |
| Kalazeera    | 2445          | 16198              | 0.30      | DBW-252   | 2500          | 20529      | 0.37      |
| BVD 203      | 2506          | 18006              | 0.33      | HD-9232   | 2667          | 25473      | 0.46      |
| IR-64        | 3053          | 34487              | 0.64      | JKW-261   | 2698          | 26606      | 0.48      |
| MTU1010      | 4084          | 63332              | 1.17      | DBW-107   | 2878          | 31441      | 0.56      |
| Sahbhagidhan | 3409          | 44233              | 0.82      | HD-2967   | 3040          | 35842      | 0.64      |
| Naveen       | 3726          | 53548              | 0.99      | BG-3      | 2533          | 21673      | 0.39      |
| Lalat        | 3962          | 60013              | 1.11      | HI-1563   | 2903          | 32071      | 0.57      |
| CD (P=0.05)  | 393           |                    |           |           | 399           |            |           |

## Umiam

**Performance of groundnut and rapeseed mustard:** In order to identify suitable varieties of major crops for mid hills of Meghalaya, a total of 12 varieties/lines of groundnut and 12 varieties/lines of rapeseed were evaluated under organic management practices. Rapeseed was sown after the harvest of groundnut under no till conditions. There was a wide variation in pod yield among groundnut varieties, ranging from 450 to 1770 kg/ha. The highest pod yield was recorded in GG7 (1770 kg/ha), which was significantly superior to all other varieties. This was followed by GJG18 (1180 kg/ha) and ICGS76 (890 kg/ha), which also performed well. These varieties were likely statistically at par with each other. The lowest yield was observed in ICGV00350 (450 kg/ha), followed by GIRNAR (490 kg/ha) and ICGV91114 (580 kg/ha). Seed yield among rapeseed varieties showed moderate variability, ranging from 280 to 450 kg/ha. The highest seed yield was recorded in DRMR (450 kg/ha), followed by PM-25 (430 kg/ha). These top-yielding varieties are likely statistically at par, given the



close range of values. The lowest seed yield was found in PT-303 (280 kg/ha), Topeshwari (330 kg/ha), TL-15 (330 kg/ha), and NRCNB (330 kg/ha) Table 7.2.2.21. Quality parameter also estimated of groundnut and mustard. Maximum oil and protein content recorded in ground nut variety GJ 7 likewise in mustard it was higher in DRMR.

**Table 7.2.2.21. Yield of groundnut and mustard varieties at Umiam under organic farming**

| Groundnut |                   | Rapeseed   |                    |
|-----------|-------------------|------------|--------------------|
| Varieties | Pod yield (kg/ha) | Varieties  | Seed yield (kg/ha) |
| TPG 41    | 750               | PM-25      | 430                |
| TG37A     | 640               | NRCNB      | 330                |
| ICGS76    | 890               | PT-303     | 280                |
| ICGV00350 | 450               | BHAWARI    | 400                |
| JL501     | 660               | DRMR       | 450                |
| GIRNAR    | 490               | Ragini     | 290                |
| GJG31     | 700               | Binoy      | 390                |
| GG7       | 1770              | PM-28      | 420                |
| ICGV91114 | 580               | PM-26      | 420                |
| KADIRI 9  | 940               | YSH        | 420                |
| GPVD 5    | 700               | TL-15      | 330                |
| GJG18     | 1180              | Topeshwari | 330                |

#### Oil and protein yield of groundnut and rapeseed mustard in organic farming at Umiam

### Ajmer

The total eight varieties each of fenugreek and nigella were evaluated under organic cultivation.

**Performance of fenugreek varieties:** The study assessed eight fenugreek varieties for plant height, number of primary branches per plant, number of pods per plant, number of seeds per pod, and seed yield. Significant variation was observed among the varieties for most traits, except the number of seeds per pod, which was statistically non-significant. The tallest plants were recorded in Ajmer Fenugreek-1 (55.60 cm), Ajmer Fenugreek-4 (54.00 cm), and Ajmer Fenugreek-2 (52.47 cm). The shortest plants were observed in Hisar Sonali (45.53 cm) and RMT-361 (48.80 cm). The highest number of primary branches was observed in Ajmer Fenugreek-3 (5.33), which was significantly superior to all others, it was followed by Hisar Sonali (4.80) and Ajmer Fenugreek-4 (4.73). The least number of branches was found in RMT-143 (3.27). Ajmer Fenugreek-3 (27.53) produced the maximum number of pods per plant, which was significantly higher than all other varieties, it was followed by Hisar Sonali (22.00) and Ajmer Fenugreek-4 (21.60). The lowest pod number was recorded in RMT-361 (16.40) and RMT-143 (16.67). Among all the varieties highest seed yield was recorded in Ajmer Fenugreek-3 (1658.33 kg/ha), which was significantly superior to all varieties, it was followed closely by Hisar Sonali (1618.33 kg/ha) and Ajmer Fenugreek-4 (1510.00 kg/ha) which were statistically at par. The lowest seed yield was observed in RMT-361 (1141.67 kg/ha), followed by Ajmer Fenugreek-2 (1295.00 kg/ha). (Table 7.2.2.22)

**Performance of nigella** A significant difference was observed among Nigella varieties for seed yield, indicating a strong genetic influence on productivity. The seed yield ranged from 135 to 180 kg/ha. The highest seed yield was recorded in Ajmer Nigella-20 (180 kg/ha), which was significantly superior to all other varieties. It was followed by Indra Nigella-1 (165 kg/ha) and Pant Krishna (151 kg/ha). Ajmer Nigella-1 (151 kg/ha) and Pant Krishna (151 kg/ha) were statistically at par with each other and with Indra Nigella-1. The lowest yield was recorded in NDBC-10 (135 kg/ha), closely followed by Ajmer Nigella-19 (137 kg/ha) and Ajmer Nigella-4 (144 kg/ha). (Table 7.2.2.23)

**Table 7.2.2.22: Performance of fenugreek varieties under organic management practices at Ajmer**

| Varieties         | Plant height (cm) at harvest | No. of primary branches plant <sup>-1</sup> | No. of Pods plant <sup>-1</sup> | No. of seeds pod <sup>-1</sup> | Seed yield (kg/ha) |
|-------------------|------------------------------|---------------------------------------------|---------------------------------|--------------------------------|--------------------|
| Ajmer Fenugreek-1 | 55.6                         | 4.6                                         | 18.1                            | 17.1                           | 1360               |
| Ajmer Fenugreek-2 | 52.5                         | 4.3                                         | 17.8                            | 16.9                           | 1295               |
| Ajmer Fenugreek-3 | 50.9                         | <b>5.3</b>                                  | 27.5                            | 15.6                           | 1658               |
| Ajmer Fenugreek-4 | 54.0                         | 4.7                                         | 21.6                            | 16.3                           | 1510               |
| Ajmer Fenugreek-5 | 51.6                         | 4.5                                         | 18.3                            | 17.0                           | 1450               |
| RMT-361           | 48.8                         | 4.2                                         | 16.4                            | 16.6                           | 1142               |
| RMT-143           | 50.7                         | 3.3                                         | 16.7                            | 15.6                           | 1492               |
| Hisar Sonali      | 45.5                         | 4.8                                         | 22.0                            | 17.4                           | 1618               |
| CD(P=0.05)        | 5.4                          | 1.0                                         | 3.7                             | NS                             | 168                |

**Table 7.2.2.23: Performance of nigella varieties to organic management practices at Ajmer**

| Nigella varieties | Seed yield (kg/ha) |
|-------------------|--------------------|
| Ajmer Nigella-1   | 151                |
| Ajmer Nigella-20  | 180                |
| Ajmer Nigella-19  | 137                |
| Ajmer Nigella-4   | 144                |
| Indra Nigella-1   | 165                |
| Pant Krishna      | 151                |
| Azad Kalonji      | 146                |
| NDBC-10           | 135                |
| CD (P=0.05)       | 18                 |



Fenugreek variety (Hisar Sonali)



Fenugreek variety (AFg-3)



Best performing variety of fenugreek and nigella at Ajmer

## Gangtok

### Varietal performance of maize and buckwheat under organic farming

**Performance of Maize:** The study assessed twelve maize varieties for plant height, dry matter accumulation, LAI at silking stage, cob length, cob girth, No of rows per cob, no of grains per row and grain yield. Significant variation was observed among the varieties for most traits, Vivek Sankul-35 was the best performing variety, with the highest grain yield (4160 kg/ha), superior LAI (4.77), maximum cobs per row (14.69), and good cob girth. It was statistically at par with Vivek Sankul-31, Seti Makkai, and several RCM lines in terms of yield. Vivek Sankul-35, Vivek Sankul-31, Seti Makkai, Vivek Sankul-37, RCM 1-3, and RCM 1-1 can be considered at par for grain yield. Kalo Makkai recorded the lowest yield, along with Vivek Sankul-35 having the lowest cob length, making them less favorable for yield traits. (Table 7.2.2.24)

In terms of profitability Significant variation was observed among the maize cultivars for gross return, net return, return per rupee invested, profitability per day, and LUE (%). Vivek Sankul-35 emerged as the best cultivar in terms of highest gross return (85.43 ₹×10<sup>3</sup> ha<sup>-1</sup>), net return (42.26 ₹×10<sup>3</sup> ha<sup>-1</sup>), return per rupee (1.94), and profitability per day (116.14), which were statistically at par with Vivek Sankul-31 and Seti Makkai Vivek Sankul-35. Whereas Kalo Makkai had the lowest economic returns and profitability, with poor return per rupee invested. While LUE % is maximum in variety RCM 75 (38.34 %) and least in Rato Makkai (31.34 %) (Table 7.2.2.24)

**Table 7.2.2.24. Evaluation of maize composite under organic management condition**

| Maize varieties | Plant height at flowering stage (cm) | Dry matter at tasselling (g plant <sup>-1</sup> ) | LAI at silking stage | Cob length (cm) | Cob girth (cm) | No. of rows cob <sup>-1</sup> | No. of grains row <sup>-1</sup> | Grain yield (kg ha <sup>-1</sup> ) |
|-----------------|--------------------------------------|---------------------------------------------------|----------------------|-----------------|----------------|-------------------------------|---------------------------------|------------------------------------|
| Seti Makkai     | 307.44                               | 73.88                                             | 3.41                 | 15.51           | 12.75          | 12.84                         | 32.05                           | 4020                               |
| Pahenlo Makkai  | 239.69                               | 52.22                                             | 3.56                 | 15.35           | 13.04          | 12.89                         | 35.49                           | 3690                               |
| Rato Makkai     | 280.66                               | 82.90                                             | 4.54                 | 16.10           | 12.92          | 12.47                         | 37.66                           | 3470                               |
| Baiguni Makkai  | 299.20                               | 45.34                                             | 4.69                 | 15.71           | 12.98          | 12.90                         | 33.04                           | 3620                               |
| Kalo Makkai     | 261.88                               | 48.39                                             | 3.83                 | 14.12           | 11.93          | 10.19                         | 38.06                           | 3210                               |
| Satheyra        | 266.63                               | 47.16                                             | 3.99                 | 13.49           | 12.10          | 10.99                         | 29.03                           | 3370                               |
| RCM 1-1         | 221.64                               | 48.10                                             | 3.99                 | 16.73           | 12.07          | 11.83                         | 30.90                           | 3910                               |
| RCM 1-3         | 227.60                               | 46.59                                             | 3.78                 | 15.09           | 12.78          | 12.79                         | 28.15                           | 3940                               |

|                 |        |       |      |       |       |       |       |      |
|-----------------|--------|-------|------|-------|-------|-------|-------|------|
| RCM 75          | 234.13 | 51.02 | 4.26 | 12.99 | 13.00 | 33.24 | 33.55 | 3880 |
| Vivek Sankul-31 | 151.89 | 24.10 | 3.67 | 13.74 | 14.84 | 13.00 | 35.94 | 4130 |
| Vivek Sankul-37 | 159.20 | 25.84 | 4.07 | 11.51 | 13.60 | 13.75 | 32.07 | 3970 |
| Vivek Sankul-35 | 140.37 | 32.92 | 4.77 | 11.59 | 14.72 | 14.69 | 32.02 | 4160 |
| CD (P=0.05)     | 27.1   | 3.10  | 0.25 | 1.22  | 1.59  | 1.98  | 3.04  | 340  |

Table 7.2.2.25: Economics of different cultivars of maize

| Cultivars       | Gross return<br>(₹×103 ha <sup>-1</sup> ) | Net Return<br>(₹×103 ha <sup>-1</sup> ) | Return rupee <sup>-1</sup><br>invested | Profitability<br>Rs/ha/day | LUE (%) |
|-----------------|-------------------------------------------|-----------------------------------------|----------------------------------------|----------------------------|---------|
| Seti Makkai     | 80.63                                     | 37.40                                   | 1.86                                   | 102.5                      | 34.07   |
| Pahenlo Makkai  | 65.81                                     | 22.58                                   | 1.51                                   | 62.23                      | 33.96   |
| Rato Makkai     | 55.80                                     | 12.56                                   | 1.26                                   | 34.82                      | 31.34   |
| Baiguni Makkai  | 59.75                                     | 16.49                                   | 1.38                                   | 45.48                      | 31.99   |
| Kalo Makkai     | 53.66                                     | 10.42                                   | 1.13                                   | 28.97                      | 36.33   |
| Satheya         | 56.03                                     | 13.11                                   | 0.19                                   | 36.65                      | 32.52   |
| RCM 1-1         | 75.16                                     | 32.08                                   | 1.69                                   | 87.85                      | 37.97   |
| RCM 1-3         | 76.35                                     | 33.27                                   | 1.70                                   | 91.13                      | 35.86   |
| RCM 75          | 72.24                                     | 29.05                                   | 1.60                                   | 79.72                      | 38.34   |
| Vivek Sankul-31 | 82.27                                     | 39.18                                   | 1.89                                   | 107.28                     | 36.29   |
| Vivek Sankul-37 | 78.45                                     | 35.28                                   | 1.69                                   | 96.87                      | 34.33   |
| Vivek Sankul-35 | 85.43                                     | 42.26                                   | 1.94                                   | 116.14                     | 35.49   |
| CD (P=0.05)     | 8.03                                      | 3.93                                    | 0.19                                   | 21.99                      | 1.35    |



Fig 10: The performance of varietal maize under organic management.



Fig 10: The performance of varietal maize under organic management.

**Performance of buckwheat:** Grain yield and economics of buckwheat cultivars were influenced significantly. Among the buckwheat varieties, IC 49671 took maximum 126 days to maturity while IC 104727 took 108 days as minimum days to maturity. Differences among the buckwheat varieties for yield ranged from 980 to 2190 kg/ha. Maximum grain yield (2190 kg ha<sup>-1</sup>), gross return (84.26 ₹×103 ha<sup>-1</sup>), net return (40.68 ₹×103 ha<sup>-1</sup>) rupee<sup>-1</sup> invested (1.89), profitability (111.55 ₹/ha/day) was recorded under IC 109433 which was statistically at par with IC 49671, Local Meethay, and IC 104727 but



significantly higher than remaining cultivars. While Maximum LUE (34.19 %) was recorded under IC 36805 which was statistically at par with VL- UGAL, IC 49671 and IC 109433 but significantly superior over all remaining cultivars. Whereas VL-UGAL and PRB-1 recorded lowest yield and returns, and IC 15393 showed poor economic efficiency (lowest return/ rupee) despite moderate yield. (Table 7.2.2.26)

**Table 7.2.2.26. Yield and economics of buckwheat varieties under organic management condition at Gangtok**

| Variety       | Days to Maturity | Grain yield (kg ha <sup>-1</sup> ) | Gross Return (₹×10 <sup>3</sup> ha <sup>-1</sup> ) | Net Return (₹×10 <sup>3</sup> /ha <sup>-1</sup> ) | Return rupee <sup>-1</sup> invested | Profit ability (₹/ha/ day) | LUE (%) |
|---------------|------------------|------------------------------------|----------------------------------------------------|---------------------------------------------------|-------------------------------------|----------------------------|---------|
| Local Meethay | 110              | 1930                               | 75.13                                              | 31.60                                             | 1.72                                | 86.65                      | 30.37   |
| Local Teethay | 113              | 1250                               | 73.01                                              | 29.48                                             | 1.66                                | 81.03                      | 32.06   |
| IC 104727     | 108              | 1180                               | 75.60                                              | 31.96                                             | 1.70                                | 87.92                      | 29.54   |
| IC 36805      | 119              | 1330                               | 70.95                                              | 27.39                                             | 1.62                                | 75.28                      | 34.19   |
| IC 109729     | 117              | 1930                               | 47.06                                              | 21.72                                             | 1.74                                | 59.77                      | 31.93   |
| IC 15393      | 110              | 1320                               | 62.23                                              | 21.81                                             | 0.47                                | 63.45                      | 29.32   |
| IC 109433     | 121              | 2190                               | 84.26                                              | 40.68                                             | 1.89                                | 111.55                     | 33.17   |
| IC 49671      | 126              | 2140                               | 82.85                                              | 39.37                                             | 1.83                                | 107.83                     | 34.16   |
| IC 2018742    | 119              | 1270                               | 70.34                                              | 26.85                                             | 1.54                                | 73.52                      | 32.84   |
| PRB -1        | 121              | 920                                | 59.47                                              | 24.88                                             | 1.70                                | 68.18                      | 32.89   |
| VL- UGAL      | 124              | 980                                | 42.35                                              | 12.08                                             | 1.27                                | 33.27                      | 34.03   |
| SANGLA B-1    | 116              | 1030                               | 51.33                                              | 21.06                                             | 1.66                                | 58.04                      | 31.49   |
| CD (p=0.05)   | 8.16             | 140                                | 4.68                                               | 4.55                                              | 0.00                                | 12.63                      | 1.12    |



Different Buckwheat varieties at Gangtok



Buckwheat varieties under organic management

### Sardarkrushinagar

**Performance of cowpea:** Yield attributes, yield and economics of different cowpea varieties showed significant variations. Among cowpea varieties except plant population, plant height at harvest, no of branches/ plant and stover yield was non-significant. While Yield attributing characters, number of pods/plants (9.55), and 1000 grain wt. (9.87 g) resulted in significantly higher seed yield (838 kg/ha), net return (41641 ₹/ha) and benefit cost ratio (0.92) were recorded in Gujrat cowpea 4, which was statistically at par with Gujrat cowpea 3. Whereas Gujarat Cowpea 5 was the least productive and economical. (Table 7.2.2.27)

**Performance of amaranth:** A field evaluation was conducted to assess the performance of five amaranth varieties on growth, yield attributes, and economic returns. Gujarat Amaranth 5 recorded the highest Plant population per meter row length (11.5), plant height (156.5 cm), length of inflorescence (63.4) grain yield (1176 kg/ha), straw yield (2662 kg/ha), net return (28929 ₹/ha) and B:C ratio (0.56), which was statistically at par with Gujarat Amaranth 6 and Gujarat Amaranth 3. Whereas BGA 2, recorded the least yield and economically profitable. (Table 7.2.2.28)



**Table 7.2.2.27: Response of different varieties of cowpea for organic farming on yields attributes and yield at SK Nagar.**

| Varieties                        | Plant population (per meter row length) | Plant height (cm) | Number of branches/plant | Number of pods/plant | Test weight (g) | Seed yield (kg/ha) | Stover yield (kg/ha) | Cost of cultivation ( /ha) | Net return ( /ha) | B:C Ratio |
|----------------------------------|-----------------------------------------|-------------------|--------------------------|----------------------|-----------------|--------------------|----------------------|----------------------------|-------------------|-----------|
| Gujarat cowpea3 (National check) | 7.65                                    | 56.05             | 3.75                     | 8.3                  | 8.79            | 833                | 1852                 | 44995                      | 40885             | 0.91      |
| Gujarat Cowpea 4                 | 7.9                                     | 52.55             | 3.75                     | 9.55                 | 9.87            | 838                | 1898                 | 44995                      | 41614             | 0.92      |
| Gujarat Cowpea 5                 | 8.4                                     | 55.1              | 3.55                     | 7.35                 | 6.26            | 655                | 1551                 | 44995                      | 23182             | 0.52      |
| Gujarat Cowpea 6                 | 8.4                                     | 54.6              | 3.9                      | 8.15                 | 8.71            | 792                | 1713                 | 44995                      | 36267             | 0.81      |
| Gujarat Cowpea 7                 | 8.15                                    | 56.45             | 3.6                      | 7.45                 | 7.28            | 694                | 1644                 | 44995                      | 27274             | 0.61      |
| CD (P=0.05)                      | NS                                      | NS                | NS                       | 0.98                 | 1.54            | 132                | NS                   |                            |                   |           |

**Table 7.2.2.28: Yield attributes and yield of different Amaranth varieties at SK Nagar**

| Varieties              | Plant population (per metre row length) | Plant height (cm) | Length of inflorescence/plant(cm) | Girth of inflorescence (cm) | Test weight (g/cc) | Grain yield (kg/ha) | Straw yield (kg/ha) | Cost of cultivation ( /ha) | Net return ( /ha) | B:C Ratio |
|------------------------|-----------------------------------------|-------------------|-----------------------------------|-----------------------------|--------------------|---------------------|---------------------|----------------------------|-------------------|-----------|
| BGA 2 (National check) | 11.2                                    | 138.9             | 55.45                             | 21.7                        | 6.82               | 801                 | 1875                | 51777                      | 3223              | 0.06      |
| Gujarat Amaranth 1     | 11.25                                   | 107.15            | 50.3                              | 22.7                        | 6.84               | 995                 | 2083                | 51777                      | 16452             | 0.32      |
| Gujarat Amaranth 3     | 12.3                                    | 123.9             | 50.55                             | 23.75                       | 6.89               | 1051                | 2315                | 51777                      | 20318             | 0.39      |
| Gujarat Amaranth 5     | 11.45                                   | 156.5             | 63.4                              | 21.75                       | 6.87               | 1176                | 2662                | 51777                      | 28929             | 0.56      |
| Gujarat Amaranth 6     | 11.3                                    | 132.75            | 61.45                             | 22.2                        | 7.01               | 1104                | 2361                | 51777                      | 23935             | 0.46      |
| CD (P=0.05)            | 5.07                                    | 13.58             | 11.86                             | 11.3                        | 5.47               | 12.32               | 12.04               |                            |                   |           |



Best performing cowpea variety GC4 and Amaranth variety GA5 at SK Nagar

### Thiruvananthapuram

A comparative assessment was conducted on six greater yam varieties to evaluate their tuber yield, net income, and benefit-cost (B:C) ratio. Tuber yield of greater yam varieties ranged between 9490 to 13280 kg/plant. The maximum tuber yield was

found in variety Orissa Elite (13280 kg/plant) which was non-significant. In terms of profitability the highest net income was under Orissa Elite (425639 Rs/ha) and B:C ratio (2.15) which was higher than the rest of the varieties. Whereas the least tuber yield, net income and B:C ratio was found in variety Sree Keerthi, and is less preferable compared to others (Table 7.2.2.29).

**Table 7.2.2.29: Yield of greater yam varieties under organic management at Thiruvananthapuram**

| Varieties     | Tuber yield (kg ha <sup>-1</sup> ) | Net income (Rs ha <sup>-1</sup> ) | B:C ratio |
|---------------|------------------------------------|-----------------------------------|-----------|
| Sree Keerthi  | 9490                               | 198107                            | 1.53      |
| Sree Karthika | 11230                              | 302584                            | 1.82      |
| Sree Swathy   | 9880                               | 221684                            | 1.60      |
| Orissa Elite  | 13280                              | 425639                            | 2.15      |
| Sree Nidhi    | 11840                              | 339383                            | 1.91      |
| Sree Neelima  | 10850                              | 279578                            | 1.75      |
| CD (p=0.05)   | NS                                 |                                   |           |



Field view of different varieties of greater yam under organic farming at Thiruvananthapuram

## Udaipur

### Evaluation of response of different varieties of maize and wheat grown in maize–wheat system under organic farming

**Yield and economics of different varieties of black gram:** Among the twelve varieties of maize grown under organic farming, IPU-11-02 excelled across almost all parameters such as plant height (57.2 cm), branches/ plant (7.33), pods/ plant (32), seeds/pod (6.75), test weight (37.8), seed yield (787 kg/ha) and stover yield (1705 kg/ ha), net return (56899 Rs/ha) and net return (2.46). making it the most promising and profitable variety. Which was statistically at par with KU-3, PU-1, MU-2, and IPU-10-26 in terms of yield and economic returns, though slightly lower than IPU-11-02. Whereas the variety UDAI consistently underperformed in all agronomic and economic parameters and is not recommended for cultivation under similar conditions. (Table 7.2.2.30)

**Performance of mustard:** Among the twelve varieties of mustard grown under organic farming condition DRMR-IJ-31 excelled across almost all parameters such as plant height (194.35 cm), branches/ plant (10), no of siliqua/ plant (186), seeds/siliqua (14.88), test weight (4.97), seed yield (1475 kg/ha) and stover yield (5162 kg/ ha), net return (90934 Rs/ha) and net return



(3.81). making it the most promising and profitable variety. Which was statistically at par with NRC-HB-101, PM-25, DRMR-150-35, PM-30 in terms of yield and profitability. Whereas the variety DRMR-1165-40 consistently underperformed in all agronomic and economic parameters and is not recommended for cultivation under similar conditions. (Table 7.2.2.31)

**Table 7.2.2.30: Yield attributes of different varieties of blackgram grown under organic management at Udaipur**

| Varieties   | Plant height (cm) | Number of branches/plants | Number of pods/plant | Number of seeds/pod | Test weight (g) | Seed yield (kg/ha) | Stover yield (kg/ha) | Cost of cultivation (Rs/ha) | Net return (Rs/ha) | Netreturn per rupee invested |
|-------------|-------------------|---------------------------|----------------------|---------------------|-----------------|--------------------|----------------------|-----------------------------|--------------------|------------------------------|
| IPU-11-02   | 57.2              | 7.33                      | 32                   | 6.75                | 37.8            | 787                | 1705                 | 23141                       | 56899              | 2.46                         |
| IPU-13-01   | 53.2              | 6.66                      | 28                   | 5.10                | 36.3            | 556                | 1215                 | 23141                       | 33420              | 1.44                         |
| IPU-10-26   | 54.3              | 6.66                      | 29                   | 5.30                | 36.6            | 583                | 1240                 | 23141                       | 36055              | 1.56                         |
| MU-1        | 49.0              | 5.33                      | 23                   | 4.30                | 34.8            | 417                | 910                  | 23141                       | 19273              | 0.83                         |
| PU-1        | 56.4              | 7.00                      | 30                   | 5.80                | 37.3            | 606                | 1295                 | 23141                       | 38352              | 1.66                         |
| MU-2        | 55.7              | 6.66                      | 30                   | 5.45                | 37.0            | 587                | 1270                 | 23141                       | 36550              | 1.58                         |
| KU-4        | 50.5              | 5.66                      | 25                   | 4.65                | 35.1            | 496                | 1090                 | 23141                       | 27412              | 1.18                         |
| KU-3        | 56.9              | 7.00                      | 31                   | 6.15                | 37.5            | 615                | 1355                 | 23141                       | 39509              | 1.71                         |
| MASH-479    | 49.7              | 5.66                      | 24                   | 4.50                | 35.0            | 426                | 945                  | 23141                       | 20295              | 0.88                         |
| KU-5        | 51.3              | 6.33                      | 26                   | 4.85                | 35.6            | 537                | 1170                 | 23141                       | 31510              | 1.36                         |
| VISHWAS     | 52.0              | 6.33                      | 27                   | 5.00                | 35.9            | 556                | 1210                 | 23141                       | 33393              | 1.44                         |
| UDAI        | 47.6              | 5.00                      | 21                   | 4.10                | 34.4            | 389                | 855                  | 23141                       | 16476              | 0.71                         |
| CD (p=0.05) | 6.2               | 0.749                     | 3.229                | 0.598               | 4.3             | 54.32              | 3.26                 |                             |                    |                              |

**Table 7.2.2.31: Yield attributes and yield of mustard varieties grown under organic farming at Udaipur**

| Varieties     | Plant height (cm) | No. of branches per plant | No. of siliqua /plant | No. of seed per siliqua | Test weight (g) | Seed yield (kg/ha) | Stover yield (kg/ha) | Cost of cultivation (Rs/ha) | Net return (Rs/ha) | Netreturn per rupee invested |
|---------------|-------------------|---------------------------|-----------------------|-------------------------|-----------------|--------------------|----------------------|-----------------------------|--------------------|------------------------------|
| DRMR-1165-40  | 156.70            | 7.00                      | 122                   | 12.65                   | 4.25            | 733                | 2567                 | 23895                       | 33195              | 1.39                         |
| DRMR-2017-15  | 164.20            | 7.66                      | 135                   | 13.12                   | 4.40            | 911                | 3188                 | 23895                       | 47013              | 1.97                         |
| DRMR-IJ-31    | 194.35            | 10.00                     | 186                   | 14.88                   | 4.97            | 1475               | 5162                 | 23895                       | 90934              | 3.81                         |
| DRMR-CI-16-38 | 175.90            | 8.66                      | 152                   | 13.91                   | 4.55            | 1158               | 4054                 | 23895                       | 66281              | 2.77                         |
| DRMR-150-35   | 181.95            | 9.00                      | 164                   | 14.15                   | 4.69            | 1267               | 4433                 | 23895                       | 74715              | 3.13                         |
| NRCYS-05-02   | 148.25            | 7.33                      | 130                   | 13.01                   | 4.37            | 842                | 2946                 | 23895                       | 41629              | 1.74                         |
| NRC-HB-101    | 189.50            | 9.66                      | 177                   | 14.60                   | 4.85            | 1458               | 5104                 | 23895                       | 89636              | 3.75                         |
| PM-25         | 184.70            | 9.33                      | 170                   | 14.35                   | 4.76            | 1417               | 4958                 | 23895                       | 86392              | 3.62                         |
| PM-26         | 171.10            | 8.00                      | 144                   | 13.55                   | 4.47            | 1108               | 3879                 | 23895                       | 62389              | 2.61                         |
| PM-27         | 168.60            | 8.00                      | 139                   | 13.32                   | 4.44            | 1025               | 3587                 | 23895                       | 55901              | 2.34                         |
| PM-28         | 173.45            | 8.33                      | 148                   | 13.73                   | 4.51            | 1125               | 3937                 | 23895                       | 63686              | 2.67                         |
| PM-30         | 177.20            | 8.66                      | 158                   | 14.02                   | 4.61            | 1225               | 4287                 | 23895                       | 71471              | 2.99                         |
| CD (p=0.05)   | 21.316            | 1.057                     | 19.186                | 1.668                   | 0.554           | 117.48             | 411.18               |                             |                    |                              |

## 7.2.3: Evaluation of organic management practices for insect pest in various crops

### Objective

- To evaluate the organic management practices for reducing the incidence of insect pests in major crops
- To identify the package of insect pest management for organic production system

**Year of start:** 2015-16

**Location:** Ajmer and Udaipur (Rajasthan), Almora (Uttarakhand), Coimbatore (TN) and Gangtok (Sikkim).

Centre wise results for each centre are presented below

### Ajmer

a) **Effect of different organic IPM modules for management of sucking-pests:** Six Integrated Pest Management (IPM) modules (M1 to M6) evaluated for their effectiveness in reducing thrips population and increasing fennel yield. Each module combines different organic and botanical treatments. The highest percent reduction of thrips was recorded in M3 (71.10% in fennel and 67.61% in coriander), which used garlic extract, azadirachtin, and tumba fruit extract. This module also achieved the highest fennel yield (2336 kg/ha). In contrast, the untreated control (M6) had no reduction in pest population and the lowest yield (1443 kg/ha). Other effective modules included M2 (NSKE + ker extract) and M4 (datura leaf extract with fermented buttermilk and *Verticillium lecanii*), which also showed good pest control and yield outcomes (Table 7.2.3.1).

**Table 7.2.3.1: Effect of different IPM module on yield and infestation (percent reduction) of sucking-pests**

| IPM module                                                                                                       | Percent reduction of thrips population |           | Fennel yield (kg/ha) |
|------------------------------------------------------------------------------------------------------------------|----------------------------------------|-----------|----------------------|
|                                                                                                                  | Fennel                                 | Coriander |                      |
| M1 : Sanitation + sticky trap 25 no./ha.+ neem guard 3 ml/lit.                                                   | 57.25                                  | 57.56     | 1687                 |
| M2: Field sanitation+ NSKE 5ml/lit +Ker extract 10 ml/lit.                                                       | 69.10                                  | 64.84     | 2047                 |
| M3: Garlic extract 10 ml/lit + azadirachtin 0.03% EC @ 5ml/lit + tumba fruit extract 10ml/lit.                   | 71.10                                  | 67.61     | 2336                 |
| M4: Datura leaf extract 10ml/lit + cow urine + butter milk (fermented) 50% + <i>Verticillium lecanii</i> 5g/lit. | 64.38                                  | 62.20     | 1827                 |
| M5; Neem oil 3 ml/lit + Castor leaf extract 10ml/lit + tumba fruit extract 10ml/lit.                             | 60.29                                  | 57.86     | 1756                 |
| M6: Untreated Control                                                                                            | 0.00                                   | 0.00      | 1443                 |

b) **Evaluation of plant extracts and bio-pesticides against sucking pests on coriander under organic production system:** The efficacy of various plant extracts and bio-pesticides (T1 to T9) were evaluated in reducing thrips, aphids, and whitefly populations on coriander. Among the treatments, Nimbecidine (T6) was most effective, with the highest reduction in all three pests: 66.26% for thrips, 70.76% for aphids, and 60.34% for whiteflies. *Verticillium lecanii* (T7) and neem leaf extract (T4) also showed strong pest suppression. Datura leaf extract (T3) and cow urine (T8) performed moderately well, while the control (T9) had no pest reduction. This table highlights the comparative potential of both botanical and microbial agents in managing sucking pests in coriander crops (Table 7.2.3.2).



**Table 7.2.3.2: Effect of plant extracts and bio-pesticides against sucking pests on coriander**

| Plant extracts and bio-pesticides details         | Per cent reduction in population |        |           |
|---------------------------------------------------|----------------------------------|--------|-----------|
|                                                   | Thrips                           | Aphids | White fly |
| T1- Lantana camera leaf extract-10%               | 44.67                            | 47.56  | 41.52     |
| T2- Chrysanthemum leaf extract-10%                | 49.08                            | 46.99  | 42.99     |
| T3- Datura leaf extract-10%                       | 51.62                            | 61.78  | 50.75     |
| T4 Neem leaf extract – 10%                        | 58.95                            | 63.47  | 54.12     |
| T5- Castor leaf extract-10%                       | 48.33                            | 52.58  | 44.48     |
| T6- Nimbecidine 0.03EC- 5ml/lit. (standard check) | 66.26                            | 70.76  | 60.34     |
| T7- Verticillium lecani- 5g/lit.                  | 61.24                            | 68.42  | 48.74     |
| T8-Cow urine -20%                                 | 53.79                            | 44.59  | 57.62     |
| T9- Control                                       | 0.00                             | 0.00   | 00.0      |

### Almora

The experiment conducted in lab as well as in field to test the efficacy of different bio-pesticides for management of sucking pest in soybean and toria:

**Evaluation of botanicals and bio-pesticides in laboratory and field against soybean sucking bug (Table 7.2.3.3):** A comparative evaluation of various botanical and bio-pesticide treatments against soybean sucking bugs under both laboratory and field conditions at different time intervals—24, 48, and 72 hours after treatment (HAT). Among all treatments, Diafenthiuron (0.3 g/L) exhibited the highest mortality, achieving 100% kill in both laboratory and field trials within 48 hours. In contrast, botanical treatments like Thuja seed extract (5%), Timu leaf extract (5%), and Eupatorium leaf extract (5%) showed moderate efficacy, with Eupatorium performing best in the field at 72 HAT (65.5% mortality). Other botanicals such as Parthenium leaf extract, Melia azedarach seed extract, and Dashparni ark provided lower but progressively increasing mortality over time. NSKE-based formulation also showed consistent though moderate mortality, while the control treatment exhibited negligible mortality across all time points, validating the effectiveness of the tested botanicals and bio-pesticides. Overall, the results highlight the potential of some botanical extracts, especially Eupatorium and Timu, as eco-friendly alternatives to synthetic insecticides.

**Table 7.2.3.3: Evaluation of botanicals and bio-pesticides against Soybean sucking Bug under different condition at Almora**

| Treatments                      | Laboratory mortality (%) |        |        | Field mortality (%) |        |        |
|---------------------------------|--------------------------|--------|--------|---------------------|--------|--------|
|                                 | 24 HAT                   | 48 HAT | 72 HAT | 24 HAT              | 48 HAT | 72 HAT |
| Parthenium Leaf extract 5%      | 21.1                     | 33.3   | 48.9   | 16.9                | 42.4   | 51.0   |
| Timu leaf extract 5%            | 16.7                     | 40.0   | 51.1   | 21.1                | 47.9   | 55.4   |
| Thuja seed extract 5%           | 18.9                     | 47.8   | 60.0   | 16.0                | 38.7   | 50.8   |
| Eupatorium leaf extract 5%      | 15.6                     | 27.8   | 43.3   | 23.7                | 57.9   | 65.5   |
| Melia Azedarach seed extract 5% | 16.7                     | 26.7   | 44.4   | 24.2                | 45.2   | 55.3   |
| NSKE based formulation 3ml/L    | 23.3                     | 34.4   | 45.6   | 19.6                | 41.2   | 61.0   |
| Diafenthiuron 0.3 g/L           | 73.3                     | 100.0  | 100.0  | 96.8                | 100.0  | 100.0  |
| Dashparni ark 25 ml/litre       | 14.4                     | 31.1   | 52.2   | 24.3                | 44.3   | 54.7   |
| Control                         | 0.0                      | 2.2    | 5.6    | 3.6                 | 0.0    | 2.5    |

**Evaluation botanicals and bio-agents on toria aphids under lab and field condition (Table 7.2.3.2):** Among the different botanicals and bio-agents, In laboratory conditions, Diafenthiuron showed the highest mortality, reaching 100% by 72 HAT, followed by NSKE-based formulation with 68.3%. Among botanicals, Melia azedarach and Eupatorium leaf extracts were the most effective, achieving around 36–37% mortality at 72 HAT. In field conditions, Diafenthiuron again led with 100% mortality, while botanicals like Timu, Eupatorium, and Melia azedarach reached up to 40% mortality at 72 HAT. The control treatment showed negligible mortality, confirming the effectiveness of these treatments in managing aphid populations, especially under lab settings. (Table 7.2.3.4).

**Table 7.2.3.4: Effect of botanicals and bio-agents on toria aphids in laboratory and field conditions**

| Plant extract and Concentration | Laboratory mortality (%) |        |        | Field mortality (%) |        |        |
|---------------------------------|--------------------------|--------|--------|---------------------|--------|--------|
|                                 | 24 HAT                   | 48 HAT | 72 HAT | 24 HAT              | 48 HAT | 72 HAT |
| Parthenium Leaf extract 5%      | 6.0                      | 18.0   | 30.3   | 0.0                 | 6.7    | 30.0   |
| Timu leaf extract 5%            | 7.7                      | 16.0   | 28.7   | 0.0                 | 20.0   | 40.0   |
| Thuja seed extract 5%           | 12.0                     | 16.7   | 26.3   | 0.0                 | 20.0   | 26.7   |
| Eupatorium leaf extract 5%      | 6.3                      | 14.0   | 33.7   | 6.7                 | 20.0   | 40.0   |
| Melia Azedarach seed extract 5% | 9.0                      | 17.0   | 36.7   | 6.7                 | 13.3   | 40.0   |
| NSKE based formulation 3ml/L    | 19.3                     | 31.7   | 68.3   | 3.3                 | 13.3   | 23.3   |
| Diafenthiuron 0.3 g/L           | 46.7                     | 83.7   | 100.0  | 48.3                | 90.0   | 100.0  |
| Dashparni ark 25 ml/litre       | 9.7                      | 21.3   | 33.7   | 3.3                 | 13.3   | 13.3   |
| Control                         | 0.0                      | 0.0    | 0.0    | 0.0                 | 0.0    | 1.0    |

## Gangtok

**Organic insect pest management in maize (Table 7.2.3.5):** The results from Table 7.2.3.5 indicate that among the tested bio-pesticide treatments for managing insect pests in maize, Spinosad 45 SC @ 0.3 ml/l was the most effective, recording the lowest insect score (IS) of 1.2, lowest post-treatment damage (DAS) of 3.20%, highest percent damage control (DC) at 82.60%, and the highest grain yield (GY) of 3320 kg/ha. This was followed by Beauveria bassiana and Hortispray, which also showed good pest control and relatively high yields of 2900 kg/ha and 2500 kg/ha, respectively. In contrast, the control plot recorded the highest pest infestation (IS: 6.20, DAS: 9.4%) and the lowest grain yield (240 kg/ha).

**Table 7.2.3.5: Effect of bio pesticide on insect pest management in maize**

| Treatments                               | Stem borer infestation (%) |          |          |         |               |
|------------------------------------------|----------------------------|----------|----------|---------|---------------|
|                                          | IS<br>(0-9 scale)          | %<br>DBS | %<br>DAS | %<br>DC | GY<br>(kg/ha) |
| Neem oil (1500 ppm) @ 4 ml/l             | 3.35                       | 8.65     | 5.40     | 71.22   | 1990          |
| Beauveria bassiana @ 7 g/l               | 1.68                       | 7.92     | 4.50     | 76.20   | 2900          |
| Metarhizium anisopliae @ 5 ml/l          | 3.25                       | 8.68     | 5.55     | 70.32   | 2280          |
| Petroleum oil based agrospray @ 10 ml/l  | 4.78                       | 9.55     | 6.48     | 64.25   | 1400          |
| Petroleum oil based hortispray @ 10 ml/l | 2.40                       | 7.85     | 5.20     | 74.34   | 2500          |
| Bacillus thuringiensis @ 2 g/l           | 4.20                       | 9.5      | 6.05     | 63.62   | 1860          |
| Spinosad 45 SC @ 0.3 ml/l                | 1.2                        | 5.80     | 3.20     | 82.60   | 3320          |
| Control                                  | 6.20                       | 8.5      | 9.4      | 61.40   | 240           |
| CD (p=0.05)                              | 0.88                       | 1.05     | 0.70     | 7.10    | 320           |



Note\* IS: Insect Score, % DBS: Percent damage before spray, % DAS: Percent damage after spray, % DC: Percent damage control and GY: Grain Yield



## Coimbatore

Evaluation of organic production practices for the management for insect-pest in cotton and maize

Treatment details:

| Crop   | Details                                                                                                                                                                                                                                                                                                                                                                                                                                                    |
|--------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Cotton | <p>Studies on the effect of cow urine based extracts of ginger, garlic and green chilli for the management of major insect pests</p> <p>T1 : Ginger extract 5 %</p> <p>T2 : Garlic extract 5 %</p> <p>T3 : Green chilli extract 5 %</p> <p>T4 : Ginger extract 5 % + Garlic extract 5 % + Green chilli extract 5 %</p> <p>T5 : Cow urine alone 5 %</p> <p>T6 : Neem Seed Kernel Extract 5 % (Standard check)</p> <p>T7 : Untreated check (Water spray)</p> |
| Okra   | <p>Studies on the effect of cow urine based extracts of ginger, garlic and green chilli for the management of major insect pests</p> <p>T1 : Ginger extract 5 %</p> <p>T2 : Garlic extract 5 %</p> <p>T3 : Green chilli extract 5 %</p> <p>T4 : Ginger extract 5 % + Garlic extract 5 % + Green chilli extract 5 %</p> <p>T5 : Cow urine alone 5 %</p> <p>T6 : Neem Seed Kernel Extract 5 % (Standard check)</p> <p>T7 : Untreated check (Water spray)</p> |

|       |                                                                                             |                                     |
|-------|---------------------------------------------------------------------------------------------|-------------------------------------|
| Maize | Studies on the effect of herbal leaf extracts for the management of fall army worm in maize |                                     |
|       | T1                                                                                          | : Agniasthra 10 %                   |
|       | T2                                                                                          | : Cow dung - Cow urine extract 10 % |
|       | T3                                                                                          | : Five leaf herbal extract 10 %     |
|       | T4                                                                                          | : Lantana - Calotropis extract 10 % |
|       | T5                                                                                          | : Arappu - Buttermilk extract 10 %  |
|       | T6                                                                                          | : 3G extract 10 %                   |
|       | T7                                                                                          | : Cow urine alone 10 %              |
|       | T8                                                                                          | : Neem Azal (1 %) 2ml/lit           |
|       | T9                                                                                          | : Thiodicarb 75 % WP 2g/lit         |
|       | T10                                                                                         | : Untreated check (Water spray)     |

**Best performing treatment under of organic insect & pest management practices in various crops** (Table 7.2.3.6): Among the organic management practices against insect pests in various crops at Coimbatore, application of ginger, garlic, and green chilli extract at 5% concentration was highly effective in cotton, bhendi, and maize, achieving pest incidence reductions of up to 64.21% (aphids in cotton) and yielding 1514 kg/ha in cotton, 11,764 kg/ha in bhendi, and 5123 kg/ha in maize. The Organic Integrated Pest and Disease Management (OIPDM) module performed best in crops like bhendi, brinjal, tomato, and chilli, with the highest pest reduction of 75.45% in aphids (chilli) and corresponding high yields, notably 17,803 kg/ha in brinjal, 16,634 kg/ha in tomato, and 13,740 kg/ha in chilli. Overall, both treatments significantly reduced pest incidence and enhanced yields, with the OIPDM module consistently showing superior pest suppression in solanaceous crops.

**Table 7.2.3.6: Best performing treatment under of organic insect & pest management practices in various crops**

| Name of the Crop | Insect pest           | Best performing treatment                     | Reduction in incidence compared to control (%) | Yield (kg/ha) |
|------------------|-----------------------|-----------------------------------------------|------------------------------------------------|---------------|
| Cotton           | Leafhoppers           | Ginger, garlic and green chilli extract @ 5 % | 46.22                                          | 1514          |
|                  | Thrips                |                                               | 40.36                                          |               |
|                  | Whiteflies            |                                               | 49.12                                          |               |
|                  | Aphids                |                                               | 64.21                                          |               |
| Bhendi           | Leafhoppers           | Ginger, garlic and green chilli extract @ 5 % | 44.82                                          | 11764         |
|                  | Whiteflies            |                                               | 46.54                                          |               |
|                  | Aphids                |                                               | 53.77                                          |               |
| Maize            | Fall armyworm         | Ginger, garlic and green chilli extract @ 5 % | 52.62                                          | 5123          |
| Bhendi           | Leafhoppers           | OIPDM module                                  | 64.22                                          | 11764         |
|                  | Aphids                |                                               | 58.15                                          |               |
|                  | Whiteflies            |                                               | 47.28                                          |               |
| Brinjal          | Shoot and fruit borer | OIPDM module                                  | 58.81                                          | 17803         |
|                  | Brown Leafhoppers     |                                               | 48.42                                          |               |
| Tomato           | Thrips                | OIPDM module                                  | 58.34                                          | 16634         |
|                  | Whiteflies            |                                               | 61.28                                          |               |
| Chilli           | Aphids                | OIPDM module                                  | 75.45                                          | 13740         |
|                  | Thrips                |                                               | 48.26                                          |               |
|                  | Whiteflies            |                                               | 57.2                                           |               |



## 7.2.4: Evaluation of organic management practice for diseases in crops

### Objective:

- To evaluate the management practices for management of diseases in high value crops
- To identify the suitable package for management of important diseases in selected crops

**Year of start:** 2015-16

**Locations:** (3) Ajmer (Rajasthan) Coimbatore (Tamil Nadu) and Gangtok (Sikkim).

**Results:** Centre wise results for each centre is presented below

### Ajmer

#### Management of Sclerotium rot of coriander and Ramularia blight of fennel

i. **Management of Sclerotium rot of coriander** (Table 7.2.4.1): Results indicated that, soil solarization for 21 days resulted in the lowest disease incidence (4.5%) and the highest yield (720 kg/ha), followed closely by Trichoderma application (5.5% disease, 700 kg/ha) and neem cake (5.3%, 710 kg/ha). Castor cake was comparatively less effective, with 6.6% disease and 590 kg/ha yield. The untreated control recorded the highest disease incidence (9.3%) and the lowest yield (443 kg/ha). These results indicate that soil solarization and biological amendments like Trichoderma and neem cake significantly reduced disease and improved yield.

**Table 7.2.4.1 Influence of different treatments on Sclerotium rot disease of coriander**

| Treatments                    | Coriander            |               |
|-------------------------------|----------------------|---------------|
|                               | Sclerotium Rot (PDI) | Yield (kg/ha) |
| Soil solarization (21 days)   | 4.5                  | 720           |
| Trichoderma (Soil & Seed App) | 5.5                  | 700           |
| Neem cake (0.5 T/ha)          | 5.3                  | 710           |
| Castor cake (0.5 T/ha)        | 6.6                  | 590           |
| Control                       | 9.3                  | 443           |
| CD (p=0.05)                   |                      | 112           |

\*PDI= Per cent disease incidence

ii. **Management of ramularia blight in fennel and powdery mildew disease in coriander** (Table 7.2.4.2): This table shows the effectiveness of botanical treatments on ramularia blight in fennel and powdery mildew in coriander, along with corresponding yields. Garlic extract (0.5%) was most effective in reducing ramularia blight in fennel (5.7%) and gave the highest fennel yield (1910 kg/ha), while neem oil (7.5%) also performed well with a yield of 1640 kg/ha. For coriander, neem oil was most effective in reducing powdery mildew (6.88%) and yielded 1010 kg/ha. Garlic extract was less effective against mildew (16.25%) and gave a lower yield (820 kg/ha). The control plots showed the highest disease incidence (15.3% in fennel and 32.5% in coriander) and the lowest yields, indicating the effectiveness of botanical treatments, especially neem oil and garlic extract..

**Table 7.2.4.2: Effect of different treatments on ramularia blight and powdery mildew on fennel and coriander**

| Treatments            | Fennel                 |               | Coriander            |               |
|-----------------------|------------------------|---------------|----------------------|---------------|
|                       | Ramularia Blight (PDI) | Yield (kg/ha) | Powdery mildew (PDI) | Yield (kg/ha) |
| Neem oil (0.5%)       | 7.5                    | 1640          | 6.88                 | 1010          |
| Castor oil (0.5%)     | 11.4                   | 1420          | 11.25                | 940           |
| Garlic extract (0.5%) | 5.7                    | 1910          | 16.25                | 820           |
| Onion extracts (0.5%) | 10.0                   | 1450          | 22.50                | 780           |
| Control               | 15.3                   | 1220          | 32.50                | 680           |

### Coimbatore

Evaluation of organic management practice for diseases in crops (Table 7.2.4.3):

- In bhendi, the Organic Integrated Pest and Disease Management (OIPDM) module—comprising erection of bird perches, installation of yellow sticky traps and pheromone traps (5 per acre), border cropping with cowpea, barrier cropping with sorghum, foliar spray of azadirachtin 10,000 ppm @ 2 ml per litre, application of fermented buttermilk with *Bacillus subtilis* @ 0.5%, followed by foliar spray of panchagavya @ 3%—proved effective in reducing the incidence of yellow vein clearing disease by 74.38% over the control. This treatment also recorded the highest yield of 11,764 kg/ha.
- In brinjal, the OIPDM module with similar interventions recorded the maximum reduction in the incidence of little leaf disease (86.28% reduction over control), along with the highest yield of 17,803 kg/ha.
- In tomato, the OIPDM module—consisting of bird perches, yellow sticky traps, pheromone traps @ 5 per acre, border cropping with cowpea, barrier cropping with sorghum, and foliar spray of *Bacillus subtilis* @ 0.5%—was effective in controlling multiple diseases: leaf blight (58.65% reduction), tomato leaf curl virus (78.45% reduction), and tomato spotted wilt virus (83.55% reduction) over the control. The resulting yield was 16,634 kg/ha.
- In chilli, the OIPDM module with the complete set of practices (as in bhendi and brinjal) effectively reduced the incidence of yellow leaf curl disease by 62.82% over control and recorded a higher yield of 13,740 kg/ha.

**Table 7.2.4.3: Evaluation of organic management practice for diseases in crops**

| Name of the Crop | Disease                              | Best performing treatment | Reduction in incidence compared to control (%) | Yield (kg/ha) |
|------------------|--------------------------------------|---------------------------|------------------------------------------------|---------------|
| Bhendi           | Yellow vein clearing disease (Virus) | OIPDM                     | 74.38                                          | 11764         |
| Brinjal          | Little leaf disease (MLO)            | OIPDM                     | 86.28                                          | 17803         |
| Tomato           | Early blight (Fungal)                | OIPDM                     | 58.65                                          | 16634         |
|                  | Tomato leaf curl virus               | OIPDM                     | 78.45                                          |               |
|                  | Tomato spotted wilt virus            | OIPDM                     | 83.55                                          |               |
| Chilli           | Yellow leaf curl disease (Virus)     | OIPDM                     | 62.82                                          | 13740         |

### Gangtok

Effect of biopesticide on organic disease management in maize-based cropping system

Among the treatments, Spinosad 45 SC @ 0.3 ml/l was the most effective, resulting in the lowest *Turcicum* leaf blight incidence (20.35%) and the highest grain yield (3320 kg/ha). This was followed by *Beauveria bassiana* @ 7 g/l and Petroleum oil-based hortispray @ 10 ml/l, which also showed relatively low disease incidence (21.60% and 24.30%, respectively) and high yields (2900 and 2500 kg/ha). In contrast, the control recorded the highest disease incidence (54.15%) and the



lowest yield (240 kg/ha), indicating the clear advantage of biopesticide applications for disease management and yield improvement in maize under organic conditions.

**Table 7.2.4.4: Effect of biopesticide on organic disease management in maize**

| Treatments                               | Turcicum leaf blight Disease incidence (%) | Grain yield (kg/ha) |
|------------------------------------------|--------------------------------------------|---------------------|
| Neem oil (1500 ppm) @ 4 ml/l             | 41.44                                      | 1990                |
| Beauveria bassiana @ 7 g/l               | 21.60                                      | 2900                |
| Metarhizium anisopliae @ 5 ml/l          | 30.20                                      | 2280                |
| Petroleum oil based agrospray @ 10 ml/l  | 45.22                                      | 1400                |
| Petroleum oil based hortispray @ 10 ml/l | 24.30                                      | 2500                |
| Bacillus thuringiensis @ 2 g/l           | 43.15                                      | 1860                |
| Spinosad 45 SC @ 0.3 ml/l                | 20.35                                      | 3320                |
| Control                                  | 54.15                                      | 240                 |
| CD (p=0.05)                              | 9.92                                       | 320                 |

## 7.2.5: Evaluation and Validation of Natural Farming Practices in different Agro-ecologies

### Objectives

1. To document the natural farming practices adopted by farmers in different regions
2. To characterize the inputs used under natural farming
3. To study the influence of natural farming practices on crop productivity, soil health and economics in different agro ecologies
4. To evaluate and integrate the natural farming inputs in to organic farming packages

**Year of Start:** The experiment was originally planned during November 2019 in Annual Group Meeting with the aim of to extend the study on Natural Farming practices on different crops in various regions to identify the crops and regions where the low input based Natural Farming (NF) practices can be recommended. The study was started from kharif 2020. Studies were undertaken at 20 locations covering 16 states.

A total 77 natural farming farmers located in 45 blocks under 17 districts covering 11 States were surveyed under geo-referenced characterization for natural farming. Land holding size were characterized ranging from 0.41 to 1.15 for marginal, 0.6 to 3.0 small and 2.34 to 10.6 ha. Cow, goat poultry are the major livestock maintained by the farmers. Jeevamrit, Ghanjeevamrit, Beejamrit, Neemastra,, Bramhastra and Dasparni extract etc. are major source of input using for crop production. Difficulty in preparation of natural farming input, self-life of organic inputs is very less and selling of product are the major constraints. Details are presented in chapter 7.1.1.

**Detail of treatments:** Treatments: 5, Replications: 3, Design: RBD, Plot size: Minimum 100 m<sup>2</sup> /treatment/ replication.

| Treatments     | Details                                                                                                                                                                                                                      |
|----------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| T <sub>1</sub> | Control (No addition of any inputs except labour for operations including weeding)                                                                                                                                           |
| T <sub>2</sub> | Complete NF (1. Beejamrit + Ghanjeevamrit + Jeevamrit; 2. Crop residue mulching; 3. Intercropping; 4. Whapasa)                                                                                                               |
| T <sub>3</sub> | AI-NPOF package                                                                                                                                                                                                              |
| T <sub>4</sub> | Integrated Crop Management (50% nutrient application through organic manures and 50% nutrient application through inorganic sources with the use of Neemastra, Agniastra, Brahmastra, and Dashparni ark for pest management) |
| T <sub>5</sub> | Integrated Crop Management (50% nutrient application through organic manures and 50% nutrient application through inorganic sources with application of need-based pesticides for pest management)                           |

Locations and cropping systems: 20 centers with 08 major commonly practiced cropping systems were undertaken. Location-wise details of cropping systems and mulching materials are as under:

| Locations                   | Cropping system                                            | Mulching material                                                     |
|-----------------------------|------------------------------------------------------------|-----------------------------------------------------------------------|
| Ajmer, Udaipur and SK Nagar | Groundnut + sesame – fennel + cabbage                      | Stover of fennel during kharif and leaves of fennel during rabi       |
| Almora, Bajaura and Gangtok | Soybean + maize (2:1) – garden pea + green coriander (2:1) | Wheat straw during kharif & maize straw during rabi                   |
| Bhopal, Jabalpur and Raipur | Soybean + maize – wheat + mustard                          | Mustard residue mulch during Kharif and soybean residue mulch in rabi |
| Coimbatore and Dharwad      | Cotton + green gram – sorghum + chickpea                   | Maize stover @ 5 t/ha in both the seasons                             |



|                                   |                                                    |                                                        |
|-----------------------------------|----------------------------------------------------|--------------------------------------------------------|
| Calicut and Umiam                 | Turmeric + cowpea                                  | Dried coconut leaves /other plants as per availability |
| Karjat, Ranchi and Narendrapur    | Rice + dhaincha – maize grain/ sweet corn + cowpea | Azolla in kharif<br>Rice straw in rabi                 |
| Ludhiana, Modipuram and Pantnagar | Maize + cowpea – wheat + chickpea                  | Rice straw @ 5 t/ha in both the seasons                |
| Thiruvananthapuram                | Cassava + vegetable cowpea – green gram            | Residue mulching @ 5 t/ha as per availability          |

The results of each center are presented below

Ajmer, Udaipur, and Sardarkrushinagar followed the same cropping system: groundnut + sesame – fennel + cabbage.

**Ajmer:** Complete natural farming recorded system equivalent yield of 2487 kg/ha which is 10.9% and 9.3% decrease than organic and integrated crop management + chemical pesticides (ICMCP) respectively. Under complete natural farming, soil organic carbon recorded higher (0.36%) compared to control (0.26%). Complete natural farming recorded net return of Rs. 1,29,980 with cost of cultivation of Rs. 52,487. Natural farming resulted in reduction in cost of cultivation by 44.3% and 23.5% over organic and integrated crop management + chemical pesticides (ICMCP) respectively.

|                                                                                     |                                                                                      |
|-------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------|
|   |   |
| Groundnut + sesame under AI-NPOF package                                            | Groundnut + sesame under NF Practice                                                 |
|  |  |
| Coriander under complete NF                                                         | Coriander under AINP-OF                                                              |

**Udaipur:** Complete natural farming recorded system equivalent yield of 3093 kg/ha which is 27.3% and 33.9% decrease than organic and integrated crop management + chemical pesticides (ICMCP) respectively. Under complete natural farming, soil organic carbon recorded numerically higher (0.70%) compared to control (0.66%). Complete natural farming recorded net return of Rs. 2,40,953 with cost of cultivation of Rs. 68,485. Natural farming resulted in reduction in cost of cultivation by 36.8% and 24.3% over organic and integrated crop management + chemical pesticides (ICMCP) respectively.



Groundnut +sesame under complete NF and AI-NPOF package during kharif at Udaipur



Fennel +cabbage under complete NF and AI-NPOF package during rabi at Udaipur

**Sardarkrushinagar:** Complete natural farming recorded system equivalent yield of 2527 kg/ha which is 9.1% and 17.8% decrease than organic and integrated crop management + chemical pesticides (ICMCP) respectively. Under complete natural farming, soil organic carbon recorded numerically higher (0.21%) compared to control (0.16%). Complete natural farming recorded net return of Rs. 1,02,900 with cost of cultivation of Rs. 86,932. Natural farming resulted in reduction in cost of cultivation by 24.2% and 2.4% over organic and integrated crop management + chemical pesticides (ICMCP) respectively.



Groundnut +sesame under complete NF package and AI-NPOF during kharif at SK Nagar



Fennel +cabbage under complete NF and AI-NPOF package during rabi at SK Nagar

Almora, Bajaura and Gangtok followed the same cropping system : Soybean + maize – garden pea + green coriander

**Almora:** Complete natural farming recorded system equivalent yield of 7431 kg/ha which is 26.8% and 38.4% decrease than organic and integrated crop management + chemical pesticides (ICMCP) respectively. Under complete natural farming, soil organic carbon recorded numerically higher (1.27%) compared to control (1.06%). Complete natural farming recorded net return of Rs. 1,28,969 with cost of cultivation of Rs. 1,72,418. Natural farming resulted in reduction in cost of cultivation by 8.8% and –4.6% over organic and integrated crop management + chemical pesticides (ICMCP) respectively.



Soybean + maize under NF during kharif and Pea+coriander during rabi at Almora

**Bajaura:** Complete natural farming recorded system equivalent yield of 7578 kg/ha which is 17.6% and 25.3% decrease than organic and integrated crop management + chemical pesticides (ICMCP) respectively. Under complete natural farming, soil organic carbon recorded numerically higher (0.76%) compared to control (0.71%). Complete natural farming recorded net return of Rs. 2,45,213 with cost of cultivation of Rs. 2,23,176. Natural farming resulted in reduction in cost of cultivation by 24.5% and 4.3% over organic and integrated crop management + chemical pesticides (ICMCP) respectively.



Soybean+ maize system under NF, AINP-OF & ICM at Bajaura during kharif



Pea+ green coriander under NF, AI-NPOF & ICM practice at Bajaura during rabi

**Gangtok:** Complete natural farming recorded system equivalent yield of 8076 kg/ha which is 8.2% increase than organic. Under complete natural farming, soil organic carbon recorded numerically higher (1.55%) compared to control (1.52%). Complete natural farming recorded net return of Rs. 201 with cost of cultivation of Rs. 36,020. Natural farming resulted in increase in cost of cultivation by 8.1% over organic.



Performance of Maize + Soybean- Pea + Coriander under complete NF at Sikkim

Bhopal, Jabalpur and Raipur followed the same cropping system i.e. Soybean + maize – wheat + mustard

**Bhopal:** Complete natural farming recorded system equivalent yield of 2180 kg/ha which is 23.7% and 38.6% decrease than organic and integrated crop management + chemical pesticides (ICMCP) respectively. Under complete natural farming, soil organic carbon recorded numerically higher (0.67%) compared to control (0.61%). Complete natural farming recorded net return of Rs. 55,159 with cost of cultivation of Rs. 41,362. Natural farming resulted in reduction in cost of cultivation by 23.3% and 21.9% over organic and integrated crop management + chemical pesticides (ICMCP) respectively.



Performance of soybean +maize under complete NF, AINP-OF and ICM at Bhopal



**Jabalpur:** Complete natural farming recorded system equivalent yield of 1316 kg/ha which is 17.8% and 52.9% decrease than organic and integrated crop management + chemical pesticides (ICMCP) respectively. Under complete natural farming, soil organic carbon recorded numerically higher (0.62%) compared to control (0.60%). Complete natural farming recorded net return of Rs. 38,668 with cost of cultivation of Rs. 36,630. Natural farming resulted in reduction in cost of cultivation by 29.3% and 25.7% over organic and integrated crop management + chemical pesticides (ICMCP) respectively.

**Raipur:** Complete natural farming recorded system equivalent yield of 2580 kg/ha which is 28.3% and 33.2% decrease than organic and integrated crop management + chemical pesticides (ICMCP) respectively. Under complete natural farming, soil organic carbon recorded numerically higher (0.62%) compared to control (0.55%). Complete natural farming recorded net return of Rs. 70,029 with cost of cultivation of Rs. 59,397. Natural farming resulted in reduction in cost of cultivation by 26.1% and 18.2% over organic and integrated crop management + chemical pesticides (ICMCP) respectively.

Coimbatore and Dharwad followed the same cropping system: cotton + greengram – sorghum + chickpea

**Coimbatore:** Complete natural farming recorded system equivalent yield of 2794 kg/ha which is 8.7% and 17.9% decrease than organic and integrated crop management + chemical pesticides (ICMCP) respectively. Under complete natural farming, soil organic carbon recorded numerically higher (1.11%) compared to control (0.81%). Complete natural farming recorded net return of Rs. 81,008 with cost of cultivation of Rs. 1,08,260. Natural farming resulted in reduction in cost of cultivation by 17.9% and 24.6% over organic and integrated crop management + chemical pesticides (ICMCP) respectively.

**Dharwad:** Complete natural farming recorded system equivalent yield of 3216 kg/ha which is 3.3% decrease than organic and 2.0% increase over integrated crop management + chemical pesticides (ICMCP). Soil organic carbon and economic data were not available.



Calicut and Umiam followed the same cropping system: Turmeric –fellow

**Calicut:** Complete natural farming recorded system equivalent yield of 16,250 kg/ha which is 12.6% decrease than organic and 32.1% increase over integrated crop management + chemical pesticides (ICMCP). Soil organic carbon data was not available. Complete natural farming recorded net return of Rs. 1,10,540 with cost of cultivation of Rs. 1,85,300.

**Umiam:** Complete natural farming recorded system equivalent yield of 12,580 kg/ha which is 42.7% and 37.7% decrease than organic and integrated crop management + chemical pesticides (ICMCP) respectively. Soil organic carbon data was not available. Complete natural farming recorded net return of Rs. 71,365 with cost of cultivation of Rs. 60,397. Natural farming resulted in reduction in cost of cultivation by 20.1% and 18.2% over organic and integrated crop management + chemical pesticides (ICMCP) respectively.

Karjat, Ranchi and Narendrapur followed same cropping system i.e. Rice + dhaincha – maize grain/sweet corn + cow pea



Performance of Turmeric at Calicut and Umiam under complete NF practice

**Kajrat:** Complete natural farming recorded system equivalent yield of 7951 kg/ha which is 36.3% and 43.6% decrease than organic and integrated crop management + chemical pesticides (ICMCP) respectively. Under complete natural farming, soil organic carbon recorded numerically higher (1.05%) compared to control (1.00%). Complete natural farming recorded net return of Rs. 65,147 with cost of cultivation of Rs. 99,793. Natural farming resulted in reduction in cost of cultivation by 25.4% and 15.5% over organic and integrated crop management + chemical pesticides (ICMCP) respectively.



Performance of rice + dhaincha under natural farming at Karjat

**Ranchi:** Complete natural farming recorded system equivalent yield of 4112 kg/ha which is 11.8% and 14.1% decrease than organic and integrated crop management + chemical pesticides (ICMCP) respectively. Under complete natural farming, soil organic carbon recorded numerically higher (0.64%) compared to control (0.59%). Complete natural farming recorded



net return of Rs. 1,40,296 with cost of cultivation of Rs. 61,700. Natural farming resulted in reduction in cost of cultivation by 16.3% and 21.6% over organic and integrated crop management + chemical pesticides (ICMCP) respectively.

**Narendrapur:** Complete natural farming recorded system equivalent yield of 9370 kg/ha. Under complete natural farming, soil organic carbon recorded numerically higher (0.57%) compared to control (0.50%). Complete natural farming recorded net return of Rs. 1,01,222 with cost of cultivation of Rs. 97,428.



Performance of maize + cow pea under natural farming at Narendrapur

Ludhiana, Modipuram and Pantnagar followed the same cropping system i.e. Maize + cowpea – wheat + chickpea

**Ludhiana:** Complete natural farming recorded system equivalent yield of 9131 kg/ha which is 35.7% and 44.7% decrease than organic and integrated crop management + chemical pesticides (ICMCP) respectively. Under complete natural farming, soil organic carbon recorded numerically higher (0.47%) compared to control (0.44%). Complete natural farming recorded net return of Rs. 1,41,422 with cost of cultivation of Rs. 83,839. Natural farming resulted in reduction in cost of cultivation by 6.7% and 14.4% over organic and integrated crop management + chemical pesticides (ICMCP) respectively.



Performance of maize + cowpea- wheat + chickpea under complete natural farming at Ludhiana

**Modipuram:** Complete natural farming recorded system equivalent yield of 4569 kg/ha which is 33.4% and 48.3% decrease than organic and integrated crop management + chemical pesticides (ICMCP) respectively. Under complete natural farming, soil organic carbon recorded numerically higher (0.45%) compared to control (0.43%). Complete natural farming recorded net return of Rs. 68,657 with cost of cultivation of Rs. 86,100. Natural farming resulted in reduction in cost of cultivation by 37.1% and 19.0% over organic and integrated crop management + chemical pesticides (ICMCP) respectively.



Maize + cowpea – wheat + chickpea system under complete farming at Modipuram

**Pantnagar:** Complete natural farming recorded system equivalent yield of 9201 kg/ha which is 22.6% and 37.2% decrease than organic and integrated crop management + chemical pesticides (ICMCP) respectively. Under complete natural farming, soil organic carbon recorded numerically higher (0.88%) compared to control (0.73%). Complete natural farming recorded net return of Rs. 1,60,280 with cost of cultivation of Rs. 44,845. Natural farming resulted in reduction in cost of cultivation by 32.5% and 29.4% over organic and integrated crop management + chemical pesticides (ICMCP) respectively.



Performance of maize + cowpea – wheat + chickpea system under at Pantnagar

**Thiruvananthapuram:** Cassava+ vegetable cowpea – green gram was evaluated. Complete natural farming recorded system equivalent yield of 74,491 kg/ha which is 1.3% increase over organic and 29.0% decrease than integrated crop management + chemical pesticides (ICMCP). Under complete natural farming, soil organic carbon recorded numerically higher (1.08%) compared to control (1.01%). Complete natural farming recorded net return of Rs. 11,60,702 with cost of cultivation of Rs. 3,34,840. Natural farming resulted in reduction in cost of cultivation by 15.7% and 17.8% over organic and integrated crop management + chemical pesticides (ICMCP) respectively.



7.2.5.1: Yield of main and inter crops (*khari*) under different natural farming practices in different agro-ecologies

| Cropping System                                    | Centre             | Control   |            | Complete NF |            | AI-NPOF package |            | Integrated Crop Management + NF based pest control methods (ICMNF) |            | Integrated Crop Management + chemical pesticides (ICMP) |            |
|----------------------------------------------------|--------------------|-----------|------------|-------------|------------|-----------------|------------|--------------------------------------------------------------------|------------|---------------------------------------------------------|------------|
|                                                    |                    | Main crop | Inter crop | Main crop   | Inter crop | Main crop       | Inter crop | Main crop                                                          | Inter crop | Main crop                                               | Inter crop |
| Groundnut + sesame – fennel + cabbage              | Ajmer              | 424       | 186        | 454         | 217        | 505             | 319        | 513                                                                | 358        | 509                                                     | 352        |
|                                                    | Udaipur            | 400       | 180        | 450         | 195        | 700             | 255        | 760                                                                | 260        | 805                                                     | 295        |
|                                                    | Sardarkrushinagar  | 718       | 340        | 1045        | 633        | 972             | 529        | 1002                                                               | 558        | 1015                                                    | 542        |
| Maize + cowpea – wheat + chickpea                  | Ludhiana           | 3070      | 12850      | 2770        | 10940      | 3830            | 16220      | 4130                                                               | 18630      | 4380                                                    | 19050      |
|                                                    | Modipuram          | 971       | 2514       | 1643        | 2986       | 3025            | 2208       | 3676                                                               | 2583       | 3904                                                    | 2417       |
|                                                    | Pantnagar          | 1853      | 8565       | 3941        | 11447      | 4983            | 14677      | 6285                                                               | 18092      | 6141                                                    | 17327      |
| Rice + dhaincha – maize grain/sweet corn + cow pea | Karjat             | 1501      | 2945       | 2415        | 3500       | 3146            | 4100       | 3575                                                               | 4180       | 3542                                                    | 4105       |
|                                                    | Ranchi             | 2284      |            | 2674        |            | 2790            |            | 3118                                                               |            | 2933                                                    |            |
|                                                    | Narendrapur        | 2630      |            | 2750        |            |                 |            |                                                                    |            |                                                         |            |
| Soybean + maize – Gardenpea + green coriander      | Almora             | 1400      | 505.9      | 2846        | 672.8      | 3971            | 653.5      | 3242                                                               | 788.5      | 5601                                                    | 529.6      |
|                                                    | Bajaura            | 827       | 1778       | 1241        | 2470       | 1690            | 2708       | 1827                                                               | 2990       | 1839                                                    | 2955       |
|                                                    | Gangtok            | 1592      | -          | 2041        | 3652       | 2761            | -          | -                                                                  | -          | -                                                       | -          |
| Soybean + maize – wheat + mustard                  | Bhopal             | 393       | 909        | 568         | 1118       | 637             | 1402       | 728                                                                | 1628       | 807                                                     | 1783       |
|                                                    | Jabalpur           |           |            |             |            |                 |            |                                                                    |            |                                                         |            |
|                                                    | Raipur             | 501       | 1345       | 563         | 2420       | 630             | 3511       | 645                                                                | 3568       | 688                                                     | 3719       |
| Turmeric –fellow                                   | Calicut            | 15000     | -          | 13387       | 650        | 18560           | -          | 14880                                                              | -          | 12253                                                   | -          |
|                                                    | Umiyam             | 9500      | Nil        | 11600       | 490        | 21970           | Nil        | 20850                                                              | Nil        | 20180                                                   | Nil        |
|                                                    | Coimbatore         | 894       |            | 1190        | 334        | 1821            |            | 2289                                                               |            | 2145                                                    |            |
| Cotton + greengram – Sorghum + cowpea              | Dharwad            | 374       | 351        | 672         | 485        | 774             | 474        | 447                                                                | 472        | 693                                                     | 471        |
|                                                    | Thiruvananthapuram | 56479     | 509        | 71358       | 605        | 69903           | 798        | 78253                                                              | 520        | 101295                                                  | 736        |

## 7.2.5.2: Yield of main and inter crops (rabi) under different natural farming practices in different agro-ecologies

| Cropping System                                    | Centre             | Control   |            | Complete NF |            | AI-NPOF package |            | Integrated Crop Management + NF based pest control methods (ICMNF) |            | Integrated Crop Management + chemical pesticides (ICMP) |            |
|----------------------------------------------------|--------------------|-----------|------------|-------------|------------|-----------------|------------|--------------------------------------------------------------------|------------|---------------------------------------------------------|------------|
|                                                    |                    | Main crop | Inter crop | Main crop   | Inter crop | Main crop       | Inter crop | Main crop                                                          | Inter crop | Main crop                                               | Inter crop |
| Groundnut + sesame – fennel + cabbage              | Ajmer              | 1117      | 838        | 1206        | 868        | 1332            | 882        | 1222                                                               | 973        | 1231                                                    | 939        |
|                                                    | Udaipur            | 1270      | 3955       | 1365        | 4200       | 1976            | 5075       | 2042                                                               | 5225       | 2167                                                    | 5380       |
|                                                    | Sardarkrushinagar  | 495       |            | 613         |            | 1072            |            | 1384                                                               |            | 1297                                                    |            |
| Maize + cowpea – wheat + chickpea                  | Ludhiana           | 1950      | 670        | 2150        | 950        | 4190            | 1360       | 4620                                                               | 1550       | 4750                                                    | 1640       |
|                                                    | Modipuram          | 1635      | 201        | 2193        | 212        | 3046            | 146        | 3590                                                               | 76         | 3754                                                    | 84         |
|                                                    | Pantnagar          | 529       | 589        | 1289        | 883        | 1894            | 1088       | 2459                                                               | 1533       | 2164                                                    | 1457       |
| Rice + dhaincha – maize grain/sweet corn + cow pea | Karjat             | 5147      | 102        | 7064        | 168        | 11968           | 252        | 13529                                                              | 311        | 13485                                                   | 301        |
|                                                    | Ranchi             | 3393      | 1959       | 4571        | 2191       | 4053            | 2461       | 5642                                                               | 2711       | 5423                                                    | 2631       |
|                                                    | Narendrapur        | 3320      | -          | 3900        | -          | -               | -          | -                                                                  | -          | -                                                       | -          |
| Soybean + maize – Gardenpea + green coriander      | Almora             | 4600      | 681        | 4880        | 1375       | 7046            | 1622       | 7408                                                               | 1670       | 7075                                                    | 2018       |
|                                                    | Bajaura            | 4288      | 1196       | 5521        | 2025       | 6349            | 2677       | 7376                                                               | 2853       | 7351                                                    | 2716       |
|                                                    | Gangtok            | 4887      | -          | 6192        | 617        | 7341            | -          | -                                                                  | -          | -                                                       | -          |
| Soybean + maize – wheat + mustard                  | Bhopal             | 1309      | 180        | 1728        | 203        | 2603            | 240        | 2918                                                               | 336        | 2941                                                    | 390        |
|                                                    | Jabalpur           | 1246      | 370        | 1552        | 446        | 2253            | 396        | 2620                                                               | 746        | 3083                                                    | 1035       |
|                                                    | Raipur             | 1024      | 192        | 1219        | 256        | 1801            | 393        | 1915                                                               | 404        | 1951                                                    | 424        |
| Turmeric –fellow                                   | Calicut            | -         | -          | -           | -          | -               | -          | -                                                                  | -          | -                                                       | -          |
|                                                    | Umiyam             | -         | -          | -           | -          | -               | -          | -                                                                  | -          | -                                                       | -          |
| Cotton + greengram – Sorghum + cowpea              | Coimbatore         | 1604      |            | 2014        | 350        | 2695            |            | 2804                                                               |            | 2750                                                    |            |
|                                                    | Dharwad            |           | 1237       |             | 2863       |                 | 3134       |                                                                    | 2643       |                                                         | 2702       |
| Cassava+ vegetable cowpea – green gram             | Thiruvananthapuram | 45        |            | 152         |            | 93              |            | 129                                                                |            | 159                                                     |            |



Table 7.2.5.3: System equivalent yield (Kg/ha) of various cropping systems as influenced by different natural farming practices

| Cropping system                                    | Centres            | Control | Complete NF | AI-NPOF package | Integrated Crop Management + NF based pest control methods (ICMNF) | Integrated Crop Management + chemical pesticides (ICMP) |
|----------------------------------------------------|--------------------|---------|-------------|-----------------|--------------------------------------------------------------------|---------------------------------------------------------|
| Groundnut + sesame – Fennel + cabbage              | Ajmer              | 2329    | 2487        | 2792            | 2792                                                               | 2743                                                    |
|                                                    | Udaipur            | 2869    | 3093        | 4253            | 4422                                                               | 4679                                                    |
|                                                    | Sardarkrushinagar  | 1682    | 2527        | 2781            | 3168                                                               | 3072                                                    |
| Maize + cowpea – wheat + chickpea                  | Ludhiana           | 8767    | 9131        | 14203           | 15818                                                              | 16523                                                   |
|                                                    | Modipuram          | 3614    | 4569        | 6864            | 8326                                                               | 8844                                                    |
|                                                    | Pantnagar          | 5132    | 9201        | 11878           | 15407                                                              | 14638                                                   |
| Rice + dhaincha – maize grain/sweet corn + cow pea | Karjat             | 5511    | 7951        | 12489           | 14165                                                              | 14088                                                   |
|                                                    | Ranchi             | 3562    | 4112        | 4664            | 4644                                                               | 4786                                                    |
|                                                    | Narendrapur        | 8448    | 9370        | -               | -                                                                  | -                                                       |
| Soybean + maize – Gardenpea + green coriander      | Almora             | 5173    | 7431        | 10156           | 9763                                                               | 12065                                                   |
|                                                    | Bajaura            | 5385    | 7578        | 9195            | 10270                                                              | 10141                                                   |
|                                                    | Gangtok            | 4700    | 8076        | 7416            | -                                                                  | -                                                       |
| Soybean + maize – wheat + mustard                  | Bhopal             | 1674    | 2180        | 2856            | 3324                                                               | 3549                                                    |
|                                                    | Jabalpur           | 1071    | 1316        | 1601            | 2212                                                               | 2796                                                    |
|                                                    | Raipur             | 1854    | 2580        | 3599            | 3709                                                               | 3863                                                    |
| Turmeric –fellow                                   | Calicut            | 13400   | 16250       | 18600           | 14900                                                              | 12300                                                   |
|                                                    | Umiyam             | 9500    | 12580       | 21970           | 20850                                                              | 20180                                                   |
| Cotton + greengram – Sorghum + chickpea            | Coimbatore         | 1631    | 2794        | 3059            | 3577                                                               | 3408                                                    |
|                                                    | Dharwad            | 2265    | 3216        | 3327            | 2816                                                               | 3153                                                    |
| Cassava+ vegetable cowpea – green gram             | Thiruvananthapuram | 58702   | 74491       | 73500           | 80938                                                              | 104901                                                  |

Table 7.2.5.4: Economics of various crop and intercrops as influenced by different natural farming practices

| Cropping system                                    | Locations          | Cost of cultivation (Rs./ha) |             |                 |                                                                    |                                                         |          | Net return (Rs./ha) |                 |                                                                    |                                                         |
|----------------------------------------------------|--------------------|------------------------------|-------------|-----------------|--------------------------------------------------------------------|---------------------------------------------------------|----------|---------------------|-----------------|--------------------------------------------------------------------|---------------------------------------------------------|
|                                                    |                    | Control                      | Complete NF | AI-NPOF package | Integrated Crop Management + NF based pest control methods (ICMNF) | Integrated Crop Management + chemical pesticides (ICMP) | Control  | Complete NF         | AI-NPOF package | Integrated Crop Management + NF based pest control methods (ICMNF) | Integrated Crop Management + chemical pesticides (ICMP) |
| Groundnut + sesame – Fennel + cabbage              | Ajmer              | 33,740                       | 52,487      | 94,160          | 68,429                                                             | 68,615                                                  | 1,34,074 | 1,29,980            | 1,16,109        | 1,37,167                                                           | 1,36,442                                                |
|                                                    | Udaipur            | 59,425                       | 68,485      | 1,08,325        | 90,075                                                             | 90,475                                                  | 2,28,075 | 2,40,953            | 3,08,119        | 3,41,814                                                           | 3,65,355                                                |
|                                                    | Sardarkrushinagar  | 68,032                       | 86,932      | 1,14,644        | 91,012                                                             | 84,824                                                  | 49,590   | 1,02,900            | 75,621          | 1,20,195                                                           | 1,19,867                                                |
| Maize + cowpea – wheat + chickpea                  | Ludhiana           | 87,550                       | 83,839      | 89,850          | 96,869                                                             | 97,935                                                  | 1,22,547 | 1,41,422            | 2,65,220        | 2,26,780                                                           | 2,41,950                                                |
|                                                    | Modipuram          | 59,350                       | 86,100      | 1,36,750        | 1,06,246                                                           | 1,06,396                                                | 37,916   | 68,657              | 86,769          | 1,07,352                                                           | 1,15,302                                                |
|                                                    | Pan Nagar          | 45,800                       | 44,845      | 66,460          | 63,000                                                             | 63,529                                                  | 70,013   | 1,60,280            | 1,97,620        | 2,81,389                                                           | 2,63,730                                                |
| Rice + dhaincha – maize grain/sweet corn + cow pea | Karjat             | 86,570                       | 99,793      | 1,33,725        | 1,17,294                                                           | 1,18,128                                                | 4,407    | 65,147              | 81,708          | 1,35,087                                                           | 1,21,510                                                |
|                                                    | Ranchi             | 55,300                       | 61,700      | 73,700          | 77,700                                                             | 78,700                                                  | 1,05,891 | 1,40,296            | 1,18,695        | 1,63,805                                                           | 1,52,036                                                |
|                                                    | Narendrapur        | 1,06,236                     | 97,428      |                 |                                                                    |                                                         | 74,534   | 1,01,222            |                 |                                                                    |                                                         |
| Soybean + maize – Gardenpea + green coriander      | Almora             | 1,19,491                     | 1,72,418    | 1,89,019        | 1,70,045                                                           | 1,64,381                                                | 1,04,553 | 1,28,969            | 2,10,851        | 2,33,366                                                           | 2,80,595                                                |
|                                                    | Bajaura            | 1,59,616                     | 2,23,176    | 2,95,506        | 2,37,326                                                           | 2,33,269                                                | 1,18,694 | 2,45,213            | 2,60,662        | 2,70,931                                                           | 2,71,774                                                |
|                                                    | Gangtok            | 28,012                       | 36,020      | 33,311          |                                                                    |                                                         | 731      | 201                 | 181             |                                                                    |                                                         |
| Soybean + maize – wheat + mustard                  | Bhopal             | 42,165                       | 41,362      | 53,932          | 55,805                                                             | 52,948                                                  | 31,885   | 55,159              | 72,012          | 90,725                                                             | 1,03,706                                                |
|                                                    | Jabalpur           | 29,830                       | 36,630      | 51,778          | 47,393                                                             | 49,318                                                  | 30,045   | 38,668              | 37,856          | 72,688                                                             | 1,01,631                                                |
|                                                    | Raipur             | 38,732                       | 59,397      | 80,418          | 72,660                                                             | 72,571                                                  | 57,457   | 70,029              | 98,463          | 75,165                                                             | 81,365                                                  |
| Turmeric –fellow                                   | Calicut            | 1,54,700                     | 1,85,300    |                 |                                                                    |                                                         | 1,45,300 | 1,10,540            | 1,54,500        | 1,09,400                                                           | 67,260                                                  |
|                                                    | Umiyam             | 53,468                       | 60,397      | 75,529          | 84,094                                                             | 73,899                                                  | 65,231   | 71,365              | 1,58,610        | 1,25,300                                                           | 1,16,760                                                |
| Cotton + green-gram – Sorghum + chickpea           | Coimbatore         | 74,630                       | 1,08,260    | 1,31,865        | 1,47,755                                                           | 1,43,285                                                | 37,285   | 81,008              | 61,132          | 87,193                                                             | 76,006                                                  |
|                                                    | Dharwad            |                              |             |                 |                                                                    |                                                         |          |                     |                 |                                                                    |                                                         |
| Cassava+ vegetable cowpea – green gram             | Thiruvananthapuram | 2,93,350                     | 3,34,840    | 3,97,100        | 4,25,355                                                           | 4,07,355                                                | 8,82,144 | 11,60,702           | 10,76,172       | 11,98,246                                                          | 16,95,979                                               |



Table 7.2.5.5: Soil organic carbon at the end of crop cycle as influenced by different natural farming practice

| Cropping system                                    | Locations          | Control | Complete NF | AI-NPOF package | Integrated Crop Management + NF based pest control methods (ICMNF) | Integrated Crop Management + chemical pesticides (ICMP) |
|----------------------------------------------------|--------------------|---------|-------------|-----------------|--------------------------------------------------------------------|---------------------------------------------------------|
| Groundnut + sesame – Fennel + cabbage              | Ajmer              | 0.26    | 0.36        | 0.32            | 0.40                                                               | 0.36                                                    |
|                                                    | Udaipur            | 0.66    | 0.70        | 0.75            | 0.72                                                               | 0.72                                                    |
|                                                    | Sardarkrushinagar  | 0.16    | 0.21        | 0.18            | 0.18                                                               | 0.18                                                    |
| Maize + cowpea – wheat + chickpea                  | Ludhiana           | 0.44    | 0.47        | 0.48            | 0.47                                                               | 0.47                                                    |
|                                                    | Modipuram          | 0.43    | 0.45        | 0.59            | 0.49                                                               | 0.45                                                    |
|                                                    | Panthagar          | 0.73    | 0.88        | 0.90            | 0.79                                                               | 0.76                                                    |
| Rice + dhaincha – maize grain/sweet corn + cow pea | Karjat             | 1.00    | 1.05        | 1.06            | 1.05                                                               | 1.05                                                    |
|                                                    | Ranchi             | 0.59    | 0.64        | 0.66            | 0.68                                                               | 0.68                                                    |
|                                                    | Narendrapur        | 0.50    | 0.57        |                 |                                                                    |                                                         |
| Soybean + maize – Gardenpea + green coriander      | Almora             | 1.06    | 1.27        | 1.41            | 1.19                                                               | 1.30                                                    |
|                                                    | Bajaura            | 0.71    | 0.76        | 0.84            | 0.80                                                               | 0.81                                                    |
|                                                    | Gangtok            | 1.52    | 1.55        | 1.57            |                                                                    |                                                         |
| Soybean + maize – wheat + mustard                  | Bhopal             | 0.61    | 0.67        | 0.75            | 0.70                                                               | 0.68                                                    |
|                                                    | Jabalpur           | 0.60    | 0.62        | 0.70            | 0.63                                                               | 0.61                                                    |
|                                                    | Raipur             | 0.55    | 0.62        | 0.64            | 0.64                                                               | 0.63                                                    |
| Turmeric –fellow                                   | Calicut            |         |             |                 |                                                                    |                                                         |
|                                                    | Umiam              |         |             |                 |                                                                    |                                                         |
| Cotton + greengram – Sorghum + chickpea            | Coimbatore         | 0.81    | 1.11        | 1.03            | 0.87                                                               | 0.84                                                    |
|                                                    | Dharwad            |         |             |                 |                                                                    |                                                         |
| Cassava+ vegetable cowpea – green gram             | Thiruvananthapuram | 1.01    | 1.08        | 1.58            | 1.34                                                               | 1.10                                                    |

Table 7.2.5.6: Total weed density (g/m<sup>2</sup>) as influenced by different natural farming practice

| Cropping system                                    | Centres                                    | Weed Density (Kharif) |             |                 |                                                                    |                                                         | Weed Density (Rabi) |             |                 |                                                                    |                                                         |
|----------------------------------------------------|--------------------------------------------|-----------------------|-------------|-----------------|--------------------------------------------------------------------|---------------------------------------------------------|---------------------|-------------|-----------------|--------------------------------------------------------------------|---------------------------------------------------------|
|                                                    |                                            | Control               | Complete NF | AI-NPOF package | Integrated Crop Management + NF based pest control methods (ICMNF) | Integrated Crop Management + chemical pesticides (ICMP) | Control             | Complete NF | AI-NPOF package | Integrated Crop Management + NF based pest control methods (ICMNF) | Integrated Crop Management + chemical pesticides (ICMP) |
| Cotton + greengram – Sorghum + chickpea            | Coimbatore (g m <sup>-2</sup> )            | 35.1                  | 8.9         | 20.4            | 27.3                                                               | 25.1                                                    | 44.1                | 10.8        | 25.8            | 34.1                                                               | 30.6                                                    |
|                                                    | Dharwad                                    |                       |             |                 |                                                                    |                                                         |                     |             |                 |                                                                    |                                                         |
| Cassava+ vegetable cowpea – green gram             | Thiruvananthapuram (nos. m <sup>-2</sup> ) | 122.0                 | 151.0       | 169.0           | 147.0                                                              | 139.0                                                   | 79.0                | 81.0        | 74.0            | 88.0                                                               | 139.0                                                   |
|                                                    |                                            |                       |             |                 |                                                                    |                                                         |                     |             |                 |                                                                    |                                                         |
| Groundnut + sesame – Fennel + cabbage              | Ajmer (g m <sup>-2</sup> )                 | 15.6                  | 6.3         | 16.3            | 15.0                                                               | 12.5                                                    | 43.7                | 25.0        | 24.0            | 12.1                                                               | 16.9                                                    |
|                                                    | Udaipur                                    | 44.0                  | 50.0        | 17.0            | 14.0                                                               | 12.0                                                    | 30.0                | 25.0        | 10.0            | 13.0                                                               | 11.0                                                    |
| Maize + cowpea – wheat + chickpea                  | Sardarkrushinagar                          |                       |             |                 |                                                                    |                                                         |                     |             |                 |                                                                    |                                                         |
|                                                    | Ludhiana (g m <sup>-2</sup> )              | 35.4                  | 84.4        | 36.5            | 35.6                                                               | 36.4                                                    | 78.8                | 106.2       | 70.2            | 66.8                                                               | 74.5                                                    |
| Rice + dhaincha – maize grain/sweet corn + cow pea | Modipuram                                  | 126.0                 | 75.0        | 113.0           | 134.0                                                              | 141.0                                                   | 52.0                | 48.0        | 97.0            | 128.0                                                              | 120.0                                                   |
|                                                    | Pantnagar                                  | 128.5                 | 165.5       | 107.5           | 87.0                                                               | 96.5                                                    | 5.3                 | 15.8        | 4.0             | 4.7                                                                | 4.7                                                     |
| Soybean + maize – Gardenpea + green coriander      | Karjat                                     |                       |             |                 |                                                                    |                                                         |                     |             |                 |                                                                    |                                                         |
|                                                    | Ranchi                                     |                       |             |                 |                                                                    |                                                         |                     |             |                 |                                                                    |                                                         |
| Soybean + maize – wheat + mustard                  | Narendrapur                                |                       |             |                 |                                                                    |                                                         |                     |             |                 |                                                                    |                                                         |
|                                                    | Almora                                     |                       |             |                 |                                                                    |                                                         |                     |             |                 |                                                                    |                                                         |
| Turmeric –fellow                                   | Bajaura                                    | 3.2                   | 3.0         | 3.5             | 3.4                                                                | 3.4                                                     | 2.2                 | 2.0         | 2.6             | 2.5                                                                | 2.5                                                     |
|                                                    | Gangtok                                    | 76.8                  | 60.7        | 58.5            |                                                                    |                                                         | 26.9                | 24.9        | 21.6            |                                                                    |                                                         |
|                                                    | Bhopal                                     | 67.0                  | 97.0        | 41.7            | 36.7                                                               | 29.3                                                    | 46.0                | 97.5        | 43.5            | 35.0                                                               | 32.0                                                    |
|                                                    | Jabalpur                                   |                       |             |                 |                                                                    |                                                         |                     | 62.0        | 82.0            | 95.0                                                               | 84.0                                                    |
|                                                    | Raipur                                     | 1.9                   | 6.8         | 2.1             | 2.0                                                                | 2.0                                                     |                     | 11.9        | 6.1             | 6.0                                                                | 5.9                                                     |
|                                                    | Calicut                                    |                       |             |                 |                                                                    |                                                         |                     |             |                 |                                                                    |                                                         |
|                                                    | Umiyam                                     | 50.0                  | 38.0        | 33.0            | 36.0                                                               | 29.0                                                    |                     |             |                 |                                                                    |                                                         |
|                                                    |                                            |                       |             |                 |                                                                    |                                                         |                     |             |                 |                                                                    |                                                         |



## 7.2.6: Farmer participatory validation of Organic and Natural Farming practices in farmers' field under SCSP/STC sub plans

**Objective:** To evaluate and integrate the natural farming inputs in to organic farming packages

**Approach:** Validation of natural farming practices in farmer's field under SCSP / STC sub plans

**Locations:** (7) Bajaura (HP), Coimbatore (TN), Gangtok (SK), Ranchi (JH), Thiruvananthapuram (KL), Udaipur (RJ), and Umiam (ML).

**Year of start:** 2020

| Treatments                      | Details                                                                                    |
|---------------------------------|--------------------------------------------------------------------------------------------|
| T <sub>1</sub>                  | Farmers package                                                                            |
| T <sub>2</sub>                  | AI-NPOF package                                                                            |
| T <sub>3</sub>                  | NF practice (Beejamrit, Ghanjeevamrit, Jeevamrit, Neemaster, Brhamaster and Dashparni ark) |
| Number of farmers:<br>Minimum 8 |                                                                                            |

Centre wise results of each centres are presented below. Treatments are same for all locations and minimum 8 farmers covered under the programme. Across all centres, natural farming proved to be a cost-effective and competitive alternative to conventional and AINPOF packages. While AINPOF generally delivered higher yields, natural farming achieved reasonable returns with lower cultivation costs, making it suitable for low-input sustainable agriculture, particularly for smallholders under SCSP/STC initiatives.

### 1. Bajaura (Himachal Pradesh)

At Bajaura, 4 farmers from villages like Baag, Ukhalldhar, Pipshu, and Palsher in the Balichowki block of Mandi district adopted the tomato–cauliflower cropping system for the validation of organic and natural farming practices. Under this system, the control plots recorded the highest yields for both kharif (15,126 kg/ha) and rabi (14,263 kg/ha) crops. The AINPOF package produced moderate yields (11,958 and 11,592 kg/ha), whereas natural farming plots had lower yields (9,688 and 9,758 kg/ha). However, natural farming significantly reduced the cost of cultivation to Rs. 2.27 lakh/ha, compared to Rs. 3.39 lakh/ha under AINPOF. Natural farming significantly reduced the cost of cultivation by 33.23% compared to the AINPOF package.

### 2. Coimbatore (Tamil Nadu)

In Coimbatore, 10 farmers from nine villages such as Devarayapuram, Narasipuram, and Perur Chettipalayam across the Thondamuthur and Annur blocks adopted a groundnut–fodder sorghum–dhaincha cropping system. Here, AINPOF recorded the highest yields in both seasons (kharif: 2,564 kg/ha; rabi: 17,879 kg/ha), followed by natural farming (2,287 and 16,240 kg/ha), and control (1,723 and 14,276 kg/ha). The cost of cultivation under natural farming was ₹64,597 per hectare, which was 18.33% lower than AINPOF's ₹79,100 per hectare. Net returns were highest in AINPOF plots (Rs. 1.91 lakh/ha), followed closely by natural farming (Rs. 1.77 lakh/ha), reflecting both systems' profitability, with natural farming offering a more economical approach.

### 3. Gangtok (Sikkim)

In Timpyem village of Rumtek-Martam block, 30 farmers adopted a maize + soybean – vegetable pea + coriander cropping system under the project. Under this system, AINPOF again led in productivity, with yields of 3,512 kg/ha (kharif) and 1,843 kg/ha (rabi). Natural farming yielded slightly less (2,632 and 2,244 kg/ha), while control plots lagged behind. Despite a

slightly higher cost of cultivation in natural farming (Rs. 82,600/ha), the cost difference between natural farming (₹82,600/ha) and AINPOF (₹85,500/ha) was relatively small, resulting in a 3.39% reduction.

#### **4. Thiruvananthapuram (Kerala)**

In the Adoor block of Pathanamthitta district, 10 farmers from Ezhamkulam, Erath, and Kodumon villages adopted the cassava + vegetable cowpea – green gram system. Only kharif season yield data was available. The AINPOF plots performed best with a yield of 61,725 kg/ha, followed by natural farming (43,208 kg/ha) and control (17,000 kg/ha). However, due to absence of cost and net return data, a complete economic evaluation was not possible. Still, the yield data highlights natural farming's superior performance over control and its potential as an effective alternative.

#### **5. Udaipur (Rajasthan)**

At Udaipur, 5 farmers from Basiwada and Birothi villages in the Jhadol block followed a maize–wheat cropping system. Here too, AINPOF plots had the highest yields (kharif: 2,500 kg/ha; rabi: 4,200 kg/ha), while natural farming gave 1,750 and 2,850 kg/ha, respectively. Natural farming reduced the cost by 25.72%, lowering it from ₹81,550 under AINPOF to ₹60,570 per hectare. Thus, while yields under natural farming were lower, the returns remained economically viable, indicating good input-output efficiency.



**Table 7.2.6.1: Details of farmers, cropping systems undertaken for validation of organic and natural farming practices in farmers field under SCS/STC at different locations**

| States                    | Centres    | Name of district surveyed | Name of blocks         | Name of village                                                                                                                                    | Number of farmers covered | Cropping system adopted by farmer         |
|---------------------------|------------|---------------------------|------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------|---------------------------|-------------------------------------------|
| Himachal Pradesh          | Bajaura    | Mandi                     | Balichowki             | Baag, Ukhalldhar, Pipshu, Palsher                                                                                                                  | 04                        | Tomato-cauliflower                        |
| Tamil Nadu                | Coimbatore | Coimbatore                | Thondamuthur and Annur | Devarayapuram, Ikkaibooluvampatti, Jagirnaickenpalyam, Madampatti, Madavarayapuram, Narasipuram, Perur Chettipalayam, Naranapuram and Odderpalayam | 10                        | Groundnut - fodder sorghum - dhaincha     |
| Sikkim                    | Gangtok    | East District Sikkim      | Rumtek-Martam          | Timpyem                                                                                                                                            | 30                        | Maize + soybean-vegetable pea + coriander |
| Kerala Thiruvananthapuram |            | Pathanamthitta            | Adoor                  | Ezhamkulam, Erath & Kodumon                                                                                                                        | 10                        | Cassava + vegetable cowpea-green gram     |
| Rajasthan                 | Udaipur    | Udaipur                   | Jhadole                | Basiwada and Birothi                                                                                                                               | 05                        | Maize-wheat                               |

**Table 7.2.6.2: Yield (kg/ha) of major crops, cost of cultivation and net return in farmers field under AINPOF and Natural farming condition at different locations**

| Centres            | Cropping systems                          | Yield of Kharif crop (kg/ha) |                  |                          | Yield of rabi crop (kg/ha) |                  |                          | Cost of cultivation (Rs/ha) |                  |                          | Net return (Rs/ha) |                  |                          |
|--------------------|-------------------------------------------|------------------------------|------------------|--------------------------|----------------------------|------------------|--------------------------|-----------------------------|------------------|--------------------------|--------------------|------------------|--------------------------|
|                    |                                           | Control                      | AI-NPOF pack-age | Natural Farming pack-age | Control                    | AI-NPOF pack-age | Natural Farming pack-age | Control                     | AI-NPOF pack-age | Natural Farming pack-age | Control            | AI-NPOF pack-age | Natural Farming pack-age |
| Bajaura            | Tomato-Cauliflower                        | 15126                        | 11958            | 9688                     | 14263                      | 11592            | 9758                     | 309757                      | 339469           | 226726                   | 580543             | 370691           | 355954                   |
| Coimbatore         | Groundnut - fodder sorghum - dhaincha GM  | 1723                         | 2564             | 2287                     | 14276                      | 17879            | 16240                    | 58999                       | 79100            | 64597                    | 130530             | 191161           | 177490                   |
| Gangtok            | Maize + soybean-vegetable Pea + coriander | 2772                         | 3512             | 2632                     | 955                        | 1843             | 2244                     | 75300                       | 85500            | 82600                    | 146100             | 218600           | 207400                   |
| Thiruvananthapuram | Cassava + vegetable cowpea-green gram     | 17000                        | 61725            | 43208                    | -                          | -                | -                        | -                           | -                | -                        | -                  | -                | -                        |
| Udaipur            | Maize-wheat                               | 1485                         | 2500             | 1750                     | 2510                       | 4200             | 2850                     | 44830                       | 81550            | 60570                    | 75890              | 113240           | 80665                    |



Input distribution and capacity building programme organized for farmers under SCSP at Bajauara Kullu, Himachal Pradesh



Input distribution and capacity building programme organized for farmers under SCSP at Coimbatore, Tamil Nadu



Farmers Participatory validation of organic & natural Farming practices- snapshots of field observation at Coimbatore



Input distribution and capacity building programme organized for farmers under SCSP at Thiruvananthapuram



## 7.3 Programme: Development of Integrated Organic Farming System Model

### Objective

- To evaluate the modules of organic production system to develop integrated organic farming system

Farming system modules

| Module                    | Components                                                                                             |
|---------------------------|--------------------------------------------------------------------------------------------------------|
| Crop                      | Identified high value crops of organic farming + required quantity of fodder for livestock             |
| Livestock                 | Cow/Buffalo/Goat/Poultry depending upon the location and size of the model                             |
| Complimentary enterprises | Biogas, Vermi-compost unit, live fencing, seed/planting material production unit & boundary plantation |

**Locations :** (10) Calicut, Thiruvananthapuram (Kerala), Coimbatore (Tamil Nadu), Gangtok (Sikkim), Ludhiana (Punjab), Pantnagar (Uttarakhand), Raipur (Chhattisgarh), Sardarkrushinagar (Gujrat), Udaipur (Rajasthan) and Umiam (Meghalaya).

**Year of start:** 2013-14

Results of each centre is described below

### Calicut (Kerala)

Out of the total income of ₹4,38,102 generated through the system, livestock (comprising two cows) contributed the highest share of ₹3,58,152, accounting for 81.75% of the total. This included income from milk production (₹2,83,952) and cow dung (₹74,200), highlighting the economic significance of integrating dairy in organic systems. The cropping systems occupied an area of 0.36 ha and included coconut, turmeric, and fodder crops. Together, they contributed ₹75,000, making up 17.12% of the total income. Among these, coconut (with 55 palms) contributed ₹45,000, and turmeric added ₹30,000, while fodder, although essential for livestock sustainability, did not generate income because of feed to the animals. Horticultural crops such as banana, tapioca, and vegetable cowpea were grown on 0.03 ha and contributed ₹4,950, representing only 1.13% of the income, suggesting their supportive role in household nutrition and income diversification. The total expenditure incurred for running the IOFS model was ₹2,41,800, leading to a net profit of ₹1,96,302. Additionally, the model generated 322 man-days of employment per year, indicating its potential in promoting rural livelihood and sustainable employment.

**Table 7.3.1: Area, yield and income from IOFS model at Calicut**

| Integrated organic farming system Enterprises | Crop/Livestock                        | Area (ha) | Area share (%) | Yield (Kg)/L/ Nos | Unit Rate (Rs) | Income (Rs) | Income share (%) |
|-----------------------------------------------|---------------------------------------|-----------|----------------|-------------------|----------------|-------------|------------------|
| Cropping Systems                              | Coconut (55 Nos)                      | 0.26      |                | 1500 nos.         | 30             | 45,000      | 17.12            |
|                                               | Fodder (Co3, Co4, DHN6, Congo Signal) | 0.06      |                | 13000 kg          | 0              | 00          |                  |
|                                               | Turmeric                              | 0.04      |                | 500 kg            | 60             | 30,000      |                  |
|                                               | Total                                 | 0.36      | 90             |                   |                | 75,000      |                  |
| Livestock (2 Cows)                            | Milk                                  |           |                | 4302.3 L          | 66             | 2,83,952    | 81.75            |
|                                               | Cow dung                              |           |                | 13250             | 5.6            | 74200       |                  |
|                                               | Total                                 | 0.01      | 2.5            |                   |                | 3,58,152    |                  |

| Integrated organic farming system Enterprises | Crop/Livestock | Area (ha) | Area share (%) | Yield (Kg)/L/ Nos | Unit Rate (Rs) | Income (Rs) | Income share (%) |
|-----------------------------------------------|----------------|-----------|----------------|-------------------|----------------|-------------|------------------|
| Horticulture                                  | Banana         | 0.01      |                | 65 Kg             | 30             | 1950        | 1.13             |
|                                               | Tapioca        | 0.005     |                | 60 Kg             | 25             | 1500        |                  |
|                                               | Veg. cow pea   | 0.0025    |                | 25Kg              | 60             | 1500        |                  |
|                                               | Total          | 0.03      | 7.5            |                   |                | 4950        |                  |
| Grand Total                                   |                |           |                |                   |                | 4,38,102    | 100              |
| Total Expenditure (Rs)                        |                |           |                |                   |                | 2,41,800    |                  |
| Net Profit (Rs)                               |                |           |                |                   |                | 1,96,302    |                  |
| Employment generation Man days/year           |                |           |                |                   |                | 322         |                  |



Pictures of IOFS model at Calicut

### Thiruvananthapuram (Kerala)

The results of the Integrated Organic Farming System (IOFS) model present a comprehensive details of diversified and sustainable income generation through the integration of crop and animal enterprises. The total gross income from the system was ₹12,55,597, of which the animal components were the major contributors, accounting for ₹8,79,659 or approximately 72% of the total income. Among animal-based outputs, milk yielded ₹4,80,287 from 8,576.55 litres, followed by cow urine which remarkably contributed ₹3,28,600, and cow dung adding ₹70,772—demonstrating the effective utilization of livestock by-products. The crop component, though secondary in income share, added ₹3,30,439 with a total tuber equivalent yield (TEY) of 11,014.62 kg. Fodder grass alone contributed ₹2,25,000, highlighting its dual role in supporting livestock nutrition and income. Other key crops such as cucumber (₹30,245), cassava (₹20,853), amaranthus (₹20,207), and banana



(₹10,850) also contributed significantly, while minor crops like bhindi, brinjal, cowpea, and lemongrass added to diversity and market resilience. The total cost of running the IOFS model was ₹11,47,650, with ₹2,40,400 spent on crops and a significantly higher ₹9,07,250 on animal components. IOFS model achieved a net income of ₹1,07,947 with a benefit:cost ratio of 1.09.

Table 7.3.2: Description of the tuber crops based IOFS model developed in 75 cents (0.3 ha)

| Enterprises                                 | Components                                                                                        | Area (cent) | % area share | % income share |
|---------------------------------------------|---------------------------------------------------------------------------------------------------|-------------|--------------|----------------|
| Cropping system (Food Crops + Horticulture) | Taro + maize                                                                                      | 10          | 13           | 0.46           |
| Cassava + amaranthus                        |                                                                                                   | 5           | 7            | 2.60           |
|                                             | Banana + (amaranthus – elephant foot yam)                                                         | 10          | 13           | 2.44           |
|                                             | Vegetables (bhindi, amaranthus, tomato, cucumber, cluster bean, sword bean, winged bean, brinjal) | 20          | 27           | 1.69           |
| Fruit crops                                 | Pineapple                                                                                         | 5           | 7            | 0.28           |
| Fodder crops                                | Hybrid Napier grass                                                                               | 5           | 7            | 13.73          |
| Dairy unit                                  | 13 cows + 3 calves                                                                                | 10          | 13           | 76.99          |
| Hedge crops                                 | Agathi (Sesbania sp.)                                                                             | 3           | 4            | 1.18           |
| Hedge tree                                  | Moringa                                                                                           | 2           | 3            | 0.05           |
| Pest repellent crops                        | Lemon grass                                                                                       | 3           | 4            | 0.24           |
| Nutrient recycling unit                     | Vermi compost unit                                                                                | 2           | 3            | 0.35           |

## 1. Income generation from IOFS

### a) Crop components

Table 7.3.3: Yield, tuber equivalent yield and income of different crops

| Name of crop     | Total yield (kg) | TEY (kg) | Income generated (Rs.) |
|------------------|------------------|----------|------------------------|
| Bhindi           | 255.14           | 255.14   | 7654                   |
| Amaranthus       | 336.79           | 673.57   | 20207                  |
| Cucumber         | 1008.18          | 1008.18  | 30245                  |
| Vegetable cowpea | 23.20            | 38.67    | 1160                   |
| Chilli           | 16.94            | 22.58    | 677                    |
| Drumstick        | 20.99            | 27.99    | 840                    |
| Banana           | 241.11           | 361.67   | 10850                  |
| Maize/Sorghum    | 20.65            | 34.42    | 1033                   |
| Brinjal          | 216.59           | 216.59   | 6498                   |
| Sword bean       | 64.84            | 64.84    | 1945                   |
| Pineapple        | 39.08            | 32.56    | 977                    |
| Cassava          | 834.11           | 695.09   | 20853                  |
| Fodder grass     | 45000.00         | 7500.00  | 225000                 |
| Lemon grass      | 500.00           | 83.33    | 2500                   |
| Total            |                  | 11014.62 | 330439                 |

## b) Animal components

Table 7.3.4: Quantity of milk and income from dairy unit

| Name of produce | Quantity produced (litre/kg) | TEY (kg) | Revenue generated (Rs.) |
|-----------------|------------------------------|----------|-------------------------|
| Milk            | 8576.55                      | 16010    | 480287                  |
| Cow dung        | 54440                        | 2359     | 70772                   |
| Cow urine       | 32860                        | 10953    | 328600                  |
| Total           |                              | 29332    | 879659                  |

## 2. Cost incurred

| Item   | Crop component (Rs.) | Animal component (Rs.) |
|--------|----------------------|------------------------|
| Labour | 231400               | 327250                 |
| Input  | 9000                 | 580000                 |
| Total  | 240400               | 907250                 |

## 3. Economics of IOFS

| Total tuber equivalent yield (kg) | 40337   |
|-----------------------------------|---------|
| Gross income (Rs.)                | 1255597 |
| Gross cost (Rs.)                  | 1147650 |
| Net income (Rs.)                  | 107947  |
| B:C Ratio                         | 1.09    |





### Coimbatore (Tamil Nadu)

The Integrated Organic Farming System (IOFS) model established at Coimbatore was implemented on a total area of 0.40 hectares, encompassing diverse components including multiple cropping systems, livestock (dairy unit), composting and recycling units, boundary plantations, agroforestry, beekeeping, and pest-repellent plants aim was to enhance productivity, ensure sustainability, and generate continuous farm income through optimal resource recycling and component integration.

#### Overall System Performance

The total gross return from the IOFS model was ₹2,87,206, while the cost of cultivation amounted to ₹2,24,221, resulting in a net return of ₹62,985 for the year. The model achieved a Benefit-Cost (B:C) Ratio of 1.28, indicating economic viability. Additionally, the Sustainable Value Index (SVI), computed based on five years of performance data, stood at 0.19, reflecting moderate but consistent sustainability under organic management conditions (Table 7.3.5):.

#### Component-Wise Analysis (Table 7.3.5)

##### 1. Cropping Systems

Three main cropping systems were followed:

- **Okra–Maize–Green Manure (Dhaincha)** :This system was practiced on 0.14 ha, comprising 35% of the total IOFS area. It achieved a combined yield of 11,764 kg in kharif and 5,123 kg in rabi, with a cotton-equivalent yield of 4,379 kg. The system generated a gross return of ₹81,204 with a cost of ₹62,094, resulting in a net return of ₹14,470. This cropping system accounted for 31.4% of the total income, showing high profitability and effective land utilization.
- **Cotton–Sorghum–Green Manure (Dhaincha)**: This rotation produced 1,514 kg during kharif and 3,521 kg during rabi, with a cotton-equivalent yield of 2,594 kg. It generated a gross return of ₹45,955 against a cost of ₹37,859, yielding a net return of ₹4,910. Although profitable, its economic contribution was modest compared to the okra-based system.
- **Fodder Cropping System (Bajra Napier Hybrid CO-5 + Desmanthus viragatus)**: Occupying 0.06 ha (15% of the area), this system produced 15,500 kg of fodder, which was used for feeding the dairy animals. No direct income was generated, but it played a crucial role in supporting the livestock component by meeting their fodder requirements and reducing external feed dependency.

## 2. Livestock Component (Dairy Unit)

The dairy unit, consisting of two Jersey crossbred cows and two calves, was managed over an area of 0.008 ha (2% of total area). The cows produced 1,124 litres of milk, sold at ₹60/litre, earning ₹67,440. Additionally, income from culling of three animals contributed another ₹50,000, making the total gross return ₹1,17,440. After accounting for the cost of ₹1,06,731, the net return stood at ₹10,709, contributing 16.6% to total income. The integration of fodder crops further enhanced the efficiency of this unit.

## 3. Composting and Nutrient Recycling

This unit, occupying 0.004 ha (1%), utilized cow dung and urine for compost and bio-input production. The system produced:

- 13,410 kg of compost
- 9,934 litres of cow dung slurry
- 3,412 kg of cow dung compost

The compost unit provided both direct returns and indirect benefits through soil health enhancement. The net monetary return from compost sale or equivalent value was ₹4,265, contributing 9.9% to the total income. Additionally, internal recycling of organic matter saved costs and contributed another 9.8% as value-added input recycling.

## 4. Boundary Plantations

A variety of plantation crops—coconut, banana, annual moringa, and curry leaf—were grown along the boundaries on 0.02 ha (5%) of land. These plantations yielded 1,533 coconut-equivalent nuts annually, generating a gross income of ₹27,630 with a cost of ₹6,833, resulting in a net return of ₹20,798, which was the highest among all individual components, contributing 32.2% to the total income. This shows the significant potential of perennial crops for income generation even from marginal land spaces.

## 5. Agroforestry, Beekeeping, and Pest-Repellent Plants

These auxiliary components included:

- Agroforestry with 14 trees on 0.016 ha (4%)
- Beekeeping with 4 hives (*Apis cerana indica*) on 0.004 ha (1%)
- Pest-repellent plants comprising 44 species on 0.008 ha (2%)

While no direct income was recorded for these units in the current cycle, they contributed immensely to ecosystem services including pollination, pest regulation, biodiversity conservation, and microclimate improvement. Their long-term value in sustaining productivity and reducing input costs is substantial.

As a result, the IOFS model at Coimbatore demonstrated the economic and ecological viability of organic farming when various farm enterprises contributors to income were:

- Boundary plantations (32.2%)
- Okra-based cropping system (31.4%)
- Livestock unit (16.6%)
- Compost and recycling units (9.9% + 9.8%)



Table 7.3.5: Component wise yield and income of IOFS model at Coimbatore

| Modules                | Particulars                                                 | Area (ha) | % share of area | Yield (kg)    |      |                                                             | Gross return (Rs.) | Cost of cultivation (Rs.) | Net return (Rs.) | Percent share of income |
|------------------------|-------------------------------------------------------------|-----------|-----------------|---------------|------|-------------------------------------------------------------|--------------------|---------------------------|------------------|-------------------------|
|                        |                                                             |           |                 | kharif        | Rabi | Cotton equivalent yield                                     |                    |                           |                  |                         |
| Cropping systems       | 1. Okra-maize-green manure (Dhaincha)                       | 0.14      | 35              | 11764         | 5123 | 4379                                                        | 81,204             | 62,094                    | 14,470           | 31.4                    |
|                        | 2. Cotton-sorghum-green manure (Dhaincha)                   |           |                 | 1514          | 3521 | 2594                                                        | 45,955             | 37,859                    | 4,910            |                         |
|                        | 3. Bajra Napier Hybrid-CO (BN) 5 Desmanthus-viragatus       |           |                 | 15500<br>4500 |      | fed to the cattle's                                         | -                  | -                         | -                |                         |
| Livestock (dairy unit) | Jersey (cross breed - 2 nos. + 2 calves)                    | 0.06      | 15              |               |      | 1124 litres                                                 | 67,440             | 1,06,731                  | 10,709           | 16.6                    |
|                        | Three animals were culled through which Rs.50000 was earned | 0.008     | 2               |               |      | Selling price Rs. 60/litre                                  | 50,000             |                           |                  |                         |
| Compost production     | Cow dung production                                         | 0.004     | 1               |               |      | 13410 kg                                                    |                    |                           |                  | 9.9                     |
|                        | Cow urine production                                        |           |                 |               |      | 9934 litres                                                 |                    |                           |                  |                         |
| Recycling              | Compost production                                          |           |                 |               |      | 3412 kg                                                     | 6824               | 2559                      | 4,265            | 9.8                     |
| Boundary plantations   | Coconut, Banana                                             | 0.02      | 5               |               |      | 1533 nuts per year (production on coconut equivalent basis) | 27,630             | 6,833                     | 20,798           | 32.2                    |
|                        | Annual moringa                                              |           |                 |               |      |                                                             |                    |                           |                  |                         |
|                        | Curry leaf                                                  |           |                 |               |      |                                                             |                    |                           |                  |                         |
|                        | Agroforestry (14 trees)                                     | 0.016     | 4               |               |      |                                                             |                    |                           |                  |                         |
|                        | Pest repellent plants: (44 plant species)                   | 0.008     | 2               |               |      |                                                             |                    |                           |                  |                         |
|                        | Bee keeping (4 Indian bee - Apis cerana indica hives)       | 0.004     | 1               |               |      |                                                             |                    |                           |                  |                         |
|                        | Total                                                       | 0.40      | 100             |               |      |                                                             | 2,87,206           | 2,24,221                  | 62,985           |                         |
|                        | Benefit cost ratio                                          |           |                 |               |      |                                                             |                    | 1.28                      |                  |                         |
|                        | Sustainable Value Index (based on previous 5 years data)    |           |                 |               |      |                                                             |                    | 0.19                      |                  |                         |



### Gangtok (Sikkim)

An IOFS model was developed in 0.6 ha area at research farm of ICAR-Sikkim Centre, Tadong, Sikkim. The IOFS model maintains a wide bio-diversity having fishery, dairy, poultry, large cardamom nursery, field crops, etc., maize/rice-based cropping system has been the backbone of the farmers' economy and livelihood security in Sikkim. From an 0.6 ha IOFS model, net return of Rs 77,002 was received by crop component from 0.47 ha area, Rs 64,676 was received by dairy (0.05 ha), Rs 22,320 and 7,404 obtained from poultry and fishery, whereas Rs 6000 was received from vermicomposting. From large cardamom, Rs 17,000 was received. From this 0.60 ha IOFS model, gross income of Rs. 3,10,144 was obtained with total cost of the Rs. 1,32,744 per annum resulted in net return of Rs. 1,77,400 was realized with BCR of 3.05 (Table 7.4.4).



Some photograph's from IOFS model at Gangtok



Table 7.3.6: Component wise area, production and economics of IOFS model at Gangtok

| Modules                         | Particulars                                      | Area (ha) | Production (yield kg/ha)                                                                        |      |        | Total cost of production (Rs) | Gross return (Rs) | Net return (Rs) | B: C ratio |
|---------------------------------|--------------------------------------------------|-----------|-------------------------------------------------------------------------------------------------|------|--------|-------------------------------|-------------------|-----------------|------------|
|                                 |                                                  |           | Kharif                                                                                          | Rabi | Summer |                               |                   |                 |            |
| Maize-based cropping system     | Maize-pahenlo dal-vegetable pea                  | 0.32      | 3500                                                                                            | 1000 | 7000   | 27,920                        | 50,213            | 22,293          | 1.80       |
|                                 | Maize-pahenlo dal-buckwheat                      |           | 3500                                                                                            | 1000 | 950    |                               |                   |                 |            |
| Vegetable-based cropping system | Cauliflower-spinach-coriander-broccoli-fenugreek | 0.08      | Cauliflower : 4500<br>Spinach : 1500<br>Coriander : 1000<br>Broccoli : 5000<br>Fenugreek : 1000 |      |        | 34,414                        | 72,123            | 37,709          | 2.10       |
|                                 | Large cardamom                                   | 0.07      | 10.4 kg/year                                                                                    |      |        | 3,000                         | 20,000            | 17,000          | 6.67       |
|                                 | Dairy (1 milch cow + 1 calf)                     | 0.05      | 2170 lit/year                                                                                   |      |        | 43,890                        | 1,08,564          | 64,674          | 2.47       |
|                                 | Vermicompost                                     | 0.03      | 16.3 t/ha                                                                                       |      |        | 5,000                         | 11,000            | 6,000           | 2.20       |
|                                 | Poultry (25 Vanaraja birds)                      | 0.01      | 83.4 kg meat/year and 3000 egg/year                                                             |      |        | 15,800                        | 38,120            | 22,320          | 2.41       |
|                                 | Fishery (Composite)                              | 0.04      | 24.9 kg/year                                                                                    |      |        | 2,720                         | 10,124            | 7,404           | 3.72       |
| Total                           | Total                                            | 0.60      |                                                                                                 |      |        | 1,32,744                      | 3,10,144          | 1,77,400        | 3.05       |

## Ludhiana (Punjab)

**Table 7.3.7: Component wise details of integrated organic farming system unit**

| Components                                           | Variety/Breed     | Area (m²)/ no. |
|------------------------------------------------------|-------------------|----------------|
| Crops (including field crops, pulses, oilseeds etc.) |                   |                |
| Basmati rice                                         | Pusa Basmati 1121 | 1000           |
| Kharif moong                                         | ML 1808           | 500            |
| Sugarcane                                            | CoJ 88            | 500            |
| Turmeric                                             | Punjab Haldi 2    | 500            |
| Kharif maize                                         | JC 12             | 500            |
| Maize (fodder)                                       | J 1006            | 1000           |
| Wheat                                                | Unnat PBW 343     | 1000           |
| Gobhi sarson                                         | GSC 7             | 500            |
| Berseem                                              | BL 42             | 1000           |
| Summer moong                                         | SML 832           | 500            |

**Table 7.3.8: Yield of different crops/cropping system in IOFS model unit**

| Cropping systems/crops          | Area (m <sup>2</sup> ) allocated | Yield (kg) |
|---------------------------------|----------------------------------|------------|
| Basmati rice-wheat              | 1000                             | 340-374    |
| Kharif moong-wheat-summer moong | 500                              | 30-218-39  |
| Maize- gobhi sarson             | 500                              | 282-120    |
| Maize- berseem                  | 1000                             | 3344-9773  |
| Sugarcane                       | 500                              | 3790       |
| Turmeric                        | 500                              | 1150       |

**Table 7.3.9: Economics of dairy component of integrated organic farming system unit**

| Economics of cow                                                                 | Amount (₹) |
|----------------------------------------------------------------------------------|------------|
| Income generated by sale of milk                                                 | 44363      |
| Income generated through sale of one heifer<br>(value not included in economics) | 26500      |
| Cow dung used to prepare FYM                                                     | 4200       |
| Cost of feed                                                                     | 18753      |
| Bypass fat and minerals                                                          | 3749       |
| Medicines and other misc charges                                                 | 2785       |
| Labour cost (@ 2 working hours/day (Rs 50/hr)                                    | 6874       |
| Input cost                                                                       | 32161      |
| Gross returns                                                                    | 48563      |
| Net returns                                                                      | 16402      |

**Table 7.3.10: Economics of integrated organic farming system model unit**

| Economics               | Components |       | Total  |
|-------------------------|------------|-------|--------|
|                         | Crops      | Dairy |        |
| Gross returns (₹)       | 70843      | 48563 | 119406 |
| Cost of cultivation (₹) | 27258      | 32161 | 59419  |
| Net returns (₹)         | 43585      | 16402 | 59987  |
| B:C                     | 1.60       | 0.51  | 1.01   |

**Table 7.3.11: GHG emission under different cropping systems in IOFS model unit**

| Crops/Cropping systems          | CO <sub>2</sub> -e (kg) |
|---------------------------------|-------------------------|
| Basmati rice-wheat              | 70.5                    |
| Kharif moong-wheat-summer moong | 53.3                    |
| Maize- gobhi sarson             | 32.1                    |
| Maize- berseem (Fodder)         | 37.3                    |
| Sugarcane                       | 44.6                    |
| Turmeric                        | 33.2                    |



## Results

### 1. Crop Component (Table 7.3.8)

Under the IOFS model at Ludhiana, diversified cropping systems were adopted over a 4000 m<sup>2</sup> area. The Basmati rice–wheat system yielded 340–374 kg, while Kharif moong–wheat–summer moong produced 30 kg, 218 kg, and 39 kg, respectively, on 500 m<sup>2</sup>, indicating good pulse intensification. The Maize–gobhi sarson system yielded 282 kg and 120 kg, and Maize–berseem gave high fodder productivity with 3344 kg maize and 9773 kg berseem on 1000 m<sup>2</sup>. High-value crops like sugarcane (3790 kg) and turmeric (1150 kg) on 500 m<sup>2</sup> each showed strong yield potential. Economically, crops generated gross returns of ₹70,843, with a cost of cultivation of ₹27,258, resulting in net returns of ₹43,585 and a B:C ratio of 1.60, reflecting high profitability from organic crop production.

### 2. Dairy Component (Table 7.3.9)

The dairy unit, based on one cow, yielded ₹44,363 from milk sales, and ₹4,200 worth of cow dung for FYM. Though ₹26,500 was earned from the sale of a heifer, it was not considered in the economic calculation. The input cost was ₹32,161, including feed, supplements, medicines, and labour. This resulted in gross returns of ₹48,563, net returns of ₹16,402, and a B:C ratio of 0.51, showing moderate returns and emphasizing the non-monetary value of nutrient cycling.

### 3. System-Level Economics (Table 7.3.10)

Combining both components, the total gross returns of the IOFS model were ₹1,19,406, with a total input cost of ₹59,419, leading to net returns of ₹59,987 and an overall B:C ratio of 1.01, indicating that the integrated organic system was economically viable and self-sustaining.

### 4. Environmental Impact – GHG Emissions (Table 7.3.11)

Among the cropping systems, Basmati rice–wheat had the highest GHG emissions at 70.5 kg CO<sub>2</sub>-e, while Kharif moong–wheat–summer moong emitted 53.3 kg CO<sub>2</sub>-e. Emissions were lower for Maize–gobhi sarson (32.1 kg), Maize–berseem (37.3 kg), Turmeric (33.2 kg), and Sugarcane (44.6 kg), highlighting that diversified and legume-based systems have reduced environmental footprints under organic management.

### Pantnagar (Uttarakhand)

#### Area allocation for different enterprises under IOFS model; at Pantnagar

| Enterprises                        | Area (m <sup>2</sup> ) |
|------------------------------------|------------------------|
| Cattle Shed and Infrastructure     |                        |
| Cow Shed, Labour Shed, Small Store | 450                    |
| Fish Pond                          | 350                    |
| Compost Pit                        | 100                    |
| Vegetable area                     | 750                    |
| Different crops area               | 2350                   |

**Table 7.3.12: Yield of different crops under Integrated Organic Farming System Models.**

| Crops                              | Area (m <sup>2</sup> ) | Yield (kg/plot)    | Sale Price (Rs. /kg) | Revenue Generated (Rs) for 750m <sup>2</sup> |
|------------------------------------|------------------------|--------------------|----------------------|----------------------------------------------|
| Type-3-Sarbati                     | 750                    | Type 3 @ 212       | 35.31                | 7486                                         |
|                                    |                        | Sarbati @ 301      | 28.0                 | 8428                                         |
| Total                              |                        |                    |                      | 15914                                        |
| Tilak Chandan- Black Wheat         | 750                    | Tila Chandan @ 318 | 35.3                 | 11225                                        |
|                                    |                        | Black Wheat @ 216  | 28.0                 | 6048                                         |
| Total                              |                        |                    |                      | 17273                                        |
| PB-1509-Sugarcane+ Lentil + Garlic | 750                    | PB-1509 @ 270      | 35.3                 | 9531                                         |
|                                    |                        | Sugarcane @ 6588   | 3.6                  | 23717                                        |
|                                    |                        | Lentil @ 80        | 80                   | 6400                                         |
|                                    |                        | Garlic @ 35        | 200                  | 7000                                         |
| Total                              |                        |                    |                      | 46648                                        |
| Winter Vegetables                  |                        |                    |                      |                                              |



|                         |     |       |     |            |
|-------------------------|-----|-------|-----|------------|
| Onion                   | 750 | 260.0 | 20  | 5200       |
| Capcicum                |     | 30.0  | 40  | 1200       |
| Cabbage                 |     | 160.0 | 20  | 3200       |
| Tomato                  |     | 190.0 | 25  | 4750       |
| Cauli flower            |     | 94.0  | 15  | 1410       |
| chilli                  |     | 69.0  | 50  | 3450       |
| Broccoli                |     | 70.0  | 30  | 2100       |
| Fish                    |     | 21.0  | 155 | 3255       |
| Total                   |     |       |     | 24565      |
| Summer Vegetables       |     |       |     |            |
| Lady Finger             | 750 | 190.0 | 20  | 3800       |
| Tinda                   |     | 97.0  | 30  | 2910       |
| Cucumber                |     | 146.0 | 20  | 2920       |
| Water millon            |     | 75.0  | 20  | 1500       |
| Total                   |     |       |     | 11130      |
| Total Revenue Generated |     |       |     | 123366.0/- |

Note: Cattle shed, Cattle movement area, fish pond, compost pits, cow urine collection and fortification chamber, small store, labour shed are under construction. The revenue generated by the crops are shown in the Table 7.3.13

**Table 7.3.13 Cost of cultivation, net returns and B:C ration under Integrated Organic Farming System Models.**

| Crops                              | Rice Equivalent Yield (kg/750m²) | System Productivity (kg/750m²) | Total Cost of Cultivation (Rs/750m²) | Net returns (Rs/750m²) |
|------------------------------------|----------------------------------|--------------------------------|--------------------------------------|------------------------|
| Type-3-Sarbati                     | 222.8                            | 434.8                          | 6174                                 | 10567                  |
| Tilak Chandan- Black Wheat         | 159.9                            | 477.9                          | 6174                                 | 12225                  |
| PB-1509-Sugarcane+ Lentil + Garlic | 155.8                            | 425.8                          | 3567                                 | 12828                  |
|                                    | 181.8                            | 451.8                          |                                      | 10567                  |
| Winter Vegetable                   |                                  |                                |                                      |                        |
| Onion                              | -                                | -                              | 8230                                 | 16335                  |
| Capcicum                           |                                  |                                |                                      |                        |
| Cabbage                            |                                  |                                |                                      |                        |
| Tomato                             |                                  |                                |                                      |                        |
| Cauli flower                       |                                  |                                |                                      |                        |
| chilli                             |                                  |                                |                                      |                        |
| Brocolli                           |                                  |                                |                                      |                        |
| Fish                               |                                  |                                |                                      |                        |

|                   |   |   |      |      |
|-------------------|---|---|------|------|
| Summer Vegetables |   |   |      |      |
| Lady Finger       | - | - | 6180 | 4950 |
| Tinda             |   |   |      |      |
| Cucumber          |   |   |      |      |
| Water melon       |   |   |      |      |

**Table 7.3.14: Yield of different cropping system under Integrated Organic Farming System Models:**

| Cropping system                    | Yield kg/ha | Net Return Rs/750m <sup>2</sup> | Net Return Rs. /ha |
|------------------------------------|-------------|---------------------------------|--------------------|
| Type-3-Sarbati                     | 2827        | 10567                           | 140887             |
|                                    | 4013        |                                 |                    |
| Tilak Chandan- Black Wheat         | 4240        | 12225                           | 163000             |
|                                    | 2880        |                                 |                    |
| PB-1509-Sugarcane+ Lentil + Garlic | 3600        | 12828<br>13828                  | 171040<br>184373   |
|                                    | 87840       |                                 |                    |
|                                    | 2133        |                                 |                    |
|                                    | 933         |                                 |                    |

## Results

The Integrated Organic Farming System (IOFS) model at Pantnagar demonstrated commendable performance through diversified cropping, integrated fishery, and seasonal vegetable cultivation. Among the crop systems, PB-1509–Sugarcane + Lentil + Garlic emerged as the most profitable, generating ₹46,648 per 750 m<sup>2</sup>, primarily due to high returns from sugarcane and garlic. Tilak Chandan–Black Wheat followed with ₹17,273, while Type-3 Sarbati earned ₹15,914. Winter vegetables contributed ₹24,565, with onion and tomato being the major contributors, whereas summer vegetables fetched ₹11,130. Fish farming, integrated within the system, yielded 21 kg of fish worth ₹3,255. From an economic standpoint, PB-1509–Sugarcane + Lentil + Garlic had the highest net return (₹12,828) and the lowest cultivation cost (₹3,567), indicating strong economic efficiency. Winter vegetables, despite higher input costs, provided the maximum net return (₹16,335), while Tilak Chandan–Black Wheat and Type-3 Sarbati generated ₹12,225 and ₹10,567, respectively. In terms of system productivity, Tilak Chandan–Black Wheat recorded the highest yield (4240 kg/ha), while PB-1509-based systems achieved the highest economic return (₹1,84,373/ha). Overall, the IOFS model at Pantnagar proved to be both productive and profitable, with integrated units like cattle shed, fish pond, compost pits, and fortified cow urine chamber—currently under construction—expected to further enhance system sustainability and resource recycling.





### Raipur (Chhattisgarh)

The results of the Integrated Organic Farming System (IOFS) model at Raipur show the performance of different cropping systems and farm components in terms of productivity, economics, energy efficiency, water use, and environmental impact.

#### Performance of Cropping Systems (Table 7.3.16)

Among all the cropping systems evaluated, the Rice–Sweet corn–Green gram system recorded the highest total productivity of 2049 kg. However, the Rice–Wheat–Green gram system gave the highest net return of ₹16,491, even though its productivity was slightly lower at 1911 kg. This system also had a lower total cost of ₹20,596, making it the most economically efficient. The Maize–Potato–Green gram system, grown on raised beds, also performed well with a total productivity of 1359 kg and a high net return of ₹14,891 at a cost of ₹11,484. Similarly, the Rice–Tomato–Green manure system (on sunken beds) achieved 1000 kg of produce and ₹10,272 net return with a moderate cost of ₹9,132. Other systems like Rice–Onion + Coriander–Green manure and Rice–Cabbage–Green manure had lower productivity (950 kg and 877 kg, respectively) but were cost-effective, resulting in net returns of ₹9,745 and ₹8,727. The system with Sorghum–Berseem + Mustard–Maize (fodder) showed the lowest productivity (583 kg) and lowest net return (₹5,100), though it had a low cost of ₹6,232. In total, the seven cropping systems generated 8730 kg of total productivity, with a total cultivation cost of ₹89,047 and a combined net return of ₹80,391. These results highlight that while productivity is important, net returns depend more on the balance between cost and market value of the crops.

#### Component-wise Performance of IOFS (Table 7.3.17)

The component-wise analysis of the IOFS model at Raipur provides a broader view of how each enterprise contributes economically, socially, and environmentally.

- The cropping system was the main contributor to income, giving a net return of ₹80,389, 131 man-days of employment, and producing 381,199 MJ of energy output. It also had a decent water productivity of 0.55 kg/m<sup>3</sup> and greenhouse gas (GHG) emissions of 711 kg CO<sub>2</sub>-equivalent.
- The dairy unit generated a good net return of ₹46,771, created 105 man-days of employment, and added ₹21,327 worth of recycled residues. However, it required high energy input and had high GHG emissions (4096.1 kg CO<sub>2</sub>-e), indicating environmental cost.

- The goatry unit gave a net return of ₹33,890, supported 96 man-days, and had moderate emissions (287.5 kg CO<sub>2</sub>-e). The fishery unit showed a net return of ₹10,713, with low energy use and emissions, making it a clean and efficient component.
- The poultry unit, though economically weaker with a net return of ₹13,151, showed very high GHG emissions (1892.09 kg CO<sub>2</sub>-e) for its scale, making it environmentally unsustainable in the current setup.
- The vermi-compost unit provided a net return of ₹17,897 and a significant residue recycling value of ₹26,357, but it emitted the highest GHG (26,968.7 kg CO<sub>2</sub>-e) of all components.
- The biogas/compost pit was highly efficient, giving a small but positive net return of ₹7,004 and excellent energy productivity (0.194 kg/MJ) and water productivity (1.18 kg/m<sup>3</sup>). It also contributed significantly to emission reduction.
- The horticulture unit (including kitchen garden and boundary plantation) stood out by creating the highest employment (427 man-days) and the highest residue recycling value (₹92,486), even though the net return was moderate (₹17,819).

One hectare IOFS model generated a total net return of ₹2,27,635 from a total cost of ₹3,14,432. The cropping system was the largest contributor to income, while components like horticulture, biogas, and vermi-compost played important roles in enhancing sustainability, recycling, and employment. The total GHG sink from the system was 31,816.8 kg CO<sub>2</sub>-equivalent, indicating its potential to support climate-friendly farming.



**Table 7.3.15: Area allocated to different enterprises**

| Name of the enterprise                                                    | Area (m <sup>2</sup> ) | Area (ha) |
|---------------------------------------------------------------------------|------------------------|-----------|
| <b>Cropping System</b>                                                    |                        |           |
| Rice-sweet corn-green gram                                                | 2000                   | 0.2       |
| Rice - wheat-green gram                                                   | 2000                   | 0.2       |
| Rice-onion + coriander-green manure                                       | 600                    | 0.06      |
| Rice-cabbage – green manure                                               | 500                    | 0.05      |
| Rice-tomato – green manure (sunken bed)                                   | 500                    | 0.05      |
| Maize (sweet corn)–potato – green gram (raised bed)                       | 500                    | 0.05      |
| Sorghum - berseem+mustard -maize (fodder) + cowpea                        | 1000                   | 0.1       |
| <b>Dairy</b>                                                              | 120                    | 0.012     |
| <b>Fishery cum duckery</b>                                                | 925                    | 0.0925    |
| <b>Goatry</b>                                                             | 70                     | 0.007     |
| <b>Poultry</b>                                                            | 70                     | 0.007     |
| <b>Mushroom unit</b>                                                      | 35                     | 0.0035    |
| <b>Vermicompost unit</b>                                                  | 100                    | 0.01      |
| <b>Biogas/compost pit</b>                                                 | 90                     | 0.009     |
| Area under supporting (roads, farmstead, pump house, threshing floor etc) | 760                    | 0.076     |
| Horticulture (Kitchen Garden +Boundary /Bund plantation)                  | 730                    | 0.073     |
| Grand total                                                               | 10,000                 | 1.00 ha   |

**Table 7.3.16: Total productivity (TP) cost and net return of different cropping system in IOFS model at Raipur**

| Cropping System                           | Total Productivity (kg) | Total cost (Rs) | Total Net Return (Rs)* |
|-------------------------------------------|-------------------------|-----------------|------------------------|
| 1. Rice-Sweet corn-Green gram             | 2049                    | 24595           | 15165                  |
| 2. Rice - Wheat-Green gram                | 1911                    | 20596           | 16491                  |
| 3. Rice-Onion+Coriander-Green manure      | 950                     | 8705            | 9745                   |
| 4. Rice-Cabbage-Green manure              | 877                     | 8303            | 8727                   |
| 5. Rice-Tomato-Green manure (sunken bed)  | 1000                    | 9132            | 10272                  |
| 6. Maize-Potato – Green gram (raised bed) | 1359                    | 11484           | 14891                  |
| 7. Sorghum-berseem+Mustard-maize (fodder) | 583                     | 6232            | 5100                   |
| Grand total                               | 8730                    | 89047           | 80391                  |

Table 7.3.17: Component-wise economics, energy, water productivity of IOFS model at Raipur

| IOFS Component                               | Cost of cultivation | Net return | Employment Generation (man days) | Residue recycle worth (Rs) | Sustainable value index | Energy inputs (MJ) | Energy output (MJ) | Energy productivity (Kg MJ <sup>-1</sup> ) | Water Productivity (REY kg/m <sup>3</sup> ) | GHG emission CO <sub>2</sub> -e (kg) |
|----------------------------------------------|---------------------|------------|----------------------------------|----------------------------|-------------------------|--------------------|--------------------|--------------------------------------------|---------------------------------------------|--------------------------------------|
| Cropping System                              | 89048               | 80389      | 131                              | 31758                      | 0.45                    | 38718              | 381199             | 0.809                                      | 0.55                                        | 711                                  |
| Dairy                                        | 84177               | 46771      | 105                              | 21327                      | 0.40                    | 480008             | 57740              | 0.004                                      | 47.87                                       | 4096.1                               |
| Fishery                                      | 9476                | 10713      | 21                               | -                          | 0.57                    | 3072               | 6911               | 0.041                                      | 0.43                                        | 235.5                                |
| Goatry                                       | 38329               | 33890      | 96                               | 3266                       | 0.60                    | 108626             | 2772               | 0.002                                      | 396.00                                      | 287.5                                |
| Poultry                                      | 39235               | 13151      | 12                               | 2641                       | 0.27                    | 6548               | 2358               | 0.021                                      | 1892.09                                     | 32.9                                 |
| Vermi-compost unit                           | 19055               | 17897      | 12                               | 26357                      | 0.15                    | 9189               | 113583             | 0.001                                      | 0.80                                        | 26968.7                              |
| Biogas/compost pit                           | 6665                | 7004       | 39                               | 7137                       | 0.57                    | 646163             | 564562             | 0.194                                      | 1.18                                        |                                      |
| Horti. (Kitchen garden +boundary plantation) | 28447               | 17819      | 427                              | 92486                      | 0.07                    | 38718              | 381199             | 0.809                                      | 0.55                                        | 1646.7                               |
| Total                                        | 3,14,432            | 2,27,635   | 131                              | 31758                      | 0.79                    | 480008             | 57740              | 0.004                                      | 47.87                                       | Total sink<br>31816.8                |



## Sardarkrushinagar (Gujarat)

Components of IOFS model at SK Nagar

| Module                         | Components                                           | Area allocation (ha) |
|--------------------------------|------------------------------------------------------|----------------------|
| Crops                          | 1. Cowpea-wheat- pearl millet                        | 0.12                 |
|                                | 2. F. sorghum- amaranth- green gram                  | 0.12                 |
|                                | 3. Groundnut- F. oat- Green gram                     | 0.14                 |
| Livestock+vermi-compost        | Cow -2 (Kankrej)                                     | 0.01                 |
| Jeevamrit + Ghanjeevamrit unit |                                                      | 0.003                |
| Nutrient recycling unit        |                                                      | 0.006                |
| Azolla unit                    |                                                      | 0.001                |
| Complimentary enterprises      | Boundary plantations: Ardusa, gliricidia, Hy. Napier |                      |
| Total                          |                                                      | 0.40                 |

## Results

- The Integrated Organic Farming System (IOFS) model implemented at Sardarkrushinagar, Gujarat, over a total area of 0.40 hectares demonstrated impressive results in terms of productivity, profitability, energy efficiency, and sustainability. The model consisted of three main components: cropping systems, livestock and allied enterprises, and boundary plantations. Among these, the cropping systems were practiced on 0.38 ha and yielded a groundnut equivalent yield of 1109 kg/ha. The cost of cultivation for this component was ₹60,900, resulting in net returns of ₹15,714. The livestock and allied components, though occupying only 0.02 ha, contributed significantly with a groundnut equivalent yield of 2346 kg/ha, a cultivation cost of ₹1,50,896, and net returns of ₹11,195. Additionally, the boundary plantations, despite not occupying a specific measured area, added 219 kg/ha in yield, with minimal cultivation costs of ₹1,524 and a comparatively high net return of ₹13,629.
- Altogether, the entire IOFS model achieved a total groundnut equivalent yield of 3674 kg/ha, a total cost of cultivation amounting to ₹2,13,320, and a total net return of ₹40,538. On a daily basis, this translated to a system productivity of 25.17 kg, with a system profitability of ₹278 per hectare per day. The model also generated employment at the rate of 0.35 man-days per hectare per day, indicating its positive impact on rural livelihoods.
- Energy analysis of the IOFS model revealed that it was highly energy efficient. Among the different cropping sequences, the cowpea-wheat-fodder pearl millet combination stood out with the highest net energy return of 587,587 MJ/ha and an energy use efficiency of 19.08. This system also recorded the highest energy productivity of 3986 kg/MJ and a specific energy value of 12.71 MJ/kg, indicating efficient conversion of energy input into yield. The boundary plantation component showed high energy efficiency, with an output energy of 194,580 MJ/ha from an input of just 8 MJ/ha, resulting in a net energy return of 194,572 MJ/ha and an energy use efficiency of 24,819.0.

**Table 7.3.18: Yield and economics of IOFS Model at Sardarkrushinagar**

| Farming system components      | Total Area (ha) | Groundnut equivalent yield (kg/ha) | Cost of cultivation (₹/unit) | Net Returns (₹/unit) |
|--------------------------------|-----------------|------------------------------------|------------------------------|----------------------|
| Cropping systems               | 0.38            | 1109                               | 60900                        | 15714                |
| Livestock and allied component | 0.02            | 2346                               | 150896                       | 11195                |
| Boundary plantation            | -               | 219                                | 1524                         | 13629                |
| Total                          | 0.40            | 3674                               | 2,13,320                     | 40,538               |



|                       |                       |
|-----------------------|-----------------------|
| System productivity   | 25.17 kg/day          |
| System profitability  | 278 (₹/day/ha)        |
| Employment generation | 0.35 (Mandays/ha/day) |

**Table 7.3.19: Energy analysis of integrated organic farming systems model (0.40 ha)**

| Cropping systems                   | Input energy (MJ/ha) | Output energy (MJ/ha) | Net energy returns (MJ/ha) | Energy use efficiency | Energy productivity (kg/MJ) | Specific energy (MJ/kg) |
|------------------------------------|----------------------|-----------------------|----------------------------|-----------------------|-----------------------------|-------------------------|
| cowpea -wheat- fodder pearl millet | 32496                | 620083                | 587587                     | 19.08                 | 3986                        | 12.71                   |
| Fodder sorghum- amaranth-greengram | 34495                | 462333                | 439354                     | 13.40                 | 1035                        | 34.01                   |
| Groundnut-fodder oat-greengram     | 30294                | 412440                | 393924                     | 13.61                 | 1156                        | 31.80                   |
| Boundary plantation                | 8.0                  | 194580                | 194572                     | 24819.0               | 11145                       | 10120                   |
| Total                              | 97293                | 1689437               | 1615437                    | 248650                | 17323                       | 10198                   |



Integrated Organic Farming systems Model at Sardarkrushinagar

### Udaipur (Rajasthan)

The Integrated Organic Farming System (IOFS) model at Udaipur demonstrated a diverse and effective approach by integrating crops, fodder, vegetables, fruits, and compost units. In the cropping component, sweet corn and black gram in kharif season produced 1395 kg of maize equivalent yield (MEY) with a net return of ₹19,812 and a return of ₹1.58

per rupee invested, while rabi wheat gave a MEY of 2210 kg and a high net return of ₹51,204 with a return of ₹3.78 per rupee. The fodder component included maize + cowpea and berseem, yielding good returns—berseem gave a remarkable ₹29,175 net return and ₹8.04 return per rupee. In vegetables, okra and pea had lower profitability, with okra yielding a net return of ₹1,450 and a return ratio of just 0.50, whereas pea gave ₹2,401 and 1.36 respectively. Fruit production from guava yielded a net return of ₹1,000 with a return ratio of 0.83. The compost unit contributed significantly with production of 2,200 kg NADEP compost, 6,600 kg vermi-compost, 1,200 kg compost, 120 liters vermi-wash, and biodynamic inputs (BD 500 and BD 501), which enhance soil fertility and sustainability. Overall, the IOFS model at Udaipur demonstrated an integrated and economically viable system, generating a total gross return of ₹1,12,280. (Table 7.3.20).

**Table 7.3.20: Yield and economics of different components of organic farming system at Udaipur**

| Farming System components |                         | Area (ha) | Yield (kg)                        | MEY (kg) | Cost of cultivation (Rs) | Gross return (Rs./ha) | Net return (Rs/ha) | Net return per rupee invested |
|---------------------------|-------------------------|-----------|-----------------------------------|----------|--------------------------|-----------------------|--------------------|-------------------------------|
| 1. Crops                  |                         |           |                                   |          |                          |                       |                    |                               |
| Kharif                    | Sweet corn + black gram | 0.25      | 500 (Sweetcorn) +120 (Black gram) | 1395     | 12520                    | 32332                 | 19812              | 1.58                          |
| Wheat Rabi                |                         |           | 2210                              | 2748     | 12000                    | 63204                 | 51204              | 3.78                          |
| 2. Fodder                 |                         |           |                                   |          |                          |                       |                    |                               |
| Kharif                    | Fodder maize + cowpea   | 0.05      | 2025 (maize) 215 (cowpea)         | 621      | 4250                     | 11489                 | 7239               | 1.70                          |
| Rabi                      | Berseem                 |           | 5987                              | 1780     | 3755                     | 32930                 | 29175              | 8.04                          |
| Zaid                      | Sesbania                |           | Used as a green manuring          |          |                          |                       |                    |                               |
| 3. Vegetable              |                         |           |                                   |          |                          |                       |                    |                               |
| Kharif                    | Okra                    | 0.10      | 130                               | 211      | 2000                     | 3450                  | 1450               | 0.50                          |
| Rabi                      | Pea                     |           | 213                               | 346      | 4000                     | 6401                  | 2401               | 1.36                          |
| 4. Fruits                 | Guava                   | 0.04      | 55                                | 119      | 1200                     | 2200                  | 1000               | 0.83                          |
|                           | Total                   |           |                                   | 7220     |                          |                       | 112280             |                               |
| 5. Compost unit           | NADEP compost           | 0.01      | 2200 kg                           |          |                          |                       |                    |                               |
|                           | Vermi-compost           |           | 6600 kg                           |          |                          |                       |                    |                               |
|                           | Compost                 |           | 1200 kg                           |          |                          |                       |                    |                               |
|                           | Vermi-wash              |           | 120 lit                           |          |                          |                       |                    |                               |
|                           | BD 500                  |           | 1.9 kg                            |          |                          |                       |                    |                               |
|                           | BD 501                  |           | 1.5 kg                            |          |                          |                       |                    |                               |



Sweet corn + Blackgram (2:2)



Fodder maize+fodder cowpea



Berseem



Crops and orchard under IOFS at Udaipur

## Umiam (Meghalaya)

### Components of the IOFS model

The IOFS model comprised of different enterprises such as cereals (rice & maize), pulses (lentil, & pea), oilseeds (soybean, & rapeseed), vegetable crops (French bean, tomato, carrot, okra, brinjal, cabbage, potato, broccoli, cauliflower, chili, & coriander, etc.), fruits (Assam lemon, papaya, & peach), dairy unit (two milch cow + calf), fodder crops (broom, guinea & napier grass), central fish pond, manure and vermi-compost unit. A farm pond of 460 m<sup>2</sup> area is used for life saving irrigation, and aquaculture. Climbing vegetables like bottle gourd, chow-chow, cucumber, and ridge gourd were grown vertically on a structure over part of the pond dyke. Dairy unit washings were directed into the pond to boost zooplankton and phytoplankton growth, supporting fish growth. While the solid waste from cow shed was used for FYM making and vermicomposting.



### Economics

The total cost of cultivation was recorded at Rs. 62,945/- per year under the IOFS model with an area of 0.43 ha. A total net return of Rs. 86,989/- per year was achieved under the IOFS model which is much higher than the region's farmer common practices of rice mono-cropping or improved practice of rice-vegetables cropping system (Table 5). The highest contribution towards the total net return was contributed by crop component of the model followed by dairy and fishery component. The net return from dairy component was calculated only in terms of milk production since the cow dung produced was recycled back into the model which was used as manure for crop production.

**Table 7.3.21: Economics of different components under the IOFS models**

| Components | Area (Ha) | COC (₹.) | GR (₹.) | NR (₹.) | B:C ratio |
|------------|-----------|----------|---------|---------|-----------|
| Crops      | 0.373     | 27,535   | 70,560  | 43,025  | 1.56      |
| Diary      | 0.004     | 22,450   | 56,940  | 34,490  | 1.53      |

|              |             |               |                 |               |             |
|--------------|-------------|---------------|-----------------|---------------|-------------|
| Fishery      | 0.05        | 4,910         | 13,000          | 80,90         | 1.65        |
| Duckery      | -           | 3,850         | 9433            | 5,583         | 1.45        |
| VC           | 0.01        | 4,200         |                 | -4200         |             |
| <b>Total</b> | <b>0.43</b> | <b>62,945</b> | <b>1,49,934</b> | <b>86,989</b> | <b>1.55</b> |

### Nutrient recycling

For 0.43 ha area, on farm nutrient recycling in IFOS could produce an amount of 64.9 kg N, 19.8 kg  $P_2O_5$  and 54.7 kg  $K_2O$ . Hence, 98.03 % of the total N requirement, 83.89 % of the total  $P_2O_5$  requirement and total of 99.45 %  $K_2O$  requirement could be met within the model itself and only 1.97% of the total N requirement, 16.11% of the total  $P_2O_5$  requirement and 0.55 % of  $K_2O$  is required to be met from the external source to sustain the model. The nutrient requirement of the model from external source would be reduced substantially with the efficient recycling of pond silt, intercropping with legume, use of biofertilizers such as azotobacter, rhizobium, phosphorus solubilizing microorganism etc.

### Energy dynamics of the IOFS model

The energy dynamics of the IOFS model were calculated, in which the total energy input (EI) of 50,351 MJ was incurred, and generated an energy output (EO) of 1,28,307 MJ, net energy (NE), energy use efficiency (EUE) and specific energy (SE) of 77,956 MJ, 2.54 and 5.77, respectively. Among the components, dairy recorded the highest EI at 23,090 MJ, followed by crops (10,181 MJ), while vermicomposting had the lowest EI (424 MJ). Further, crops exhibit the highest EO (85698 MJ) and NE (75517 MJ), with EUE of 8.42 and a low SE (2.96), indicating a favorable energy balance.



Different components of the IOFS model at Umiam



## 7.4 Programme: Capacity building including policy support to Central and State agencies

### Title: Value chain development with aggregation model for organic farming

#### Objective

- Value chain development with aggregation model for organic farming conceive and demonstration

**Locations:** (5) Calicut, (Kerala), Coimbatore (Tamil Nadu), Pantnagar (Uttarakhand), Raipur (Chhattisgarh) and Umiam (Meghalaya).

**Year of start:** Kharif 2021

**Table 7.4.1: State, location, name of group formed and brief interventions activity at different location under Value chain development with aggregation model for organic farming**

| Name of State | Name of District | Name of the village | Name of block | Number of farmers identified | Name of group if formed | Crops/ Commodities covered                                                                              | Brief progress of interventions and activities                                                                                                                               |
|---------------|------------------|---------------------|---------------|------------------------------|-------------------------|---------------------------------------------------------------------------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Chhattisgarh  | Dhamtari         | Hathband            | Kurud         | 35                           | FPO Hathband            | Scented rice and vegetables                                                                             | Linkage with FPO for organic production system and time to time advice for different issues related to organic farming and market.                                           |
| Kerala        | Kozhikode        | Chelannur           | Chelannur     | 57                           | Parappara SC colony     | Turmeric                                                                                                | Turmeric seed rhizomes 2500 kg/ha, vermicompost 2 tons, Neemcake 2 tons, Micronutrients, Biocapsules, TNAU improved Turmeric boiler, polisher, pulveriser etc were supplied. |
| Meghalaya     | Ri-Bhoi          | Mynsain, Pynthor    | Bhoirymbong   | -                            | Mynsain, Pynthor        | Rice, Maize, Ginger, Turmeric, Broccoli, Cabbage, Cauliflower, Lettuce, Coriander, Pea, Carrot, Brinjal | -                                                                                                                                                                            |

| Name of State | Name of District | Name of the village | Name of block     | Number of farmers identified                           | Name of group if formed                                   | Crops/ Commodities covered                             | Brief progress of interventions and activities                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              |
|---------------|------------------|---------------------|-------------------|--------------------------------------------------------|-----------------------------------------------------------|--------------------------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Tamil Nadu    | Erode            | Kullamplayam        | Gobichettipalayam | 850 (600 marginal, 150 small and 100 medium and large) | Maruthu Collective Farming Farmers Producer Company Ltd., | Banana, Rice, Sugarcane, Turmeric, Tapioca and Coconut | <p>The following is the Value Chain management plan for banana which was given a shape</p> <p>a. Elim Fruits, a banana ripening chamber was approached, whose MD Mr. J. Rajendran was willing to enter into contract with the FPO members to procure banana at a reasonable price than the market Price</p> <p>b. Location specific Organic Practices for Rice was shortlisted and a capacity building programme has been programmed for the interested farmers. Entire value chain of rice cultivation was discussed threadbare and the cost reduction and maximization of profit through complete mechanization using Rice Transplanter was contemplated and to be operationalized soon among selected farmers</p> <p>c. Organic Jaggery making is another business plan which is being pursued for which the members who are owing jiggery manufacturing units have been sensitized.</p> |



| Name of State | Name of District | Name of the village                                                                                   | Name of block | Number of farmers identified | Name of group if formed | Crops/ Commodities covered | Brief progress of interventions and activities |
|---------------|------------------|-------------------------------------------------------------------------------------------------------|---------------|------------------------------|-------------------------|----------------------------|------------------------------------------------|
| Uttarakhand   | Nainital         | Dhamar Devi, Ginitigarw, Hawal Kota, Kalyanpur, SanzulaNarSingh, Nathujala, Bhandari Simal,Mayarampur | Kotabagh      | 50                           |                         | Basmati rice and Wheat     |                                                |

**Table 7.4.2: Preparation of State level action plan for policy support to reduce mineral fertilizers**

| Location and State  | Name of the districts for which action plan prepared                                                                                                | Crops covered                                                                                                                                                                                                                                                                                  | Crops/Commodities covered                                                                                                                   | Brief progress on preparation of report                                                                                                                                                                                                                              |
|---------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Calicut (Kerala)    | Kozhikode                                                                                                                                           | Turmeric                                                                                                                                                                                                                                                                                       | Turmeric                                                                                                                                    | GRB 35 was supplied to turmeric growers to reduce mineral fertilizer and to enhance growth and yield of turmeric.                                                                                                                                                    |
| Dharwad (Karnataka) | 1. Bagalkot<br>2. Bidar<br>3. Chitradurga<br>4. Dharwad<br>5. Gadag.<br>6. Gulbarga<br>7. Kolar<br>8. Tumkur<br>9. Vijayapura<br>10. Uttara Kannada | Pulses / legumes (Greengram, Blackgram, Cowpea, Soybean, Pigeonpea, Chickpea) Oilseeds (Groundnut, Soybean, Safflower) Millets (Foftail, Little, Finger millets) Spices (Turmeric, Pepper, Ginger, Garlic, Chilli) Plantations (Sugacane) Horticulture crops (Drumstick, Mango, Guava, Sapota) | Sugarcane/Organic Jaggery Millets / Processing and value addition Pulses / Processing units, Dhal processing Spices / Organic turmeric unit | Discussion meetings with Organic Federations (15) of each district regarding district organic action plans. And these are under progress and later it will be finalised in consultation with Organic Cell, Department of Agriculture, Govt. of Karnataka, Bengaluru. |

## 8

# PUBLICATIONS AND HUMAN RESOURCE DEVELOPMENT

## 8.1 Publications

### 8.1.1: Research Papers

#### Ajmer

- Lal, S., Lal, G., Meena, N.K., Meena, R.D., Chaudhary, N. Choudhary<sup>1</sup> M.K. and Saxena<sup>1</sup>, S. N. 2023. Stability analysis of yield, yield attributes and essential oil content in fennel (*Foeniculum vulgare* Mill.) evaluated under a long-term organic production system. *Journal of Horticultural Sciences*, 18(1): 90-97. Naas rating 6.1.
- Lal, G., Lal, S., Meena, S.S., Chaudhary, M.K. and Kumar, N.2023. Growth, Yield and Quality of Cluster Bean Varieties as Influenced by Organic Production System. *Legume Research*. DOI: 10.18805/LR-5113. Naas rating 6.67
- S Lal, G Lal, NK Meena, CK Jangir, MK Choudhary, N Chaudhary, SS Meena, RD, Meena, MD 2023. Long-term Experiment on Fennel-cluster Bean Cropping System as Affected by Production Systems: A Strategy for Improving Yield, Quality and Soil Fertility. *Legume Research*, 10.18805/LR-5186. Naas rating. 6.8
- G Lal, S Lal, S S Meena, M K Chaudhary, N Kumar. 2023. Growth, Yield and Quality of Cluster Bean Varieties as Influenced by Organic Production System. *Legume Research*, 10.18805/LR-5113. Naas rating. 6.8
- S Lal., G Lal, N.K. Meena R.D. Meena, N Chaudhary M K Choudhary. and S N Saxena. 2023. Stability analysis of yield, yield attributes and essential oil content in fennel (*Foeniculum vulgare* Mill.) evaluated under a long-term organic production system. *Journal of Horticultural Sciences*, 18(1) : 90-97, 2023. Naas rating. 6.10

#### Bhopal

- Shubham Singh, Amar Bahadur Singh, Asit Mandal, Jyoti Kumar Thakur, Abinash Das, Poonam Singh Rajput, Girijesh Kumar (2023) Chemical and microbiological characterization of organic supplements and compost used in agriculture. *Emergent Life Sciences Research*, 9(2): 234-244. NAAS Rating 4.68
- S. Singh, A. B. Singh, A. Mandal J. K. Thakur, N. K. Sinha, A. Das, R. Elanchezhian, P. S. Rajput, G. K. Sharma. (2024) Response of Nature-Based and Organic Farming Practices on Soil Chemical, Biological Properties and Crop Physiological Attributes under Soybean in Vertisols of Central India. *Eurasian Soil Science*, 57 (1244-1260. NAAS Rating 7.4.
- JK Thakur, Asit Mandal, Nishant K Sinha, AB Singh, Somasundaram Jayaraman, Abhay Omprakash Shirale, Ashok K Patra, Aditya Rathore, Abinash Das, Dolamani Amat (2024) Culturable Diversity of Endophytic and Rhizoplane Colonizing Bacteria of Indian Mustard (*Brassica juncea* (L.) Czern&Coss), affected by Soil Types and Assessment of Plant Growth Promoting Attributes.. *Geomicrobiology Journal*. 568-576. NAAS Rating 8.3.

#### Calicut

- Thankamani C K, Srinivasan V and Sarathambal C, 2004, Identification of suitable management system for enhancing yield of rainfed turmeric (*Curcuma longa* L.), *International Journal of Research in Agronomy*, SP-7(4): 42 – 47. NAAS Rating 5.20



Saljuna K.P., Thankamani. C.K., Krishnamurthy K.S, Gayathri Pavithran and M. Alagupalamuthirsolai, 2023. Effect of growth regulators on the growth and yield of ginger (*Zingiber officinale* Rosc.) under polyhouse condition. *Journal of Plantation Crops*, 51(1):16-22. NAAS Rating 5.20

Thankamani, CK, Sariga Martin, P Saranya, V Srinivasan, C Sarathambal and S.Shanmughavel (2024). Assessment of enriched dairy waste compost as ingredient in potting medium for production of rooted black pepper cuttings. *Journal of Emerging Technologies and Innovative Research*, 11(9):433-443. NAAS Rating 7.95

Saljuna, K. P., Thankamani , C. K., Alagupalamuthirsolai , M., Krishnamurthy , K. S., & Pavithran , G (2024). Effect of Plant Growth Regulators on Nutrient and Quality Changes in *Zingiber officinale* Rosc. *Journal of Scientific Research and Reports*, 30(4), 36–44. NAAS Rating 5.17

### Coimbatore

Suganthi M, Manickam S, Ganesh R and Sunitha R. 2023. Study of Physicochemical, Cooking and Nutritional Properties of Selected Traditional Rice Varieties of Tamil Nadu. *Madras Agric. Journal* (110): 7-9 (<https://doi.org/10.29321/MAJ.10.200718>). Naas rating 4.52

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S. P. Lalid Kumar M. R. Latha P. Janaki E. Parameswari T. Kalaiselvi R. Krishnan. 2023. Natural Farming Practices Impact on Yield and Macro Nutrient Uptake of Sorghum *International Journal of Plant & Soil Science* (35):221-227. Naas rating 5.07

M. Monicaa, R. Krishnan, R. Sunitha, S. Sanbagavalli, S. Manickam, A. Senthil, S.P. Sangeetha 2023. Assessing the Impact of Natural Farming Practices on Quality Parameters of Cotton (*Gossypium hirsutum*) *Indian Journal of Agricultural Research*, Published online. Naas rating 5.20

M. Monicaa, R. Krishnan, R. Sunitha, S. Sanbagavalli, S. Manickam, A. Senthil, S.P. Sangeetha Comparing the influence of natural farming on cotton (*Gossypium hirsutum*) yield and economics with integrated and organic farming. *Journal of Applied and Natural Science*. Published online. Naas rating 4.28

### Gangtok

Kumar A, Avasthe RK, Singh RK, Babu S, Das SK, Ravisankar N, Panwar AS, Qureshi A, Laha R, Mishra VK, Bhupenchandra I, Prasad SK. 2023. Productivity and profitability of maize (*Zea mays*) cultivars under organic management condition in mid hills of Sikkim. *Indian Journal of Agronomy*. 68 (1): 26-29. NAAS rating 5.21.

Kumar A, Singh R, Avasthe RK, Das SK, Mishra VK, Krishnan V, Babu S. 2024. Growth and production potential of buckwheat genotypes under organic farming in the Eastern Himalayan region of India. *Proceedings of the Indian National Science Academy*. <https://doi.org/10.1007/s43538-024-00299-6>. NAAS rating 6.90

### Jabalpur

Kochale Priya, Sharma P.B., Sahu R.P., Gulaiya S., Patel K.K. and Sharma A. 2023. Soil Micro-flora as influenced by Nutrient Management Practices and Cropping System. *Biological Forum – An International Journal*, 15(9): 440-443. NAAS Rating 4.96.

Sahu R.P., Sharma P.B. and Vishwakarma S.K. 2024. Response of rice based cropping systems under different nutrient management practices. *Journal of Farming Systems Research and Development*.

## Ludhiana

- Singh A, Aulakh CS, Chawla N and Sidhu AS 2023. Pre-harvest exogenous application of growth regulators extends storability and maintains the seed potato quality. *Journal of Stored Products Research* 102, 102129. ISSN 0022-474X. (NAAS 8.70)
- Aulakh CS, Ravisankar N, Sidhu AS and Sharma S 2023. Crop productivity and soil health under organic farming: a review. *Indian Journal of Agronomy* 68. (NAAS: 5.55)
- Thakur M, Aulakh CS and Sidhu AS 2023. Productivity and economic feasibility of vegetable-based cropping system under organic and natural farming conditions in Indo-Gangetic plains of India. *Indian Journal of Horticulture* 80(04), 385-390. (NAAS: 6.00)
- Singh A, Aulakh CS and Sidhu AS. 2024, Increasing the seed production efficiency of autumn potato with plant growth regulators. *Crop Science* 1-11. (NAAS: 8.30)
- Singh A, Aulakh C S, Neena Chawla and Sidhu A S 2023. Seed potato growth and yield affected by plant growth regulators under seed plot technique. *Potato Journal* 50(2): 204-208. (NAAS: 5.29)
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- Singh A, Aulakh CS and Sidhu AS 2024. Optimizing phosphorus requirement of seed potato through organic and inorganic sources in north-west India. *Journal of Plant Nutrition* DOI: 10.1080/01904167.2024.2369071. (NAAS Rating 8.10)
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## Modipuram

- Debashis Dutta, Amrit Lal Meena, Chandra Bhanu, PC Ghasal, Jairam Choudhary, Sunil Kumar, RP Mishra, MA Ansari, Raghavendra KJ, AK Prusty, PC Jat, Poonam Kashyap, Peyush Punia, Mahima Dixit, Omkar Singh, Ashutosh Kumar Rai, Adarsh Kumar Meena, Shivam Rath, Poonam Yadav. 2024. Sustainable Soil Management for Climate Resilience: Long-Term Management Effects on Soil Carbon Sequestration and Nitrogen Dynamics in a Semi-Arid Tropical Inceptisol of India. *Journal of Soil Science and Plant Nutrition*, 24: 4407–4426. [NAAS Rating: 9.90]
- Azad S. Panwar, Meraj A. Ansari, Natesan Ravisankar, Subhash Babu , Ashisa K. Prusty , Prakash C. Ghasal , Jairam Choudhary , Mohammad Shamim , Raghuvir Singh , K. J. Raghavendra , Debashis Dutta<sup>1</sup> , Amrit L. Meena , Gautam V. Chauhan , Majhrool H. Ansari , Raghavendra Singh , C. S. Aulakh , D. K. Singh and P. B. Sharma, 2023. Effect of organic farming on the restoration of soil quality, ecosystem services, and productivity in rice–wheat agroecosystems. *Frontiers in Environmental Science*. 10 [NAAS Rating: 10.6]
- Amrit Lal Meena, Raghu Nath Pandey, Dinesh Kumar, Debashis Dutta, VK Sharma, Minakshi Karwal, Meraj Alam Ansari, Mahaveer Nogiya, KJ Raghavendra, PC Ghasal, Jairam Choudhary, RP Mishra, Chandra Bhanu, PC Jat, Sunil Kumar, AS Panwar. 2023. The long-term (13 years) effect of rice based organic farming on soil sulphur dynamics in a typic ustochrept soil of indo Gangetic plain of India. *Journal of Soil Science and Plant Nutrition*. 23(1): 651-667. [NAAS Rating: 9.90 ]

## Narendrapur

- Shibasis Mukherjee, Ayanita Basak, Argha Chakraborty, Rupak Goswami, Krishnendu Ray, Nasim Ali, Sayantan Santra, Alok Kumar Hazra, Sudipta Tripathi, HIRAK Banerjee, Jayanta Layek, Azad S. Panwar, Natesan Ravisankar, Meraj



A. Ansari, Gautam Chatterjee, 2023. Revisiting the oldest manure of India, Kunapajala: Assessment of its animal waste recycling potential as a source of plant biostimulant. *Frontiers in Sustainable Food Systems*. 6:1073010. NAAS Rating 11.01

### **Pantnagar**

Gangadhar Nanda, D.K. Singh, Subhas Chandra, P.C. Pandey, Ajaya Srivastava, N. Ravishankar & Shilpi Gupta 2024 Different in productivity and soil properties in rice-based cropping systems under long-term organic, integrated and conventional production. *Biological Agriculture & Horticulture* doi.org/10.1080/01448765.2024.2370288 (NAAS 7.50)

Pranjali Singh, Deep Chandra Suyal, Saurabh Kumar, Dhananjay Kumar Singh and Reeta Goal 2024. Long term organic farming impact on soil nutrient status and grain yield at the foothill of Himalayas. *Frontiers in Environmental Science* 12:1378926. (NAAS 10.60)

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Shivvendra Singh, Sumit Chaturvedi, Prayasi Nayak, Vipin Chandra Dhyani, Tony Manoj K. Nandipamu, Dhananjay Kumar Singh, Pratibha Gudapaty, Prabhakar Mathyam, Kanchu Srinivasrao and Kasivelu Govindaraju (2023) Carbon offset potential of biochar based straw management under rice- wheat system along Indo-Gangetic Plains of India. *Science of the Total Environment* 897 (165176): 1-12. (NAAS 16.75)

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### **Raipur**

Pradhan A., Dixit A., Sonkar A. and Talukdar L (2024). Influence of rain and wind dynamics on lodging of rice (*Oryza sativa*) varieties under rainfed agro-ecology. *The Indian Journal of Agricultural Sciences* 94(12):1293-1298. NAAS Rating 6.40

Pradhan A., Agrawal S., Malaiya S., Nayak V. and Amarnath (2005), Integrated farming system approaches for sustainable and climate resilient agriculture. *The Indian Journal of Agricultural Sciences.*, 95(3), 266–271. NAAS Rating 6.40

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### Thiruvananthapuram

Suja, G., Jaganathan, D. and Sooraj, C.S. Potential manure management options for organic farming in horticultural crops submitted for *Journal of the Indian Society of Soil Science* (NAAS Score: 5.34).

Suja G., Sreekumar J., Sunitha S. and Jacob John. Short-duration cassava (*Manihot esculenta* Crantz) in cropping system for profitability, energy efficiency and soil restoration. Accepted for *Current Horticulture* (NAAS Score: 4.62).

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### Udaipur

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Satya Narayan Gurjar, Arvind Verma, Roshan Choudhary, S.C. Meena, Devendra Jain, Monika Choudhary<sup>1</sup>, Ashok Kumar Samota & Ruchika Choudhary. 2022. Effect of Weed Management on Nutrient Content and uptake of Lentil (*Lens culinaris* Medik. L.). *Frontiers in Crop Improvement*. 10 (III): 1483-1485

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S.K. Dhaka, L.N. Dashora, Dilip Singh, Gajanand Jat, R.S. Choudhary, J. Choudhary and Roshan Choudhary. 2022. Effect of Organic Manures and Nutrient Levels on Productivity of Hybrid Maize in Southern Rajasthan. *Indian Journal of Fertilisers*. 18 (5): 490-497 Pinky Yadav, S.K. Sharma, Roshan Choudhary, Gajanand Jat, B. Upadhyay, S.S. Sisodia and Sonal Athnere. 2023. Effect of different Natural Farming Practices on NPK and Chlorophyll Content of Cowpea (*Vigna unguiculata* L.) under Sub Humid Southern plains of Rajasthan. *Biological Forum – An International Journal* 15(1): 289-293

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- Pooja Garwa, S.S. Lakhawat, S.K. Sharma, B.G. Chhipa, B. Upadhyay, M.K. Kaushik, D.S. Dhakre, Akshay Raj Singh Panwar and Susheel Songara. 2022. Response of Organic Manures and Aerated Liquid Formulations on Germination and Vegetative Parameters of Beetroot (*Beta vulgaris* L.). *Frontiers in Crop Improvement*. 10: 1317-1323
- Kiran Verma, S.S. Lakhawat, Virendra Singh, S.K. Sharma, B. Upadhyay, R.H. Meena, Praveen K. Meena and Gajendra Chawla. 2022. Effect of Organic Nutrient Management on Growth, Yield and Quality Parameters of Knolkhol (*Brassica oleracea* Var. *Gongylodes*). *Frontiers in Crop Improvement*. 10: 1355-1358

### 8.1.2: Books/Book Chapter

#### Coimbatore

- M. Suganthy, P. Janaki, E. Parameswari, R. Krishnan, P.S. Kavitha, M. Ramasubramanian and M.K. Kalarani, 2024. *Natural Farming - Present Status and Future Prospects*, Darshan Printers, 6A, Pudhukinar Street, P.N. Pudur, Coimbatore, ISBN: 978-93-92032-93-6487p
- Suganthy, M., Renuka Rani B and Sharma N. R., 2024. *Natural Farming for Sustainable Agriculture MANAGE*, Hyderabad ISBN: 978-81-19663-10-1; 190p
- P.S. Kavitha, M. Suganthy, E. Parameswari, Ramasubramanian P. Janaki, M. Kavino, R. Krishnan and M. K. Kalarani, 2024. *Futuristic strategies and Options for profitable organic farming*, Dharshan Printers, Coimbatore, ISBN: 978-93-92032-76-9; 463p.

### 8.1.3: Technology Bulletins/ Pamphlets/ Popular Articles

#### Ajmer

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- Shiv Lal, N.K. Meena, N. Chaudhary, S. N. Saxena, M.K. Chaudhary, R.D. Meena, C.K. Jangid, and V. Bhardwaj, 2023. Organic production of fennel, ICAR-NRCSS, Ajmer. 2/2023

### Bhopal

- B. Singh, Asit Mandal, J. K. Thakur, Asha Sahu, Sudeshna Bhattacharjya and Ashok K. Patra, 2023. Composting Technology for Organic Farming: Issues and Perspective in India. In: Research Advancements in Organic Farming (Eds): Jatindra Nath Bhakta and Sukanta Rana ISBN: 979-8-88697-519-2, Nova Science Publishers, pp81-113
- Abinash Das, Shubham Singh, Khushboo Rani, Himansu Sekhar Gouda, Bhabani Mahakuda, Arkaprava Roy, Jyoti Kumar Thakur, Ranabir Chakraborty, 2024. Natural Farming: Status, Challenges and Prospects. In Futuristic Trends in Agriculture Engineering & Food Sciences. e-ISBN: 978-93-5747-995-0 IIP Series, Volume 3, Book 23, Chapter 18.
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- अविनाश दास, ए.बी .सिंह, जे.केठाकुर, शुभम सिंह, पूनम सिंह राजपूत एवंखुशबुरानी, 2024. प्राकृतिक खेती में रोग और कीट प्रबंधन. मृदा स्वस्थ आलोक. 53-55

### Calicut

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### Coimbatore

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### **Gangtok**

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### **Karjat**

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### **Ludhiana**

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- Walia SS, Kalra VP and Sidhu AS, 2024. Diversification options for farmers of Punjab. Progressive Farming , 60(05):5-6
- Thakur M, Sidhu AS and Choudhary AK, 2024. Jaivik kheti wich sabjiyan di kashat. Krishi Jagran, 26(05): 28-29

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### Narendrapur

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### Pantnagar

- D. K. Singh, S. K. Yadav, Megha Pun, Maya Krishna, Sonam Rawat, Supriya Tripathi, P. K. Singh and Yogesh Sharma (2023). Organic Farming: Transforming science into practice towards healthy ecosystem. Indian Journal of Agronomy.
- S. K. Yadav, D. K. Singh, Supriya Tripathi and Kirti Sharma (2023). Organic Farming in India: A Vision towards a Healthy, National Indian Farmer's Digest, pp 9-12.
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### Ranchi

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### Thiruvananthapuram

- Suja, G., Jaganathan, D., Sheela, M.N., Sajeev, M.S., Makesh Kumar, T. and Harish, E.R. 2023. Cassava (Technical bulletin). ICAR-Central Tuber Crops Research Institute, Sreekariyam, Thiruvananthapuram, Kerala, India. Technical Bulletin No. (93) 74

### Udaipur

- Verma, A., Sharma, R. K., Trivedi, A., Singh, H., Jain, D. Jain., R. K. and Yadav, S. K..2024. Compendium – Natural Farming: A Way Forward for Resource Conservation and Ecological Balance, ICAR- Centre for Advanced Faculty Training on Organic Farming.. DOR, MPUAT, Udaipur, Rajasthan. Pp 1-274.
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### Umiam

- Biswakarma, N., Makdoh, B., Gulleibi, N.C., Saikia, R., Rajbonshi, N., K.M Reddy, Layek, J., Krishnappa Rangappa, Das, S., Hazarika, S and Mishra, V.K., 2023. Integrated Farming System, and Integrated Organic Farming System in the North-east Region of India. The Director, ICAR RC for NEH Region, Umiam-793103, Meghalaya, ICARNEH-ML-TB-2024-32.



## 8.2 Human Resources Development

### 8.2.1: Student guided

#### Bhopal

| Name of Student | Title of thesis                                   | Name of Advisor | Date of completion of Viva Voce |
|-----------------|---------------------------------------------------|-----------------|---------------------------------|
| Shubham Singh   | Evaluation of Natural Farming Practices in Wheat" | Dr. A. B. Singh |                                 |

#### Coimbatore

| Name of Student   | Title of thesis                                                                                | Name of Advisor | Date of completion of viva-voce |
|-------------------|------------------------------------------------------------------------------------------------|-----------------|---------------------------------|
| M. Monicaa        | Evaluation of natural farming practices in garden land ecosystem in western zone of Tamil Nadu | Dr. S. Krishnan | 29.12.2023                      |
| S. P. Lalid Kumar | Nutrient flow, dynamics and budgeting in natural farming and assessment of soil health         | Dr. P. Janaki   | 02.11.2023                      |

#### Jabalpur

| Name of Student               | Title of thesis                                                                                                                 | Name of Advisor | Date of completion of Viva Voce |
|-------------------------------|---------------------------------------------------------------------------------------------------------------------------------|-----------------|---------------------------------|
| Dharaviya Rahul G M.Sc.(Agri) | Effect of integrated nutrient management on yield and quality of summer pearl millet (Pennisetum glaucum (L.) R. Br.) varieties | Dr. L.J.Desai   | 13/7/2023                       |
| Prajapati Varsha B. Ph.D.     | Effect of integrated nutrient management in green gram - mustard cropping sequence under North Gujarat condition                | Dr. L.J.Desai   | Continue                        |
| Chaudhari Pankaj R. Ph.D.     | Evaluation of natural farming practices in groundnut - wheat crop sequence under North Gujarat condition                        | Dr. L.J.Desai   | Continue                        |
| Parmar Sonal S. M.Sc.(Agri)   | Integrated weed management in summer pearl millet (Pennisetum glaucum (L.) R. Br.)                                              | Dr. L.J.Desai   | Continue                        |
| Kamlesh kumar M.Sc.(Agri)     | Integrated weed management in mustard [Brassica juncea. (Czern and Coss)] under North Gujarat condition                         | Dr. L.J.Desai   | Continue                        |

#### Ludhiana

| Name of Student   | Title of thesis                                                        | Name of Advisor | Date of completion of Viva Voce |
|-------------------|------------------------------------------------------------------------|-----------------|---------------------------------|
| Harsh Kumar Mahey | Evaluation of natural farming practices in maize-wheat cropping system | Dr C S Aulakh   | 04-01-2024                      |

#### Narendrapur

| Name of Student | Title of thesis                                                                                              | Name of Advisor      | Date of completion of Viva Voce |
|-----------------|--------------------------------------------------------------------------------------------------------------|----------------------|---------------------------------|
| Atanu Ghosh     | Identification of bioactive compounds of Agniastra, an eco-friendly bio-pesticide (MSc Project)              | Dr Gautam Chatterjee | 15 June, 2024                   |
| Krishnendu Sau  | Exploring the microbicidal and insecticidal properties of the natural bio-pesticide Brahmastra (MSc Project) | Dr Gautam Chatterjee | 15 June, 2024                   |

**Raipur**

| Name of Student    | Title of thesis                                                                                                                                                                      | Name of Advisor   | Date of completion of Viva Voce |
|--------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------------|---------------------------------|
| Miss Neha Nevendra | Effect of organic nutrient sources on growth and yield of traditional scented rice ( <i>Oryza sativa</i> L.) variety Lokti Machhi Selection -1                                       | Dr. S. Agrawal    | Kharif 2023-24                  |
| Mukesh Chandrakar  | Effect of differentiate organic nutrient sources on growth, productivity and profitability of scented rice under organic production systems variety Lokti Machhi Selection -1 (Rice) | Dr. M. C. Bhambri | Kharif 2023-24                  |
| Chongtham Rini     | Evaluation of different cultivars of field pea under organic production system                                                                                                       | Dr. S. Agrawal    | Rabi 2023-24                    |

**Sardarkrushinagar**

| Name of Student               | Title of thesis                                                                                                                         | Name of Advisor | Date of completion of Viva Voce |
|-------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------|-----------------|---------------------------------|
| Dharaviya Rahul G M.Sc.(Agri) | Effect of integrated nutrient management on yield and quality of summer pearl millet ( <i>Pennisetum glaucum</i> (L.) R. Br.) varieties | Dr. L.J.Desai   | 13/7/2023                       |
| Prajapati Varsha B. Ph.D.     | Effect of integrated nutrient management in green gram - mustard cropping sequence under North Gujarat condition                        | Dr. L.J.Desai   | Continue                        |
| Chaudhari Pankaj R. Ph.D.     | Evaluation of natural farming practices in groundnut - wheat crop sequence under North Gujarat condition                                | Dr. L.J.Desai   | Continue                        |
| Parmar Sonal S. M.Sc.(Agri)   | Integrated weed management in summer pearl millet ( <i>Pennisetum glaucum</i> (L.) R. Br.)                                              | Dr. L.J.Desai   | Continue                        |
| Kamlesh kumar M.Sc.(Agri)     | Integrated weed management in mustard [ <i>Brassica juncea</i> L. (Czern and Coss)] under North Gujarat condition                       | Dr. L.J.Desai   | Continue                        |

**Thiruvananthapuram**

| Name of Student | Title of thesis                                                                              | Name of Advisor | Date of completion of Viva Voce |
|-----------------|----------------------------------------------------------------------------------------------|-----------------|---------------------------------|
| Sarika Nandan   | Organic production of vegetables as intercrops in cassava                                    | Dr. G. Suja     | Ongoing                         |
| Devi Sanjeev    | Natural farming vs organic farming in cassava-based cropping system -Unravelling the science | Dr. G. Suja     | Ongoing                         |

**Udaipur**

| Name of Student           | Title of thesis                                                                                                                     | Name of Advisor | Date of completion of Viva Voce |
|---------------------------|-------------------------------------------------------------------------------------------------------------------------------------|-----------------|---------------------------------|
| Devshruti Rathore (M.Sc.) | Effect of nutrient management practices on soil properties and productivity of Blackgram ( <i>Vigna mungo</i> L.) in clay loam soil | Dr R K Sharma   | May, 2024                       |



| Name of Student            | Title of thesis                                                                                                               | Name of Advisor     | Date of completion of Viva Voce |
|----------------------------|-------------------------------------------------------------------------------------------------------------------------------|---------------------|---------------------------------|
| Adarsh Sharma (Ph.D.)      | Yield and Economics in Wheat ( <i>Triticum aestivum</i> L.) as Influenced by Sowing Methods and Nutrient Management Practices | Dr S K Sharma       | July, 2024                      |
| Anshul Sharma (M.Sc.)      | Nitrogen management in sweet corn under organic farming                                                                       | Dr S K Sharma       | July, 2024                      |
| Deependra Singh (M.Sc.)    | Effect of pelleted vermicompost and its scheduling on growth and yield of organic greengram                                   | Dr Roshan Choudhary | June, 2024                      |
| Rajendra Choudhary (M.Sc.) | Performance of soybean ( <i>Glycine max</i> ) under various doses and time of application of panchagavya                      | Dr Roshan Choudhary | July, 2024                      |

**8.2.2: Training organised:****Ajmer**

| Name of the training      | Date (s)   | Number of participants | Venue of training |
|---------------------------|------------|------------------------|-------------------|
| Organic fennel production | 16.07.2024 | 50                     | Sirohi            |

**Bajaura**

| Name of the training        | Date (s)   | Number of participants | Venue of training          |
|-----------------------------|------------|------------------------|----------------------------|
| Organic and natural farming | 04.10.2023 | 20                     | Off campus Village Bhaltha |
| Organic and natural farming | 27.01.2024 | 20                     | Off campus Village Patadhi |

**Bhopal**

| Name of the training                                                                                                                                                 | Date (s)        | Number of participants | Venue of training |
|----------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------|------------------------|-------------------|
| Natural Farming and Soil Health                                                                                                                                      | 2-4 August 2023 | 30                     | ICAR-IISS Bhopal  |
| Organized training to RAEO on organic farming and composting techniques                                                                                              | 14.12.2023      | 25                     | ICAR-IISS Bhopal  |
| Field visit and training on Organic farming and composting to Agrilclinic trainees of MANAGE at Bhopal. under Indo-European chamber of commerce and Industry, Bhopal | 6.11.2023       |                        | ICAR-IISS Bhopal  |

**Coimbatore**

| Title of the Training Organized                                       | Period              | Category of Participants                   | No. of Participants |
|-----------------------------------------------------------------------|---------------------|--------------------------------------------|---------------------|
| Training to the Extension Officers of State Department of Agriculture | 28.11.22 - 30.11.22 | EOs of State Department of Agri & Horti    | 30                  |
| Paid training programme on "Organic Farming"                          | 07.12.22            | Farmers, Home gardener, Agri entrepreneurs | 28                  |

| Title of the Training Organized                                                    | Period              | Category of Participants                | No. of Participants |
|------------------------------------------------------------------------------------|---------------------|-----------------------------------------|---------------------|
| Training on Organic and Natural Farming                                            | 23.12.22            | Farmers                                 | 50                  |
| Training on "Organic Farming"                                                      | 4.01.23             | EOs of State Department of Agri & Horti | 30                  |
| Training on "Organic Farming"                                                      | 9.01.23-11.01.23    | EOs of State Department of Agri & Horti | 30                  |
| Training on "Organic Farming"                                                      | 23.01.23 - 25.01.23 | EOs of State Department of Agri & Horti | 30                  |
| Training on "Organic Farming"                                                      | 30.01.23 - 1.02.23  | EOs of State Department of Agri & Horti | 30                  |
| Training on "Organic Farming"                                                      | 6.02.23 - 8.02.23   | EOs of State Department of Agri & Horti | 30                  |
| Training on "Organic Farming"                                                      | 20.02.23 - 22.02.23 | EOs of State Department of Agri & Horti | 30                  |
| Training on "Organic Farming"                                                      | 27.02.23 - 01.03.23 | EOs of State Department of Agri & Horti | 30                  |
| Training on IOFS and awareness creation in TNIAMP Sub-basins in KVK, Pappalapatty  | 07.03.23            | Farmers                                 | 30                  |
| Training on IOFS and awareness creation in TNIAMP Sub-basins in KVK, Pappalapatty  | 08.03.23            | Farmers                                 | 30                  |
| Training on IOFS and awareness creation in TNIAMP Sub-basins in Sandhiyur, Salem   | 10.03.23            | Farmers                                 | 30                  |
| Training on IOFS and awareness creation in TNIAMP Sub-basins in KVK, Sirugamani    | 16.03.23            | Farmers                                 | 30                  |
| Training on IOFS and awareness creation in TNIAMP Sub-basins in KVK, Needamangalam | 17.03.23            | Farmers                                 | 30                  |
| Training on IOFS and awareness creation in TNIAMP Sub-basins in KVK, Vridhachalam  | 20.03.23            | Farmers                                 | 30                  |
| Training on IOFS and awareness creation in TNIAMP Sub-basins in KVK, Tindivanam    | 21.03.23            | Farmers                                 | 30                  |
| Training on IOFS and awareness creation in TNIAMP Sub-basins in KVK, Madurai       | 23.03.23            | Farmers                                 | 30                  |
| Training on IOFS and awareness creation in TNIAMP Sub-basins in KVK, Vamban        | 24.03.23            | Farmers                                 | 30                  |

### Gangtok

| Name of the training                                                                                               | Date (s)                                          | Number of participants | Venue of training                                       |
|--------------------------------------------------------------------------------------------------------------------|---------------------------------------------------|------------------------|---------------------------------------------------------|
| Technological Intervention cum Input Distribution Programme for Doubling the Farmer's Income (DFI)                 | January 25, 2024<br>Phenzong Timpyem, East Sikkim | 32                     | ICAR- Sikkim Centre, Tadong, Sikkim and KVK East Sikkim |
| Three days training programme on organic farming for farmers of Sikkim                                             | 15/02/2024<br>KVK, East Sikkim                    | 39                     | ICAR- Sikkim Centre, Tadong, Sikkim and KVK East Sikkim |
| FRONTLINE DEMONSTRATION cum Input Support Program on Organic Farming for Tribal Farmers under TSP and NPOF Project | March, 25-27 2024<br>ICAR- Sikkim Centre          | 27                     | ICAR- Sikkim Centre, Tadong, Sikkim and KVK East Sikkim |
| Training cum Input Support Programme for Promoting Improved Technology of Maize Production                         | October 12, 2023<br>ICAR- Sikkim Centre           | 41                     | ICAR- Sikkim Centre, Tadong, Sikkim and KVK East Sikkim |



## Karjat

| Name of the training                                                       | Date (s)                     | Number of participants | Venue of training                     |
|----------------------------------------------------------------------------|------------------------------|------------------------|---------------------------------------|
| Training programme on Organic rice production system                       | 30 <sup>th</sup> May, 2022   | 60                     | Kalamgaon, Tal. Shahapur, Dist. Thane |
| Krishi Din Programme                                                       | 1 <sup>st</sup> July, 2022   | 40                     | Karjat, Dist. Raigad                  |
| Awareness programme on Organic farming                                     | 12 <sup>th</sup> Aug., 2022  | 65                     | Karjat, Dist. Raigad                  |
| Workshop on Natural Farming                                                | 25 <sup>th</sup> Aug., 2022  | 45                     | Rabgaon, Tal. Sudhagad                |
| Training programme on Preparation of inputs in Organic and Natural Farming | 14 <sup>th</sup> Oct., 2022  | 100                    | Dahigaon, Tal. Sudhagad               |
| Sheti shalla on pulses and vegetables                                      | 11 <sup>th</sup> Jan., 2023  | 55                     | Usroli Tal. Kalyan Dist. Thane        |
| Kisan Gosti programme                                                      | 2 <sup>nd</sup> March, 2023  | 85                     | Dodamarg Dist. Sindhudurg             |
| Training programme on Natural Farming and Millets                          | 19 <sup>th</sup> March, 2023 | 110                    | Takipathar Tal. Shahapur, Dist. Thane |

## Ludhiana

| Name of the training                                                                                                                                                                                                                                   | Date (s)             | Number of participants | Venue of training                 |
|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------------------|------------------------|-----------------------------------|
| Training course on, "Organic Farming (Vermicompost and use of bio-fertilizers for enhancing crop yield and soil fertility)" for farmers and farm women organized by School of Organic Farming, PAU, Ludhiana in collaboration with SDC, PAU, Ludhiana. | August 7-11, 2023    | 35                     | Skill Development Centre, PAU     |
| Coordinated exposure visit of students of Police DAV Public School, Civil lines, Ludhiana to School of Organic Farming, PAU, Ludhiana                                                                                                                  | December 1, 2023     | 105                    | School of Organic Farming, PAU    |
| Training camp for PAU Organic Farmers Club (Regd) members organized by SDC and School of Organic Farming, PAU, Ludhiana as technical coordinator                                                                                                       | January 25, 2024     | 52                     | Dr Manmohan Singh Auditorium, PAU |
| Training course on, "Organic Farming (Vermicompost and use of bio fertilizers for enhancing crop yield and soil fertility)" for farmers and farm women organized by School of Organic Farming, PAU, Ludhiana in collaboration with SDC, PAU, Ludhiana  | February 19-23, 2023 | 33                     | Skill Development Centre, PAU     |
| Training camp for PAU Organic Farmers Club (Regd) members organized by SDC and School of Organic Farming, PAU, Ludhiana as Technical Coordinator                                                                                                       | May 16, 2024         | 52                     | Dr Manmohan Singh Auditorium, PAU |
| In-service training course on, "Concept and Scope of Natural Farming in Punjab" organized by SDC, PAU as Technical Coordinator                                                                                                                         | May 17, 2024         | 05                     | Skill Development Centre, PAU     |

| Name of the training                                                                                                                                                                                                                                                                                                               | Date (s)      | Number of participants | Venue of training              |
|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------|------------------------|--------------------------------|
| One-day training programme entitled “Tutorial Classes for SC Students on Training and Capacity Building” organized by School of Organic Farming, Punjab Agricultural University, Ludhiana under the scheme ‘Development and Strengthening of State Agricultural Universities ICAR-1, Subcomponent: Schedule Caste-Sub Plan (SC-SP) | March 27,2024 | 30                     | School of Organic Farming, PAU |

### Modipuram

| Name of the training                                                | Date (s)             | Number of participants | Venue of training     |
|---------------------------------------------------------------------|----------------------|------------------------|-----------------------|
| Nature Positive Farming in view of Climate Change and Food Security | 19-23 February, 2024 | 25                     | ICAR-IIFSR, Modipuram |

### Narendrapur

| Name of the training                                                                                                                                                                                     | Date(s)         | Number of participants | Venue of training             |
|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------|------------------------|-------------------------------|
| One-day Agricultural Technology Awareness Programme (ATAP) to commemorate the 125th Anniversary of the Ramakrishna Mission under the Vivekananda Krishi Mitra Prakalpa funded by the Government of India | 4 October, 2023 | 119 farmers            | Haripal, Hooghly, West Bengal |

### Raipur

| Name of the training                                                                                                       | Date (s)              | Number of participants | Venue of training   |
|----------------------------------------------------------------------------------------------------------------------------|-----------------------|------------------------|---------------------|
| Training Programme on Hi-tech Agriculture and Internet of Things (IoT) for Bankers of Chhattisgarh, BIRD (NABARD), Kolkata | 14 - 16 February 2024 | 52                     | IGKV Raipur         |
| Training Programme on Participatory seed production of millets at Khairkheda village, NABARD, Ro Raipur                    | 25 December 2024      | 123                    | Khairkheda, Charama |

### Thiruvananthapuram

| Name of the training                                                                                                                                                | Date (s)        | Number of participants | Venue of training                                            |
|---------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------|------------------------|--------------------------------------------------------------|
| Stakeholders Interface Meeting on Natural Farming (Hybrid mode)                                                                                                     | 31 July 2024    | 104                    | ICAR-CTCRI Thiruvananthapuram, Kerala                        |
| Fifth QRT Meeting of ICAR-IIFSR (including AICRP on IFS & AINPOF)                                                                                                   | 07-08 June 2024 | 25                     | ICAR-CTCRI Thiruvananthapuram, Kerala                        |
| Online course on Natural Farming: Principles & Practices and recorded a lecture on the topic ‘Landscape based integrated natural farming system’ as resource person | 17 August 2024  | NA                     | Massive Open Online Course (MOOC) Lab, MANAGE, Hyderabad, on |

**Udaipur**

| Name of the training                                                                                                              | Date (s)              | Number of participants | Venue of training   |
|-----------------------------------------------------------------------------------------------------------------------------------|-----------------------|------------------------|---------------------|
| ICAR sponsored 21 days CAFT training programme on Natural Farming: A Way Forward for Resource Conservation and Ecological Balance | 06-26 February, 2024  | 24                     | DOR, MPUAT, Udaipur |
| ICAR IDP NAHEP sponsored 15 days training programme on Natural Farming :Present Status and Future Prospects                       | 04-18 September, 2023 | 30                     | DOR, MPUAT, Udaipur |

**Umiam**

| Name of the training                                                                                 | Date (s)                                        | Number of participants | Venue of training                        |
|------------------------------------------------------------------------------------------------------|-------------------------------------------------|------------------------|------------------------------------------|
| Natural farming and Integrated Organic Farming System (IOFS) for Sustainable Livelihood in Meghalaya | 20 <sup>th</sup> to 25 <sup>th</sup> July, 2023 | 25                     | ICAR RC for NEH Region, Umiam, Meghalaya |

**8.2.3: Radio talk /Television talks****Bhopal**

- All India Radio/Doordarshan – As an Expert in Krishi Darshan Programmme (Mrada Awasth Par Vishesh Karykram), Date of Broadcasting 5<sup>th</sup> December 2022.
- All India Radio/Doordarshan – As an Expert in Krishi Darshan Programmme (Kharif Fasalo me Jaivik Khad Ki Upyogita), Date of Broadcasting 17<sup>th</sup> August 2022
- All India Radio/Doordarshan – As an Expert in Krishi Darshan Programmme (Kenchuakhad ka mahatv), Date of Broadcasting 12<sup>th</sup> April 2023
- All India Radio/Doordarshan – As an Expert in Krishi Darshan Programmme (Kharif fasalo ki jaivik kheti avam mridaswasth), Date of Broadcasting 03 June 2023.

**Ludhiana****Radio Talks**

- Kanak di jaivik kheti. AIR Jalandhar. 28.10.2022
- Jaivik kheti liye mapdhand ate pramikaran. AIR Jalandhar. 10.01.2023
- Jaivik kheti samen dhyan yog gallan. AIR Jalandhar. 12.02.2023
- Jaivik kheti vich dhyan rakhan yog gallan. AIR Jalandhar. 4.07.2023

**TV Talks**

- Fertilizer and weed management in wheat. DD Punjabi. 15.01.2023
- Jaivik kheti de miar ate parmanikaran. DD Jalandhar. 15.02.2023
- Green manuring and its importance in organic farming, DD Punjabi. 20.03.2023
- Jaivik kheti kiven shuru kariye. DD Jalandhar. 20.04.2023
- Jaivik kheti, DD Jalandhar. 19.07.2023

## Technologies generated from project and shared with State agencies /Stakeholders

| Centre     | Name of Technology                                                | Name of agency/Stakeholder to whom technology was shared | Coverage (Area in ha or number of beneficiaries, included in the State / Central sector schemes)                                                         | Documental evidence for the claim if any (Please attach the relevant document with the application) |
|------------|-------------------------------------------------------------------|----------------------------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------------------------------------------------------------------------------------------|
| Ajmer      | PoP of organic fennel production                                  | Fennel growers                                           | 100, Rajasthan State                                                                                                                                     |                                                                                                     |
| Bajura     | PoP of organic coriander production                               | Coriander growers                                        | 100, Rajasthan State                                                                                                                                     |                                                                                                     |
| Bhopal     | Nil                                                               | -                                                        | -                                                                                                                                                        | -                                                                                                   |
| Calicut    | Stable Turmeric variety for organic farming<br>Sudarsana & Suguna | Agriculture Department                                   | 20 ha                                                                                                                                                    | IRC 2024                                                                                            |
| Coimbatore | IOFS 1 acre model for garden land ecosystem                       | KVKs of TNAU and Organic farmers of Tamil Nadu           | Established in 14 KVKs of TNAU through funds received from Tamil Nadu State Government and disseminated to the organic farmers of Tamil Nadu             | G.O (Ms) 32 with the budget provision of Rs. 35 lakhs                                               |
|            | Organic Package of practices for finger millet                    | Organic Farmers of Tamil Nadu                            | 15 large-scale demonstrations are being conducted in Coimbatore, Krishnagiri and Thiruvannamalai districts of Tamil Nadu @ 5 demonstrations per district | Proceedings of Crop Scientist Meet - Millets 2023                                                   |
|            | Organic Package of practices for barnyard millet                  | Organic Farmers of Tamil Nadu                            | 15 large-scale demonstrations are being conducted in Coimbatore, Krishnagiri and Thiruvannamalai districts of Tamil Nadu @ 5 demonstrations per district | Proceedings of Crop Scientist Meet - Millets 2023                                                   |
| Gangtok    | Development of scientific organic package for large cardamom      | Govt. of Sikkim                                          | 107 with 9.46 ha coverage area                                                                                                                           | Technical Bulletin No. ICAR/SK/TB/02/2024                                                           |
| Ranchi     | Nil                                                               | -                                                        | -                                                                                                                                                        | -                                                                                                   |



| Centre             | Name of Technology                                                                                                    | Name of agency/Stakeholder to whom technology was shared                         | Coverage (Area in ha or number of beneficiaries, included in the State / Central sector schemes) | Documental evidence for the claim if any (Please attach the relevant document with the application) |
|--------------------|-----------------------------------------------------------------------------------------------------------------------|----------------------------------------------------------------------------------|--------------------------------------------------------------------------------------------------|-----------------------------------------------------------------------------------------------------|
| Pantnagar          | Technology for sugarcane based cropping system                                                                        |                                                                                  |                                                                                                  |                                                                                                     |
|                    | Technology for organic vegetable production                                                                           |                                                                                  |                                                                                                  |                                                                                                     |
| Raipur             |                                                                                                                       |                                                                                  |                                                                                                  |                                                                                                     |
| Thiruvananthapuram | Organic farming of cassava                                                                                            | Farmers through Coconut Development Board funded project at Tiruppur, Tamil Nadu | 0.6 ha                                                                                           | Progress Report of CDB Project 2023-24                                                              |
|                    | Organic farming of elephant foot yam                                                                                  | Farmers through Coconut Development Board funded project at Tiruppur, Tamil Nadu | 0.4 ha                                                                                           | Progress Report of CDB Project 2023-24                                                              |
| Udaipur            | Evaluation of natural farming practices in different groundnut + sesame intercropping                                 | AINPOF                                                                           | Included in Package of Practices of State Govt (Copy enclosed)                                   | Attached                                                                                            |
|                    | Evaluation of natural farming practices in different fennel + cabbage intercropping                                   | AINPOF                                                                           | Included in Package of Practices of State Govt (Copy enclosed)                                   | Attached                                                                                            |
|                    | Yield and Economics in Wheat (Triticum aestivum L.) as Influenced by Sowing Methods and Nutrient Management Practices | RKVY                                                                             | Included in Package of Practices of State Govt (Copy enclosed)                                   | Attached                                                                                            |
|                    | Nitrogen management in sweet corn (Zea mays L. sachharata) under organic farming                                      | RKVY                                                                             | Included in Package of Practices of State Govt (Copy enclosed)                                   | Attached                                                                                            |
|                    | Performance of soybean (Glycine max) under various doses and time of application of panchagavya                       | RKVY                                                                             | Included in Package of Practices of State Govt (Copy enclosed)                                   | Attached                                                                                            |
| Umiam              | Effect of Pelleted Vermicompost and its scheduling on Growth and Yield of Green gram (Vigna radiata L.)               | RKVY                                                                             | Included in Package of Practices of State Govt (Copy enclosed)                                   | Attached                                                                                            |
|                    | Nil                                                                                                                   | -                                                                                | -                                                                                                | -                                                                                                   |

## 9

## APPENDIX

### Details of crops and varieties used in evaluation of organic, inorganic and integrated production systems at various locations

| Location   | Crop                   | Variety                                                                                                       |
|------------|------------------------|---------------------------------------------------------------------------------------------------------------|
| Bajaura    | Black gram (Kharif)    | Palampur- 93                                                                                                  |
|            | Okra (Kharif)          | Palam Komal                                                                                                   |
|            | French bean (Kharif)   | Falguni                                                                                                       |
|            | Cauliflower (Rabi)     | Madhuri                                                                                                       |
|            | Pea (Rabi)             | Pb-89                                                                                                         |
|            | French bean (Summer)   | Shakira                                                                                                       |
|            | Summer squash (Summer) | Angelina                                                                                                      |
|            | Tomato (Summer)        | Hybrid 537                                                                                                    |
| Bhopal     | Soybean                | JS-2034                                                                                                       |
|            | Durum wheat            | HI-8737                                                                                                       |
|            | Mustard                | Pusa Bold                                                                                                     |
|            | Chickpea               | RVG-203                                                                                                       |
|            | Linseed                | JL-9                                                                                                          |
| Calicut    | Ginger                 | Varada                                                                                                        |
|            | Turmeric               | Prathibha, Alleppey Supreme, Varna, Sobha, Sona, Kanthi, Suvarna, Suguna Sudarsana, Kedaram, Prabha, Pragathi |
| Coimbatore | Daincha                | Local                                                                                                         |
|            | Chillies               | CO1 Hybrid                                                                                                    |
|            | Brinjal                | CO 2                                                                                                          |
|            | Pearlmillet            | CO(Cu) 10                                                                                                     |
|            | Barnyard millet        | CO(KV) 2                                                                                                      |
|            | Tomato                 | PKM 1                                                                                                         |
|            | Finger millet          | ATL 1                                                                                                         |
| Dharwad    | Pigeonpea              | ICP-8863                                                                                                      |
|            | Greengram              | DGGV 2                                                                                                        |
|            | Sorghum                | SPV 2217                                                                                                      |
|            | Groundnut              | GPBD 4                                                                                                        |
|            | Hy. cotton             | DCH-32                                                                                                        |



| Location  | Crop           | Variety                             |
|-----------|----------------|-------------------------------------|
| Karjat    | Maize          | DWR 2006                            |
|           | Soyabean       | DSB 21                              |
|           | Rice           | Karjat-4                            |
|           | Brinjal        | Krishna F1                          |
|           | Chickpea       | Vijay                               |
| Jabalpur  | Field bean     | Konkan wal-1                        |
|           | Onion (White)  | Alibag local                        |
|           | Soyabean       | JS 20-98                            |
|           | Wheat          | JW 3382                             |
|           | Lentil         | IPL 316                             |
| Ludhiana  | Berseem        | J B - 1                             |
|           | Mustard        | Pusa Agrani                         |
|           | Green gram     | Shikha                              |
|           | Sorghum fodder | MP Chari                            |
|           | Basmati rice   | Panjab basmati 7                    |
| Modipuram | Sesame         | Punjab Til No. 2                    |
|           | Moong (summer) | SML 832                             |
|           | Moong (Kharif) | ML 2056                             |
|           | Wheat          | Unnat PBW343                        |
|           | Chickpea       | PBG 8                               |
| Pantnagar | Lentil         | LL1373                              |
|           | Basmati rice   | PB-6                                |
|           | Rice           | Saket-4                             |
|           | Maize Grain    | Bajaura pop corn/Madhuri sweet corn |
|           | Green cob      | Madhuri                             |
| Pantnagar | Wheat          | HI - 8498                           |
|           | Okra           | Arka Anamika                        |
|           | Potato         | Chipsona-3                          |
|           | Barley         | DWRB-91                             |
|           | Green gram     | Pusa vishal                         |
| Pantnagar | Mustard        | Pusa bold                           |
|           | Sesbania       | Ses pant-1                          |
|           | Basmati rice   | Pusa basmati-1                      |
|           | Wheat          | UP-2572                             |
|           | Chickpea       | Pant kabuli chana-1                 |
| Pantnagar | Vegetable Pea  | Arkel                               |
|           | Potato         | Kufri jyoti                         |

| Location | Crop                              | Variety                                        |
|----------|-----------------------------------|------------------------------------------------|
| Raipur   | Coriander                         | Harit RS-5                                     |
|          | Sesbania                          | Pant Ses-1                                     |
|          | Rice                              | Pusa-1509                                      |
|          | Soybean                           | PS 1347                                        |
|          | Maize                             | PSM-3                                          |
|          | Pigeon pea                        | UPAS 120                                       |
|          | Cowpea                            | PL-3                                           |
|          | Mustard                           | Toria                                          |
|          | Soybean                           | JS – 9752                                      |
|          | Sweet corn                        | Sugar-75                                       |
| Ranchi   | Field pea                         | Pant sabji matar” (PSM 3)                      |
|          | Cabbage                           | Godavari F1                                    |
|          | Tomato                            | Laxmi F1 Hybrid                                |
|          | Rice                              | Birsamati                                      |
|          | Wheat                             | K- 9107                                        |
|          | Onion                             | Arka niketan                                   |
| Umiam    | Potato                            | Kufri Ashoka                                   |
|          | Okra                              | Aprajita                                       |
|          | Rice (sunken bed) kharif          | Megha Aromatic-2, Lampnah, Ngoba, Shahsarang-1 |
|          | Bhindi                            |                                                |
|          | Carrot                            | New Koroda                                     |
|          | Potato                            | Kufri jyoti                                    |
| Ajmer    | French bean                       | Naga local                                     |
|          | Tomato                            | Rocky                                          |
|          | Cabbage                           | Golden Acre                                    |
|          | Fennel                            | AF-2                                           |
|          | Coriander                         | ACr-2                                          |
| Almora   |                                   |                                                |
|          |                                   |                                                |
|          |                                   |                                                |
| Gangtok  | Maize (Pre-kharif)                | RCM-1-1                                        |
|          | Ginger (Pre-kharif)               | Gorubuthane                                    |
|          | Turmeric (Pre-kharif)             | RCT-10                                         |
|          | Soybean (kharif)                  | RCS-1-10                                       |
|          | Black gram (Pahenlo Dal) (kharif) | SK-PD-3 (Pahenlo dal)                          |
|          | Buckwheat (Rabi)                  | Local Teethay                                  |



| Location           | Crop                | Variety              |
|--------------------|---------------------|----------------------|
|                    | Rajmash (Rabi)      | SKR-57               |
|                    | French bean (Rabi)  | -                    |
|                    | Toria (Rabi)        | TS-38                |
| Narendrapur        | Paddy               | Satabdi, Gobindobhog |
|                    | Broccoli            | Princess             |
|                    | Vegetable Pea       | MS10                 |
|                    | Mustard             | B9                   |
|                    | French Beans        | Falguni              |
|                    | Green gram          | Samrat               |
|                    | Sesame              | Tilotomma            |
| Sardar Krushinagar | Groundnut           | TG 37 A              |
|                    | Green gram (kharif) | GM 4                 |
|                    | Wheat               | GW 451               |
|                    | Coriander           | GDLC1                |
|                    | Fennel              | GF 12                |
|                    | Green gram (summer) | GM 4                 |
|                    | Vegetable cowpea    | Swati                |
| Thiruvananthapuram | Cassava             | Sree Vijaya          |
|                    | Groundnut           | Co-7                 |
|                    | Taro                | Sree Kiran           |
|                    | Black gram          | Co-6                 |
|                    | Green gram          | Co-8                 |
|                    | Vegetable cowpea    | Anaswara             |
| Udaipur            | Sweet corn          | Sugar 75             |
|                    | Blackgram           | PU 31                |
|                    | Maize               | Pratap QPM Hybrid-1  |
|                    | Fodder Maize        | Pratap Makka 6       |
|                    | Cowpea              | Doli                 |
|                    | Clusterbean         | Gayatri-71           |
|                    | Wheat (Durum)       | HI 8713              |
|                    | Wheat (Aestivum)    | Raj 4120             |
|                    | Gram                | GNG 1581             |
|                    | Fenugreek           | RMT-305              |
|                    | Soyabean            | RKS-24               |

10

## ANNEXURES

## Contact Address of NPOF Centres

## ICAR-IIFSR, Modipuram

| Name and address                                                                                                                                                                 | Phone no.          | Email                    |
|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------------|--------------------------|
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## Principal Investigators at different Centres

| State            | Location & Name of SAU/<br>ICAR institute | Name of Principal Investigator & Address                                                                                                                                 | Mobile no.  | Email ID                                           |
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| Gujarat          | SDAU, Sardarkrushinagar                   | Dr. L.J. Desai<br>Chief agronomist & PI, AI-NPOF, Centre for<br>Research on IFS, Dantiwada Agricultural University,<br>Sardarkrushinagar – 385 506.<br>Dist: Banaskantha | 9429310273  | sknagar.npof@gmail.com_sknagar.main@gmail.com      |
| Himachal Pradesh | HAREC, Bajaura, Kullu                     | Dr. Surender Kumar Thakur<br>Prof. & PI, AI-NPOF, CSKHPKV, Hill Agricultural<br>Research and Extension Centre, Bajaura, Kullu-175<br>125                                 | 9418193270  | bajaura.npof@gmail.com_sktphkv@gmail.com           |



| State          | Location & Name of SAU/<br>ICAR institute | Name of Principal Investigator & Address                                                                                                                                                                  | Mobile no.   | Email ID                                                |
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| Kerala         | ICAR-IISR, Calicut                        | Dr. V Srinivasan<br>Principal Scientist & Head Crop Production & PHT &<br>PI, AI-NPOF, ICAR-Indian Institute of Spices Research,<br>Kozhikode (Calicut)-673 012                                           | 9495083552   | calicut.npof@gmail.com<br>thankamani@spices.res.in      |
|                | ICAR-CTCRI,<br>Thiruvananthapuram         | Dr. (Mrs) G. Sujia<br>Head (crop Production) & PI, AI-NPOF, ICAR-Central<br>Tuber Crops Research Institute, Sreekaraiyam,<br>Thiruvananthapuram 695 017                                                   | 9847248697   | thiruvananthapuram.npof@gmail.com<br>sujaagin@yahoo.com |
|                | ICAR-IISS, Bhopal                         | Dr. J. K. Thakur<br>Sr. Scientist (Agril Microbiology) & PI AI-NPOF, ICAR-<br>Indian Institute of Soil Sciences, Nabi, Bagh, Berasia<br>Road, Bhopal-462 038                                              | 9752855252   | bhopal.npof@gmail.com<br>jyoti.thakur@icar.gov.in       |
| Madhya Pradesh | JNKVV, Jabalpur                           | Dr Vikas Gupta<br>Chief Agronomist AICRP-IFS & PI, AINP-OF,<br>Department of Agronomy, Jawaharlal Nehru Krishi<br>Vishwa Vidyalaya, Krishi Nagar Colony, Adhartal,<br>Jabalpur-482 004                    | 9893211994   | jabalpur.npof@gmail.com<br>pbsharma5159@gmail.com       |
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## ACRONYMS

|      |                                         |       |                                                    |
|------|-----------------------------------------|-------|----------------------------------------------------|
| ALE  | : Aquous leaf extract                   | N     | : Nitrogen                                         |
| ASE  | : Aquous seed extract                   | NF    | : Natural Farming                                  |
| BBF  | : Broad bed and furrow                  | NC    | : Neem coated                                      |
| B:C  | : Benefit: Cost                         | NEOC  | : Non edible oil cakes                             |
| BD   | : Biodynamic                            | NPV   | : Nuclear Polyhedrosis virus                       |
| CC   | : Cost of cultivation                   | NR    | : Net returns                                      |
| CDM  | : Cowdung manure                        | NRPRI | : Net return per rupee invested                    |
| Cu   | : Copper                                | OC    | : Organic carbon                                   |
| DSR  | : Direct seeded rice                    | P     | : Phosphorus                                       |
| DTPA | : Diethylene triamine penta acetic acid | PG    | : Panchagavya                                      |
| EC   | : Enriched compost                      | pH    | : Negative logarithm of hydrogen ion concentration |
| ECe  | : Electrical conductivity               | PMDS  | : Pre Monsoon Dry Sowing                           |
| Fe   | : Iron                                  | PPM   | : Parts per million                                |
| FB   | : Flat bed                              | RBD   | : Randomized block design                          |
| FYM  | : Farm yard manure                      | RP    | : Rock phosphate                                   |
| GLM  | : Green leaf manure                     | RSB   | : Raised and sunken bed                            |
| GM   | : Green manure                          | SRI   | : System of rice intensification                   |
| GR   | : Gross returns                         | SSP   | : Single super phosphate                           |
| IOFS | : Integrated organic farming system     | TSP   | : Tribal sub plan                                  |
| ITK  | : Indigenous technical knowledge        | VC    | : Vermicompost                                     |
| K    | : Potassium                             | Zn    | : Zinc                                             |
| KC   | : Karanj cake                           |       |                                                    |
| Mn   | : Manganese                             |       |                                                    |
| MOP  | : Muriate of potash                     |       |                                                    |

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