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2022-23

ANNUAL REPORT
2022-23

भाकृअनुप
ICAR

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

भा.कृ.अनु.प.भारतीय कृषि प्रणाली अनुसंधान संस्थान
मोदीपुरम, मेरठ-250 110, भारत

ICAR-Indian Institute of Farming Systems Research
Modipuram, Meerut - 250 110, India

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

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ALL INDIA NETWORK PROGRAMME ON ORGANIC FARMING

ICAR-Indian Institute of Farming Systems Research

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 2022-23 is based on experimental data generated during *kharif*, *rabi* and summer seasons of 2021-22. The other details are relevant up to March 2023.
- 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 of the Director, ICAR-Indian Institute of Farming Systems Research 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 2021-22 at 20 co-operating centres are processed, compiled, and published as Annual Report 2022-23. I take this opportunity to record my sincere thanks to **Dr Himanshu Pathak**, 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 extend my gratitude to **Dr. S.K. Chaudhari**, Deputy Director General (Natural Resource Management) for his constant guidance and mentoring the scheme to develop organic farming packages. Inputs and support received from **Dr S. Bhaskar**, Former ADG (Agronomy, Agroforestry and Climate Change) and **Dr Rajbir Singh**, Assistant Director General (Agronomy, Agroforestry and Climate Change) for improving the output of the scheme is duly acknowledged. The guidance and support received from **Dr A.S. Panwar**, Former Director, ICAR-Indian Institute of Farming Systems Research, Modipuram and **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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(N. Ravisankar)
Project Coordinator, AICRP-IFS &
National Principal Investigator, AINP-OF

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ABSTRACT

The salient research findings made during 2021-22 under All India Network Programme on Organic farming is given below

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

Bajaura: Vegetable crops were evaluated in four cropping systems under organic, inorganic and towards organic approaches. The performance of majority of crops was in the order to organic <towards organic < inorganic. Organic management resulted in yield level of 6050, 760, and 8990 kg/ha in *kharif* for frenchbean, black gram and lady finger which was 5.2% higher than towards organic for frenchbean, and 7.3 and 7.7% lower than towards organic for blackgram and lady finger respectively. Organic package resulted 1.6, 9.5 and 9.7% lower yield than inorganic. In terms of system equivalent yield (cauliflower equivalent), black gram-cauliflower-summer squash resulted in higher cauliflower equivalent yield (25115 kg/ha) among the cropping systems. Among different management practices, inorganic management with State recommendation resulted in higher equivalent yield (25160 kg/ha) followed by integrated. Cauliflower equivalent yield was decreased to the tune of 11.8 whereas with integrated it was marginally decreased only 2.3% only.

Bhopal: Soybean based system with wheat, mustard, chickpea and linseed were evaluated under organic, inorganic and towards organic approaches. 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 826, 4297, 1425, 1287 and 1607 kg/ha for soybean, wheat, mustard, chickpea and linseed which was 5.9, 4.3, 7.7, 8.5 and 3.2% lower than towards organic respectively. In terms of system equivalent yield (soybean equivalent), it was also in the order of inorganic < organic < towards organic management. Among the cropping systems, soybean-linseed recorded higher soybean equivalent yield of 2765 kg/ha followed by soybean-wheat (2637 kg/ha).

Calicut: Ginger and turmeric were evaluated under organic, inorganic and towards organic approaches. Yield of ginger and turmeric been in order of inorganic < organic < towards organic. Organic management package resulted in yield of 10274 and 29800 kg/ha respectively for ginger and turmeric which was 22.7 and 13.4% lower than towards organic but 95 and 12.4% higher than inorganic respectively.

Coimbatore: All the vegetable crops and millets performed better in order to inorganic < organic < towards organic. Organic management resulted in yield level of 19141, 13865 and 21306 kg/ha in *kharif* which is 6.6, 2.3 and 6.0% lower than towards organic for brinjal, chilli and tomato respectively. Similar trends were observed for *rabi*. System equivalent yield (brinjal equivalent) recorded in order to organic < towards organic < inorganic among the nutrient management practices. Among the cropping systems, tomato -finger millet-green manure (*dhaincha*) resulted in higher equivalent yield of 25703 kg/ha which was 5.6 and 11.4% higher than brinjal - pearl millet and chillies - barnyard millet respectively.

Dharwad: Pigeon pea and cotton based inter cropping systems was evaluated under organic, inorganic and towards organic nutrient management. Among different combinations of intercropping system, pigeon pea intercropping system resulted in higher equivalent yield in order of towards organic < inorganic < organic while cotton based intercropping systems observed in reverse order. In term of equivalent yield (PEY) recorded in order of inorganic < organic < towards organic. Pigeon pea+ ground nut recorded highest PEY among the other intercropping systems.

Jabalpur: Soybean-based cropping systems with combination of wheat (*duram*), mustard, berseem (seed and fodder), lentil and sorghum (fodder) was evaluated. Performance of soybean recorded in order of inorganic < towards organic <

organic which was 25 and 17.5% higher than inorganic and towards organic approaches. In r*abi*, all the crops performed better in order of organic < towards organic < inorganic. Organic management resulted in yield level of 2780, 1362 and 670 kg/ha in *rabi* for wheat, mustard and lentil which was 20.2, 16.5 and 23.1% lower than towards organic. Total mean productivity in terms of basmati rice equivalent was recorded higher with 100% inorganic nutrient management (5477 kg/ha) followed by organic (5093 kg/ha) among the production packages. Among cropping systems, basmati rice- berseem seed & fodder led to record maximum basmati rice equivalent yields (6238 kg/ha) followed by basmati rice – mustard-green gram of 4942 kg/ha.

Karjat: The rice-based cropping systems in combination with vegetable crops were evaluated. Rice crop performed better in order to organic < inorganic < towards organic. Organic management resulted in mean yield of rice 3264 kg/ha which was 3.8 and 1.9% lower than towards organic and inorganic. During r*abi,* yield of brinjal found to be 15.9% lower with organic than inorganic, however, chickpea, field bean resulted in higher yield with organic which was 24.6 and 14.6% increase than inorganic respectively. Performance of white onion was in order of inorganic < organic < towards organic. Organic management resulted in yield of onion 14346 kg/ha. System productivity in term of rice equivalent was in the order of inorganic < towards organic < organic. Organic management resulted in system equivalent yield of 22095 kg/ha which was about 25% higher than inorganic management practice. Among the cropping systems, rice- brinjal system produced maximum rice equivalent yield (26906 kg/ha) than others cropping systems.

Ludhiana: Four cropping system consisting of two rice-based, one moong-wheat summer moong and one sesame- lentil system was evaluated under organic inorganic and towards organic management approaches. Yield of basmati rice was in order of organic < inorganic < towards organic. Organic management resulted in mean yield of rice 3825 kg/ha which was 8.9 and 8.4% lower than towards organic and inorganic respectively. Yield of wheat and lentil was in the order of organic < towards organic < inorganic. Organic management resulted in yield level of 1320 and 1350 kg/ha for chick pea and lentil. Chickpea yield 14.8% recorded higher than towards organic whereas, lentil recorded 12.4% lower yield. System productivity in term of rice equivalent was in order of inorganic < towards organic < organic. Among cropping systems, *kharif* moong-wheat-summer moong resulted in higher system productivity of 11813 kg/ha followed by basmati rice-wheat-green manure.

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. Yield of black rice and okra was in order of inorganic < towards organic < organic whereas finger millet and black gram yield been in order of towards organic < organic < inorganic. Organic management resulted in yield level of 342, 2193, 9164 and 1024 kg/ha for black rice, finger millet, okra and black gram which was 11.0, 12.6 and 6.0% higher for black rice, finger millet and okra than towards organic. In *rabi* barley pea and tomato yield was in order of towards organic < organic < inorganic. Organic management practice resulted in yield level of barley pea tomato 2935, 41230 and 10330 kg/ha. 32.5 & 20.4% lower yield for barley and tomato was recorded over towards organic. Systems productivity among the various production packages was in order of towards organic < inorganic < organic. Black gram-tomato-green manure (*sunhemp*) recorded higher rice equivalent yield of 16008 kg/ha because of higher yield of tomato and good premium price followed by okra-vegetable pea of 11590 kg/ha among the cropping systems.

Pantnagar: Basmati rice based four cropping systems was evaluated under organic inorganic and towards organic approaches. Performance of majority of crops was in the order of organic < inorganic < towards organic. Organic management resulted in yield level of 4618, 4138, 1536 and 8854 for basmati rice, wheat, mustard and vegetable pea equivalent. Under organic management yield difference for basmati rice was only 28 kg/ha. 16.3 and 12.3% lower yield recorded for wheat and mustard respectively. System productivity in terms of basmati rice equivalent yield recorded higher with towards organic (7999 kg/ha) having 50% nutrients through organic manures + 50% nutrients through inorganic sources followed by inorganic and organic. Among all the cropping systems, higher system productivity was recorded with basmati rice-vegetable pea +coriander-*sesbania* system (8642 kg/ha) followed by basmati rice-mustard (8161 kg/ha).

Raipur: Soybean based cropping systems were evaluated with maize, field pea, tomato, and cabbage under organic, inorganic and towards organic approaches. The performance of majority of crops was in the order of towards organic <organic < inorganic. Organic management resulted in yield level of 2259, 14963, 6797, 49433 and 45480 kg/ha for soybean, maize, field bean, tomato and cabbage which was 8.4, 19.1, 15.8, 22.1 and 16.6% higher than towards organic.

System equivalent yield (Soybean equivalent) among the nutrient management practices was in order of towards organic < organic < inorganic. Among the cropping systems, soybean-tomato resulted in higher equivalent of 13414 kg/ha followed by soybean cabbage.

Ranchi: Four rice-based cropping systems were evaluated wherein wheat, onion, potato and okra were grown. The performance of rice was in the order of towards organic < inorganic < organic. Organic management practice either with organic manures equivalent to 100 % N requirement of the system or 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] resulted in higher mean yield of rice (3511 and 3376 kg/ha respectively) which was 26.8 and 21.9% higher than towards organic. In *rabi*, onion and potato follow the same trends and found to be higher by 6.8 and 47.9% than towards organic respectively whereas performance of wheat and okra was in the order of organic < towards organic < inorganic.

Umiam: Four vegetable-based cropping system namely were grown on raised beds and four rice varieties Megha Aromatic 2, Shahsarang-1, Ngoba, Lampnah taken on sunken beds under four management practices viz. 100% organic, 75% organic + innovative practice i.e. (10 % vermiwash and 10% cow urine), integrated management with 50% inorganic+50% organic and 100 %inorganic. Performance of bhindi was in the order of towards organic < organic< inorganic. Organic management resulted in mean yield of bhindi 11943 kg/ha which was about 6.1% higher than towards organic. Rest other vegetable crops on the raised bed performed better in the order of inorganic < organic < towards organic. Organic management resulted in yield level of 17530, 17950, 6860, 15740 kg/ha. Potato and tomato yield was 11.2 and 3.7% lower than towards organic.

Ajmer: Spices crops coriander and fennel was evaluated in four cropping system under organic, inorganic and towards organic approaches. The performance of majority of the crops was in the order of inorganic < organic < towards organic. Organic management resulted in mean yield of cowpea as sole crop 1000 kg/ha which was about 7 and 14% lower than towards organic and inorganic respectively.0 Yield of fennel and coriander under organic management recorded of 1608 and 717 kg/ha which was16.5 and 9.5% lower than towards organic respectively. System equivalent yield (cowpea) was in the order of organic < inorganic < towards organic. Among cropping systems, cow pea + maize (4:2) - fennel + cabbage (2:1) recorded highest equivalent yield of 4286 kg/ha followed by cow pea – fennel.

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. Organic management resulted in yield level of 3433 and 2560 kg/ha in the *kharif* for grain amaranth and finger millet which was 82.8 and 66.0% higher than towards organic respectively. Similar trends was observed for *rabi* crops. System equivalent yield recorded in the order of inorganic < towards organic < organic. Among the two systems, grain amaranth-wheat + lentil recorded highest equivalent yield of 3262 kg/ha which was about 32% higher than finger millet + black soybean-wheat + toria.

Gangtok: Maize based four cropping system was evaluated under organic inorganic and towards organic approaches. The performance of the majority of crops was in the order of inorganic < towards organic < organic. Organic management resulted in yield of maize (mean, 3300 kg/ha) in the *kharif* which was about 11.0% higher than towards organic. Similar trends for *rabi* crops were observed. In *rabi*, organic management resulted in higher yield of 12.1, 17.0, 11.8 and 11.1% than towards organic for french bean, buckwheat, rajmash and toria respectively.

Narendrapur: Rice based four cropping systems was evaluated. The performance of rice was in the order of inorganic < towards organic < organic. Organic management resulted in higher yield of rice (mean yield 3911 kg/ha) which was only 2.0% higher than towards organic. In *rabi*, majority of the crops was in order of inorganic < organic < towards organic. Organic nutrient practice resulted in higher yield of mustard by 7.22 and 17.4% than towards organic and inorganic respectively. Other crops broccoli and frenchbean vegetable pea by 2.6 and 8.3% lower yield with organic than towards organic. In summer the performance of the crops was in the order of inorganic < towards organic < organic. System equivalent yield was also resulted in the order of inorganic < towards organic < organic. Among the systems, rice (shatabdi) -frenchbean-green gram recorded highest equivalent yield.

Sardarkrushinagar: Performance of majority of the crops was in the order of organic < towards organic < inorganic. Organic management resulted in yield level of 1253 and 542 kg/ha in kharif for groundnut and green gram which was only 1.5 and 7.0% lower than towards organic respectively. Wheat crop was also lower by 3.2 and 9.8% with organic practice management than towards organic and inorganic respectively. System equivalent yield (ground nut equivalent) for management practice was in order of organic < towards organic < inorganic. Among the cropping systems, green gram - coriander - vegetable cowpea resulted in higher equivalent yield of 4418 kg/ha.

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 crops was in the order of towards organic < inorganic < organic. Organic management resulted in yield level of 14109 and 7331 kg/ha (mean) for cassava and taro which was 6.6 and 53% higher than towards organic respectively. Similar trend was observed for summer crops *.i.e* cowpea, groundnut, black gram and green gram which also resulted in 24.6, 15.0, 69.3 and 20.6% higher yield respectively. System equivalent (cassava equivalent) was in the order of inorganic < towards organic < organic. Among the systems, cassava-based system resulted in higher equivalent yield of 17883 kg/ha.

Udaipur: Performance of majority of crops was in the order of organic < inorganic < towards organic. Organic management resulted in yield level of 3302, 435, 5118 and 565 kg/ha in *kharif* for maize+ black gram, black gram, sweet corn+ black gram and soybean which 13.02, 20.9, 10.3 and 20.4% lower than towards organic. Similar trends was observed for *rabi* which 11.1, 7.8, 13.0 and 10.9% also lower than towards organic. System equivalent yield was in order of towards organic < organic < inorganic. Among the cropping systems, maize + blackgram (2:2)–wheat (durum)–sesbania (GM) resulted in higher equivalent yield of 9340 kg/ha followed by sweet corn + blackgram (2:2)–chickpea opf 9170 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 conditions. Among the maize varieties, Bajaura Makka and Girija recorded best performing varieties which recorded yield of 5130 & 4910 kg/ha respectively though, number of cobs per hectare were recorded maximum in Girija (39688) but fresh weight of cob was maximum in Bajaura Makka. Among wheat varieties, variety HPW-368 and HPW-373 recorded significantly higher grain yield (3420 and 3200 kg/ha) and found to be best performing varieties. All the traits such as number of tillers per m2 (94.7) and 1000-grains weight (46.4g) was found significantly higher in HPW-368.

Bhopal: Different varieties of groundnut and mustard was evaluated for their yield response to screen out as promising varieties for organic practices. Among the groundnut varieties cultivar GPBD-5 out performed in terms of yield followed by GJG-17. Seed yield of GPBD-5 (1989 kg ha^{-1}) was found significantly higher than others. Among the mustard varieties grown under similar organic nutrient source and doses, Aravali and out performed better in terms of seed yield followed by CS-52. Seed yield of Aravali (1144 kg ha^{-1}) and total biomass (4580 kg ha^{-1}) was recorded.

Calicut: Among the turmeric varieties, Suguna (59.10 t/ha) followed by Pragati (56.30 t/ha) recorded higher yield and found to be suitable under organic cultivation. Though, significantly higher oil content was noticed in Shobha (6.40%) followed by Varna (5.87%) and Kanthi. Suguna (12.47%) was superior for oleoresin content on comparison with other varieties. Variety Prabha (5.87%) recorded maximum curcumin followed by Prathibha (5.71%) and Kedaram (5.5%).

Coimbatore: Twelve varieties of rice were evaluated for their performance of suitability under organic production system. Among the twelve traditional rice cultures grown organically, grain yield difference was observed significantly among the rice varieties ranged from 1859 to 4534 kg/ha. Kuzhiadichan recorded highest grain yield (4534 kg/ha) followed by Milagu samba which recorded yield of 4099 kg/ha. Variety Poonkar recorded lowest grain yield (1859 kg/ha).

Dharwad: Soybean-wheat and groundnut-sorghum was undertaken to test the suitability under organic farming. Yield of soybean varieties recorded ranged between 999 to 1615 kg/ha as soybean variety DSB-34 being higher while MACS 1188 as lower performer in term of yield/ha. In case of wheat, among the different varieties UAS BW-11421 and UAS DW-30337 performed better in term of grain yield which recorded yield of 1067 and 1037 kg/ha respectively. Among the groundnut varieties, Dh-245 and Dh 256 recorded maximum seed yield of 2380 and 2113kg/ha respectively. Among

sorghum varieties, SPV-2217 and SPV 2468 recorded maximum grain yield (1640 & 1580 kg/ha) whereas M-35-1 recorded minimum grain yield (1020 kg/ha).

Jabalpur: Twelve varieties of soybean and chickpea were evaluated for their performance and suitability under organic nutrient management. Soybean variety JS 20-69 resulted in significantly highest seed yield of 1171 kg/ha followed by JS 20-116 (1090 kg/ha) being at par to J S 20-69 (1016.67 kg/ha). Among the chickpea varieties, maximum seed yield of 1846 kg ha^{-1} was recorded with JG 12 which was closely followed by JG 16 (1543 kg ha^{-1}) and JG 322 (1512 kg ha^{-1}). Variety JG 11 recorded lowest seed yield of 796 kg ha^{-1}.

Karjat: Fifteen varieties of rice 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 grouped in four categories, rice variety Sahyadri-4 (early maturing), Sahyadri-3 (mid-late maturing), Sahyadri-5 (late maturing) and karjat-3 which is popular among farmers recorded significantly higher grain yield (4353, 4600, 4610 and 4126 kg/ha respectively) over rest of varieties. Among cowpea varieties, significantly higher seed yield (1334 kg/ha) of cowpea recorded in Konkan Sadabahar followed by Phule Sonali and Phule Pandhari of 1233 & 1226 kg/ha respectively. The variation in other varieties of groundnut from 717 to 1334 kg/ha. Panvel Red produced lower yield among the varieties.

Ludhiana: Sixteen varieties of rice and twelve varieties of wheat were evaluated in rice-wheat system for their suitability under organic management. Basmati rice grain yields varied from 1720-3730 kg/ha with a maximum per cent variation of 55.5. Basmati genotype RYT 3727 recorded the highest grain yield (3730 kg/ha) which is closely followed by RYT 3993, RYT 3998, Pusa basmati 1509 which recorded yield of 3650, 3630 and 3600 kg/ha of grain yield respectively. The lowest grain yield (1720 kg/ha) was recorded with Basmati 370. Among wheat varieties, grain yield varied from 2070-3200 kg/ha with maximum percent variation of 35.3% from lower to higher. The highest grain yield was observed in Unnat PBW 550 (3200 kg/ha) followed by Unnat PBW 660 (3030 kg/ha) and BWL 3498 (3010 kg/ha). The lowest grain yield was recorded with PBW 1 Zn (2070 q/ha).

Modipuram: Nine promising varieties of Brinjal and vegetable pea were evaluated for their suitability under organic condition. Among brinjal varieties, highest yield (19133 kg/ha) was recorded under Pusa Hara Baigan followed by Kashi Uttam (17975 kg/ha) and Hybrid F1 143 (15530 kg/ha). Among vegetable pea varieties, highest yield of vegetable pea was recorded under Prachi 10 (5542 kg/ha) followed by PS 1100 (4945 kg/ha).

Pant Nagar: Total twelve varieties of rice varieties during *kharif* and twelve varieties of wheat in *rabi* were evaluated under organic cultivation. Though maximum effective tiller (292.7) and thousand grains weight (26.6 g) found to be higher in Pant Sugandha dhan 27 and Pant dhan 24 respectively but significantly higher yield of rice recorded in HKR-47 (5464 kg/ha) followed by PR-121, PD-24 and NDR-359 of 5248,5206 and 5194 kg/ha respectively. Among wheat varieties, Sonalika, (105 cm) attain tallest plant but 1000-grains weight recorded with UP 262 and WH 1142 (37.4 & 37.3 g respectively). Grain yield of different wheat varieties recorded in range from 2232 to 3324 kg/ha. Highest grain yield was resulted in HD-2967 (3324 kg/ha) followed by UP -2903, Sonalika and UP-2855 which recorded yield of 3252, 3224, and 3204 kg/ha respectively while lowest recorded with WH-1142 (2232 kg/ha).

Raipur: Rice varieties including traditional and scented during *kharif* and improved chickpea varieties during *rabi* were evaluated to assess their response for organic production. Among traditional aromatic rice varieties, Samund chini produced the highest yield followed by Lokti machhi which gave yields of 2526 kg/ha and 2519 kg/ha. Among the improved scented rice varieties the highest grain yield was recorded in C.G. Devbhog (3700 kg ha^{-1}) followed by C.G. Sugandhit Bhog (3424 kg ha^{-1}) and Sugandhmati (3420 kg ha^{-1}). Among the fortified rice varieties the highest grain yield of was recorded in Protezin followed by CG Madhuraj 55 and Zinco rice MS. Among chickpea varieties, significantly higher seed yield was obtained from Vijay (1424 kg ha^{-1}) which was statistically on par with RG 2009-01, JG-14 and JG -16.

Ranchi: Eleven varieties of rice and ten of wheat were evaluated for their suitability under organic farming in the system mode. Though 1000-grains weight was recorded maximum in IR 36 (24.5 g) but number of effective tillres/m^2, length of panicle, filled grains/panicle and grain yield resulted in higher in IR 64 of 246, 23.07, 53.7 and 2210 kg/ha respectively. IR 36 and MTU 1010 is the next best performing varieties in term of yield. Performance of wheat varieties, though number

of grains/spike (40.6) and 1000-grains weight (48.3 g) was higher in K-1006 with grain yield (1677 kg/ha) but JKW-261 resulted in higher grain yield of 2279 kg/ha K-1006. Lower grain yield was recorded in HI-1563 (779 kg/ha).

Umiam: 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. The highest pod yield of groundnut among the 12 lines is recorded in TPG 41 (2370 kg/ha) followed by TG37A (2350 kg/ha). The highest grain yield among the 12 varieties of rapeseed recorded in PM-25 (1160 kg/ha) followed by YSH (1140 kg/ha) and lower grain yield of rapeseed was recorded under PT-303 (650 kg/ha).

Ajmer: The total eight varieties each of green gram, cluster bean during *kharif* and coriander, fennel during *rabi* were evaluated under organic cultivation. Among the green gram varieties, MUM-2 resulted in plant height, higher primary branches, number of pods/plant, number of seeds/ pod, seed yield per hectare of 79.2 cm, 5.67 nos., 30.3 nos., 12.5 nos. and 645 kg/ha respectively followed by RMG-975 which gave 637 kg/ha of yield. Among cluster bean varieties, RGC-1038 variety perform well in all the parameters such as primary branches (12.87), number of pods per plant (61.0), number of seeds per pod (9.13) and seed yield per hectare (1566.67 kg) followed by RGC-1055. In coriander, primary branches, secondary branches, number of umbels, number of umbellets, seed yield per hectare was found to be higher in the variety Azad dhania-1 (1723kg/ha) followed by ACr-1 (1691.67 kg/ha) and Hissar Anand (1533kg/ha). Among fennel varieties, variety GF-12 outperformed for all the parameters such as primary branches (10.53), secondary branches (20.13), umbels per plant (32.47), umbellets per umbel (26.53) and seed yield per hectare (3067 kg) followed by AF-1 (3033 kg/ha).

Gangtok: Maize and buckwheat varieties was evaluated under organic management. Among the maize varieties, Maximum number of grains row^{-1} (37.93) was observed under Kalo makkai which was statistically at par with Rato makkai, Vivek Sankul-31 but significantly higher than other cultivars. Significantly higher value of grain yield (4100 kg/ha) was observed under Vivek Sankul-35 as compared to other cultivars but remained statistically at par with Vivek Sankul-31 and Seti makkai. Among the buckwheat varieties, yield ranged recorded from 920 to 2190 kg/ha. Maximum grain yield (2190 kg/ha) was recorded under Local Meethay which was statistically at par with IC-109433, IC109729, IC49671.

Sardarkrushinagar: Eight verities of each crop in groundnut-wheat-green gram system were grown for their performance under organic farming**.** Among groundnut varieties, yield attributing characters plant height (54.6cm), number of branches/plants (5.27), number of pods/plants (23.4), pod weight/plant (10.10 g) resulted in significantly higher pod yield (1627 kg/ha) recorded in GJG 17 which was at par with GG 20 (SS) in case of pod yield. Among different variety of wheat, variety GW 451 variety outperformed better and recorded highest grain yield (3565 kg/ha) as compared to other wheat variety. Variety GW496 is the next best performing variety in term of yield which recorded 3380 kg/ha. Among the green gram varieties, GM 4 resulted in higher number of pods/plant (25.5), number of seeds/pod (7.7), seed yield (756 kg/ha) as compare to other variety. Gm-5 is the next best performing variety in term of yield which recorded 713 kg/ha.

Thiruvananthapuram: Twelve varieties of cassava evaluated suitable for organic management practices with varying duration and nutrient requirements. Tuber yield of cassava varieties ranged between 0.955 to 1.278 kg/plant and 11.79 to 20.51 t/ha. Among the varieties, Sree Reksha (CR-24-4) outperformed better which recorded 20.51 t/ha yield, which is at par to Sree Pavithra which is next best performing variety (18.31 t/ha) and closely followed by H-165 (17.58 t/ha).

Udaipur: Evaluation of response of different varieties of maize and wheat grown in maize–wheat system under organic farming. Among the twelve varieties of maize grown under organic farming, variety Pratap Hybrid Maize3 outperformed significantly better in term of weight of grains/cob, test weight and grain yield of 112.4, 257 and 5895 kg/ha respectively. Other best performing varieties such as, Sugar-75 among sweetcorn varieties, VL Amber among popcorn and Navjot among local varieties showed comparative better performance for yield attributes and yield. Five varieties of each *Triticum aestivum* and *duram* and two varieties of local wheat was evaluated under organic management. Among the *Triticum aestivum* HI-1531 recorded higher yield of 4720 kg/ha. Similarly, among the duram varieties, HI 8713 gave significantly higher yield of 5636 kg/ha.

Evaluation of Natural Farming Practices in different agro ecologies

Ajmer: Cow pea + maize - coriander + fenugreek cropping system were evaluated. Complete natural farming recorded system equivalent yield of 1912 kg/ha. Under complete natural farming, soil organic carbon recorded numerically higher (0.27%) compared to control (0.26%). Complete natural farming recorded net return of Rs. 82,093 with cost of cultivation of Rs. 25,640. Natural farming resulted in reduction in cost of cultivation by 60.73% and 50.52% over organic and integrated crop management respectively.

Udaipur: Cowpea + maize - fennel + cauliflower cropping system were evaluated. Under complete natural farming system equivalent yield recorded 7337 kg/ha. Soil organic carbon (0.71%) was recorded with complete natural farming which higher over control (0.67%) however it was 4.05% lower than organic. Complete natural farming recorded net return of Rs. 1,74,362/ha with cost of cultivation of 81,805 /ha. Natural farming resulted in reduction in cost of cultivation by 17.62% organic package.

Sardarkrushinagar: Cowpea +maize -fennel+ cauliflower cropping system were evaluated. Under complete natural farming, system equivalent yield of 1379 kg/ha. Under complete natural farming soil organic carbon was recorded 1.32% which was 20% higher over control (1.10%). Complete natural farming recorded net return of Rs. 23,668/ha with cost of cultivation of 38,457/ha which found to be a negative in term of return.

Almora: Soybean + maize - vegetable pea + green coriander systems were evaluated. Complete natural farming recorded system equivalent yield of 7920 kg/ha. Soil organic carbon recorded 0.87% under complete natural farming which is 6.1% higher over control but 29.84% was decreased over organic package (NF-4). Complete natural farming practice recorded net return of Rs 2,65,436/ha with cost of cultivation of 1,09,033. Natural farming resulted in reduction in cost of cultivation by 0.45% over organic package.

Bajaura: Complete natural farming recorded system equivalent yield of 5814 kg/ha. Soil organic carbon (0.85%) recorded under complete natural farming which is 28.7% higher over control. Complete natural farming practice recorded net return of Rs 2,56,403/ha with cost of cultivation of 87,000 in soybean+ maize - vegetable pea + green coriander systems. Natural farming resulted in reduction in cost of cultivation about 5.7 % over organic.

Gangtok: Complete natural farming recorded system equivalent yield of 8039 kg/ha. Soil organic carbon (1.17%) recorded under complete natural farming which was 31.4% higher compared to control (0.89%). Complete natural farming practice recorded of Rs 2,65,900 /ha with cost of cultivation of 1,20,230 in soybean+ maize - vegetable pea + green coriander systems. Natural farming resulted in increased significantly in cost of cultivation by 45.4% over organic.

Bhopal: Soybean+ maize - wheat + mustard recorded system equivalent yield of 5297 kg/ha. Net return of Rs. 39,895/ha recorded in complete natural farming with cost of cultivation of Rs.52,343/ha. Complete natural farming practice resulted in reduction in cost of cultivation by 35.4 and 38.7% over organic and integrated crop management (ICMCP) practice respectively.

Raipur: Soybean + maize - wheat + mustard systems were evaluated. Complete natural farming practice recorded system equivalent yield of 2720 kg/ha. Complete natural farming recorded soil organic carbon of 0.64% which is 12.2% higher over control. Net return of Rs. 55,274/ha recorded in complete natural farming with cost of cultivation of Rs.79,015 /ha. Complete natural farming practice resulted in reduction in cost of cultivation by 5.9% over organic practice and increase in cost of cultivation by 8.3% over integrated crop management (ICMCP) practice.

Coimbatore: Cotton + green gram - sorghum + chickpea cropping system was evaluated. Complete natural farming practice recorded system equivalent yield of 2730 kg/ha. Complete natural farming recorded soil organic carbon of 0.71% which was 14.5% higher over control. Net return of Rs. 85,662/ha recorded in complete natural farming with cost of cultivation of Rs.78,210/ha. Complete natural farming practice resulted in reduction in cost of cultivation by 46.2 and 48.1% over organic and integrated crop management (ICMCP) practice respectively.

Dharwad: Complete natural farming practice recorded system equivalent yield of 670 kg/ha. Complete natural farming recorded soil organic carbon of 0.88% which was 15.7% higher over control. Net return of Rs. 29,516/ha recorded under

complete natural farming with cost of cultivation of Rs.44,122/ha in cotton + green gram - sorghum + chickpea cropping system. Complete natural farming practice resulted in reduction in cost of cultivation by 29.1 and 21.3% over organic practice and integrated crop management (ICMCP) respectively.

Umiam: Turmeric + cowpea - green gram cropping system were evaluated. Under complete natural farming system equivalent yield recorded 11400 kg/ha. Complete natural farming recorded net return of Rs. 1,27,700 /ha with cost of cultivation of 65,644/ha. Natural farming resulted in reduction in cost of cultivation by 26.6 and 34.0% over organic practice and integrated crop management (ICMCP) respectively.

Karjat: Rice + dhaincha - sweetcorn + cowpea cropping system was evaluated. Complete natural farming practice recorded system equivalent yield of 8735 kg/ha. Complete natural farming recorded soil organic carbon of 1.03% which was 3% higher over control but about 1.9% lower than organic package. Net return of Rs. 12,741/ha recorded in complete natural farming with cost of cultivation of Rs.1,56,716 /ha. Natural farming resulted in reduction in cost of cultivation by 29.0 and 18.0% over organic practice and integrated crop management (ICMCP) respectively.

Ranchi: Rice-sweet corn cropping system was evaluated. Complete natural farming practice recorded system equivalent yield of 5676 kg/ha. Complete natural farming recorded soil organic carbon of 0.62% which was significantly higher by 37.7% over control. Net return of Rs. 94,284/ha recorded in complete natural farming with cost of cultivation of Rs.58,500/ ha. Complete natural farming practice resulted in reduction in cost of cultivation by 23.5 and 27.5% over organic and integrated crop management (ICMCP) practice respectively.

Ludhiana: Maize + cowpea - wheat + chickpea cropping system was evaluated. Complete natural farming practice recorded system equivalent yield of 3500 kg/ha. Complete natural farming recorded soil organic carbon of 0.40% which was about 4.7% lower over control. Net return of Rs. 24,802/ha with cost of cultivation of Rs.52,360/ha recorded in complete natural farming. Complete natural farming practice resulted in reduction in cost of cultivation by 48.6 and 16.0% over organic and integrated crop management (ICMCP) practice respectively.

Modipuram: Complete natural farming practice recorded system equivalent yield of 3247 kg/ha which. Complete natural farming recorded soil organic carbon of 0.55% which was 7.8% higher over control (0.41%). Net return of Rs. 11,614/ha with cost of cultivation of Rs.72,480/ha recorded in complete natural farming from maize + cowpea - wheat + chickpea cropping system. Complete natural farming practice resulted in reduction in cost of cultivation by 32.07 and 22.9% over organic and integrated crop management (ICMCP) practice respectively.

Thiruvananthapuram: Cassava - cowpea cropping system was evaluated. Complete natural farming practice recorded system equivalent yield of 47019 kg/ha. Complete natural farming recorded soil organic carbon of 0.93% which was 3.1% lower over control (0.86%). Net return of Rs. 6,98,901/ha with cost of cultivation of Rs.2,41,470/ha recorded in complete natural farming. Complete natural farming practice resulted in reduction in cost of cultivation by 29.7 and 27.8% over organic and integrated crop management (ICMCP) practice respectively.

Development of Integrated Organic Farming System models

Calicut (Kerala): The plot with spices, fodder and vegetables combination was evaluated under IOFS model. The crops were black pepper, turmeric, fodder grasses (CO-3, CO-4), Tapioca, Banana, cowpea, Coconut, were planted and established. Two cows and their calves were maintaining. Turmeric 1250 kg, Banana 600 kg, Tapioca 800 kg and vegetable cowpea 244 kg, coconut 2120 nos. were harvested. Fodder grass fed to the cows that are maintained at ICAR-IISR farm and balance was sold. Net profit of Rs 2,58,245 was received from one-acre IOFS model. Employment generated Man days/year is 626 (Table 7.4.1). Maximum income shares 60.97% was came from livestock followed by horticulture (19.38%) and cropping systems (17.18%)

Thiruvananthapuram (Kerala): Net returns of Rs. 1,71,277 was achieved from tuber crop-based farming system, tuber equivalent yield of 20.2 tons obtained from IOFS model involving tuber crops from an area of 75 cents. Total 5515 liter/kg milk yield was recorded. The % share of area and income of the various components of IOFS is given in Table 7.3.2 and 7.3.6.

Coimbatore (Tamil Nadu): System productivity in term of cotton equivalent was recorded higher with bhendi-maize-*dhaincha* of 727 kg as compared to cotton-sorghum-*dhaincha* cropping system which recorded CEY of 438 kg. Through crop component, an income of Rs.33,415 was obtained. Two numbers of Jersey cross bred produced 1129 litre of milk and realised of Rs. 67,770 as gross return. Fodder obtained from crop component (maize and cumbu Napier) is being fed to the animals. Annually 13.32 tonnes of cow dung and 9782 litres of urine were obtained from livestock which were applied to the crops to boost the yield. From this manure 86.2 kg of N, 36.4 kg of P_2O_5 and 115.6 kg of K_2O with the value of Rs.6346 was saved. Recycling of the on-farm resources such as crop residues and litters were converted into compost, from these units on an average 3560 kg of compost per annum was produced of the value of Rs. 6380. Fodder grass cumbu napier CO (CN) 5 and desmanthus (*Deamanthus varigatus*) harvested 25.1 tonnes at regular intervals and being fed to the NPOF cattle. In this system on an average 986 nuts per year was obtained with the average cost of Rs.10.17 per nut. Rs 16,126 was obtained as net income generation from boundary plantation. From this IOFS model, gross income of Rs. 2,09,877 was obtained with total cost of the Rs. 1,50,161 per annum and the net return of Rs.59,716 was realized with BCR of 1.4.

Gangtok (Sikkim):

Net return of Rs 56,644 was received by crop component from 0.4 ha area, Rs 64,829 was received by dairy (0.05 ha), Rs 7231and 37,291 obtained from fishery and poultry, whereas Rs 6000 was received from vermicomposting. Highest return was recorded from large cardamom of Rs 1,78,000. From this 0.60 ha IOFS model, gross income of Rs. 2,95,869 was obtained with total cost of the Rs. 1,31,349 per annum resulted in net return of Rs. 1,74,420 was realized with BCR of 2.25. The highest contribution towards the total net return was contributed by large cardamom of the model followed by dairy and crop.

Sardarkrushinagar (Gujarat): Integrated Organic Farming Systems (IOFS) model comprised different components *viz.*, crops (0.24 ha), green fodder crops (0.15 ha), dairy + vermi compost (0.01 ha) and boundary plantation. Total net profit of Rs 19021 was received by crop component from 0.24 ha area, Rs 18501 was received by fodder unit (0.15 ha) and Rs 3820 was received from boundary plantation. Rs 1686 was loss in livestock component due to dry period of cow for long spell. Total net profit from all the components of IOFS model including boundary plantation was Rs 39656 from 0.40 hectare area. The highest contribution towards the total net return was contributed by crop component of the model. Under the IOFS model, net return per rupee invested (0.26), system productivity (8.15 kg/day) and system profitability (Rs 109./day) was achieved with 83 man-days of employment generation.

Udaipur (Rajasthan)

An integrated organic farming system model for 0.45 ha comprising of field crops sweet corn + black gram – wheat (0.25 ha) fodder crops maize fodder + cowpea – berseem (0.05 ha) – *sesbania* green manuring, vegetables in 0.10 ha (okra and cauliflower), fruit crop guava (0.04 ha) and compost unit in 0.01 ha. Total maize equivalent yield of 6466 kg/ha recorded from the IOFS model. Gross and net return of Rs. 1,22,269 and 76,528 /ha was obtained from the integrated organic farming system model with the cost of Rs. 40,200 with 2.04 NRPRI.

Umiam (Meghalaya): The total cost of cultivation was recorded at Rs. 69,462/- per year under the IOFS model with an area of 0.43 ha. A total net return of Rs. 90,360/- per year was achieved under the IOFS model which is about to Rs. 2,09,652/ha and much higher than the region's farmer common practices of rice mono-cropping or improved practice of rice-vegetables cropping system. The highest contribution towards the total net return was contributed by crop model, component of the model followed by dairy and fishery component.

INTRODUCTION 1

The total factor productivity growth score prepared by National Institute of Agricultural Economics and Policy Research, New Delhi has revealed that technology-driven growth has been highest in Punjab and lowest in Himachal Pradesh. It implies that some of the states like Himachal Pradesh, Uttarakhand, Madhya Pradesh, Rajasthan, Jharkhand and north-eastern region of India have not been influenced much by the modern inputs of agriculture like chemical fertilizers and pesticides. Moreover, despite all technological advancements, the nutrient use efficiency is on lower side. On the other hand, it has been proved scientifically and convincingly that integrated use of organic manures with chemical fertilizers improves the use efficiencies of the latter owing to concurrent improvement of soil physical, chemical and biological properties. The water holding capacity of the soil also gets improved on account of regular use of organic manures. It is estimated that various organic resources having the total nutrient potential of 32.41 million tonnes will be available for use in 2025. To feed the projected of population of 1.7 billion in 2050, 400 million tonnes of food need to be produced which is expected to require around 60 million tonnes of nutrients. Conservative estimates indicate, around 15 million tonnes of nutrients can be shared through organic manures and other sources. Hence, niche area and crop approach for promotion of organic farming is considered to be a viable and efficient option for promotion of certified organic farming while in other areas towards organic approach otherwise called as integrated crop management would better in achieving the targets of food production besides ensuring sustainability in agriculture. 'Towards organic' (integrated crop management) approach for input-intensive areas (food hubs) and 'certified organic' approach by integrating tradition, innovation and science in the de-facto organic areas (hill and rainfed/dryland regions) has been found to be better option for national food security, higher household income and climate resilience which will further enhance the safe food production and meet the social values.

Third party certified and in conversion cultivated area under organic farming reached to 5.39 million ha by March 2023 (APEDA, 2023) while around 0.73 m ha is brought under participatory Guarantee System (PGS). Therefore, currently around 4 % of net cultivated area is either under certified or in conversion process of organic farming. India is producing wide range of crops under organic management with oilseeds, sugar crops, fiber crops, cereals and millets and pulses occupy the large chunk of the basket. Government of India has set a target of bringing minimum of 20 % net cultivated area under organic and natural farming by March 2032 (NITI Aayog). However, organic farming promotion is constrained due to limitations in terms of yield, availability of inputs for nutrient, weed, insect and disease management among other factors. Among all the factors, nutrient management under organic farming plays very important role in achieving the desired yield levels. Besides, organic farming, natural farming is also seen as alternative production aiming to reduce the chemicals in farming. Evolving from indigenous practices and on-farm input-based management, natural farming also gives scope to increase the area under chemical free 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.

OBJECTIVES AND METHODOLOGY

2

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,*durum* and *aestivum* wheats, sorghum, barley and maize), pulsesand 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 2021-22, following experiments/study were undertaken at different centers:

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

1. Geo-referenced characterization of organic farmers
2. Documentation & validation of organic ITKs
3. 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

4. Evaluation of organic, inorganic and integrated production systems for crops and cropping systems
5. Evaluation of response of different varieties of major crops for organic farming
6. Evaluation of organic management practices for insect pest in various crops
7. Evaluation of organic management practice for diseases in crops
8. Development of scientific organic package for large cardamom
9. Evaluation and validation of natural farming practices in different agro-ecologies
10. Farmers participatory validation of organic and natural farming practices in farmers field under SCSP/STC sub plans

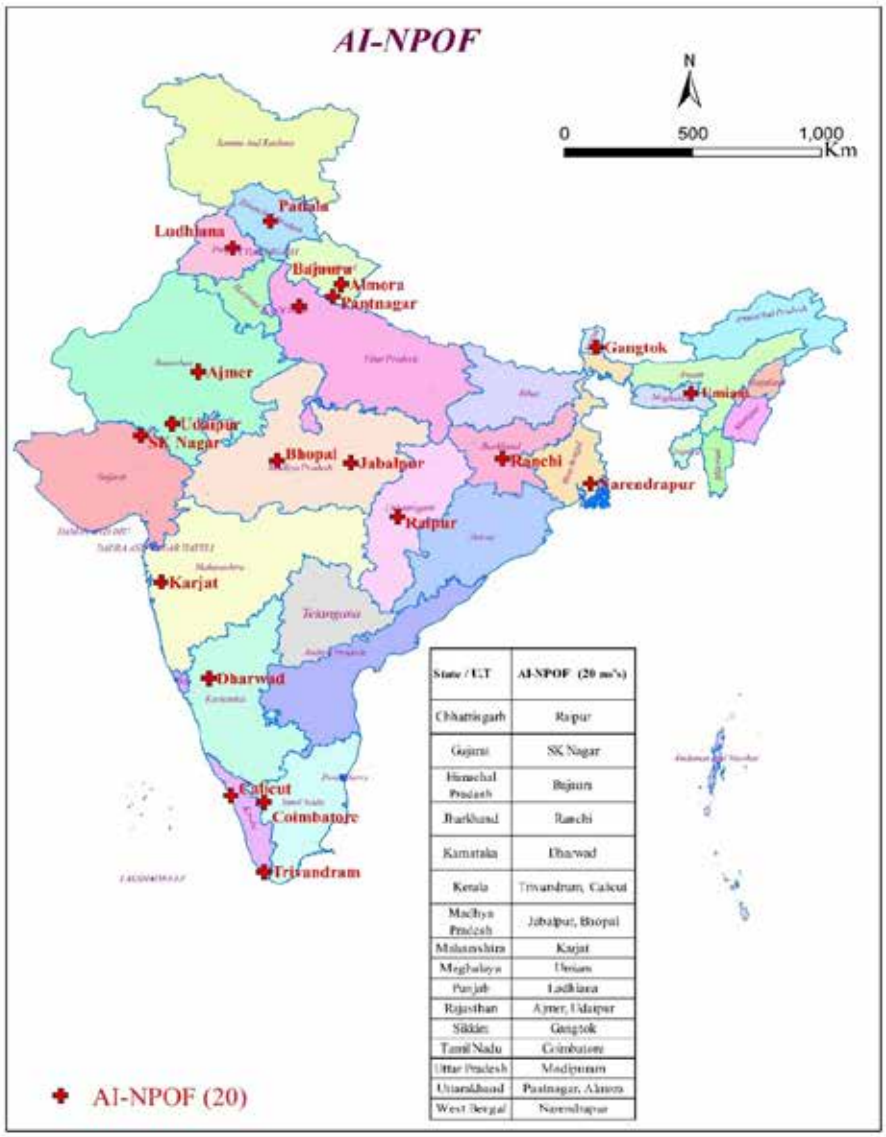
Programme 3: Integrated Organic Farming Systems

11. Development of integrated organic farming system model

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

12. 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.



State / UT	AI-NPOF (20 no's)
Chhattisgarh	Raipur
Gujarat	SK Nagar
Himachal Pradesh	Bajaura
Jharkhand	Ranchi
Karnataka	Dharwad
Kerala	Trivandrum, Calicut
Madhya Pradesh	Jabalpur, Bhopal
Maharashtra	Karjat
Meghalaya	Umiam
Punjab	Ludhiana
Rajasthan	Ajmer, Udaipur
Sikkim	Gangtok
Tamil Nadu	Coimbatore
Uttar Pradesh	Modipuram
Uttarakhand	Pantnagar, Almora
West Bengal	Narendrapur

LOCATION 3

Multi-location experiments were conducted during 2021-22 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.	Location of centre	State	Address of SAU/ICAR institute
Centres functioning from 2004-05			
	Bajaura	Himachal Pradesh	CSK HPKVV Hill Agri. Res. & Extn. Centre, Bajaura, Kullu-175 125
	Bhopal	Madhya Pradesh	ICAR-Indian Institute of Soil Science, Nabi Bagh, Berasia Road, Bhopal – 462 038
	Calicut	Kerala	ICAR-Indian Institute of Spices Research, P.B. No. 1701, Marikunnu PO, Calicut – 673 012
	Coimbatore	Tamil Nadu	Tamil Nadu Agricultural University, Coimbatore – 641 003
	Dharwad	Karnataka	University of Agricultural Sciences, Yettinagudda Campus, Krishinagar, Dharwad-580 005
	Jabalpur	Madhya Pradesh	Jawaharlal Nehru Krishi Viswa Vidyalaya, Jabalpur-482 004
	Karjat	Maharashtra	Dr. Balasaheb Sawant Konkan Krishi Vidypeeth, RARS, Karjat, Dist. Raigad – 410 201
	Ludhiana	Punjab	Punjab Agricultural University, Ludhiana-141 004
	Modipuram	Uttar Pradesh	ICAR-Indian Institute of Farming Systems Research, Modipuram, Meerut -250 110
	Pantnagar	Uttarakhand	G.B. Pant University of Agriculture Sciences & Technology, Pantnagar, Udham Singh Nagar – 263 145
	Raipur	Chhattisgarh	Indira Gandhi Krishi Vishwavidyalaya, Raipur-492 012
	Ranchi	Jharkand	Birsa Agricultural University, Kanke, Ranchi – 834 006
	Umiam	Meghalaya	ICAR Research Complex for NEH Region, Umiam – 737 102
Centres functioning from 2015-16			
	Ajmer	Rajasthan	ICAR-National Research Centre on Seed Spices, Tabiji, Ajmer-305 206,
	Almora	Uttarakhand	ICAR-Vivekananda Parvatiya Krishi Anusandhan Sansthan, Almora-263 601
	Gangtok	Sikkim	ICAR Research Complex for NEH Region, Sikkim Centre, Tadong, Gangtok -737102
	Narendrapur	West Bengal	School of Agriculture & Rural Development, Ramakrishna Mission Vivekananda University, PO Belur Math, Howrah-711 202
	Sardar Krushinagar	Gujarat	Sardar Krushinagar-Dantiwada Agricultural University, Sardar Krushinagar, Banaskantha –385 506

Sl. No.	Location of centre	State	Address of SAU/ICAR institute
	Thiruvananthapuram	Kerala	ICAR-Central Tuber Crops Research Institute, Sreekariyam, Thiruvananthapuram - 695 017
	Udaipur	Rajasthan	Agricultural Research Station, Maharana Pratap University of Agriculture & Technology, Udaipur- 313 001

MANPOWER 4

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.

SOIL AND CLIMATE 5

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	1018.5	24.6	9.6	88.6	31.8^{0}N	77^{0}E
	Bhopal	Vertisols, Clay Montmorillonite/smectite type	906.2	32.67	20.91	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	967	29.8	21.3	86	11°	77°.0’
	Dharwad	Clay loam	582.8	31.2	18.8	76.9	15°26’	75°07’
	Jabalpur	Vertisoils, Chromusterts	1096.10	32.4	17.7	78.2	23°90’	79°90’
	Karjat	Red and medium black	3457	42.9	11.6	-	18°92’	77°33’
	Ludhiana	Ustochrepts-Ustic pramments association, alluvial, sandy & sandy loam	73.7	33.52	17.02	76.22	24°35’	74°42’
	Modipuram	Alluvium soilsTypic ustochrept	747.0	43.5	2.5	72.7	29°4’	77°46’
	Pantnagar	Hapludolls, very deep alluvium coarse loomy soils	1191.5	30.1	17.7	84.2	29°N	79°30’
	Raipur	Ochraquals association, deep black soil	830	33.4	20.8	79.6	21°16’	81°36’
	Ranchi	Ultic Palesustalfs, very deep soils	1611.2	30.2	15.7	85.1	-	-
	Umiam	Clay loam	2631.9	26.2	15.3	63.6	24°44’	76°48’

Sl. No.	Name of centre	Soil Type	Weather				Latitude (N)	Longitude (E)
			Rainfall (mm)	Temperature (°C)		R.H (%)		
				Max.	Mini.			
Centres functioning from 2015-16								
	Ajmer	Sandy loam	450	-	-	-	36°01'	22°31'
	Almora	-	-	-	-	-	-	-
	Gangtok	-	2853.3	29.69	7.20	90.42	27°32'	88°60'
	Narendrapur	-	-	-	-	-	-	-
	Sardar Krushinagar	-	931.2	34.31	20.32	61.33	24°-19'	72°-19'
	Thiruvananth-apuram	-	1297.7	32.29	24.23	91.54	-	-
	Udaipur	Clay loam	813.2	32.15	17.08	71.00	24º35′	74º42′

Initial nutrient status of soil (2021-22)

Centre	OC (%)	N (kg/ha)	P (kg/ha)	K (kg/ha)	S (ppm)	Fe (ppm)	Zn (ppm)	pH	EC (ds/m)
Bajaura	-	-	-	-	-	-	-	-	-
Bhopal	0.53	154.2	12.8	530	4.92	5.52	0.74	7.85	0.50
Calicut	1.8	196	6.6	146	-	32.0	0.10	4.96	.30
Coimbatore	0.66	247	17.5	495	-	30.40	4.10	8.3	0.06
Dharwad	5.87	273.9	28.40	359	13.06	9.50	1.46	7.5	0.13
Jabalpur	0.68	263	12.6	296	9.6	2.39	0.35	7.2	0.39
Karjat	1.14	230	20.0	327	-	-	1.72	7.02	0.28
Ludhiana	0.56	278	36.3	134	-	-	-	8.1	0.50
Modipuram	0.59	-	-	-	-	-	-	-	-
Pantnagar	1.04	350	35.8	235	30.8	30.24	0.84	6.8	0.29
Raipur	0.64	237	13.0	274	-	-	-	7.67	0.28
Ranchi	0.38	-	-	-	-	-	-	-	-
Umiam	1.32	-	-	-	-	-	-	-	-
Centres functioning from 2015-16									
Ajmer	0.28	124.60	11.91	336.22	-	-	-	7.13	0.13
Almora	-	-	-	-	-	-	-	-	-
Gangtok	0.88	237.6	14.07	273.6	23.78	-	2.18	5.57	-
Narendrapur	0.89	-	72.03	254.8	-	-	-	6.07	0.19
Sardar Krushinagar	0.33	141	13.5	180.0	8.20	8.40	0.68	7.22	0.15
Thiruvananthapuram	-	-	-	-	-	-	-	-	-
Udaipur	0.56	155.76	2.87	250.13	-	-	-	8.1	0.50

BUDGET

A total budget of Rs. 251.42 lakhs were released to 21 centers during 2021-22. The centre wise allocations of funds are given below.

Name of University / Institutes	A. Other than STC/SCSP/NEH							SCSP Compomnent								Grant-in-Aid, under NEH Component				Grand Total
	Grant-in-Aid 'General'						Total Other than STC/ SCSP/ NEH	Grant-in-Aid 'General'			Grant-in-Aid 'Capital'				Total SCSP	Grant-in-Aid 'General'				
	Domestic T.A.	Research Expenses	Operational charges	Sub Total	Information Technology	Sub Total		Research Expenses	Operational charges	Total SCSP	Equipments	Works	Livestock	Sub Total		Domestic T.A.	Research Expenses	Operational charges	Total NEH	
IGKV, Raipur	0.06	4.82	3.54	8.42	0.50	0.50	**8.92**	0.00	0.00	0.00	0.00	0.00	0.00	0.00	**0.00**	0.00	0.00	0.00	**0.00**	**8.92**
SDAU, S.K. Nagar	0.06	1.18	3.54	4.78	0.50	0.50	**5.28**	0.00	0.00	0.00	0.00	0.00	0.00	0.00	**0.00**	0.00	0.00	0.00	**0.00**	**5.28**
HAREC, Bajaura	0.35	1.28	3.40	5.03	0.50	0.50	**5.53**	3.40	4.89	8.29	2.50	0.00	0.00	2.50	**10.79**	0.00	0.00	0.00	**0.00**	**16.32**
BAU, Ranchi	0.21	1.43	3.55	5.19	0.00	0.00	**5.19**	3.00	4.50	7.50	0.92	0.00	0.00	0.92	**8.42**	0.00	0.00	0.00	**0.00**	**13.61**
ICAR-IISR, Calicut	0.06	4.70	6.66	11.42	0.50	0.50	**11.92**	0.00	0.00	0.00	0.00	0.00	0.00	0.00	**0.00**	0.00	0.00	0.00	**0.00**	**11.92**
ICAR-CTCRI, Trivandram	0.00	2.65	5.12	7.77	0.00	0.00	**7.77**	9.09	6.14	15.23	0.90	1.60	0.00	2.50	**17.73**	0.00	0.00	0.00	**0.00**	**25.50**
UAS, Dharwad	0.06	1.43	3.55	5.04	0.50	0.50	**5.54**	0.00	0.00	0.00	0.00	0.00	0.00	0.00	**0.00**	0.00	0.00	0.00	**0.00**	**5.54**
JNKVV, Jabalpur	0.06	1.43	3.55	5.04	0.00	0.00	**5.04**	0.00	0.00	0.00	0.00	0.00	0.00	0.00	**0.00**	0.00	0.00	0.00	**0.00**	**5.04**
ICAR-IISS, Bhopal	0.06	1.43	7.11	8.60	0.50	0.50	**9.10**	0.00	0.00	0.00	0.00	0.00	0.00	0.00	**0.00**	0.00	0.00	0.00	**0.00**	**9.10**
KKV, Dapoli	0.00	1.43	3.55	4.98	0.00	0.00	**4.98**	0.00	0.00	0.00	0.00	0.00	0.00	0.00	**0.00**	0.00	0.00	0.00	**0.00**	**4.98**
ICAR Res. Comp., Umiam	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**	0.40	6.59	8.40	**15.39**	**15.39**
PAU, Ludhiana	0.32	2.13	8.09	10.54	0.50	0.50	**11.04**	0.00	0.00	0.00	0.00	0.00	0.00	0.00	**0.00**	0.00	0.00	0.00	**0.00**	**11.04**
MPUA&T, Udaipur	0.30	2.70	5.06	8.06	0.50	0.50	**8.56**	6.29	6.99	13.28	2.50	0.00	0.03	2.53	**15.81**	0.00	0.00	0.00	**0.00**	**24.37**
ICAR-NRC Seed Spices, Ajmer	0.30	1.43	6.96	8.69	0.50	0.50	**9.19**	0.00	0.00	0.00	0.00	0.00	0.00	0.00	**0.00**	0.00	0.00	0.00	**0.00**	**9.19**
ICAR-RC-NEH, Gangtok	0.06	0.00	0.02	0.08	0.50	0.50	**0.58**	0.00	0.00	0.00	0.00	0.00	0.00	0.00	**0.00**	0.13	6.82	8.31	**15.26**	**15.84**
TNAU, Coimbatore	0.06	2.72	6.56	9.34	0.50	0.50	**9.84**	5.00	6.30	11.30	2.50	0.00	0.00	2.50	**13.80**	0.00	0.00	0.00	**0.00**	**23.64**
ICAR-IIFSR, Modipuram	0.00	0.56	6.85	7.41	0.00	0.00	**7.41**	0.00	0.00	0.00	0.00	0.00	0.00	0.00	**0.00**	0.00	0.00	0.00	**0.00**	**7.41**
National PI,ICAR-IIFSR, Modipuram	0.40	0.08	8.97	9.45	0.64	0.64	**10.09**	0.00	0.00	0.00	0.00	0.00	0.00	0.00	**0.00**	0.00	0.00	0.00	**0.00**	**10.09**
GBPUA&T, Pantnagar	0.20	4.48	7.37	12.05	0.50	0.50	**12.55**	0.00	0.00	0.00	0.00	0.00	0.00	0.00	**0.00**	0.00	0.00	0.00	**0.00**	**12.55**
ICAR-VPKAS, Almora	0.20	1.78	3.41	5.39	0.50	0.50	**5.89**	0.00	0.00	0.00	0.00	0.00	0.00	0.00	**0.00**	0.00	0.00	0.00	**0.00**	**5.89**
RMVU, Narendrapur	0.30	1.78	7.22	9.30	0.50	0.50	**9.80**	0.00	0.00	0.00	0.00	0.00	0.00	0.00	**0.00**	0.00	0.00	0.00	**0.00**	**9.80**
Total	3.06	39.44	104.08	146.58	7.64	7.64	**154.22**	26.78	28.82	55.60	9.32	1.60	0.03	10.95	**66.55**	0.53	13.41	16.71	**30.65**	**251.42**

RESEARCH RESULTS 7

Programme 7.1: Characterization of Organic and Natural farming inputs and practices

7.1.1: Geo-referenced characterization of organic 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 (Table 7.1.1-7.1.4).

Bajaura

Geo reference characterization survey was carried out for organic and natural farming farmers involving uncertified 30 farmers (10 organic farmers and 20 natural farming farmers). The survey was carried out in Udaipur block of Lahual and Spiti district of Himachal Pradesh. Started organic & natural farming in the year 2019. Majority of farmers fall under medium category (av. Size is 1.40 ha). Among the surveyed famers of the village, average livestock population maintained by the farmers was dairy cattle -2, goat-1 and horse-1 under organic and dairy (cattle/buffalo):2, sheep: 9, goat: 1, horse: 0.35 under natural farming. Organic farming use FYM, vermicompost and cow urine as organic resources while Jeevamrit, Ghanjeevamrit and Beejamirt was the major sources of nutrients in natural farming. Cow urine @ 1L/10L water and Agniastra @ 6-10L/ 200L of water, using as plant protection input for organic and natural farming. Off-season pea and potato are the major crops grown by the farmers in the surveyed location. The average green pod yield in farmer's field is high as compare to station trial due to the reason that pea in survey village is grown in kharif and yield is high, whereas station pea was grown in rabi and generally yield are low because of low temperature in winter season. Hence the yield gap among station trial and farmers field was - 29.6 % in case of pea.

Bhopal

Geo-referenced organic cluster survey was carried out in Golkhedi, kalyanpura, Bheropura and Prempura, under Block-Phanda, Tehsil- Hujur, District- Bhopal. Maximum land holding of respondent was 25 acre while minimum was 1 acre of which the maximum area under organic farming was 15 acre and minimum was 0.5 acre. All the farmers using FYM and vermicompost as organic resources while those practicing natural farming used Jivamrit and Ghanjivamrit use as nutrients source. Crop residue available for recycling varied between 1–18 tonnes per year among the farmers. Most of farmers cultivated soybean and rice crop during *kharif* season while wheat and chickpea were grown during *rabi* season and some of farmers raised vegetables crop if assured irrigation water was available. Neemastra Brahmastra, Panchpatti and dashparni were used as a pesticide under natural farming. Neem oil, cow urine and buttermilk were used as organic pesticide for the control of insect pest and diseases in crops. Only 10-20 % of organic produces retained for household consumption and the rest sold out in either krishimandi or local market. The yield gap between research station and organic farmers' field were recorded to be 18.3% and 15.6%, respectively for soybean and wheat crop. The reasons behind adoption of organic/ natural farming were minimum purchase of external market inputs, policy support and encouragement, healthy produce and improvement in soil health.

Calicut

Geo-reference characterization of organic cluster at Palakuzhi, Palakkad was surveyed. Livestock maintained by farmers-cow, goat, hen. Major crops grown under organic farming- Black pepper and Nutmeg. Category of farmers-large-2/ marginal-12/small-16. Major mode of weed management- manual and grass cutter. Major reason for adoption of organic farming-for healthy, crop's long life and safe food. The yield gap between on-station and organic farmers' field were found to be 40% for black pepper and 8% for nutmeg. Unavailability of workers and organic manures, yield loss are the major constraints for organic farming.

Coimbatore

Thondamuthur Block was selected under PKVY scheme for geo-tagged characterization of organic and Natural Farming farmers involving 30 households in 3 different villages (Semmedu,Theenapalayam,Thenamanallur). Category of farmers-Large:4 ha, Small:1.5 ha and Marginal:0.5 ha. Group cultivates high value crops such as turmeric, arecanut, coconut, onion, bhendi, tomato and brinjal. Member of the groups involved in entrepreneurial activities like sale of panchagavya, ganajeevamruth, fermented fruits extract, mulluseethaa jam, organic ghee, desi poultry birds and eggs, organic coconut etc Adopted innovative implements and equipment's such as electric water pump, manually operated arecanut harvester and electric jeevamrith mixer and panchagavya drip system. Yield gap between on-station experiment and farmers field found to be 37.5, 25.7, 31.8 36.7, 20.8, 18.2 and 26.7 in tomato, brinjal, bhendi, onion, coconut, arecanut and turmeric respectively under organic farming condition whereas, under natural farming it was 29.2, 31.8 and 46.7 in coconut, arecanut and turmeric respectively.

Dharwad

The three villages of Dharwad, Gadag , Haveri districts were surveyed for geo-tagged characterization of organic and Natural Farming farmers but number of farmers really practicing organic farming is 25 and that too in their 30% of their cultivated area. Though the farmers are interested in organic farming due to benefits like soil health and quality food they are not able to convert their entire land under organic farming because of the reasons mentioned above. The number of natural farming farmers is very less. They are basically organic farmers, under shortage of organic manures; they are adopting Beejamrit, Jeevamrit and Ghanajeevamrit for nutrient source. They are using Neemaster, Agniaster, Brahmaster for control of insect pests and sour butter milk for disease control. Yield gap between on-station experiment and farmers field found to be 3.33, 9.37, 6.66 10.8 and 25% in green gram, soybean, chilli, groundnut and *rabi* sorghum respectively under organic farming condition during initial years of conversion. Under natural farming, yield gap between on-station experiment and farmer's field recorded for green gram, soybean, groundnut, rabi sorghum and maize of 17.69, 16.94, 13.10, 14.44 and 15% respectively. More time required for preparation of liquid organic manures and local plant protection extracts. Non- availability of required quantity of organic manures, inadequate number of owned livestock, lack of organized market facility for organic produce of farmers, no confidence in organic farming (due to fear of lower yields), lack of support and risk coverage during transition to organic farming and organic certification is cumbersome and expensive for small and marginal farmers were the constraints for organic farming.

Jabalpur

Geo-tagged characterization of organic and natural farming farmers was taken at villages of Keolari and Padaria in Panagar block and Nigai, Bichhua in Kundam block of Jabalpur district in Madhya Pradesh. Total 24 farmers were surveyed. Kodo, Kutki, Pigeon pea, Chickpea are the major crops grown by the organic farmers. Most of the farmers using FYM @ 2.8 t/ ha as source of organic manure. Farmers maintaining cow and buffalo as milch animal including goat. Cow urine, Neem leaf extract, Dashparni ark (plant extracts), butter milk etc. are the major plant protection input. The yield of wheat under organic farming at farmers field was noted to decrease by 26.04% whereas the yield of Kodo, Kutki, Pigeon pea were recorded on station of 2000, 1800 and 900kg/ha which about 40, 55.6 and 33.3 percent lower yields compared to farmers field. Yield gap between on-station experiment and farmer's field found to be 40.0, 55.55 and 33.33% in kodo, kutki and pigeonpea respectively under organic farming condition during initial years of conversion. Major constraints for adoption of organic farming such as lack of awareness regarding certification and marketing process, lack of premium prices for organic

produce and reduced yield, poor availability of good quality organic manure and weeds and insect pest control are major problems.

Karjat

A total 30 farmers were surveyed under geo-referenced characterization in Roha block in Raigad-District of Maharashtra. Total numbers of farmers surveyed 30, in which all doing organic farming. Average holding size of organic farmer/farm small: 30. All the surveyed farmers using FYM and vermicompost as major sources of nutrients. Average quantity of plant protection inputs used 5 Lit. /ha. They are using cow urine for insect management. Rice, pulses, mango are the major crops grown under organic farming. Majority of farmers-controlled weeds through hand weeding in seasonal crops. The yield gap of major crops grown under organic farming was observed 26.4% in rice, 26.5% in okra and 86% in pulse at farmers field compared to on-station experiment. Reasons for adoption of organic farming are customer demand + traditional farming. Scarcity of laborer's and high wage rates due to urbanization and industrialization, lack of information about organic inputs, non-availability of labours at the time of transplanting and harvesting, fluctuation in market prices and lack of co-operative marketing are the major constraint.

Ludhiana

Total of 20 organic farmers were surveyed under geo-referenced characterization at Ludhiana district. Mean holding size of organic farmers/farm is 1.0 ha. Most all the organic farmers are having dairy cattle (cow/buffalo). Basmati rice, wheat, vegetables, millets and turmeric are major crops being grown by farmers. Farmyard manure, vermicompost, compost, jeevamrit, ghanjeevamrit are the major source of nutrition for organic production. For plant protection management, farmers are using neem and other plant-based products formulations. Weeds were being managed by hand weeding, mechanical hoeing and mulching. The mean yield of basmati rice (3700 kg/ha), wheat (3400 kg/ha), Turmeric (15000kg/ha) and millets (600 kg/ha). Yield gap between on-station experiment and farmers' field was found to be 7.9% in basmati rice and 23.5% in wheat. The major constraint faced by farmers in adoption of organic farming was labour intensive operations and lack of marketing facilities. Non-availability of subsidized inputs, lack of premium on organic products, 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 input and practices was carried out in Muzaffarnagar, Bulandshahar, Hapur and Sambhal, Total 15 farmers was surveyed out of which 10 farmers practicing organic farming while 5 farmer doing natural farming. Mean holding size of the farmers is 3.31 ha and only about 23% area they are using for organic and natural farming. All are maintaining dairy cattle cow and buffalo with mean cattle 4.5. Sugarcane, wheat, rice, mustard, pulses (black gram/green gram) and forage crops (sorghum, berseem etc.) are the major crops. FYM, vermi-compost and mustard cake are the major source of nutrient and most of the farmers are now using different microbial consortia with organic manure. *Trichoderma* spp. (4-6 kg/ha), *Pseudomonas fluorescens* (4-6 kg/ha), *Fermented buttermilk* (FBM) (30-60 l/ha), Dashparni extract, *Beauveria bassiana* , *Metarrhizium* biological agent were using for pest and disease management. Productivity of different field crops (Sugarcane, Wheat and Mustard) was found lower at farmer's field by 4.91-31.68% as compared to on-station crop yields. Yield gap between on-station experiment and farmers field for major crop found to be 29.31 for sugarcane, 13.60 for basmati rice, 4.91 for wheat and 31.68 for mustard.

Pantnagar

A total 40 nos. of organic and natural farming farmers were surveyed under geo-referenced characterization in Kotabagh block of Nainital district. There were no natural farming farmers in surveyed villages. Average holding size of organic farmer/farm ha^{-1} large: 2.50 ha, small: 0.37 and marginal:1.25. Average livestock population cow-4-5, buffalo-2-3, and goat-1. Farmers are using FYM, vermi compost as source of organic manure and cow urine fortified with neem leaves/neem oil/garlic paste for plant protection purposes. 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

mostly for their own consumptions. Productivity of the traditional basmati rice (Pusa 1509) is 37% less than the on-station trial; however, wheat yield is 20% less. Yield gap between on-station experiment and farmers field for major crop found to be 37% for rice and 20% for wheat.

Raipur

Geo-referenced characterization of 29 organic farmers was carried out at Amodi village under Aarang block of Raipur district. Mean holding size of surveyed organic farmers is 1.87 ha. The livestock maintained by the farmers are cow, buffalo and bullock with average livestock population of 5.0 cattle's. The main crops grown under organic farming were scented rice few farmers grow jwar, maize and vegetables pumpkin, tomato and chilli having assured irrigation facility. FYM is main source of organic manure prepared from the livestock maintained and on an average 5 t/ha FYM is used in the field. For plant protection, neem oil, seed treatment with trichoderma was used for disease management. For weed management hand weeding has been adopted by majority of farmers for weed management in various crops. The average cost involved in weed management was Rs 4500 ha^{-1}. The yield gap of 25.31% was observed in aromatic rice over experimental yield. Other crops like Kodo Kutki, Kulthi and Ragi were grown for family consumption only. All the organic farmers have PGS certification.

Umiam

ICAR Research Complex for NEH Region under the NPOF project geo-referenced characterization of organic farmers was conducted in three (3) villages namely Mynsain, Pynthor & Umden and Umbathiang in RiBhoi District of Meghalaya. Mean holding size of surveyed organic farmers is 1.7 ha. The livestock maintained by the farmers are cow, buffalo, goat, poultry and piggry. The main occupation of the villagers is agriculture. Paddy, maize, ginger, French bean and some vegetables are main crops cultivated by the villagers. Ginger is the cash crop and is the most profitable as ginger is non-perishable crop, and it has become a major source of income for the farmers. Paddy is mostly cultivated for self-consumption. There are other crops and vegetables that the villagers grow like Potato, Turmeric, Okra, Sweet potato, yam, Cabbage, cauliflower, Carrot, pumpkin, Chillies etc. Crop enhancement inputs are purely organic based that are accessible and available within the village. Growth enhancement inputs such as manure comes in the form of farmyard manure which is either cow dung or pig manure, poultry manure, vermicompost and other composted materials. For most farmers, manure is collected from their livestock shed while for some is purchased. Weed management adopted by the farmers is basically a mechanical/ manual approach which involves physical disturbance/uprooting of the weeds, through activities including hoeing with spades, pulling weeds, tilling the soil before or after weeds emerge, and mowing. Pest management is purely practiced by the villagers by manual and traditional means. As most of the farmers grow their local pest resistant varieties, incidence of large scale attack is very less. However, with the introduction of high yielding cultivars, report of some pest attack is noticed. After scientific intervention by ICAR, organic pest management options are being promoted. Crops produced are either utilized for household consumption or marketed if there is a surplus. Production profit analysis of crops cultivated and marketed from the three villages all year round reveals that production profit is maximum in the kharif season than when compared to production profit generated from the other 2 agro season. Production profit is highest in the kharif season since the major crops cultivated in this season such as rice, maize, ginger and turmeric are cultivated in larger land area as compared to other food crops belonging to other cropping seasons. Due to lack of irrigation facilities and absence of winter rain, cultivation of crops in this season is very limited.

Ajmer

A total of 35 farmers were characterized under geo-referenced characterization survey out of which 30 come under organic farming and 5 natural farming farmers was there. Soil type of the surveyed farms is sandy and sandy loam in nature. Average holding size of organic farmer/farm is 2.25 ha. The livestock maintained by the farmers are cow/buffalo-3 and goat-1. Farmers are using 10 t/ha FYM +600 kg Vermicompost as nutrient source for crop production. Bajra and moong, guar and cumin occupy the major area under organic farming and natural farming. Farmers are following hand weeding for controlling weeds and are using *Trichoderma*, neem oil and homemade bio-pesticide (Neemaster, Agniaster, Brahmaster) for pests and disease management. Average yield in bajra is 1089 & 900 kg/ha, gaur 1040 kg/ha (NF) and moong 680 kg/ha under organic and natural farming condition respectively. The yield gap of 13.97% was observed in moong over experimental

yield. Major constraints were disease & pest management, availability of bio-pesticide and bio-fertlizers.

Almora

A total of 26 farmers were surveyed for geo-referenced characterization in Almora district. The average holding size of the organic farmers was characterized 1.7 ha large, 0.3 small farm holder. Livestock maintained by farmers are cow/buffalo, goat and poultry with average population 1.5, 2.8 and 1. Finger millet, wheat, paddy, toria and Jangora are the major crops grown by organic farming farmers. The FYM was main organic manure source but some of the farmers were also used vermicompost with FYM. All the farmers were practicing hand weeding for controlling of the weeds. Yield gap between on-station and farmers field of major crops found to be 76.9, 80.2, 46.0, 67.5% lower at farmers field in finger millet, wheat, barnyard millet, and paddy respectively under organic farming. Wild animal (Wild boar, monkey, stray animal) menace is the major problem/constraints.

Gangtok

A total of 30 farmers/farms surveyed for organic farming and natural farming in East Sikkim (Sikkim). Average land holding size under organic/NF farming is 1.0 ha. Average livestock population per household found to be cattle/buffalo-4.0, Goat-6, poultry-28 and pig-04. All the surveyed farmers using Farmyard manure (FYM), Pig manure, Poultry manure, Vermicompost as source of nutrient. Major crops grown under organic and natural farming are rice, maize, buckwheat, ginger, turmeric, seasonal vegetables. For weed management, hand weeding, mulching and intercropping were major practice. Yield gap for rice, maize, soybean and buckwheat found to be 33, 34, 89.8 and 30.3% lower at farmers compared to on-station experimentation under organic farming while 24 and 49.8% was under natural farming for maize and soybean respectively.

Sardarkrushinagar

Under geo-tagged characterization of organic and Natural Farming farmers, 30 natural farming farmers/farms were surveyed in 13 villages under 4 blocks namely Vadali, Vijaynagar, Idar, Khedbrahma in Sabarkantha district of Gujarat. Average land holding size under natural farming farmers is 2.29 ha. Number of animals per household is found to be 3.0. All the natural farming farmers using jeevamrit, beejamrit and ghanjeevamrit and inter cropping whereas Neemastra, Dashparni ark and Bramhastra using for management of insect pest. Weed management adopted by natural farming farmers is basically hand weeding practices. Majority of farmers growing ground nut and wheat. Average yield of groundnut is 1380 kg/ha and wheat was 3240 kg/ha on on-station experiment. The yield gap between on-station experiment and farmer's field recorded by 16.45 and 17.56% respectively under Natural Farming.

Thiruvananthapuram

Geo-referenced survey of 30 farmers practicing organic farming in Pathanamthitta district of Kerala was conducted. The survey was carried out in Adoor block of the district. Ninety per cent of the farmers belonged to the small and marginal group with a land holding size <2 ha. Average land holding size was 1.21 ha. Average livestock population per household found to be cattle/buffalo-1.0, Goat-6, poultry-3, duck-0.26 and apiculture-0.166. Most of the farming situation surveyed was rainfed (80%) and the remaining irrigated. Being health conscious and aware of the quality of the organic produce, all the farmers used the organic produce for their house-hold consumption (100%), and the surplus was sold to the market by 100% of the farmers. The soil type was laterite (100%). Major Crops: Fruit crops (banana, mango, jack fruit); Vegetables (okra, brinjal, bitter gourd, snake gourd, bottle gourd, ridge gourd, ash gourd, pumpkin, cucumber, chillies, amaranth, vegetable cowpea); Root and tuber crops (cassava, yams, elephant foot yam, taro, sweet potato, coleus, arrow root); Spices (ginger, turmeric, pepper) and Plantation crops (coconut, arecanut, cashew, rubber, betel leaves), Flower crops: Marigold. About 40% of the surveyed farmers owned cow, 20% had goat, 60% had poultry (hen and duck) and 3.33% had apiary as an integral part of organic farming. Organic recycling units: Animal wastes were converted to excellent manures using vermi compost units (13.33% farms) (with an average capacity to produce nearly 200 kg compost/annum). Nutrient sources for organic farming constituted cow dung slurry/FYM (100%), poultry manure (60%), vermicompost (33.33%), neem cake (53.33%), groundnut cake (26.67%), bio-formulations like *Panchagavya* (36.67%), *Jeevamrutham* (26.67%), and green manuring (23.33%). Ash (66.67%), bone meal (53.33%) and PGPR Mix.1 (33.33%) were also used. Majority of farmers conducted

soil testing before raising the crop. Pest & disease management: Through application of neem oil-garlic emulsion (40%), neem soap (43.33%), neem oil (40%), fish amino acid (50%), egg amino acid (20%), *kanthari* emulsion (40%), *Beauveria* (50%), *Trichoderma* (60%), *Pseudomonas* (63.33%), *kanjivellam* (36.67%) and PGPR Mix. 2 (30%). Also practicing cultural methods, intercropping, trap crops on field bunds and some indigenous practices. Constraints faced: High input cost, non-availability of quality organic manures, loss due to flood and other natural calamities, labour shortage, low price of the produce, damage due to wild boar, peacock and other wild animals and high cost for leased land. Mean yield of cassava and Elephant foot yam at farmers field recorded of 39525 and 40525 kg/ha and yield gap over on-station found to be by 7.81 and 31.49% respectively.

Udaipur

A total of 45 farmers in Chittorgarh district surveyed under geo-referenced characterization out of which 5 farmers practicing natural farming. Maize and wheat are the major crop under organic farming while soybean, wheat, gram and mustard crop were also gown by natural farming farmers. Under organic farming characterization, average land holding size is 2.47 ha out of which average size under organic farming is 1.05 ha. Average number of animals/households 7.07. Vermicompost production is 3.26 tonne year $^{-1}$ and crop residues available for recycling are 2.48 ton/household. Majority of farmers grow maize in *kharif* and wheat in Rabi. Average yield of maize is 21.47 q/ha wheat is 29.10 q/ha. Fruit and vegetables were grown organically for home consumption. On average, 11.45 ton FYM/ha in maize during *Kharif* and 15.3 tonne FYM/ha in wheat during *Rabi* was used. Neem leaves, buttermilk and Gau-mutra were used for plant protection in crops, fruit and vegetables. For weed management hand weeding and weed hoe is used. Yield gap was found to be 6.19, 11.53, 28.86 and 27.71% for maize, black gram, wheat and chickpea respectively between on-station experimentation and farmer's field. Lack of right technical knowledge on organic production, timely availability of inputs, low productivity in crops, lack of marketing opportunities of organic produce, low quantity of organic produce to sale with a single farmer were the major constraints.

Table 7.1.1: Basic details of organic and natural farming farmers/farms at various locations

Name of centre	Name of the district surveyed	Number and Name of block		Number of villages surveyed	Total number of farmers surveyed	Organic Farmers	Natural Farmers	Average land holding size (ha)		Farmers land size characterization (nos.)					
										Organic Farming			Natural farming		
								OF	NF	0-0.5 ha	0.5-1.5 ha	>1.5 ha	0-0.5 ha	0.5-1.5 ha	>1.5 ha
Bajaura	Lahual & Sapiti	1	Udaipur	1	30	10	20	1.36	1.54	0	4	6	0	4	16
Bhopal	Bhopal	1	Phanda	4	34	10	34		-	-	-	-	-	-	-
Calicut	Palakkad	1		1	30	30	0	-	-	12	16	2	-	-	-
Coimbatore	Coimbatore	1	Thondamuthu	3	65	30	10	-	1.0	-	-	-	-	-	-
Dharwad	Dharwad, Gadag, Haveri	3	-	3	30	25	5	-	-	-	-	-	-	-	-
Jabalpur	Jabalpur	2	Panagar and Kundam	4	24	4	0	-	-	-	-	-	-	-	-
Karjat	Raigad	1	Roha	3	30	30	0	-		-	-	-			
Ludhiana	Ludhiana	4	-	20	20	20	0	1.0	-	-	-	-	-	-	-
Modipuram	Muzaffarnagar, Bulandshahar, Hapur, Sambhal		-		15	10	5	3.313	1.06	-	-	-	-	-	-
Pantnagar	Nainital	1	Kotabagh	8	40	40	0	-	-	-	-	-	-	-	-
Raipur	Raipur	1	Aarang	1	32	30	0	1.87	-	-	-	-	-	-	-
Ranchi	Chatra, Hazaribagh, Ranchi	4	Simariya, Lawalaung Barkatha, & Barhi	6	75	10	10		0.5	-	-	-	-	-	-
Umiam	Ri-Bhoi	1	Bhoirymbong	3	310	310	0	0.14	-	-	-	-	-	-	-
Ajmer	Nagaur	1	Parabatsar	4	30	30	5	2.25	2.40	-	-	-	-	-	-
Almora	Almora	1	Hawabagh	2	26	26	-	-	-	-	-	-	-	-	-
Gangtok	Gangtok	1	Rumtek Martam	1	30	30	30	-	-	-	-	-	-	-	-
Narendrapur	Nadia	1	Hanskhali	1	20	20	0	-	-	-	-	-	-	-	-
S K Nagar	Sabarkantha	4	Vadali, Vijaynagar, Idar, Khedbrahma	13		30	30		2.29	-	-	-			
Thiruvanantha-puram	Pathanamthitta	1	Adoor	8	30	30	0			-	-	-	-	-	-
Udaipur	Chittorgarh	1	Akola	3	40	40	5	-	5.6	-	-	-	-	-	-

Table 7.1.2. Mean livestock population input practiced by organic/natural farmig at different location

Name of centre	Name of the district surveyed	Name of block	Average livestock population per household (Nos.)			Input practice by the farmers under organic farming		Input practice by the farmers under natural farming	
			Livestock	OF	NF	name of input	Aver. quantity	name of input	quantity
Bajaura	Lahual & Sapiti	Udaipur	Dairy (cattle/buffalo): Goat: Sheep: Horse: Poultry:	2 1 6 1 -	37 (20) 9 1 0.35 -	FYM & Vermincompost	20-25t/ ha	Beejamrit, ghanjeevamrit jeevamrit, ,	500 l/ha 250 kg/ha 1 kg/kg of seed treatment
Bhopal	Bhopal	Phanda	Dairy cattle	4.4	4.4	Vermicompost & CDM	3 t/ha	Jeevamrit Ghanjeevamrit	250 -500 litres/ ha 500-1000 kg/ha
Calicut	Palakkad		Dairy (cattle/buffalo): Goat: Poultry:	8 4 6	-	Cow dung, Poultry manure	5.0 t/ha	-	-
Coimbatore	Coimbatore	Thondamuthu	Cattle Buffalo Goat Poultry	2 1 5 10	2 5 5	FYM Vermicompost	2.5 t/ha 5.0 t/ha	Beejamrit, Jeevamrit, Ghanjeevamrit	500 l/ha 250 kg/ha 200 kg/ha
Dharwad	Dharwad , Gadag , Haveri	-	Dairy (cattle/buffalo): Goat Poultry Bullocks	3 0 0	2 0 0 2	FYM Vermicompost Crop residues	2.0 t/ha	Beejamrut, Jeevamrut, Ghanjeevamrut Mulching	5 litre kg/kg seed treat. 500 l/ha 300 kg/ha
Jabalpur	Jabalpur	Panagar and Kundam	Dairy (cattle/buffalo) Goat	2 5	2 5	FYM	2.8 t/ha	-	-
Karjat	Raigad	Roha	Dairy (cattle/buffalo) Goat	1	-	FYM, Vermicompost	25 q/ha	-	-
Ludhiana	Ludhiana	-	Dairy (cattle/buffalo)	2	-	FYM, Vermicompost, jeevamrit, ghanjeevamirt	20 t/ha	-	-
Modipuram	Muzaffarnagar, Bulandshahar, Hapur, Sambhal	-	Dairy (cattle/buffalo)	4.5	4.4	FYM/compost Vermicompost	20.40 t/ha 2.76 t/ha	Beejamrit, Jeevamrit, Ghanjeevamrit	20 lit/100 kg seeds 500 lit./ha 1787.5 kg/ha
Pantnagar	Nainital	Kotabagh	Dairy (cattle) buffalo Goat	4-5 2-3 1	-	FYM, Vermi compost, Green manure	10t/ha	-	-
Raipur	Raipur	Aarang	Dairy (cattle/buffalo) Goat Poultry	5.0 0 0	-	FYM Vermi compost	5.0 t/ha 0.75 t/ha	-	-

Ranchi	Chatra, Hazaribagh, Ranchi	Simariya, Lawalaung Barkatha, & Barhi	Dairy(cattle/buffalo) Goat: Poultry:	2 4 10	2 4 10	FYM Vermicompost, Karanj cake	5.0 t/ha	Mulching, Intercropping	
Umiam	Ri-Bhoi	Bhoirymbong	Dairy (cattle/buffalo) Goat Poultry Piggery	0.16 0.12 10 1.6		Vermicompost, FYM, Compost, Poultry manure, Pig manure	4.2 t/ha		
Ajmer	Nagaur	Parabatsar	Dairy (cattle/buffalo) Goat	3 1	3 1	FYM + Vermicompost	10 t/ ha+600 kg/ha	Beejamrit, jeevamrit, ghanjeevamrit	1.0 lit/kg seeds 500 lit/ha 150 kg/ha
Almora	Almora	Hawabagh	Dairy (cattle/buffalo) Goat Poultry	1.5 2.8 1		FYM	3.75 t/ha		
Gangtok	Gangtok	Rumtek Martam -	Dairy (cattle/buffalo) Goat Poultry Pig	4 6 28 4	4 6 28 4	FYM Pig manure Poultry manure Vermicompost	5- t/ha	Jeevamrit (litres/ ha) Ghanjeevamrit (kg/ha) Beejamirt (kg /kg of seeds)	
Narendrapur	Nadia	Hanskhali	Dairy (cattle/buffalo) Goat Poultry (Duck)	2-3 1 2-3		Dried cow dung compost	6 t/ha		
S K Nagar	Sabarkantha	Vadali, Vijaynagar, Idar, Khedbrahma	Dairy (cattle/buffalo)		3			Jeevamrit: Ghanjeevamrit: Beejamirt (kg /kg of seeds):	250 (litres/ha) 200 (kg/ha)
Thiruvanantha-puram	Pathanamthitta	Adoor	Dairy (cattle/buffalo) Goat: Poultry Duck Apiculture	1 0.6 3 0.266 0.166		FYM, Vermicompost, Neem cake, Groundnut cake, Poultry manure, Goat manure, *Gomuthram, Panchagavyam, Jeevamritham, Ghanajeevamrutham*, Green manuring, Ash, Bone meal, PGPR Mix.1	1.5 t/ha		
Udaipur	Chittorgarh	Akola	Dairy (cattle/buffalo) Goat: Poultry	5 2 0		FYM and Vermicompost	11.45 t/ha	Jeevamrit:	216 lit/ha

Table 7.1.3. Major crop, yield and yield gap under organic and natural farming farmers at different location

Centre name	Name of the district surveyed	Name of block	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)	Farmers field yield (kg/ha)	Yield gap (%)	On-station yield (kg/ha)	Farmers field yield (kg/ha)	Yield gap (%)
Bajaura	Lahual & Sapiti	Udaipur	Pea	6890	8935	(-) 29.6	6760	9916	(-) 46.5
			Potato	14000	15412	(+) 10.08	14000	15323	(+) 9.45
			Kidney beans	-	-	-			
Bhopal	Bhopal	Phanda	Rice				-	-	-
			Soybean	826	675	18.3	711	539	24.2
			Wheat	4297	3625	15.6	3038	2189	27.9
			Chickpea						
Calicut	Palakkad		Black pepper	570	800	40	-	-	-
			Nutmeg	470	510	8	-	-	-
			Clove						
Coimbatore	Coimbatore	Thondamuthu	Hybrid tomato	40	25	37.5			
			Brinjal	35	26	25.7			
			Bhendi	22	15	31.8			
			Onion	15	9.5	36.7			
			Coconut	120 nuts/year	95 nuts /tree	20.8	120 nuts/ year	85 nuts /tree	29.2
			Arecanut	22 ton /ha	18 ton /ha	18.2	22 ton /ha	15 ton /ha	31.8
			Turmeric	30	22	26.7	30.0	16	46.7
Dharwad	Dharwad, Gadag, Haveri	-	Greengram	750	725	3.33	650	535	17.69
			Soybean	800	725	9.37	725	630	16.94
			Chilli	600	560	6.66			
			Groundnut	2500	2230	10.8	1200	1070	13.10
			Black gram	-	-	-			
			Rabi Sorghum	1250	1000	25.00	900	770	14.44
			Safflower	-	-	-			
			Maize	-	-	-	1800	1630	15
			Cotton	-	-	-	-	-	-
			Millets	-	-	-	-	-	-

Centre name	Name of the district surveyed	Name of block	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)	Farmers field yield(kg/ha)	Yield gap (%)	On-station yield (kg/ha)	Farmers field yield (kg/ha)	Yield gap (%)
Jabalpur	Jabalpur	Panagar and Kundam	Kodo,	2000	1200	40.00	-	-	-
			Kutki	1800	800	55.55			
			Pigeonpea	900	600	33.33			
			Chickpea						
Karjat	Raigad	Roha	Rice	3476	2750	26.40			
			Pulses	1395	750	86.00			
			Okra	12650	10000	26.50			
Ludhiana	Ludhiana		Wheat	3985	3050	23.5			
			Basmati rice	3825	3520	7.9			
Modipuram	Muzaffarnagar, Bulandshahar, Hapur, Sambhal	-	Sugarcane	110000	77760	29.31			
			Wheat	4500	4279	4.91			
			Rice	4398	3800	13.60			
			Mustard	2200	15.03	31.68			
Pantnagar	Nainital	Kotabagh	Basmati Rice	4280	2683	37			
			Wheat	3782	3028	20			
Raipur	Raipur	Aarang	Scented rice	4030	3010	25.31			
Ranchi	Chatra, Hazaribagh, Ranchi	Simariya, Lawalaung Barkatha, & Barhi	Fingermillet	1500	1200	20			
			Cowpea						
			Chick pea	1800	1500				
			Blackgram	1000	800	20	1200	1000	16.6
			Linseed				800	600	25.0
			lentil				800	700	12.5
			Scented small grain rice	2500	18000	28.8	1800	1400	22.2

Centre name	Name of the district surveyed	Name of block	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)	Farmers field yield (kg/ha)	Yield gap (%)	On-station yield (kg/ha)	Farmers field yield (kg/ha)	Yield gap (%)
Umiam	Ri-Bhoi	Bhoirymbong	Rice	4230	3352	23.40			
			Maize	3500	2579	35.10			
			Potato	20580	15220	25.20			
			French bean	6880	5675	19.50			
Ajmer	Nagaur	Parabatsar	Bajra	-	10.89	-		9.0	
			Moong	7.75	6.80	13.97			
			Gaur					10.40	
Almora	Almora	Hawabagh	Finger millet	2000	463	76.9			
			Wheat	1800	357	80.2			
			Paddy	1800	585	67.5			
			Barnyard millet	1096	592	46.0			
Gangtok	Gangtok	Rumtek Martam	Rice	3590	1890	33.0			
			Maize	3275	2250	34.0	2620	2050	24.0
			Soybean	1526	960	89.8	2230	1896	49.8
			Buckwheat	1150	780	30.3			
			Vegetable Pea						
Narendrapur	Nadia	Hanskhali	Rice	3863.63	2800-3200	22.35			
S K Nagar	Sabarkantha	Vadali, Vijaynagar, Idar, Khedbrahma	Groundnut				1380	1185	16.45
			Wheat				3240	2756	17.56
Thiruvananthapuram	Pathanamthitta	Adoor	Cassava	36660	39525	+7.81			
			Elephant foot yam	30862	40525	+31.49			
Udaipur	Chittorgarh	Akola	Maize	2280	2147	6.19	2280	1796	-26.94
			Blackgram	435	390	11.53			
			Wheat	3750	2910	28.86	3750	2250	-66.66
			chickpea	1175	920	27.71	1175	1112	-5.66
			Soyabean				565	933	+39.44

Table 7.1.4. Plant protction input, weed management practice for organic/ natural farmig farmers at different location.

Name of location	Name of the district surveyed	Plant protection input used (Insect pest & disease management practice)		Weed management practice		Constraints	
		Organic	Natural Farming	Organic	Natural Farming	Organic	Natural Farming
Bajaura	Lahual & Sapiti	Cow urine @ 1L/ 10L water	Agniastra @ 6-10L/ 200Lwater, Cow urine @ 1L/10 L water	Manual	Manual	Marketing and non-availability of organic inputs	Marketing and non-availability of organic inputs
Bhopal	Bhopal	Neem oil, cow urine, butter milk@5 Liter/ha	Neemastra, Brahmastra, Dashparni@5-6 litre/ ha	Hand weeding	Hand weeding	No Premium price and market for organic produce, Poor access to the certification	No market available for natural farming produce Weed problem Low yield as compared to conventional farming
Calicut	Palakkad	Psudomonas, Trichoderma, Neem oil, Neem cake@7 kg per hectare and 10 l per hectare		Hand weeding and brush cutter		Climatic change Wild animal attack Not getting premium price Problems in certification	-
Coimbatore	Coimbatore	Panchagavya- 7.5 lit /ha Neem kernel extract-250 lit Neem oil-7.5 lit Herbal leaves extract-12.5 lit (5 leaves) Fish amino acid – 200 lit (Diluted) Butter milk - 500 lit (Diluted) Traps- 12 Nos/ac	Neem kernel extract - 250 lit Herbal leaves extract -12.5 lit	Hand weeding	Mulching	Requirement of large quantities of organic inputs Labour intensive and time consuming Inadequate market facilities for sale of organic products No premium / guarantee price for organic products 60 % farmers were not renewed their organic certification due to difficulty in maintenance of records. But they have	Heavy infestation of Pest and diseases Inadequate market facilities for the sale of products No premium / guarantee price for products

Name of location	Name of the district surveyed	Plant protection input used (Insect pest & disease management practice)		Weed management practice		Constraints	
		Organic	Natural Farming	Organic	Natural Farming	Organic	Natural Farming
Dharwad	Dharwad, Gadag-, Haveri	Neemoil, 250 g/ha (seed rate of trap crop) Buttermilk, Cowurine, Biopesticides and bio-fungicides and growing trap crops like marigold, castor, cowpea, okra 1 kg to 2 kg or 1 ltr to 2 ltr of bio pesticides or fungicides depending on the intensity of pests and diseases	Neemaster, Agniaster, Brahmaster, Dashaparni ark and Sour Buttermilk@500 ltr/ha	Hand weeding, Inter cultivation, Growing intercrops	Mulching, Intercropping	About 3% to 30 % yield reduction in the initial years of the conversion when compared to ARS yields Non availability of required quantity of organic manures Less number of livestock Lack of organized market facility No confidence in the organic farming(due o fear of lower yields Lack of support and risk coverage during transition to organic farming Organic certification is cumbersome and expensive for small and marginal farmers. Rabi Sorghum was affected by Fall armyworm in farmers field and control measures were initiated after a delay hence the yield gap.	Prevailing mindset of chemical farming lot of time consumption for preparation of liquid organic manures and local plant protection extracts Natural farming farmers got good results in the organically amended soil only where as 40% yield reduction was observed in fields newly brought under Natural farming Unable to maintain crop diversity

Name of location	Name of the district surveyed	Plant protection input used (Insect pest & disease management practice)		Weed management practice		Constraints	
		Organic	Natural Farming	Organic	Natural Farming	Organic	Natural Farming
Jabalpur	Jabalpur	Cow urine, Neem leaf extract, butter milk etc.. @ 20 litre		manual weeding		Lack of awareness regarding certification and marketing process Lack of premium prices for organic produce and reduced yield Poor availability of good quality organic manure Weeds and insect pest control are major problems	Farmers have adopted commercial farming in surveyed area. Lack of knowledge and application of four pillars of NF.
Karjat	Raigad	Cow urine @5 lit./ha	-	hand weeding	-	Low Yield Non Availability of farm labour Marketing and rates for organic produce High rates of wages Lack of technical knowledge	-
Ludhiana	Ludhiana	Neem based pesticides - 2.5 lt/ha Neemastra - 10.0 lt/ha Agniastra - 12 lt/ha Brahmastra - 10.0 lt/ha	-	Hand hoeing, mechanical hoeing, mulching	-	High labour cost Low yields Weeds problem Marketing Price premium No subsidy on organic inputs	-
Modipuram	Muzaffarnagar, Bulandshahar, Hapur, Sambhal	Trichoderma spp. (4-6 kg/ha) Pseudomonas fluorescens (4-6 kg/ha) Fermented buttermilk (FBM) (30-60 l/ha) Dashparni extract, Beauveria bassiana , Metarrhizium	Dashparni extract, Neemastra, Agniastra, Fermented buttermilk 30L/ha (average three times/crop @500ml/ tank of 15L)	Manual, Mechanical, Mulching, Intercropping	Manual, Mechanical, Mulching, Intercropping	Weeds remained number one problem among all the pests and responsible for increased cost of cultivation (1-2 extra weeding/ inter-cultures are required for each crop which is costing about Rs.6000/ha)	Lack of marketing facility and premium price Laboure intensive and high cost of weeding Lower productivity of crops

Name of location	Name of the district surveyed	Plant protection input used (Insect pest & disease management practice)		Weed management practice		Constraints	
		Organic	Natural Farming	Organic	Natural Farming	Organic	Natural Farming
Pantnagar	Nainital	Cow urine+ Neem leaves/ Neem oil/ Garlic/ Chilli paste.(45-50 l/ha)		Hand weeding		Availability of sufficient and quality organic inputs. Organic seeds and quality bio-inoculants Disease infestation Termite problems Premium price of wheat is not obtained	
Raipur	Raipur	Neem oil – 2 lit/ha Tricho cards – 5-6/ha		Hand weeding		Lack of technical knowledge of improved organic farming practices Lack of weed management technology under organic farming. Non availability of organic plant protection inputs. Lack of organized market for organic produce	
Ranchi	Chatra, Hazaribagh, Ranchi	Neem oil, Karanj oil@2litr/ha	Dashparni@10 l/ha	Manual	Manual	Certification, marketing, Manures,	Lack skill development related with Beeja amrit,Ghanjia amrit and jeeva amrit,lack of local var. Marketing, Price
Umiam	Ri-Bhoi	*Trichoderma Viride*, *Beaveria bassiana,* Vermiwash, Neem oil @50 ml		Hand Weeding and manual Weeding by spade, wheel, hoe		Water in Availability in Winter season, Quality seed materials, organic pesticides	
Ajmer	Nagaur	2-3 kg *Trichoderma* and 2.0 lit Neem oil	Neem oil, homemade pesticide@2.0 lit/ha	Hand weeding	Hand weeding	Disease & Pest Management, availability of bio-pesticide, bio-fertlizers	Disease & Pest Management, Weeds infestations, Low yield
Almora	Almora	Ash		Manual		Wild Animal (monkey, wild boar,ape), Lake of irrigation water	

Name of location	Name of the district surveyed	Plant protection input used (Insect pest & disease management practice)		Weed management practice		Constraints	
		Organic	Natural Farming	Organic	Natural Farming	Organic	Natural Farming
Gangtok	Gangtok	Neem oil, blitox, COC, botanicals (4ml/lit)	Botanical spray@ 3ml/litr	Mulching, hand weeding, zero tillage	Mulching ,zero tillage	The major problems identified are lack of availability of quality seeds and planting materials. The farmers are also facing problem in controlling the emerging the pest and diseases organically. Moreover, the farmers are not getting premium market price for their organic products. There is need to encourage the farmers for value addition, packaging and marketing.	The yield of the crops grown under natural farming is less in comparison to organic farming.
Narendrapur	Nadia	150 litre working solution/ ha (5 litre of leaf extract in 100 litre water)		Hand weeding			
S K Nagar	Sabarkantha		Neemastra(200 lit/ha), Dasparni extract (200 lit/ha), Brahmastra		Hand weeding	.	Selling of products
Thiruvana-thapuram	Pathanamthitta	Neem oil: 4 l/ha *Beauveria* liquid 4 l/ha or *Beauveria* WP 4 kg/ha *Trichoderma*: 100 kg/ha *Pseudomonas*: 100 kg/ ha Fish amino acid: 4 l/ha		Cultural methods		High input cost Non- availability of quality organic manures Loss due to flood and other natural calamities Labour shortage Low price of the produce Damage due to wild boar, peacock and other wild animals High cost for leased land	
Udaipur	Chittorgarh	Neem leaf extract and fermented butter milk@42 lit./ha	62.5 kg/ha neem leaf paste and 75 liter/ha cow urine	Hand weeding, hand hoeing	Hand weeding, mulching	Low yield of crops Marketing problem Poor technical knowledge Timely availability of inputs Poor mechanisation	Low yield of crops Lack of premium price Nutrient deficiency and disease problem Based on livestock resources

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: Ajmer, Coimbatore, Gangtok, Narendrapur and Udaipur. Ajmer and Narendrapur not reported results

Results: Centre wise results for each Centre are presented below.

Coimbatore (Table 7.1.2.1)

Name of the ITKs identified for validation

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

Among the different ITKs evaluated in cotton 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 crop resulted in recorded higher yield of 2051 kg/ha. In maize crop, 3G extract @ 5% was also performed better and recorded highest yield of 4358 kg/ha with minimum incidence of fall worm.

Table 7.1.2.1: Performance of 3G extract on sucking pests in cotton and maize crop at Coimbatore

Name of the crop in which validated	Best performing treatment	Insect pest	Reduction in incidence compared to control (%)	Yield (kg/ha)
Cotton	Ginger, garlic and green chilli extract @ 5 %	Leafhoppers	62.80	1416
		Thrips	52.70	
		Whiteflies	55.40	
		Aphids	68.20	
Maize	Ginger, garlic and green chilli extract @ 5 %	Fall armyworm	48.60	4357

Gangtok (Table 7.1.2.2)

Name of the ITKs identified for validation

i. Cow urine (5%)
ii. Cow urine (10%) farmer's practice
iii. Cow urine (15%)
iv. Control (only water spray)

Name of crops in which ITK's validated: Tomato and cucurbitaceous vegetables

It was observed that all the treatments showed significantly improvement in the yield of cabbage, red cherry pepper, radish, tomato, bottle gourd and bitter gourd as compared to control. There was no significant difference observed between farmer's practice and higher doses applied (15%). Results indicated that application of 10% cow urine perform the better and recorded highest yield of cabbage, tomato, bottle gourd and bitter gourd however, red cherry and radish recorded maximum yield with application of higher concentration of cow urine (15%) but not much variation observed within the concentration of cow urine. Yield of cabbage, tomato, bottle gourd and bitter gourd increased with application of 10% spray of cow urine over with 5% concentration of cow urine application by 26.1, 12.2, 8.01 and 6.0%.

Table 7.1.2.2: Yield of vegetable crops as influenced by cow dung and cow urine application at Gangtok

Name of ITK'S	Cabbage	Red Cherry pepper	Radish	Tomato	Bottle gourd	Bitter gourd
	Yield (kg m^{-2})			Yield (kg/plant)		
Cow urine (5%)	6.40	1.33	4.70	4.90	8.73	2.83
Cow urine (10%) farmer's practice	8.07	1.70	6.47	5.50	9.43	3.00
Cow urine (15%)	7.77	1.80	6.60	4.73	8.50	2.83
Control (only water spray)	3.90	0.70	2.70	1.83	3.83	1.52

Udaipur (Table 7.1.2.3 to 7.1.2.7)

A. Effect of *Jeevamrut* based liquid organic formulations on yield of organic black gram

Name of ITKs: Jeevamrut based liquid organic formulations

Treatment de tails

Jeevamrit (Control)	:	2 Lit Jeevamrit
Jeevamrit + LLE (2.5 %)	:	2 lit Jeevamrit + 50 ml Lemongrass Leaf Extract (2.5 %)
Jeevamrit + ALE (2.5 %)	:	2 lit Jeevamrit + 50 ml Aloevera Leaf Extract (2.5 %)
Jeevamrit + LLE (2.5 %) + ALE (2.5 %)	:	2 lit Jeevamrit + 50 ml Lemongrass Leaf Extract (2.5 %) + 50 ml Aloevera Leaf Extract (2.5 %)
Jeevamrit + Silica (1 %)	:	2 lit Jeevamrit + 20 gm Silica (1 %)
Jeevamrit + Vermiwash (5%)	:	2 lit Jeevamrit + 100 ml Vermiwash (5 %)
Jeevamrit + LLE (2.5 %) + ALE (2.5 %) + Silica (1 %) + Vermiwash (5 %)	:	2 lit Jeevamrit + 50 ml Lemongrass Leaf Extract (2.5 %) + 50 ml Aloevera Leaf Extract (2.5 %) + 100 ml Vermiwash (5 %) + 20 gm Silica (1 %)

Six indigenous Jeevamrut based liquid organic formulations were evaluated for their efficacy on growth and yield of black gram under pot culture (Table 7.1.2.4). Among the indigenous ITKs, application of *Jeevamrit + LLE (2.5 %) + ALE (2.5 %) +*

Different types of jeevamrit based liquid organic manures at Udaipur

Silica (1 %) + Vermiwash (5 %) outperformed better resulted in significantly higher black gram yield (30.60 gram/pot) and it was higher by 17.04% over the Jeevamrit only. Maximum bacterial count was found in Jeevamrit + silica (1%) + vermiwash (5%) + LLE (2.5%) + ALE (2.5%) while maximum fungal and actinomycetes count were recorded in Jeevamrit + ALE (2.5%).

Table 7.1.2.3: Microbial properties of different types of Jeevamrit based liquid organic manure and its effect on yield black gram at Udaipur

Treatments	Yield (g/pot)	Total bacterial count (cfu/ml)	Total fungal Count (cfu/ml)	Total Actinomycetes (cfu/ml)
Jeevamrit (Control)	25.40	0.85×10^7	0.6×10^4	4×10^4
Jeevamrit + LLE (2.5 %)	27.50	2.6×10^7	7.5×10^4	3×10^4
Jeevamrit + ALE (2.5 %)	28.60	1.9×10^8	37.5×10^4	77.5×10^4
Jeevamrit + LLE (2.5 %) + ALE (2.5 %)	29.10	6.5×10^7	2.15×10^4	50×10^4
Jeevamrit + Silica (1 %)	27.00	8.00×10^7	1.1×10^4	6.5×10^4
Jeevamrit + Vermiwash (5%)	29.20	4.80×10^7	3.15×10^4	18.85×10^4
Jeevamrit + LLE (2.5 %) + ALE (2.5 %) + Silica (1 %) + Vermiwash (5 %)	30.60	0.85×10^7	2.25×10^4	41×10^4
CD (P = 0.05)	1.00			

B. Effect of soil and foliar application of compost tea on growth, yield and quality of soybean

Name of ITKs: Compost tea

Treatment details

(A) Soil application of compost tea	Control (Water spray)
	500 lit ha^{-1}
	750 lit ha^{-1}
	1000 lit ha^{-1}
	1250 lit ha^{-1}
(B) Foliar application of compost tea	Control (Water Spray)
	25%
	50%
	75%
	100%

Biochemical analysis of compost tea

pH	:	6.76-6.82
EC (ds/m)	:	0.905-0.915
N (%)	:	0.391-0.399
P (%)	:	0.149-0.160
K (%)	:	0.477-0.490
Total Bacterial Count (CFU)	:	0.2×10^8
Total Fungal Count (CFU)	:	1.2×10^5
Total Actinomycetes (CFU)	:	0.65×10^5
Acid Phosphatase (µg/ml)	:	0.37931
Alkaline Phosphatase (µg/ml)	:	0.310345
Dehydrogenase (µg/ml)	:	14.17544

Indigenous ITK compost tea evaluated for their efficacy on growth and yield of soybean through soil (before sowing) and foliar application at 45 and 60 days after sowing. Among the different treatments of compost tea, application of @ 1250 lit/

ha before sowing and foliar spray @ 100% (at 45 & 60 DAS) gave significantly higher yield, net return and benefit cost ratio of soybean as compare to control.

Table 7.1.2.4: Effect of soil and foliar application of compost tea on yield of soybean at Udaipur

Treatments	Soybean yield (kg/ha)	Net return (Rs/ha)	B:C ratio
Soil application of compost tea			
Control (Water spray)	1030	34228	1.15
500 lit ha^{-1}	1250	46376	1.51
750 lit ha^{-1}	1247	46879	1.50
1000 lit ha^{-1}	1686	70844	2.23
1250 lit ha^{-1}	1769	75774	2.35
CD (P=0.05)	49.2	2893	0.09
Foliar application (compost tea)			
Control (Water Spray)	1256	45818	1.48
25%	1288	50158	1.61
50%	1462	58604	1.87
75%	1483	59594	1.89
100%	1494	59928	1.89
CD (P=0.05)	49.2	2893	0.09

Compost tea 750 lit @ 50% as foliar application

Compost tea 1250 lit/ha 100% as foliar application

Compost tea 500 lit/ha 75% as foliar application

Control

Effect of soil and foliar application of compost tea on soybean at Udaipur

C. Effect of different organic pesticides and their concentration on brinjal shoot and fruit borer and marketable yield of brinjal

Name of ITKs: Botanicals organic pesticides

Treatment details

1. Control
2. Dashparni @ 5 %
3. Dashparni @ 7.5 %
4. Dashparni @ 10 %
5. Teekha Sat 5 %
6. Teekha Sat 7.5 %
7. Teekha Sat 10 %
8. Spinosad @ 50 a. i. (45 SC)

Dashparni (40 days)

Trees: Neem (5 kg), Babool (2 kg), Karanj (2 kg) (NBK) : 9

Fruit plant: Custard apple (2 kg) Papaya (2 kg) (CAP) : 4

Ornamental: Tulsi (2 kg), Nerium (2 kg) (TUNE) : 4

Wasteland plants: Dhatura (2 kg), Aak (2 kg), Castor (2 kg) (DAC) : 6

Medicinal: Turmeric (500 g), Ginger (500 g), Garlic (500 g), Green chilli (500 g), Tobacco (1 kg)

Method of preparation: Crush leaves of all plant and mix them with 5 kg cow dung and 5 lit cow urine and make it 200 lit by adding 165 lit water and ferment it for 40 days. Shake regularly three times a day. Extract after crushing and filtering. The extract can be stored up to 6 months and is sufficient for one acre.

Teekha sat (CGDN boiling)

Method of preparation: Mix 500 g green chilli paste, 500 g garlic paste, 1 kg dhatura leaves and 500 g neem leaves in 10 lit cow urine. The mixture is then boiled till it remain half of its original quantity. The mixture is sieved and stored in bottles.

Results (Table 7.1.2.5-6)

Botanical pesticides with different concentrations were evaluated for efficacy on growth, yield and economics of brinjal. Results showed that among the eight botanicals pesticides, application of Spinosad 50 a.i. maximum overall mean reduction in incidence of shoot and fruit borer recorded of 57.67% followed by application of dasparni @ 10% (51.33%). Reduction in incidence of shoot and fruit borer in brinjal found to be more effective by 12.35 and 16.1% with Spinosad 50 a.i. over higher concentration of Dasparni and Teekha sat @ 10%. Among the dasparni, teekha sat and Spinosad 50 a.i., yield of brinjal found to be higher with application of dasparni @ 10% concentration along with net return and benefit cost ratio of 17200 kg/ha, Rs. 3,02680/ha and 7.33 respectively

Table 7.1.2.5: Effect of different organic pesticides on shoot and fruit borer in brinjal at Udaipur

Treatments		PTP							Overall Mean reduction (%)
		First spray			Second spray				
		3	7	10	3	7	10		
T_1	Control	2.67 (1.77)	8.67 (3.03)	9.33 (3.13)	6.67 (2.68)	11.20 (3.42)	10.40 (3.30)	8.00 (2.91)	-
T_2	Dashparni @5%	2.33 (1.68)	7.33 (2.80)	8.00 (2.91)	5.33 (2.41)	9.60 (3.17)	8.80 (3.05)	6.40 (2.62)	41.00 (39.81)

Treatments		PTP							Overall Mean reduction (%)
		First spray			Second spray				
		3	7	10	3	7	10		
T_3	Dashparni @7.5%	2.67 (1.77)	6.67 (2.68)	7.33 (2.79)	4.67 (2.27)	8.80 (3.04)	8.00 (2.91)	5.60 (2.47)	45.33 (42.32)
T_4	Dashparni @10%	2.67 (1.77)	4.67 (2.27)	5.33 (2.41)	2.67 (1.77)	6.40 (2.62)	5.60 (2.47)	3.20 (1.92)	51.33 (45.76)
T_5	Teekha Sat @5%	2.67 (1.77)	6.33 (2.61)	7.33 (2.79)	4.67 (2.26)	8.80 (3.04)	7.60 (2.84)	5.60 (2.46)	42.67 (40.78)
T_6	Teekha Sat @7.5%	2.00 (1.56)	5.67 (2.48)	6.33 (2.61)	3.67 (2.03)	7.60 (2.84)	6.80 (2.69)	4.40 (2.20)	47.67 (43.66)
T_7	Teekha Sat @10%	2.67 (1.77)	5.33 (2.41)	6.33 (2.61)	3.33 (1.95)	7.60 (2.84)	6.40 (2.62)	4.00 (2.12)	49.67 (44.81)
T_8	Spinosad 50 a.i.	2.33 (1.68)	4.33 (2.20)	4.67 (2.27)	1.67 (1.46)	5.60 (2.47)	5.20 (2.38)	2.00 (1.57)	57.67 (49.41)
	CD (P=0.5)	N.S	0.60	0.43	0.40	0.42	0.41	0.29	2.03

*Figures in parenthesis are retransformed per cent values

Dashparni @ 7.5 %

Dashparni @ 10 %

Teekha Sat 10 %

Shoot and fruit borer in brinjal

Effect of organic pesticide on brinjal at Udaipur

Table 7.1.2.6: Effect of different organic pesticides and their concentration on marketable yield of brinjal at Udaipur

	Dose (ml/ L)	Marketable yield (kg ha^{-1})	NR (Rs/ha)	B:C ratio
Control	-	9720	154400	3.86
Dashparni @ 5 %	50	13000	218740	5.30
Dashparni @ 7.5 %	75	16140	281510	6.82
Dashparni @ 10 %	100	17200	302680	7.33
Teekha Sat 5 %	50	12350	206400	5.08
Teekha Sat 7.5 %	75	14170	242700	5.96
Teekha Sat 10 %	100	14600	251200	6.16
Spinosad @ 50 a. i. (45 SC)		13450	228400	5.63
CD (P=0.05)		1536.2	30724.91	0.75

D Effect of organic manures and liquid formulations on growth, yield and quality of okra [*Abelmoschus esculentus* (L.) Moench] cv. "Arka Anamika"

Treatment details

Main plot: Organic manures (M) - 03

(i) M1: FYM 1/3rd + Vermicompost 1/3rd + Neem cake 1/3rd equivalent to 100 % RDN
(ii) M2: FYM 1/3rd + Enriched compost 1/3rd+Vermicompost 1/3rd equivalent to 100% RDN
(iii) M3: FYM 1/3rd + PROM 1/3rd + Neem cake 1/3rd equivalent to 100 % RDN

Sub plot: Liquid formulations spray (LM) – 06

(i) L1: Panchagavya spray (3%) at first flowering and 15 DAF (Days after flowering)
(ii) L2: Jeevamrut (Spray @ 500 litre/ha) at first flowering and 15 DAF
(iii) L3: Cow urine spray (10%) at first flowering and 15 DAF
(iv) L4: Vermiwash spray (10%) at first flowering and 15 DAF
(v) L5: Matka khad spray (10%) at first flowering and 15 DAF
(vi) L6: Control (water spray) at first flowering and 15 DAF

Result:

Three organic manure mixtures and six liquid formulations spray was evaluated to study the effect of organic and liquid organic manure on growth and yield of okra. Results indicated that maximum yield and net return was recorded with application of 1/3rd FYM + 1/3rd PROM + 1/3rd NC equivalent to 100% RDN +panchagavya 3%. Among the different liquid formulations, L1 (Panchagavya spray 3%) recorded higher yield and net return from okra which is statistically on par with L4 (Vermiwash spray 10%) and it was higher by 24.4 and 15.9% over control in term of yield.

Table 7.1.2.7: Effect of organic manures and liquid formulations on fruit yield of okra at Udaipur

Treatments	Yield (q/ha)	Net return (Rs/ha)
Organic Manures (M)		
M1 (FYM 1/3rd + VC 1/3rd + NC 1/3rd equivalent to 100% RDN)	9263	110468
M2 (FYM1/3rd + EC1/3rd + VC 1/3rd equivalent to 100% RDN)	9033	104409
M3 (FYM 1/3rd + PROM1/3rd +NC1/3rd equivalent to 100% RDN)	10422	120221
C.D (P=0.05)	497	9939.9

Treatments	Yield (q/ha)	Net return (Rs/ha)
Liquid Formulations (L)		
L1 (Panchagavya spray 3%)	10746	134497
L2 (Jeevamrut spray @ 500 lit/ha)	9634	111853
L3 (Cow urine spray 10 %)	9324	107656
L4 (Vermiwash spray 10%)	10012	119425
L5 (Matka khad spray 10%)	9081	102397
L6 Control (Water spray)	8639	94366
C.D (P=0.05)	546	10918

FYM 1/3rd + PROM 1/3rd + Neem cake 1/3rd equivalent to 100 % RDN + Panchagavya spray (3%) at first flowering and 15 DAF (Days after flowering)

FYM 1/3rd + PROM 1/3rd + Neem cake 1/3rd equivalent to 100 % RDN + Jeevamrut (Spray @ 500 litre/ha) at first flowering and 15 DAF

FYM 1/3rd + PROM 1/3rd + Neem cake 1/3rd equivalent to 100 % RDN + Cow urine spray (10%) at first flowering and 15 DAF

FYM 1/3rd + PROM 1/3rd + Neem cake 1/3rd equivalent to 100 % RDN + Vermiwash spray (10%) at first flowering and 15 DAF

7.1.3: Detailed characterization of inputs (Jeevamrit, Ghanjeevamrit, Beejamrit, Agniastra, Neemaster, Brahmaster)

Title: Biochemical characterization & molecular identification of microbial population of different organic manures

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, Ludhiana, Coimbatore, Udaipur and Calicut). Calicut not reported the results

Centre wise results are presented below

Narendrapur

Physico-chemical and microbial characterization of *Beejamrit, Ghanjivamrit and Jeevamrit* (Table 7.1.3.1-7.1.3.3)

i) Physico-chemical and microbial characterization of *Beejamrit* (Table 7.1.3.1)

pH: Decomposition leads to pH changes in the Beejamrit solution. To determine the pH of the Beejamrit solution collected after different incubation periods. The study showed a gradual drop in the pH of the Beejamrit solution after more days of incubation. The initial alkaline pH of the Beejamrit solution (8.82±0.8), on the other hand, indicates the presence of cow urine and limes in the formulation. Together, we conclude that the pH of the Beejamrit solution ranges from slightly alkaline to neutral based on its different days of incubation.

Organic carbon: The gradual depletion of organic C in the Beejamrit solution after its incubation. In this study, it was observed that the organic carbon in the Beejamrit solution undergoes gradual depletion over incubation. It is also evident from this study that organic C depletion occurred more rapidly after 1-day of decomposition. In conclusion, an amazingly uniform decomposition pattern of organic carbon and protein residues in the Beejamrit solution.

Microbial population dynamics in Beejamrit: In this study, it was observed that the overall bacterial population of the Beejamrit input did not increase considerably up to 2-days of initial decomposition. The actinomycetes and fungi population, on the other hand, do not change significantly up to 2- and 1-day of incubation, respectively. However, both of these populations decreased gradually upon further incubation. In conclusion, this study establishes that the Beejamrit solution is a microbial formulation, and the microbial abundance of Beejamrit changes based on the days of its incubation.

ii) Physico-chemical and microbial characterization of *Ghanjeevamrit* (Table 7.1.3.2)

Detailed nutrient analyses revealed that Ghanajeevamrit have low plant-available N, P, and K content. It is evident from this study that the concentration of available N (largely in NH_4^+ form) increases significantly after 2-days of decomposition However, a significant depletion of NH_4^+-N was also observed upon further incubation. These findings together indicate that NH_4^+-N reaches a maximum within the first 2-days of decomposition, implying rapid microbial activity. Plant-available N content (e.g., NH_4^+-N) of Ghanjeevamrit is in the range of 0.003 to 0.005 percent in native breed and 0.002 to 0.004 percent in HF breed. It was observed from this study that there is no change in the concentration of plant-available P (e.g., P_2O_5) upon days of decomposition However, a substantial increase in P_2O_5 content was observed only in the Ghana Jeevamrit samples after 7-days of decomposition, suggesting a possible linkage of P-solubilizing mechanisms. In this study, there was no common trend observed in the plant-available K content (e.g., K_2O) after different days of decomposition. Organic carbon gradually depleted after it incubation from 0 hours to 144 hours and recorded in range from 3.13 to 3.48 under native breed. The total bacterial count reaches its maximum after 2-days of incubation. Similarly, the total population of actinomycetes reached a peak after 2-days of incubation. However, the population of actinomycetes was found to be decreasing after 2-days of incubation. Fungal population in the Ghanjeevamrit samples has shown a significant decline over the course of incubation.

Table 7.1.3.1: Physico-chemical and microbial parameters of *Beejamrit* after different incubation period at Narendrapur

Parameters	Beejamrit Desi (D)				Beejamrit HF				Beejamrit Mixed (50D:50HF)			
	0 h	48 h	96 h	144 h	0 h	48 h	96 h	144 h	0 h	48 h	96 h	144 h
Physico-chemical parameters												
pH	8.82±0.08	8.52±0.04	8.37±0.02	8.21±0.02	9.00±0.01	7.99±0.01	7.69±0.01	7.59±0.05	8.83±0.01	8.28±0.01	8.04±0.03	7.94±0.08
EC (dS/m)	2.49±0.10	2.51±0.06	2.25±0.02	2.24±0.02	2.35±0.08	2.48±0.05	2.36±0.03	2.22±0.04	2.50±0.02	2.48±0.02	2.32±0.03	2.26±0.02
Organic C (%)	1.76±0.02	1.04±0.06	1.02±0.09	0.87±0.02	0.84±0.03	0.95±0.16	0.95±0.05	0.74±0.02	1.06±0.03	0.71±0.1	0.76±0.12	0.72±0.07
Available N (%)	-	-	-	-	-	-	-	-	-	-	-	-
Available P (PPM)	15.50±0.22	16.50±0.38	16.00±0.13	14.83±0.14	13.83±0.29	14.45±0.58	12.17±1.15	11.41±0.08	15.33±0.14	15.96±0.19	15.08±0.29	13.62±0.13
Available K (PPM)	-	-	-	-	-	-	-	-	-	-	-	-
Microbial parameters												
Total bacteria (10^{10})	14.63±2.43	16.00±1.11	17.83±1.61	10.00±2.00	12.73±1.37	15.22±0.40	11.17±1.04	5.33±1.15	13.43±1.10	15.13±0.31	10.40±0.53	7.33±1.15
Total fungus (10^{4})	7.33±1.15	6.33±1.15	3.33±1.15	3.67±1.15	7.67±2.31	7.33±1.53	5.50±0.87	6.67±0.76	7.67±0.58	5.83±1.76	5.33±2.75	4.33±1.44
Total actinomycetes (10^{8})	15.33±3.20	15.00±2.00	4.43±0.84	3.30±0.70	15.73±2.72	14.00±3.46	1.47±0.81	2.47±0.12	16.73±2.34	16.67±0.58	2.67±0.35	0.87±0.12
Total FNFs (10^{9})	19.00±3.61	33.73±1.55	36.80±1.06	11.33±3.21	9.67±0.58	13.90±0.17	13.93±1.68	5.47±0.50	13.33±2.89	22.00±4.00	11.17±5.42	4.33±0.58
Total PSB (10^{8})	10.73±2.37	14.00±1.00	7.67±2.08	3.00±1.73	12.57±0.75	12.46±0.64	6.80±2.43	1.40±0.10	10.67±1.15	10.67±1.15	6.17±1.76	1.13±0.23

Note: Data are means ± standard errors of mean

Table 7.1.3.2: Physico-chemical and microbial parameters of *Ghanjeevamrit* after different incubation period at Narendrapur

Parameters	Ghanjeevamrit prepared from Native breed				Ghanjeevamrit prepared from HF				Ghanjeevamrit prepared from native + HF			
Physico-chemical parameters	0 h	48 h	96 h	144 h	0 h	48 h	96 h	144 h	0 h	48 h	96 h	144 h
pH	6.52±0.17	6.91±0.23	8.04±0.05	7.39±0.20	4.39±0.11	6.79±0.12	8.12±0.21	8.41±0.13	5.94±0.08	7.35±0.09	7.69±0.16	7.41±0.05
EC (dS/m)	2.66±0.05	2.79±0.05	2.90±0.06	3.41±0.14	3.39±0.15	2.68±0.12	3.40±0.15	3.43±0.08	3.27±0.05	3.15±0.17	3.43±0.08	3.23±0.08
Organic C (%)	3.48±0.02	3.36±0.03	3.19±0.03	3.13±0.03	3.13±0.03	2.92±0.03	2.88±0.03	2.68±0.06	3.27±0.03	3.23±0.03	2.95±0.02	2.82±0.03
Available N (%)	0.05±0.01	0.06±0.01	0.05±0.01	0.03±0.01	0.02±0.01	0.03±0.01	0.04±0.01	0.02±0.00	0.03±0.01	0.04±0.01	0.05±0.00	0.03±0.01
Available P (PPM)	168.42±0.38	170.00±1.09	164.33±1.26	163.17±0.38	103.42±2.67	110.67±1.26	109.33±1.42	106.08±0.76	124.83±5.31	129.83±4.80	132.17±3.25	122.83±2.02
Available K (PPM)	2161.25± 30.31	2431.25± 45.07	2072.92± 13.01	1911.46± 31.30	1398.75± 125.21	1542.92± 41.20	1630.42± 30.01	1262.92± 19.22	1853.25± 2.95	1928.33± 25.66	1998.17± 2.75	1763.50± 12.32
Microbiological parameters												
Total bacteria ($x10^{12}$)	12.97±0.15	16.00±1.11	8.33±0.58	4.00±0.00	3.22±1.00	4.93±0.65	0.15±0.05	0.07±0.01	11.76±0.44	5.22±0.40	0.27±0.03	0.14±0.02
Total Fungi ($x10^{5}$)	6.33±1.53	6.67±1.53	11.33±1.15	12.67±0.58	4.33±1.15	6.33±2.89	9.00±1.73	9.67±0.58	2.67±1.15	5.67±1.15	10.00±2.00	8.33±0.58
Total Actinomycetes ($x10^{10}$)	21.67±1.29	15.00±2.00	4.77±0.32	3.43±0.12	24.40±1.78	17.33±1.53	2.00±0.30	0.77±0.03	25.73±2.72	14.00±3.46	0.53±0.23	0.47±0.12
Total FNF ($x10^{10}$)	24.33±4.04	88.40±7.66	39.47±4.01	14.67±4.16	13.33±2.89	20.67±4.62	6.50±1.14	4.33±0.58	9.67±0.58	13.90±0.17	43.93±1.68	15.47±0.50
Total PSB ($x10^{10}$)	12.40±2.62	14.67±3.06	0.40±0.10	0.07±0.01	9.00±1.00	10.67±1.15	6.17±1.76	1.33±0.58	14.23±0.68	10.46±0.56	11.97±1.17	1.27±0.15
Total Indolic Compound (µg/g)	342.00±9.00	363.00±5.20	348.00±5.20	276.00±5.20	172.33±2.31	184.50±9.00	113.83±2.75	130.50±0.00	265.67±1.15	285.83±1.04	254.50±1.50	258.00±2.29

Table 7.1.3.3: Physico-chemical and microbial parameters of *Jeevamrit* after different incubation period at Narendrapur

Parameters	Jeevamrit prepared from Native breed				Jeevamrit prepared from HF				Jeevamrit prepared from native + HF			
Physico-chemical parameters	0 h	48 h	96 h	144 h	0 h	48 h	96 h	144 h	0 h	48 h	96 h	144 h
pH	4.53±0.03	4.40±0.05	3.81±0.31	3.56±0.09	4.56±0.04	4.28±0.13	3.58±0.06	3.57±0.03	4.50±0.07	3.98±0.13	3.67±0.13	3.77±0.08
EC (dS/m)	5.32±0.03	5.71±0.07	5.55±0.04	5.61±0.06	3.78±0.03	3.89±0.11	3.92±0.03	3.77±0.08	4.32±0.10	4.59±0.06	4.37±0.09	4.43±0.06
Organic C (%)	0.66±0.01	0.55±0.02	0.27±0.04	0.21±0.03	0.40±0.02	0.29±0.04	0.23±0.01	0.14±0.02	0.64±0.06	0.49±0.06	0.43±0.11	0.17±0.01
Available N (%)	0.03±0.01	0.04±0.00	0.03±0.00	0.02±0.01	0.01±0.00	0.01±0.00	0.01±0.00	0.00±0.00	0.02±0.00	0.02±0.01	0.02±0.01	0.01±0.00
Available P (PPM)	44.33± 0.40	65.25± 1.88	50.58± 2.60	49.50± 0.57	32.37± 3.66	42.54± 1.15	43.37± 1.84	28.96± 0.71	34.12± 1.57	44.10± 0.47	42.00± 0.99	30.50± 1.11
Available K (PPM)	1097.77± 3.85	1083.33± 4.83	1194.63± 4.95	1055.37± 8.60	709.53± 4.73	712.50± 22.83	786.33± 34.36	717.60± 9.15	829.87± 9.60	904.03± 7.39	926.47± 5.25	861.10± 8.15
Microbiological parameters												
Total bacteria ($x10^{12}$)	2.97±0.15	7.39±1.69	0.03±0.01	0.03±0.01	0.22±0.03	1.26±0.12	0.09±0.01	0.07±0.01	10.78± 0.52	3.55±1.18	0.31±0.04	0.12±0.03
Total Fungi ($x10^{5}$)	2.33±0.58	1.93±0.12	15.00± 2.00	13.67± 1.15	2.33±0.58	4.00±1.00	10.00± 2.65	8.67±1.53	2.33±0.58	6.00±1.00	8.67±1.15	8.33±0.58
Total Actinomycetes ($x10^{10}$)	24.67± 2.50	15.00± 1.73	1.50±0.36	1.43±0.12	2.27±0.42	7.33±1.53	0.93±0.32	0.83±0.14	33.73± 1.01	12.33± 2.08	0.60±0.40	0.53±0.15
Total FNF ($x10^{10}$)	1.10±0.11	10.00± 2.65	6.13±2.01	7.33±1.15	0.30±0.06	0.26±0.03	0.23±0.06	0.18±0.08	0.08±0.01	4.27±0.60	83.73± 3.33	58.47± 3.01
Total PSB ($x10^{10}$)	5.47±1.12	0.01±0.00	0.04±0.01	0.02±0.01	0.02±0.00	0.06±0.01	0.03±0.02	0.04±0.01	3.93±0.21	1.12±0.07	1.63±0.08	1.23±0.15
Total Indolic Compound (µg/g)	343.50± 5.20	87.00± 2.60	76.50± 0.00	100.50± 2.660	163.50± 2.60	63.00± 0.00	69.83± 3.75	122.00± 5.27	207.13± 7.55	76.50± 0.87	64.97± 0.06	137.00± 2.29

iii) Physico-chemical and microbial characterization of *Jeevamrit* (Tables 7.1.3.3)

Jeevamrit is a fermented microbial inoculum derived from cattle excreta and forest soils. Decomposition of organic materials leads to gradual depletion of organic C in *Jeevamrit*. In this study, it was observed that the concentration of organic C, mostly in the form of carbohydrates and lipids, gradually gets depleted upon days of incubation. This observation is nicely correlated with the depletion of carbohydrate concentration and the rate of decomposition is observed to be more rapid during the first 2-days of incubation.

It is evident from this study that the concentration of available N (largely in NH_4^+ form) increases after 2-days of decomposition however, a depletion of NH_4^+-N was also observed upon further incubation. These findings together indicate that NH_4^+-N reaches a maximum within the first 2-days of decomposition. There is no change in the concentration of plant-available P (e.g., P_2O_5) upon days of decomposition However, a substantial increase in P_2O_5 content was observed only after 2-days of decomposition. There was no common trend observed in the plant-available K content (e.g., K_2O) after different days of decomposition. In the case of Jeevamrit, K_2O content has decreased slightly in concentration upon days of incubation. Bacterial population changed significantly over the course of the incubation period in the Jeevamrit. This suggests a gradual increase in the rate of bacterial activity and as a consequence, the rate of decomposition over time. Importantly, the total bacterial count reaches its maximum after 2-days of incubation.

Ludhiana

Objective

- To enumerate microbial, biochemical and chemical properties of *Beejamrit, Ghanjeevamrit* and *Jeevamrit*

Treatments

Source of ingredient	Material	NF inputs to be prepared
Native breed (NB) cow	Urine and dung (NB)	• Beejamrit = 3 types • Ghanjeevamrit = 3 types • Jeevamrit = 3 types
Holstein Friesian (HF) cow	Urine and dung (HF)	
NB + HF cow	Mixed urine and dung of native and HF breeds (50% of each)	
Characterization: 9 treatments × 3 replications = 27 samples		

Characterization of inputs (Jeevamrit, Ghanjeevamrit and Beejamrit)

Methodology: The NF inputs namely Jeevamrit and Ghanjeevamrit, 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

Jeevamrit (Table 7.1.3.4-6)

Microbial properties: In genral, population of bacteria was more in NF inputs prepared from HF cow. In jeevamrit, bacterial and fungi population was highest under HF treatment after one and two days of preparation. There was 22.2 – 29.3 per cent increase in bacterial population and 75 – 87.5 per cent decrease in fungi population at two days after preparation than first day. There was no variation in actinomycetes count in jeevamrit prepared from urine and dung of NB & HF cows

Chemical properties: In general, value of pH, EC and OC was more in NF inputs prepared from HF cow. In Jeevamrit, pH was highest under HF treatment after 24, 48 and 96 hours from preparation time. EC was higher in NF inputs prepared from Desi + HF. SOC was maximum (0.30%) in jeevamrit prepared from dung and urine of NB & HF cow after 24 hours of preparation. Available Nitrogen (0.01 %) was higher in higher in jeevamrit prepared from NB + HF 96 hours after preparation whereas available Phosphorous (0.019 %) and available K (0.013%) was higher in jeevamrit prepared from HF cow 24 hours after preparation.

Biochemical properties: In biochemical analysis, carbohydrates, total soluble protein and free fatty acids were analysed. Value of carbohydrates were higher (3.4 %) in NF inputs prepared from Desi + HF at 96 hours after preparation. Total soluble protein were higher from desi cow at the time of preparation. Fee fatty acid were higher (2.3%) from desi at 96 hours after preparation.

Table 7.1.3.4: Population of different microbes in Jeevamrit during first and second day after preparation

Treatment	Days after preparation	Microbial populations (CFU)/g		
		Bacteria (10^5)	Fungi (10^4)	Actinomycetes (10^3)
Desi cow	1	135	7	1
	2	190	1	1
HF cow	1	150	8	1
	2	205	3	1
Desi + HF cow	1	140	8	1
	2	180	2	1

CFU stands for colony forming units

Table 7.1.3.5: Chemical characterization of Jeevamrit at different time intervals

Treatments	Hours after preparation	pH (1:10)	EC (dSm^{-1})	OC (%)	Available N (%)	Available P (%)	Available K (%)
Desi cow	24	7.81	0.18	0.35	0.004	0.0184	0.008
	48	7.27	0.36	0.27	0.009	0.005	0.004
	96	7.18	0.42	0.24	0.0007	0.0006	0.0006
HF cow	24	8.20	0.16	0.35	0.007	0.019	0.013
	48	8.11	0.41	0.21	0.008	0.005	0.0021
	96	8.13	0.45	0.19	0.0004	0.0006	0.0004
Desi + HF	24	7.83	0.15	0.33	0.005	0.018	0.007
	48	7.87	0.34	0.23	0.008	0.006	0.0069
	96	7.96	0.44	0.19	0.010	0.0006	0.0007

Table 7.1.3.6: Biochemical characterization of jeevamrit at 0, 48 and 96 hours after preparation

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	2.0	1.70	1.01	1.6	1.1	0.73	0.4	1.2	2.30
HF cow	3.1	2.35	1.50	1.2	0.9	0.60	0.3	1.7	2.12
Desi + HF cow	3.4	1.80	1.11	1.3	1.2	0.80	0.3	1.6	2.29

Ghanjeevamrit (Table 7.1.3.7-9):

Microbial properties: In general, population of bacteria was more in ghanjeevamrit prepared from HF cow (Table. 5.4). In ghanjeevamrit, bacterial and fungi population was highest under HF treatment after one and two days of preparation. There was 21.1 – 31.0 percent increase in bacterial population and 50 – 66.6 per cent decrease in fungi population two days after preparation than first day. There was no variation in actinomycetes content in ghanjeevamrit prepared from dung and urine of NB & HF cows.

Chemical properties: In general, value of EC and OC was more in ghanjeevamrit prepared from HF cow (Table. 5.5). In ghanjeevamrit, pH was highest under NB cow treatment after 24, 48 and 96 hours of preparation. EC was higher in ghanjeevamrit prepared from NB + HF cow. Available Nitrogen (0.15 %) was higher in ghanjeevamrit prepared from NB cow 24 hours after preparation whereas available phosphorous (0.18 %) and available K (0.06 %) was higher in ghanjeevamrit prepared from NB + HF cow 24 hours after preparation.

Biochemical properties: In biochemical analysis, carbohydrates, total soluble protein and free fatty acids were analyzed. Value of carbohydrates was highest (17.8 %) in NF inputs prepared from NB + HF at the time of preparation. Total soluble protein was highest ghanjeevamrit prepared from NB + HF cow at the time of preparation. Free fatty acids were higher (6.12 %) in ghanjeevamrit prepared from NB + HF cow 96 hours after preparation.

Table 7.1.3.7: Population of different microbes in Ghanjeevamrit during first and second day after preparation

Treatment	Days after preparation	Microbial populations (CFU)/g		
		Bacteria (10^5)	Fungi (10^4)	Actinomycetes (10^3)
Desi cow	1	40	3	1
	2	58	1	1
HF cow	1	55	3	1
	2	70	1	1
Desi + HF	1	50	2	1
	2	65	1	1

CFU stands for colony forming units

Table 7.1.3.8: Chemical characterization of Ghanjeevamrit at different time intervals

Treatments	Hours after preparation	pH (1:10)	EC (dSm^{-1})	OC (%)	Available N (%)	Available P (%)	Available K (%)
Desi cow	24	6.92	2.2	7.5	0.15	0.13	0.009
	48	6.94	2.6	7.3	0.021	0.01	0.03
	96	6.96	2.2	7.3	0.0013	0.0019	0.0007
HF cow	24	6.20	2.4	7.7	0.008	0.13	0.007
	48	6.35	2.4	7.6	0.014	0.02	0.045
	96	6.37	2.5	7.4	0.0011	0.0019	0.005
Desi + HF cow	24	6.46	2.9	7.3	0.0095	0.18	0.06
	48	6.50	2.6	7.1	0.020	0.01	0.006
	96	6.39	2.7	7.2	0.0018	0.0012	0.008

Table 7.1.3.9: Biochemical characterization of Ghanjeevamrit at 0, 48 and 96 hours after preparation

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	13.5	11.1	9.6	13.0	9.31	7.1	1.43	3.53	4.24
HF cow	12.6	10.3	8.2	17.3	12.3	10.2	2.03	4.21	5.65
Desi + HF cow	17.8	11.7	6.6	17.4	11.3	8.9	2.57	4.59	6.12

Beejamrit (7.1.3.10-12)

Microbial analysis: Population of bacteria was more in *beejamrit* prepared from dung and urine of NB + HF cow (Table. 5.4). In *beejamrit*, bacterial and fungi population was highest under NB + HF treatment after one and two days of preparation. There was 27.5 – 35.0 per cent increase in bacterial population and 50 per cent decrease in fungi population two days after

preparation than first day. There was no variation in actinomycetes content in *beejamrit* prepared from dung and urine of NB & HF cow.

Chemical analysis: The pH was more in *beejamrit* prepared from dung and urine of NB cow whereas EC was more in NB + HF cow treatment. SOC was more in *beejamrit* prepared from dung and urine of HF cow. Available Nitrogen (0.11 %) was higher in higher in *beejamrit* prepared from NB cow 24 hours after preparation whereas available Phosphorous (0.15 %) was higher in NF inputs prepared from NB + HF cow 24 hours after preparation.

Biochemical analysis: In biochemical analysis, carbohydrates, total soluble protein and free fatty acids were analyzed. Value of carbohydrates were higher (16.8 %) in *beejamrit* prepared from NB + HF at the time of preparation. Total soluble proteins were highest *beejamrit* prepared from NB + HF cow at the time of preparation. Free fatty acids were higher (4.1 %) in NF inputs prepared from NB cow 96 hours after preparation.

Table 7.1.3.10: Population of different microbes in Beejamrit during first and second day after preparation

Treatment	Days after preparation	Microbial populations (CFU)/g		
		Bacteria (10^5)	Fungi (10^4)	Actinomycetes (10^3)
Desi cow	1	31	2	1
	2	43	1	1
HF cow	1	38	2	1
	2	59	1	1
Desi + HF	1	42	2	1
	2	58	1	1

CFU stands for colony forming units

Table 7.1.3.11: Chemical characterization of Beejamrit at different time intervals

Treatments	Hours after preparation	pH (1:10)	EC (dSm^{-1})	OC (%)	Available N (%)	Available P (%)	Available K (%)
Desi cow	24	6.62	2.20	7.1	0.11	0.11	0.008
	48	6.56	2.18	7.0	0.031	0.012	0.02
	96	6.51	2.12	7.6	0.0010	0.0014	0.0006
HF cow	24	6.11	2.34	7.5	0.006	0.11	0.006
	48	6.02	2.37	7.3	0.011	0.014	0.031
	96	5.90	2.43	7.1	0.0009	0.0013	0.004
Desi + HF cow	24	6.32	2.70	7.2	0.0067	0.15	0.05
	48	624	2.50	7.1	0.012	0.01	0.02
	96	6.10	2.34	7.0	0.0013	0.0010	0.006

Table 7.1.3.12: Biochemical characterization of Beejamrit at 0, 48 and 96 hours after preparation

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	12.6	10.2	8.43	9.0	8.8	6.58	1.32	3.43	4.1
HF cow	10.45	9.65	7..5	14.2	9.5	8.2	1.96	3.54	3.80
Desi + HF cow	16.8	10.4	5.45	14.3	10.4	7.9	1.5	2.89	3.56

Microorganisms in Agniastra, Brahmastra and Neemastra: In agniastra, bacterial count was highest followed by phosphate solubilizing microorganisms, Zn solubilizers and total fungal count. In brahmastra, bacterial count was highest followed by Zn solubilizers, nitrogen fixers and phosphate solubilizing microorganisms and in neemastra bacterial count was highest followed by nitrogen fixers and total actinomycetes count. In general, population of bacteria and Zn solubilizers was more in brahmastra (Table. 5.10). Total fungal count was highest in agniastra. Population of total actinomycetes, phosphorous solubilizing microorganism and nitrogen fixers were highest in neemastra (Table 7.1.3.13).

Table 7.1.3.13: Characterization of natural farming input (Agniastra, Brahmastra and Neemastra)

Count of microorganisms (log10 cfu/ml)	Agniastra	Brahmastra	Neemastra
Total Bacterial Count	6.176	6.881	7.584
Total Fungal Count	3.602	3.000	3.301
Total Actinomycetes Count	3.301	3.000	4.477
Phosphate Solubilizing Microorganisms	4.477	4.322	5.279
Nitrogen fixers	3.477	4.398	4.544
Zn Solubilizers	3.778	4.556	3.699

Coimbatore (Table 7.1.3.14)

Natural farming input such as Beejamrit, Jeevamrit, and Ghanjeevamrit prepared using the cow dung and cow urine collected from native breed (Gir), cross-bred (HF) and from both native and cross breed. Microbial population of bacteria, fungai and actinimycetes, N fixers (Azospirillum, Azotobacter and Bacillus sp.) and P- solubilizers *Bacillus* sp., *B. subtilis*, *Pseudomonas* sp. recorded higher with native breed (Gir) followed by HF and mixed breed among the NF input.

Table 7.1.3.14: Physico-chemical properties of natural farming inputs (Beejamrit, Jeevamrit, and Ghanjeevamrit)

Microorganisms	Beejamrutha (First day)			Jeevamrutha (7th DAP)			Gnanajeevamirtham (10th day DAP)		
	Native bred (Gir)	HF (Cross bred)	Mixed (50 % native + 50 % HF)	Native bred (Gir)	HF (Cross bred)	Mixed (50 % native + 50 % HF)	Native bred (Gir)	HF (Cross bred)	Mixed (50 % native + 50 % HF)
Bacteria (10^8)	5	13	9	8	12	5	12	9	3
Fungi (10^4) (*Aspergillus sp, Fusarium sp)*	17	5	12	32	8	18	47	10	22
Actinomycetes (10^3)	8	12	2	9	4	8	12	2	9
N- fixers (10^3) (*Azospirillum, Azotobacter and Bacillus sp.*)	46	12	9	55	23	32	12	8	20
P- solubilizers (10^3) *Bacillus* sp., *B. subtilis*, *Pseudomonas* sp.,	50	12	20	54	16	18	18	9	24

Udaipur

Microbial population of bacteria, fungi and actinomycetes and enzyme activity were found to be higher in NF input Jeevamrit, Ghanjeevamrit and Beejamrit prepared from cow dung and urine of native breed followed by HF (Table 7.1.3.15 to 7.1.3.18).

Table 7.1.3.15: Chemical and microbial composition of dung and urine of Native breed (Desi cow)

Name of input	N (%)	P (%)	K (%)	Microbial count
Desi Cow dung	0.525-0.545	0.225-0.255	0.470-0.495	Bacterial count (cfu/ml): 2.01 x 10^8-3.14 x 10^8 Fungal count (cfu/ml): 1.19 x 10^5- 2.46 X 10^5 Actinomycetes count (cfu/ml): 0.78 X 10^5 – 1.21 x 10^5
Desi Cow Urine	0.725-0.760	0.265-0.290	0.450-0.475	Bacterial count (cfu/ml): 1.10 x 10^8 - 2.30 x 10^8 Fungal count (cfu/ml): 0.67 X 10^5 - 0.90 X 10^5 Actinomycetes count (cfu/ml): 0.83 X 10^5 - 1.03 X 10^5

Table 7.1.3.16: Bio-chemical characterization of Jeevamrit at Udaipur

Parameters	Native breed	HF	Native+ HF
pH	3.90-4.10		
EC (dS/m)	1.60-1.76		
N (%)	1.04-1.22		
P (%)	0.190-0.201		
K (%)	0.200-0.291		
Bacterial count (cfu/ml)	5.37 x 10^8–6.10 x 10^8	4.95 x 10^8–5.77 x 10^8	5.01 x 10^8–6.05 x 10^8
Fungal count (cfu/ml)	3.42 X 10^4–4.05 X 10^4	3.11X 10^4–3.75X 10^4	3.17X 10^4–4.10X 10^4
Actinomycetes count (cfu/ml)	2.90 X 10^5–3.89 X 10^5	2.31 X 10^5–3.40 X 10^5	2.64 X 10^5–3.39 X 10^5
Acid phosphatase (µg/ml)	1.24 – 1.83	1.01 – 1.90	1.05– 1.64
Alkaline phosphatase (µg/ml)	2.11 – 2.98	2.00 – 2.82	2.01 – 2.90
Dehydrogenase (TPF µg/ml)	0.99 -1.80	0.94 –1.46	0.95 – 1.77

Table 7.1.3.17: Bio-chemical characterization of Ghanjeevamrit at Udaipur

Parameters	Native breed	HF	Native+ HF
pH	5.35-5.50		
EC (dS/m)	0.75-0.90		
N (%)	2.30-2.70		
P (%)	0.300-0.330		
K (%)	0.360-0.395		
Bacterial count (cfu/ml)	29.65 x 10^8–30.52 x 10^8	25.62 x 10^8–26.80 x 10^8	28.32 x 10^8–29.16 x 10^8
Fungal count (cfu/ml)	5.98 x 10^4–6.88 x 10^4	9.19 x 10^3–10.51 x 10^3	4.17 x 10^4–5.10 x 10^4
Actinomycetes count (cfu/ml)	4.01 x 10^5– 4.86 x 10^5	2.26 x 10^5–3.08 x 10^5	3.01 x 10^5–3.99 x 10^5
Acid phosphatase (µg/ml)	71.77 – 72.92	65.21 – 67.69	68.77– 70.24
Alkaline phosphatase (µg/ml)	11.04 – 12.15	7.29 – 9.01	9.47 – 11.21
Dehydrogenase (TPF µg/ml)	106.57–108.22	63.82 – 65.39	95.39 – 97.44

Table 7.1.3.18: Bio-chemical characterization of Beejamrit at Udaipur

Parameters	Native breed	HF	Native+ HF
pH	8.20-8.25		
EC (dS/m)	5.50-5.60		
N (%)	1.10-1.48		
P (%)	0.127-0.132		
K (%)	0.127-0.132		
Bacterial count (cfu/ml)	25.47×10^8–26.53×10^8	17.10×10^8–18.72×10^8	21.01×10^8–22.36×10^8
Fungal count (cfu/ml)	1.82×10^3–2.75×10^3	6.90×10^3–8.01×10^3	1.94×10^2 –2.88×10^2
Actinomycetes count (cfu/ml)	4.97×10^3–5.88×10^3	9.96×10^4–10.88×10^4	3.69×10^2–4.77×10^2
Acid phosphatase (µg/ml)	13.55 – 15.42	10.94 – 12.23	11.91– 13.68
Alkaline phosphatase (µg/ml)	8.01 – 9.63	3.01 – 4.81	2.67 – 3.94
Dehydrogenase (TPF µg/ml)	113.17–115.62	57.91 – 59.22	91.70 – 93.58

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

7.2 .1 Evaluation of organic, inorganic and towards organic (integrated) production packages for crops and cropping systems

Title of the experiment: Evaluation of management 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 (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*(Chemical)*	100 % inorganic package (No organic manures)
		State recommendation or farmers package (Choice to centres)
	Integrated management	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
Sub plot	Cropping Systems	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)
	Umiam (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
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	

Centre	Nutrient Sources	NPK contents on dry weight basis (%)		
		N	P	K
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	-
	Tephrosia*spp*	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 7.2.1 and 2)

Bajaura: Vegetable crops were evaluated in four cropping systems under organic, inorganic and towards organic approaches. The performance of majority of crops was in the order to organic <towards organic < inorganic. Organic management resulted in yield level of 6050, 760, and 8990 kg/ha in *kharif* for frenchbean, black gram and lady finger which was 5.2% higher than towards organic for frenchbean, and 7.3 and 7.7% lower than towards organic for blackgram and lady finger respectively. Organic package resulted 1.6, 9.5 and 9.7% lower yield than inorganic. In terms of system equivalent yield (cauliflower equivalent), black gram-cauliflower-summer squash resulted in higher cauliflower equivalent yield (25115 kg/ha) among the cropping systems. Among different management practices, inorganic management with State recommendation resulted in higher equivalent yield (25160 kg/ha) followed by integrated. Cauliflower equivalent yield was decreased to the tune of 11.8 whereas with integrated it was marginally decreased only 2.3% only.

Best performing production system (black gram-cauliflower-summer squash) at Bajaura

Bhopal: Soybean based system with wheat, mustard, chickpea and linseed were evaluated under organic, inorganic and towards organic approaches. 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 826, 4297, 1425, 1287 and 1607 kg/ha for soybean, wheat, mustard, chickpea and linseed which was 5.9, 4.3, 7.7, 8.5 and 3.2% lower than towards organic respectively. In terms of system equivalent yield (soybean equivalent), it was also in the order of inorganic < organic < towards organic management. Among the cropping systems, soybean-linseed recorded higher soybean equivalent yield of 2765 kg/ha followed by soybean-wheat (2637 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. Yield of ginger and turmeric been in order of inorganic < organic < towards organic. Organic management package resulted in yield of 10274 and 29800 kg/ha respectively for ginger and turmeric which was 22.7 and 13.4% lower than towards organic but 95 and 12.4% higher than inorganic respectively.

Ginger and turmeric under organic management at Calicut

Coimbatore: Vegetables brinjal, chilli and tomato in *kharif* in combination of pearl millet, barnyard millet and finger millet in *rabi* was evaluated in system mode under organic, inorganic and towards organic approaches. All the vegetable crops and millets performed better in order to inorganic < organic < towards organic. Organic management resulted in yield level of 19141, 13865 and 21306 kg/ha in *kharif* which is 6.6, 2.3 and 6.0% lower than towards organic for brinjal, chilli and tomato respectively. Similar trends were observed for *rabi*. System equivalent yield (brinjal equivalent) recorded in order to organic < towards organic < inorganic among the nutrient management practices. Among the cropping systems, tomato -finger millet-green manure (*dhaincha*) resulted in higher equivalent yield of 25703 kg/ha which was 5.6 and 11.4% higher than brinjal - pearl millet and chillies - barnyard millet respectively.

Best performing systems tomato -finger millet-green manure (*dhaincha*) at Coimbatore

Dharwad: Pigeon pea and cotton based inter cropping systems was evaluated under organic, inorganic and towards organic nutrient management. Crops green gram, soybean and groundnut was taken as intercrop with pigeon pea and cotton. Main and intercrop yield was converted into equivalent yield in term of pigeon pea equivalent. Among different combinations of intercropping system, pigeon pea intercropping system resulted in higher equivalent yield in order of towards organic < inorganic < organic while cotton based intercropping systems observed in reverse order. In term of

Comparation of organic and organic+ NF practice in pigeon pea + groundnut (1:2)

Cotton crop under organic management practice

Cotton crop under towards organic management practice

Comparision of organic inorganic and towards organic in pigeonpea at Dharwad

equivalent yield (PEY) recorded in order of inorganic < organic < towards organic. Pigeon pea+ ground nut recorded highest PEY among the other intercropping systems.

Jabalpur: Soybean-based cropping systems with combination of 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 25 and 17.5% higher than inorganic and towards organic approaches. In r*abi*, all the crops performed better in order of organic < towards organic < inorganic. Organic management resulted in yield level of 2780, 1362 and 670 kg/ha in *rabi* for wheat, mustard and lentil which was 20.2, 16.5 and 23.1% lower than towards organic. Similar trends were observed for summer crops. Total mean productivity in terms of basmati rice equivalent was recorded higher with 100% inorganic nutrient management (5477 kg/ha) followed by organic (5093 kg/ha) among the production packages. Among cropping systems, basmati rice- berseem seed & fodder led to record maximum basmati rice equivalent yields (6238 kg/ha) followed by basmati rice – mustard-green gram of 4942 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 in combination with vegetable crops were evaluated. Rice crop performed better in order to organic < inorganic < towards organic. Organic management resulted in mean yield of rice 3264 kg/ha which was 3.8 and 1.9% lower than towards organic and inorganic. During r*abi,* yield of brinjal found to be 15.9% lower with organic than inorganic, however, chickpea, field bean resulted in higher yield with organic which was 24.6 and 14.6% increase than inorganic respectively. Performance of white onion was in order of inorganic < organic < towards organic. Organic management resulted in yield of onion 14346 kg/ha. System productivity in term of rice equivalent was in the order

of inorganic < towards organic < organic. Organic management resulted in system equivalent yield of 22095 kg/ha which was about 25% higher than inorganic management practice. Among the cropping systems, rice- brinjal system produced maximum rice equivalent yield (26906 kg/ha) than others cropping systems.

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 system consisting of two rice-based, one moong-wheat summer moong and one sesame- lentil system was evaluated under organic inorganic and towards organic management approaches Yield of basmati rice was in order of organic < inorganic < towards organic. Organic management resulted in mean yield of rice 3825 kg/ha which was 8.9 and 8.4% lower than towards organic and inorganic respectively. Yield of wheat and lentil was in the order of organic < towards organic < inorganic. Organic management resulted in yield level of 1320 and 1350 kg/ha for chick pea and lentil. Chickpea yield 14.8% recorded higher than towards organic whereas, lentil recorded 12.4% lower yield. System productivity in term of rice equivalent was in order of inorganic < towards organic < organic. Among cropping systems, *kharif* moong-wheat-summer moong resulted in higher system productivity of 11813 kg/ha followed by basmati rice-wheat-green manure.

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 of black rice and okra was in order of inorganic < towards organic < organic whereas finger millet and black gram yield been in order of towards organic < organic < inorganic. Organic

management resulted in yield level of 342, 2193, 9164 and 1024 kg/ha for black rice, finger millet, okra and black gram which was 11.0, 12.6 and 6.0% higher for black rice, finger millet and okra than towards organic. In *rabi* barley pea and tomato yield was in order of towards organic < organic < inorganic. Organic management practice resulted in yield level of barley pea tomato 2935, 41230 and 10330 kg/ha. 32.5 and 20.4% lower yield for barley and tomato was recorded over towards organic. Systems productivity among the various production packages was in order of towards organic < inorganic < organic. Black gram-tomato-green manure (*sunhemp*) recorded higher rice equivalent yield of 16008 kg/ha because of higher yield of tomato and good premium price followed by okra-vegetable pea of 11590 kg/ha among the cropping systems.

Pantnagar: Basmati rice based four cropping systems was evaluated under organic inorganic and towards organic approaches. Performance of majority of crops weas in the order of organic < inorganic < towards organic. Organic management resulted in yield level of 4618, 4138, 1536 and 8854 for basmati rice, wheat, mustard and vegetable pea equivalent. Under organic management yield difference for basmati rice was only 28 kg/ha. 16.3 and 12.3% lower yield recorded for wheat and mustard respectively. System productivity in terms of basmati rice equivalent yield recorded higher with towards organic (7999 kg/ha) having 50% nutrients through organic manures + 50% nutrients through inorganic sources followed by inorganic and organic. Among all the cropping systems, higher system productivity was recorded with basmati rice-vegetable pea +coriander-*sesbania* system (8642 kg/ha) followed by basmati rice-mustard (8161 kg/ha).

Raipur: Soybean based cropping systems were evaluated with maize, field pea, tomato, and cabbage under organic, inorganic and towards organic approaches. The performance of majority of crops was in the order of towards organic <organic < inorganic. Organic management resulted in yield level of 2259, 14963, 6797, 49433 and 45480 kg/ha for soybean, maize, field bean, tomato and cabbage which was 8.4, 19.1, 15.8, 22.1 and 16.6% higher than towards organic. System equivalent yield (Soybean equivalent) among the nutrient management practices was in order of towards organic < organic < inorganic. Among the cropping systems, soybean-tomato resulted in higher equivalent of 13414 kg/ha followed by soybean cabbage.

Maize and tomato crop towards organic management practice at Raipur

Ranchi: Four rice-based cropping systems were evaluated wherein wheat, onion, potato and okra were grown. The performance of rice was in the order of towards organic < inorganic < organic. Organic management practice either with organic manures equivalent to 100 % N requirement of the system or 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] resulted in higher mean yield of rice (3511 and 3376 kg/ha respectively) which was 26.8 and 21.9% higher than towards organic. In *rabi*, onion and potato follow the same trends and found to be higher by 6.8 and 47.9% than towards organic respectively whereas performance of wheat and okra was in the order of organic < towards organic < inorganic.

Rice crop under organic and organic + NF practice at Raipur

Wheat crop under inorganic condition

Potato under organic management prctice

Onion under organic practice

Okra under organic (50% organic +NF practice)

Glimpse of field crops at Ranchi

Umiam: Four vegetable-based cropping system namely were grown on raised beds and four rice varieties Megha Aromatic 2, Shahsarang-1, Ngoba, Lampnah taken on sunken beds under four management practices viz. 100% organic, 75% organic + innovative practice i.e. (10 % vermiwash and 10% cow urine), integrated management with 50% inorganic+50%

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

organic and 100 %inorganic. Performance of bhindi was in the order of towards organic < organic< inorganic. Organic management resulted in mean yield of bhindi 11943 kg/ha which was about 6.1% higher than towards organic. Rest other vegetable crops on the raised bed performed better in the order of inorganic < organic < towards organic. Organic management resulted in yield level of 17530, 17950, 6860, 15740 kg/ha. Potato and tomato yield was 11.2 and 3.7% lower than towards organic.

Ajmer: Spices crops coriander and fennel was evaluated in four cropping system under organic, inorganic and towards organic approaches. The performance of majority of the crops was in the order of inorganic < organic < towards organic. Organic management resulted in mean yield of cowpea as sole crop 1000 kg/ha which was about 7 and 14% lower than towards organic and inorganic respectively.0 Yield of fennel and coriander under organic management recorded of 1608 and 717 kg/ha which was16.5 and 9.5% lower than towards organic respectively. System equivalent yield (cowpea) was in the order of organic < inorganic < towards organic. Among cropping systems, cow pea + maize (4:2) - fennel + cabbage (2:1) recorded highest equivalent yield of 4286 kg/ha followed by cow pea – fennel.

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

Coriander and fennel with inter crop cabbage 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. Organic management resulted in yield level of 3433 and 2560 kg/ha in the *kharif* for grain amaranth and finger millet which was 82.8 and 66.0% higher than towards organic respectively. Similar trends was observed for *rabi* crops. System equivalent yield recorded in the order of inorganic < towards organic < organic. Among the two systems, grain amaranth-wheat + lentil recorded highest equivalent yield of 3262 kg/ha which was about 32% higher than finger millet + black soybean-wheat + toria.

Gangtok: Maize based four cropping system was evaluated under organic inorganic and towards organic approaches. The performance of the majority of crops was in the order of inorganic < towards organic < organic. Organic management resulted in yield of -maize (mean, 3300 kg/ha) in the *kharif* which was about 11.0% higher than towards organic. Similar trends for *rabi* crops were observed. In *rabi*, organic management resulted in higher yield of 12.1, 17.0, 11.8 and 11.1% than towards organic for french bean, buckwheat, rajmash and toria respectively.

Narendrapur: Rice based four cropping systems was evaluated. The performance of rice was in the order of inorganic < towards organic < organic. Organic management resulted in higher yield of rice (mean yield 3911 kg/ha) which was only 2.0% higher than towards organic. In *rabi*, majority of the crops was in order of inorganic < organic < towards organic. Organic nutrient practice resulted in higher yield of mustard by 7.22 and 17.4% than towards organic and inorganic respectively. Other crops broccoli and frenchbean vegetable pea by 2.6 and 8.3% lower yield with organic than towards organic. In summer the performance of the crops was in the order of inorganic < towards organic < organic. System equivalent yield was also resulted in the order of inorganic < towards organic < organic. Among the systems, rice (shatabdi) -frenchbean-green gram recorded highest equivalent yield.

Sardarkrushinagar: Performance of majority of the crops was in the order of organic < towards organic < inorganic. Organic management resulted in yield level of 1253 and 542 kg/ha in kharif for groundnut and green gram which was only 1.5 and 7.0% lower than towards organic respectively. Wheat crop was also lower by 3.2 and 9.8% with organic practice

Groundnut, wheat and green gram under organic management practice at SK Nagar

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

management than towards organic and inorganic respectively. System equivalent yield (ground nut equivalent) for management practice was in order of organic < towards organic < inorganic. Among the cropping systems, green gram - coriander - vegetable cowpea resulted in higher equivalent yield of 4418 kg/ha.

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 crops was in the order of towards organic < inorganic < organic. Organic management resulted in yield level of 14109 and 7331 kg/ha (mean) for cassava and taro which was 6.6 and 53% higher than towards organic respectively. Similar trend was observed for summer crops *.i.e* cowpea, groundnut, black gram and green gram which also resulted in 24.6, 15.0, 69.3 and 20.6% higher yield respectively. System equivalent (cassava equivalent) was in the order of inorganic < towards organic < organic. Among the systems, cassava-based system resulted in higher equivalent yield of 17883 kg/ha.

Udaipur: Performance of majority of crops was in the order of organic < inorganic < towards organic. Organic management resulted in yield level of 3302, 435, 5118 and 565 kg/ha in *kharif* for maize+ black gram, black gram, sweet corn+ black gram and soybean which 13.02, 20.9, 10.3 and 20.4% lower than towards organic. Similar trends was observed for *rabi* which 11.1, 7.8, 13.0 and 10.9% also lower than towards organic. System equivalent yield was in order of towards organic < organic < inorganic. Among the cropping systems, maize + blackgram (2:2)–wheat (durum)–sesbania (GM) resulted in higher equivalent yield of 9340 kg/ha followed by sweet corn + blackgram (2:2)–chickpea of 9170 kg/ha.

Cassava

Taro

vegetable cowpea

Ground nut

Black gram

Green gram


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


Wheat *aestivum* and *duram* 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 package on grain yield (kg/ha) of different crops in cropping systems at various locations

Locations/Cropping systems	Organic (as per NPOP standards)						Inorganic						Towards organic (Integrated)					
	100 % organic (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]			100 % inorganic package (No- organic manures)			State recommendations or farmers package			50% Organic package +50% Inorganic package			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		
	Kharif	*Rabi*	Summer	*Kharif*	*Rabi*	Summer	*Kharif*	*Rabi*	Summer	*Kharif*	*Rabi*	Summer	*Kharif*	*Rabi*	Summer	*Kharif*	*Rabi*	Summer
Bajaura																		
Frenchbean-cauliflower-frenchbean	6050	8250	5350	5920	8400	5240	5100	4990	4400	6160	9510	5530	5750	9480	5290	5540	9360	5160
Fallow-cauliflower-tomato		8930	12530		8870	13060		5690	9780		10930	14000		10800	13730		10730	13560
Black gram-cauliflower- summer squash	760	7330	18890	780	7220	18580	630	4980	14490	840	8670	21640	820	8630	21160	800	8220	20670
Lady finger-pea	8990	6580		9150	6890		8200	4440		9960	8040		9740	7820		9300	6980	
Bhopal																		
Soybean-durum wheat	823	4297		722	3380		743	3447		765	3567		868	4487		691	3237	
Soybean- mustard	831	1425		707	1167		831	1336		814	1310		905	1544		595	1087	
Soybean- chickpea	833	1287		731	1093		785	1157		745	1120		884	1407		779	936	
Soybean- linseed	818	1607		749	1393		764	1453		807	1432		856	1660		674	1352	
Mean soybean	826			727			781			783			878			685		
Calicut																		
Ginger-Fallow	10274			5900			5260						8200			13290		
Turmeric-Fallow	29800			26800			26500						30400			25800		

Coimbatore																		
Brinjal - pearl millet-green manure (*dhaincha*) -	19141	2030		18422	1870		18082	1985		22785	2382		20491	2102		18977	1910	
Chillies - barnyard millet-green manure (*dhaincha*)	13865	1795		12896	1569		12095	1608		16589	1873		14193	1762		13386	1676	
Tomato -finger millet-Green manure (*dhaincha*)	21306	2544		19212	2420		18800	2517		27602	2831		22671	2655		19924	2474	
Dharwad																		
Pigeonpea +greengram (PEY)	1397			1176			1275			1477			1322			1092		
Pigeonpea +soybean (PEY)	1151			1016			970			1135			1033			883		
Pigeonpea +groundnut (PEY)	1560			1459			1390			1519			1432			128/0		
Cotton +greengram (CEY)	1166			996			1215			1352			1174			961		
Cotton +soybean (CEY)	800			776			826			925			888			746		
Jabalpur																		
Soybean- wheat	984	2780		965	2616		757	3514		757	2460		852	3486		852	3052	
Soybean-mustard-green gram	1060	1362	833	814	1300	643	719	1781	1279	767	1220	498	890	1632	864	965	1550	844
Soybean-berseem (fodder and seed)	1097	75.9* +378		852	74.2*+ 284		852	79.9*+ 662		761	73.8*+ 189		833	77.2* + 568		909	76.5*+ 473	
Soybean-lentil-sorghum (fodder)	909	378	50.0*	852	600	46.2*	909	809	65.9*	700	540	45.1*	871	781	57.9*	871	543	57.5*
*fodder t/ha																		
Karjat																		
Rice-brinjal	3572	27348		3165	23320		3558	32449		2978	18311		3567	28516		3132	24980	
Rice-chickpea	2851	1402		2595	1105		3027	1125		2713	987		3051	1333		2848	1179	
Rice-field bean	3197	1100		2755	947		3248	960		2832	854		3293	1095		2964	903	
Rice- onion (white)	3316	14346		3070	9290		3359	12644		2975	9140		3532	14992		3064	11035	
Mean																		

Ludhiana																		
Basmati rice-chickpea-green manure	3940	1320		4070	1030		4220	630		4270	710		4310	1150		4090	1070	
Basmati rice-wheat-green manure	3710	3400		4090	3250		4130	4210		4240	4290		4090	4020		4110	3340	
Kharif moong-wheat-summer moong	810	4570	870	720	4330	790	710	4870	600	620	4990	590	810	4790	9100	770	4450	830
Sesame-lentil	580	1350		520	1170		490	1620		480	1510		560	1540		540	1240	
Modipuram																		
Black rice –lentil – vegetable cowpea	342	-	4355	115	-	3951	264	-	4340	276	-	4382	308	-	4218	140	-	4072
Finger millet – barley – *sesbania* rostrata green manure	2193	2935		1738	1764		2186	4162		2236	4467		1948	4351		1643	2194	
Okra – vegetable pea – s*esbania* aculeata green manure	9164	4120		8345	3373		9154	4361		8462	4426		8671	3920		8146	3140	
Black gram – tomato – *sunhemp* green manure	1024			961	8253		1037	13265		1098	13536		1066	12973		876	9503	
Pantnagar																		
Basmati rice - Wheat	4528	4138		3912	3426		4095	4468		4201	4589		4602	4942		4120	4080	
Basmati rice – Mustard	4683	1536		3794	1443		3942	1671		4313	1621		4550	1750		4016	1451	
Basmati rice – Vegetable pea (4 rows vegetable pea + 2 rows coriander)	4750	6800+ 973 (8854*)		4105	5886+ 730 (7426*)		4053	(5800+ 888 (7674*)		4402	6043+ 964 (8077*)		4846	6671+ 983 (8746*)		4357	6314+ 800 (8002*)	
Basmati rice – Potato (due to rain crop completely destroyed	4513	-		3957			4090			4253			4587			4164		
*vegetable pea equivalent yield (kg/ha)																		
Raipur																		
Soybean-maize (sweet corn)	2258	14900		2000	13300		2037	13900		2297	16300		1802	12500		1430	11100	
Soybean- french bean	2300	6790		2164	6040		1916	6490		2235	6990		1938	5710		1664	5260	
Soybean-tomato	1946	49330		1765	45600		2142	47410		2277	52890		1722	40490		1537	36940	

Soybean-cabbage	2176	45480		1950	42240		2022	43250		2181	47100		1531	39000		1283	43250	
Ranchi																		
Rice -wheat	3389	2440		3254	2580		3254	2870		3076	2550		2867	2790		2181	2210	
Rice -onion	3633	15620		3498	14920		3320	15150		3111	14590		2817	14560		2425	10870	
Rice -potato	3424	20250		3289	18060		3111	19830		2902	16460		2608	105.45		2216	9080	
Rice -okra	3598	8323		3463	8624		3285	8770		3076	8325		2782	8149		2390	5145	
Umiam																		
Rice in sunken bed and vegetables on raised bed	sunken bed	raised bed		sunken bed	raised bed		sunken bed	raised bed					sunken bed	raised bed		sunken bed	raised bed	
Rice (Megha Aromatic 2)- Bhindi-Carrot	-	10760	17530	-	10790	13950	-	12030	15990	-	-	-	-	10720	17640	-	-	-
Rice (Lampnah) - Bhindi-Potato	-	11480	17950	-	10340	15840	-	11910	18870	-	-	-	-	11040	20220	-	-	-
Rice (Ngoba) - Bhindi-Tomato	-	11990	6860	-	10820	5900	-	12970	6170	-	-	-	-	10650	7120	-	-	-
Rice (Shahsarang-1) - Bhindi-Frenchbean	-	13540	15740	-	12070	14460	-	14380	13670	-	-	-	-	12610	15680	-	-	-
Ajmer																		
Cow pea + maize (4:2) - coriander + cabbage (2:1)	892+ 1036	467+ 5900		877+ 1200	483+ 5600		769+ 1236	467+ 5067		954+ 1291	650+ 6117		861+ 1327	583+ 5933		985+ 1400	683+ 6465	
Cow pea + maize (4:2) - fennel + cabbage (2:1)	954+ 1145	1200+ 6475		938+ 1164	1225+ 7175		846+ 1109	1187+ 6225		923+ 1327	1450+ 8475		923+ 1291	1387+ 8400		969+ 1382	1475+ 9200	
Cow pea - fennel	992	1608		1000	1658		917	1650		1050	1858		1000	1842		1058	1925	
Cow pea - coriander	1008	717		1017	733		933	692		1067	775		992	767		1092	792	
Almora																		
Grain Amaranth-wheat + lentil	3433.4	1245.5		3258.5	1068.8		1038.3	411.8					1877.8	712.4				
Fingermillet + black soybean-wheat + toria	2559.7	1017.1		2123.3	945.7		737.6	424.8					1541.9	537.4				
Gangtok																		
Maize + ginger (1.1)-french Bean	3300+ 7400	6167		2833+ 6833	5833					2833+ 3900	3533		2933+ 6733	5500				
Maize - soybean - buckwheat	3500	1833	1700	3067	1700	1333				2767	933	900	2967	1567	1573			

Maize + turmeric (1:1)- rajmash	3233+ 13167	1800		3233+ 11767	1833					2833+	617		3000+ 10833	850				
Maize -black gram (pahenlo dal)- toria	3167	1000	1167	3000	907	1000				2833	700	653	3000	900	650			
Narendrapur																		
Rice (Gobindobhog)-broccoli-*sesbania* green maunre		1052			1020			1002			960			989			1080	
Rice (Shatabdi) -mustard-green gram	3833	520	1025	3671	489	996	3359	443	933	3395	453	900	3744	497	1017	3378	485	983
Rice (Shatabdi) -frenchbean-green gram	3685	4842	1042	3715	4958	1075	3914	4850	929	3997	5025	901	3805	5058	1012	3823	5283	1000
Rice (Shatabdi) -vegetable pea-sesame	4216	2258	708	4062	2221	708	3698	1975	792	3578	2200	675	4099	2267	883	3860	2208	792
Sardarkrushinagar																		
Groundnut - wheat - green gram	1253	3306	553	1075	2694	494	1197	3028	564	1300	3667	664	1272	3417	533	981	2806	442
Green gram - coriander - vegetable cowpea	542	1111	3444	431	842	2972	514	994	3472	611	1200	4111	583	1039	3500	458	811	2917
Green gram - fennel - fennel continue	519	728		450	628		489	433		628	828		550	903		472	706	
Thiruvananthapuram																		
Cassava-vegetable cowpea	9562		2844	15992		2770	8031		2061	8966		1500	9577		2646	8191		2281
Cassava-groundnut	12211			12226			12540			11080			11498			18275		
Taro-blackgram	7881		1369	8493		836	6801		699	6043		589	7156		1001	3810		809
Taro-greengram	6781		703	5132		672	4887		462	6173		436	4607		568	5773		583
Udaipur																		
Maize + blackgram (2:2) – durum wheat – *sesbania* (GM)	2280+ 210 (3302*)	3750		2200+ 180 (3076*)	3640		2340+ 235 (3483*)	4050		2425+ 255 (3666*)	4155		2490+ 270 (3804*)	4220		2160+ 165 (2963*)	3500	
Blackgram – wheat (*triticum aestivum*)	435	3790		410	3700		470	3980		510	4030		370	4110		550	3520	
Sweet corn + blackgram (2:2) – chickpea	2460+ 232 (5118*)	1175		2290+ 210 (4395*)	1100		2555+ 245 (5335*)	1280		2650+ 260 (5562*)	1305		2680+ 280 (5708*)	1350		2170+ 180 (4395*)	1040	
Soybean – fenugreek	565	1595		540	1530		590	1605		660	1650		710	1790		500	1460	

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

Locations/Treatments	Organic (as per NPOP standards)		Inorganic		Towards organic (Integrated)		Mean
	100 % organic (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]	100 % inorganic package (No organic manures)	State recommendations or farmers package	50% Organic package +50% Inorganic package	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	
Bajaura (Cauliflower equivalent)							
Frenchbean-cauliflower-frenchbean	23840	23660	17970	25510	24600	24030	23268
Fallow-cauliflower-tomato	21460	21930	15470	24930	24530	24290	22102
Black gram-cauliflower-summer squash	24640	24580	18750	28180	27700	26840	25115
Lady finger-pea	18860	19490	14860	22020	21470	19770	19412
Mean	22200	22415	16763	25160	24575	23733	
Bhopal (Soybean equivalent)							
Soybean-durum wheat							2637
Soybean- mustard							2532
Soybean- chickpea							2327
Soybean- linseed							2765
Mean	2751	2325	2479	2469	2920	2176	
Coimbatore (Brinjal equivalent)							
Brinjal - pearl millet-green manure (*dhaincha*)	23458	22462	22966	28432	25605	23705	24438
Chillies - barnyard miller-green manure (*dhaincha*)	23156	21320	20573	27195	23704	22440	23065
Tomato -finger millet-Green manure (*dhaincha*)	25376	23084	22827	32132	26919	23882	25703
Mean	23997	22289	22122	29253	25409	23342	
Dharwad (Cotton equivalent)							
Pigeonpea + greengram	1397	1176	1275	1477	1322	1092	1290
Pigeonpea + soybean	1151	1016	970	1135	1033	883	1031
Pigeonpea + groundnut	1560	1459	1390	1519	1432	1280	1440
Cotton + greengram	1166	996	1215	1352	1174	961	1144
Cotton + soybean	800	776	826	925	888	746	
Mean							
Jabalpur (Rice equivalent)							
Soybean- wheat	3775	3682	3407	2246	3465	3192	3295
Soybean-mustard-green gram	5686	4788	5974	3636	4805	4764	4942
Soybean-berseem (fodder and seed)	6346	5470	7576	4864	6786	6385	6238

Soybean-lentil- sorghum (fodder)	4566	4227	4951	3435	4490	4167	4306
Mean	5093	4542	5477	3545	4887	4627	
Karjat (Rice equivalent)							
Rice-brinjal	377500	368200	340700	224600	346500	319200	26906
Rice-chickpea	568600	478800	597400	363600	480500	476400	8832
Rice-field bean	634600	547000	757600	486400	678600	638500	9508
Rice-onion (white)	456600	422700	495100	343500	449000	416700	23681
Mean	22095	17519	17690	12668	18231	15189	
Ludhiana (Wheat equivalent)							
Basmati rice-chickpea-green manure	8700	10200	7300	7600	8300	8800	8483
Basmati rice-wheat-green manure	9400	11900	11000	11200	9800	10700	10667
Kharif moong-wheat-summer moong	12000	13500	11000	10800	11600	12400	11883
Sesame-lentil	5700	6100	5900	5600	5100	5900	5717
Mean	8950	10425	8800	8800	8700	9450	
Modipuram (Rice equivalent)							
Black rice –lentil – vegetable cowpea	3688	2842	2781	2828	2809	2388	2889
Finger millet – barley – *sesbania* rostrata green manure	7798	5600	7238	7576	6979	4669	6643
Okra – vegetable pea – *sesbania* aculeata green manure	14166	12412	11574	11105	10745	9535	11590
Black gram – tomato – *sunhemp* green manure	17473	14536	17043	17520	16836	12642	16008
Mean	10781	8848	9659	9757	9342	7309	
Pantnagar (Basmati rice equivalent)							
Basmati rice - Wheat	7591	6449	7935	8147	8850	7071	7674
Basmati rice – Mustard	8084	6989	8355	8594	9170	7776	8161
Basmati rice – Vegetable pea (4 rows vegetable pea + 2 rows coriander)	9349	7963	8040	8598	9389	8514	8642
Basmati rice – Potato	4513	3957	4090	4253	4587	4164	4261
Mean	7384	6339	7105	7398	7999	6881	
Raipur (Soybean equivalent)							
Soybean-maize (sweet corn)	11744	10473	10888	12635	9756	8515	10669
Soybean- french bean	5749	5229	5203	5778	4830	4330	5187
Soybean-tomato	14480	13327	14146	15667	11973	10888	13414
Soybean-cabbage	13708	12660	11816	13130	11405	11157	12313
Mean	11420	10422	10513	11803	9491	8723	
Ranchi (Rice equivalent)							
Rice -wheat	6123	6465	4951	3820	5691	6212	5544
Rice -onion	16850	15933	12923	10932	14887	15369	14482
Rice -potato	16643	15208	7729	6319	11603	13102	11767
Rice -okra	10139	10546	8292	6177	9229	9917	9050
Mean	12439	12038	8474	6812	10353	11150	

Ajmer (Cowpea equivalent)							
Cow pea + maize (4:2) - coriander + cabbage (2:1)	2774	2775	2866	3287	2682	3244	2938
Cow pea + maize (4:2) - fennel + cabbage (2:1)	3938	4078	4392	4735	3888	4684	4286
Cow pea - fennel	3136	3211	3117	3528	3456	3625	3345
Cow pea - coriander	1964	1994	1856	2100	2014	2147	2013
Mean	2953	3015	3057	3413	3010	3425	
Almora (Finger millet equivalent)							
Grain Amaranth-wheat + lentil	4679	4327	1450		2590		3262
Fingermillet + black soybean-wheat + toria	3577	3069	1162		2079		2472
Mean	4128	3698	1306		2335		
Gangtok (Maize equivalent)							
Maize + ginger (1.1)- french Bean	13420	12640		7240	10920		11055
Maize - soybean - buckwheat	6290	5780		3230	5420		5180
Maize + turmeric (1:1)- rajmash	12640	10720		-5340	8860		9390
Maize -black gram (pahenlo dal)- toria	9320	8260		5760	6820		7540
Mean							
Nerendrapur (Rice equivalent)							
Rice (Gobindobhog)-broccoli-*sesbania* green maunre	4210	4080	4010	3840	3960	4320	4070
Rice (Shatabdi) -mustard-green gram	7450	7150	6580	6560	7290	6820	6975
Rice (Shatabdi) -frenchbean-green gram	14500	14810	14490	14820	14940	15320	14813
Rice (Shatabdi) -vegetable pea-sesame	9960	9760	9350	9120	10500	9540	9705
Mean	9030	8950	8607.5	8585	9172.5	9000	
Sardar Krushinagar (Groundnut equivalent)							
Groundnut - wheat - green gram	3677	3142	3648	4169	3888	3164	3615
Green gram - coriander - vegetable cowpea	4691	3747	4434	5303	4633	3701	4418
Green gram - fennel - fennel continue	1740	1507	1282	2050	2067	1669	1719
Mean	3369.3	2798.7	3121.3	3840.7	3529.3	2844.7	
Thiruvananthapuram (Tuber equivalent)							
Cassava-vegetable cowpea	15250	21530	12150	11970	14870	12750	14753
Cassava-groundnut	17550	17180	17310	15560	16780	22920	17883
Taro-blackgram	8130	6420	5770	7010	5700	6890	6653
Taro-greengram	10620	10170	8200	7220	9160	5430	8467
Mean	12888	13825	10858	10440	11628	11998	
Udaipur (Maize equivalent)							
Maize + blackgram (2:2)–wheat (*durum*)–sesbania (GM)	9052	9854	9032	10014	9433	8657	9340
Blackgram – wheat (*Triticum aestivum)*	7928	8466	7878	8778	8102	7668	8137
Sweet corn + blackgram (2:2)–chickpea	9035	9685	9029	9975	8895	8402	9170
Soybean – fenugreek	5946	6162	5736	6273	6397	5699	6036
Mean	7990	8542	7919	8760	8207	7607	

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^{-1} 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^{-1}. 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^{-1} 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 of10.7% over towards organic management practice. Similarly, basmati rice- wheat- green manure resulted in higher organic carbon 0.68% under organic

management practice. availabel N, P,K recorded in order organic < organic < in orgganic. Among thecropping availabiliy of NPK in the soil recorded higher with rice-weat.

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^{-1} 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^{-1}) 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^{-1}). 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 crpping systems recoded 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 physical properties (bulk density and electrical conductivity) at the end of cropping cycle at various locations

Locations/Treatments	Bulk Density (g cm^{-3})							Electricity Conductivity (ds/m)						
	Organic (as per NPOP standards)		Inorganic		Towards organic (Integrated)		Mean	Organic (as per NPOP standards)		Inorganic		Towards organic (Integrated)		Mean
	100 % organic (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]	100 % inorganic package (No organic manures)	State recommendations or farmers package	50% Organic package +50% Inorganic package	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		100 % organic (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]	100 % inorganic package (No organic manures)	State recommendations or farmers package	50% Organic package +50% Inorganic package	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	
Bhopal														
Soybean-durum wheat	-	-	-	-	-	-	-	0.323	0.308	0.347	0.287	0.305	0.313	0.314
Soybean- mustard	-	-	-	-	-	-	-	0.319	0.312	0.280	0.311	0.323	0.340	0.314
Soybean- chickpea	-	-	-	-	-	-	-	0.268	0.312	0.284	0.314	0.320	0.337	0.306
Soybean- linseed	-	-	-	-	-	-	-	0.281	0.321	0.314	0.338	0.320	0.318	0.315
Mean	-	-	-	-	-	-	-	0.298	0.313	0.306	0.313	0.317	0.327	
Dharwad (g cm-3)														
Pigeonpea +greengram (2:4)	1.20^{a}	1.22^{a}	1.31^{a}	1.25^{a}	1.26^{a}	1.25^{a}	1.25	2.07g	2.12g	2.92a-c	2.71c-e	2.49ef	2.22g	2.42a
Pigeonpea +soybean (2:4)	1.22^{a}	1.21^{a}	1.31^{a}	1.31^{a}	1.28^{a}	1.25^{a}	1.26a	2.07g	2.18g	3.03a	2.82a-c	2.58de	2.24g	2.49a
Pigeonpea +groundnut (2:4)	1.23^{a}	1.23^{a}	1.30^{a}	1.24^{a}	1.26^{a}	1.29^{a}	1.24a	2.09g	2.13g	2.96ab	2.78b-d	2.49ef	2.23g	2.45a
Cotton +greengram (1:1)	1.22^{a}	1.23^{a}	1.27^{a}	1.26^{a}	1.27^{a}	1.27^{a}	1.25a	2.09g	2.16g	2.94a-c	2.76b-d	2.49ef	2.30fg	2.46a
Cotton +soybean (1:1)	1.20^{a}	1.23^{a}	1.30^{a}	1.28^{a}	1.26^{a}	1.26^{a}	1.25a	2.11g	2.15g	2.97ab	2.78b-d	2.49ef	2.22g	2.45a
Mean	1.21^{a}	1.22^{a}	1.30^{a}	1.27^{a}	1.27^{a}	1.26^{a}		2.09d	2.15cd	2.96a	2.77ab	2.51bc	2.24cd	

Jabalpur														
Soybean- wheat	-	-	-	-	-	-	-	0.15	0.12	0.17	0.21	0.11	0.14	0.15
Soybean-mustard-green gram	-	-	-	-	-	-	-	0.18	0.15	0.15	0.16	0.15	0.11	0.15
Soybean-berseem (fodder and seed)	-	-	-	-	-	-	-	0.35	0.23	0.15	0.14	0.10	0.14	0.19
Soybean-lentil- sorghum (fodder)	-	-	-	-	-	-	-	0.19	0.22	0.19	0.17	0.15	0.12	0.17
Mean	-	-	-	-	-	-	-	0.22	0.18	0.17	0.17	0.13	0.13	
Ludhiana														
Basmati rice-chickpea-green manure	-	-	-	-	-	-	-	0.29	0.25	0.22	0.23	0.22	0.21	0.24
Basmati rice-wheat-green manure	-	-	-	-	-	-	-	0.29	0.27	0.22	0.24	0.27	0.21	0.25
Kharif moong-wheat-summer moong	-	-	-	-	-	-	-	0.36	0.34	0.25	0.23	0.30	0.28	0.29
Sesame-lentil	-	-	-	-	-	-	-	0.28	0.26	0.25	0.20	0.26	0.24	0.25
Mean	-	-	-	-	-	-	-	0.31	0.28	0.24	0.23	0.26	0.24	
Modipuram														
Black rice –lentil – vegetable cowpea	-	-	-	-	-	-	-	0.14	0.07	0.62	0.56	0.11	0.14	0.27
Finger millet – barley – *sesbania* rostrata green manure	-	-	-	-	-	-	-	0.39	0.25	0.38	0.39	0.24	0.33	0.33
Okra – vegetable pea – s*esbania* aculeata green manure	-	-	-	-	-	-	-	0.26	0.25	0.37	0.15	0.27	0.27	0.26
Black gram – tomato – *sunhemp* green manure	-	-	-	-	-	-	-	0.15	0.26	0.05	0.03	0.28	0.12	0.15
Mean	-	-	-	-	-	-	-	0.24	0.21	0.36	0.28	0.23	0.22	
Pantnagar														
Basmati rice - Wheat	-	-	-	-	-	-	-	0.38	0.28	0.51	0.38	0.39	0.32	0.38
Basmati rice – Mustard	-	-	-	-	-	-	-	0.32	0.3	0.61	0.5	0.41	0.51	0.44
Basmati rice – Vegetable pea (4 rows vegetable pea + 2 rows coriander)	-	-	-	-	-	-	-	0.55	0.36	0.47	0.41	0.42	0.44	0.44
Basmati rice – Potato	-	-	-	-	-	-	-	0.26	0.34	0.49	0.46	0.38	0.34	0.38
Mean	-	-	-	-	-	-	-	0.38	0.32	0.52	0.44	0.40	0.40	

Narendrapur														
Rice (Gobindobhog)-broccoli-*sesbania* green maunre	1.77	1.71	1.79	1.67	1.76	1.70	1.73	0.37	0.38	0.37	0.40	0.37	0.40	0.38
Rice (Shatabdi) -mustard-green gram	1.82	1.78	1.78	1.78	1.81	1.79	1.79	0.38	0.35	0.38	0.36	0.35	0.39	0.37
Rice (Shatabdi) -frenchbean-green gram	1.85	1.81	1.76	1.74	1.80	1.83	1.80	0.37	0.34	0.37	0.33	0.38	0.33	0.36
Rice (Shatabdi) -vegetable pea-sesame	1.81	1.81	1.82	1.76	1.76	1.76	1.79	0.43	0.38	0.40	0.36	0.42	0.37	0.39
Mean	1.81	1.78	1.79	1.74	1.78	1.77		0.39	0.36	0.38	0.36	0.38	0.37	
Sardarkushinagar														
Groundnut - wheat - green gram	1.44	1.44	1.48	1.47	1.44	1.44	1.45	0.20	0.19	0.18	0.18	0.20	0.19	0.19
Green gram - coriander - vegetable cowpea	1.44	1.45	1.48	1.48	1.43	1.46	1.45	0.20	0.19	0.18	0.18	0.18	0.20	0.19
Green gram - fennel - fennel continue	1.45	1.45	1.47	1.47	1.47	1.46	1.46	0.18	0.21	0.18	0.21	0.24	0.20	0.20
Mean	1.44	1.44	1.48	1.47	1.45	1.45		0.20	0.19	0.18	0.19	0.21	0.20	
Thiruvananthapuram														
Cassava-vegetable cowpea	-	-	-	-	-	-	-	0.24	0.15	0.12	0.12	0.17	0.26	0.18
Cassava-groundnut	-	-	-	-	-	-	-	0.22	0.12	0.25	0.16	0.18	0.15	0.18
Taro-blackgram	-	-	-	-	-	-	-	0.19	0.29	0.19	0.18	0.18	0.26	0.22
Taro-greengram	-	-	-	-	-	-	-	0.17	0.26	0.15	0.2	0.15	0.26	0.20
Mean	-	-	-	-	-	-	-	0.21	0.21	0.18	0.17	0.17	0.23	

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 Management (as per NPOP standards)		Inorganic Management		Towards organic (Integrated Crop Management)		Mean	Organic Management (as per NPOP standards)		Inorganic Management		Towards organic (Integrated Crop Management)		Mean
	100 % organic (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]	100 % inorganic package (No organic manures)	State recommendations or farmers package	50% Organic package +50% Inorganic package	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		100 % organic (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]	100 % inorganic package (No organic manures)	State recommendations or farmers package	50% Organic package +50% Inorganic package	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	
Bajaura														
Frenchbean-cauliflower-frenchbean	6.90	6.80	6.60	7.00	6.90	6.90	6.85	1.60	1.35	0.83	1.12	1.20	1.23	1.22
Fallow-cauliflower-tomato	7.00	6.90	6.90	7.10	7.00	6.90	6.97	1.45	1.35	0.87	1.09	1.25	1.21	1.20
Black gram-cauliflower-summer squash	6.80	7.00	6.60	7.00	6.90	7.00	6.88	1.49	1.37	0.87	1.08	1.22	1.23	1.21
Lady finger-pea	6.90	7.00	6.80	6.90	7.00	6.90	6.92	1.43	1.37	0.89	1.16	1.25	1.26	1.23
Mean	6.90	6.93	6.73	7.00	6.95	6.93		1.49	1.36	0.87	1.11	1.23	1.23	
Bhopal														
Soybean-durum wheat	7.62	7.60	7.64	7.67	7.63	7.68	7.64	1.01	0.91	0.61	0.63	0.93	0.93	0.84
Soybean- mustard	7.61	7.66	7.65	7.63	7.64	7.65	7.64	0.96	0.88	0.63	0.65	0.89	0.85	0.81
Soybean- chickpea	7.63	7.64	7.60	7.67	7.63	7.64	7.64	0.98	0.93	0.62	0.62	0.89	0.87	0.82
Soybean- linseed	7.63	7.61	7.70	7.68	7.69	7.66	7.66	0.91	0.91	0.61	0.59	0.88	0.90	0.80
Mean	7.62	7.63	7.65	7.66	7.65	7.66		0.97	0.91	0.62	0.62	0.90	0.89	

Calicut														
Ginger-Fallow	4.31	4.90	4.15		4.13	4.14		2.05	2.69	3.29		2.51	2.33	
Turmeric-Fallow	5.65	5.64	4.89		5.33	5.51		2.52	5.64	1.98		2.17	2.83	
Dharwad														
Pigeonpea +greengram (2:4) intercropping system	7.30^{a}	7.28^{a}	7.68^{a}	7.50^{a}	7.36^{a}	7.44^{a}	7.43^{a}	5.85^{ab}	5.18^{c-f}	4.20^{jk}	4.50^{g-k}	4.65^{f-k}	4.88^{e-i}	4.88^{a}
Pigeonpea +soybean (2:4) intercropping system	7.28^{a}	7.25^{a}	7.75^{a}	7.58^{a}	7.43^{a}	7.60^{a}	7.48^{a}	5.33^{b-e}	4.85^{e-i}	4.13^{k}	4.45^{h-k}	4.52^{g-k}	4.62^{f-k}	4.65^{a}
Pigeonpea +groundnut (2:4) intercropping system	7.17^{a}	7.28^{a}	7.70^{a}	7.70^{a}	7.44^{a}	7.41^{a}	7.45^{a}	5.93^{a}	5.10^{d-g}	4.35^{i-k}	4.58^{f-k}	4.83^{e-j}	5.03^{d-h}	4.97^{a}
Cotton +greengram (1:1) intercropping system	7.26^{a}	7.32^{a}	7.78^{a}	7.60^{a}	7.60^{a}	7.56^{a}	7.52^{a}	5.55^{a-d}	4.80^{e-j}	4.38^{i-k}	4.43^{h-k}	4.56^{f-k}	4.65^{f-k}	4.73^{a}
Cotton +soybean (1:1) intercropping system	7.21^{a}	7.32^{a}	7.80^{a}	7.68^{a}	7.48^{a}	7.52^{a}	7.50^{a}	5.70^{a-c}	5.18^{c-f}	4.43^{h-k}	4.50^{g-k}	4.64^{f-k}	4.95^{d-i}	4.90^{a}
Mean	7.24^{a}	7.29^{a}	7.74^{a}	7.61^{a}	7.46^{a}	7.51^{a}		5.67^{a}	5.02^{ab}	4.30^{b}	4.49^{b}	4.64^{b}	4.82^{b}	
Jabalpur								(g/kg)						
Soybean- wheat	7.40	7.50	7.60	7.70	7.40	7.80	7.57	2.70	3.40	2.20	2.40	3.10	3.80	2.93
Soybean-mustard-green gram	7.50	7.60	7.70	7.60	7.60	7.70	7.62	2.80	3.60	2.10	3.60	2.40	3.20	2.95
Soybean-berseem (fodder and seed)	7.50	7.60	7.80	7.70	7.40	7.70	7.62	3.30	3.40	2.80	3.80	3.40	3.80	3.42
Soybean-lentil- sorghum (fodder)	7.60	7.50	7.60	7.60	7.50	7.60	7.57	3.50	3.30	2.70	2.90	2.80	3.30	3.08
Mean	7.50	7.55	7.68	7.65	7.48	7.70		3.08	3.43	2.45	3.18	2.93	3.53	
Ludhiana														
Basmati rice-chickpea-green manure	7.60	7.30	7.30	7.20	7.40	7.40	7.37	0.56	0.54	0.49	0.44	0.52	0.53	0.51
Basmati rice-wheat-green manure	7.80	7.40	7.40	7.10	7.40	7.30	7.40	0.68	0.67	0.49	0.47	0.59	0.58	0.58
Kharif moong-wheat-summer moong	7.30	7.30	7.50	7.40	7.20	7.40	7.35	0.63	0.63	0.44	0.42	0.59	0.58	0.55
Sesame-lentil	7.80	7.50	7.20	7.20	7.40	7.60	7.45	0.60	0.60	0.45	0.43	0.55	0.54	0.53
Mean	7.63	7.38	7.35	7.23	7.35	7.43		0.62	0.61	0.47	0.44	0.56	0.56	

Modipuram	OC(g kg-1)													
Black rice –lentil – vegetable cowpea	7.62	7.52	7.79	7.68	7.72	7.80	7.69	8.64	8.51	6.52	6.43	7.40	7.02	7.42
Finger millet – barley – *sesbania* rostrata green manure	7.66	7.77	7.86	7.68	7.83	7.71	7.75	8.48	8.37	6.63	6.54	6.79	6.71	7.25
Okra – vegetable pea – s*esbania* aculeata green manure	7.65	7.67	7.77	7.76	7.89	7.57	7.72	8.29	8.21	6.41	6.36	7.01	6.90	7.20
Black gram – tomato – *sunhemp* green manure	7.59	7.96	7.88	7.83	7.90	7.89	7.84	8.58	8.50	6.81	6.73	6.46	6.39	7.25
Mean	7.63	7.73	7.83	7.74	7.84	7.74		8.50	8.40	6.59	6.52	6.92	6.76	
Pantnagar														
Basmati rice - Wheat	7.81	7.41	7.70	7.92	6.90	7.51	7.54	1.4	1.29	0.92	0.9	1.14	1.28	1.16
Basmati rice – Mustard	7.10	7.11	7.68	7.90	6.91	7.41	7.35	1.41	1.27	0.86	0.98	1.21	1.22	1.16
Basmati rice – Vegetable pea (4 rows vegetable pea + 2 rows coriander)	7.61	7.10	7.91	7.96	6.71	7.40	7.45	1.56	1.37	0.87	0.92	1.19	1.31	1.20
Basmati rice – Potato	7.70	7.11	7.90	7.61	7.51	6.90	7.46	1.38	1.31	0.78	0.94	1.15	1.22	1.13
Mean	7.56	7.18	7.80	7.85	7.01	7.31		1.44	1.31	0.86	0.94	1.17	1.26	
Raipur														
Soybean-maize (sweet corn)	-	-	-	-	-	-	-	0.84	0.79	0.82	0.80	0.77	0.77	0.80
Soybean- french bean	-	-	-	-	-	-	-	0.84	0.79	0.85	0.85	0.81	0.81	0.83
Soybean-tomato	-	-	-	-	-	-	-	0.82	0.78	0.78	0.83	0.75	0.76	0.79
Soybean-cabbage	-	-	-	-	-	-	-	0.76	0.76	0.77	0.83	0.75	0.75	0.77
Mean	-	-	-	-	-	-	-	0.82	0.78	0.81	0.83	0.77	0.77	
Narendrapur														
Rice (Gobindobhog)-broccoli-*sesbania* green maunre	6.77	6.80	6.67	6.73	6.77	6.65	6.73	0.91	0.87	0.79	0.78	0.86	0.83	0.84
Rice (Shatabdi) -mustard-green gram	7.03	7.06	7.05	7.03	7.01	7.06	7.04	0.94	0.85	0.69	0.68	0.86	0.84	0.81

Rice (Shatabdi) -frenchbean-green gram	7.04	6.99	7.05	7.04	7.10	7.00	7.04	0.77	0.74	0.56	0.76	0.70	0.79	0.72
Rice (Shatabdi) -vegetable pea-sesame	7.07	7.05	6.97	7.02	7.00	7.07	7.03	0.92	0.91	0.78	0.75	0.84	0.83	0.84
Mean	6.98	6.98	6.94	6.96	6.97	6.95		0.89	0.84	0.71	0.74	0.82	0.82	
Sardarkushinagar														
Groundnut - wheat - green gram	7.95	8.03	7.95	7.93	7.96	8.01	7.97	0.40	0.37	0.26	0.28	0.32	0.34	0.33
Green gram - coriander - vegetable cowpea	8.03	7.98	8.04	8.02	7.89	7.88	7.97	0.37	0.35	0.25	0.27	0.32	0.34	0.32
Green gram - fennel - fennel continue	8.01	7.96	8.07	7.93	7.97	7.78	7.95	0.36	0.35	0.25	0.27	0.30	0.33	0.31
Mean	8.00	7.99	8.02	7.96	7.94	7.89		0.38	0.36	0.25	0.27	0.31	0.34	
Thiruvananthapuram														
Cassava-vegetable cowpea	4.69	4.66	4.09	4.20	4.95	4.47	4.51	0.97	0.88	0.67	0.47	0.67	0.95	0.77
Cassava-groundnut	4.57	4.66	4.37	4.11	4.67	4.77	4.53	0.98	0.82	0.32	0.73	0.75	0.76	0.73
Taro-blackgram	4.57	4.45	4.43	3.87	4.33	4.15	4.30	1.01	1.17	0.60	0.88	0.86	0.66	0.86
Taro-greengram	4.58	4.37	4.37	4.05	4.46	4.55	4.40	0.94	1.01	0.70	0.91	0.64	0.95	0.86
Mean	4.60	4.54	4.32	4.06	4.60	4.49		0.98	0.97	0.57	0.75	0.73	0.83	

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

Locations/Treatments	Available Nitrogen (kg ha^{-1})						
	Organic (as per NPOP standards)		Inorganic		Towards organic (Integrated)		Mean
	100 % organic (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]	100 % inorganic package (No organic manures)	State recommendations or farmers package	50% Organic package +50% Inorganic package	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	
Bajaura							
Frenchbean-cauliflower-frenchbean	265.8	263.0	252.4	261.8	262.4	262.9	261.4
Fallow-cauliflower-tomato	259.7	260.4	253.9	263.0	248.0	261.0	257.7
Black gram-cauliflower-summer squash	258.4	252.1	241.5	248.2	271.8	270.6	257.1
Lady finger-pea	276.4	271.4	248.1	247.5	282.2	265.4	265.2
Mean	265.1	261.7	249.0	255.1	266.1	265.0	
Calicut							
Ginger-Fallow	258.9	288.0	395.2		300.8	272.5	
Turmeric-Fallow	337.1	345.1	235.97		257.6	337.0	
Dharwad							
Pigeonpea +greengram (2:4) intercropping system	250a	258a	228a	234a	236a	248a	242a
Pigeonpea +soybean (2:4) intercropping system	256a	242a	229a	245a	240a	250a	243a
Pigeonpea +groundnut (2:4) intercropping system	259a	255a	233a	234a	236a	240a	243a
Cotton +greengram (1:1) intercropping system	256a	240a	232a	233a	244a	240a	241a
Cotton +soybean (1:1) intercropping system	260a	253a	230a	237a	238a	230a	241a
Mean	256a	249ab	230bc	237b	239ab	242ab	
Jabalpur							
Basmati rice – durum wheat-green manure	185	248	195	173	226	252	213
Basmati rice – chickpea - maize fodder	183	252	212	184	227	242	217
Basmati rice – berseem (fodder and seed)	187	223	200	178	239	208	206
Basmati rice – vegetable pea-sorghum (fodder)	188	245	224	184	242	215	216
Mean	186	242	208	180	234	229	

Ludhiana							
Basmati rice-chickpea-green manure	367.1	363.1	316.9	320.2	349.8	352.8	345.0
Basmati rice-wheat-green manure	362.5	360.4	347.0	339.1	351.7	353.5	352.4
Kharif moong-wheat-summer moong	325.4	322.8	319.0	312.6	320.7	314.1	319.1
Sesame-lentil	362.0	360.5	318.4	318.6	358.9	352.2	345.1
Mean	354.3	351.7	325.3	322.6	345.3	343.2	
Modipuram							
Black rice –lentil – vegetable cowpea	171.4	179.8	204.9	232.1	181.6	181.9	192.0
Finger millet – barley – *sesbania* rostrata green manure	146.4	156.8	171.4	188.2	167.3	171.4	166.9
Okra – vegetable pea – *sesbania* aculeata green manure	106.6	108.7	137.9	183.9	112.9	125.4	129.2
Black gram – tomato – *sunhemp* green manure	110.8	110.8	125.4	135.9	119.2	121.3	120.6
Mean	133.8	139.0	159.9	185.0	145.3	150.0	
Pantnagar							
Basmati rice - Wheat	169.6	165.2	163.8	156.6	163.7	162.6	163.6
Basmati rice – Mustard	164.8	164.6	159.4	157.6	164.6	160.7	162.0
Basmati rice – Vegetable pea (4 rows vegetable pea + 2 rows coriander)	167.4	161.8	157.7	158.3	165.7	159.5	161.7
Basmati rice – Potato	163.3	164.8	153.5	154.6	163.2	163.6	160.5
Mean	166.3	164.1	158.6	156.8	164.3	161.6	
Raipur							
Soybean-maize (sweet corn)	252.2	240.2	243.9	251.7	227.6	228.8	240.7
Soybean- french bean	254.1	246.6	250.9	256.9	238.1	227.4	245.7
Soybean-tomato	244.0	234.7	251.5	243.0	230.4	227.4	238.5
Soybean-cabbage	240.3	226.4	222.3	247.9	237.5	225.9	233.4
Mean	247.7	237.0	242.2	249.9	233.4	227.4	
Sardarkushinagar							
Groundnut - wheat - green gram	163.1	159.9	150.5	153.7	159.9	163.1	158.4
Green gram - coriander - vegetable cowpea	150.5	169.3	153.7	150.5	153.7	153.7	155.2
Green gram - fennel - fennel continue	163.1	144.3	150.5	153.7	153.7	156.8	153.7
Mean	158.9	157.8	151.6	152.6	155.8	157.9	
Thiruvananthapuram							
Cassava-vegetable cowpea	297.9	282.2	188.2	141.1	219.5	235.2	227.4
Cassava-groundnut	266.6	250.9	203.8	188.2	297.9	250.9	243.0
Taro-blackgram	266.6	266.6	188.2	141.1	282.2	282.2	237.8
Taro-greengram	313.6	282.2	188.2	172.5	219.5	250.9	237.8
Mean	286.2	270.5	192.1	160.7	254.8	254.8	

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

Locations/Treatments	Available Phosphorus (kg ha^{-1})						
	Organic (as per NPOP standards)		Inorganic		Towards organic (Integrated)		Mean
	100 % organic (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]	100 % inorganic package (No organic manures)	State recommendations or farmers package	50% Organic package +50% Inorganic package	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	
Bajaura							
Frenchbean-cauliflower-frenchbean	76.8	76.5	48.2	59.5	78.6	73.8	68.9
Fallow-cauliflower-tomato	78.2	76.8	52.4	60.2	80.2	76.8	70.8
Black gram-cauliflower-summer squash	77.4	73.6	50.2	60.4	81.5	73.8	69.5
Lady finger-pea	73.4	73.0	47.5	57.5	77.8	78.5	68.0
Mean	76.5	75.0	49.6	59.4	79.5	75.7	
Bhopal							
Soybean-durum wheat	91.0	89.0	62.0	61.0	78.0	76.0	76.2
Soybean- mustard	89.0	86.0	62.0	58.0	83.0	86.0	77.3
Soybean- chickpea	91.0	91.0	58.0	55.0	81.0	89.0	77.5
Soybean- linseed	84.0	82.0	57.0	58.0	76.0	83.0	73.3
Mean	88.8	87.0	59.8	58.0	79.5	83.5	
Calicut							
Ginger-Fallow	23.7	48.3	15.0		5.7	21.7	
Turmeric-Fallow	158.6	115.3	113.47		118.2	129.9	
Dharwad							
Pigeonpea +greengram (2:4) intercropping system	34.00a-f	38.50ab	24.00f	30.00a-f	35.50a-e	29.00a-f	32a
Pigeonpea +soybean (2:4) intercropping system	37.00a-d	32.00a-f	28.50a-f	28.50a-f	34.50a-f	27.50b-f	31a
Pigeonpea +groundnut (2:4) intercropping system	39.00a	38.50ab	27.00c-f	30.00a-f	35.50a-e	29.50a-f	33a
Cotton +greengram (1:1) intercropping system	36.50a-e	36.00a-e	26.00d-f	29.50a-f	34.00a-f	30.00a-f	32a
Cotton +soybean (1:1) intercropping system	38.00a-c	32.00a-f	27.00c-f	25.50ef	34.00a-f	32.00a-f	31a
Mean	37a	35ab	27bc	29bc	35ab	30b	
Jabalpur							
Basmati rice – durum wheat-green manure	16.3	16.0	18.2	14.0	17.1	14.0	15.9
Basmati rice – chickpea - maize fodder	17.3	15.1	17.3	19.1	18.0	17.7	17.4
Basmati rice – berseem (fodder and seed)	18.4	18.2	16.2	17.0	15.1	17.0	17.0
Basmati rice – vegetable pea-sorghum (fodder)	17.0	16.3	15.0	14.2	16.9	15.8	15.9
Mean	17.2	16.4	16.7	16.1	16.8	16.1	

Ludhiana							
Basmati rice-chickpea-green manure	47.4	47.9	41.9	40.2	49.2	43.2	45.0
Basmati rice-wheat-green manure	51.2	50.9	47.4	46.9	45.9	47.8	48.4
Kharif moong-wheat-summer moong	50.4	48.9	47.1	45.1	47.1	49.8	48.1
Sesame-lentil	48.5	45.8	45.3	43.4	47.1	47.0	46.2
Mean	49.4	48.4	45.4	43.9	47.3	47.0	
Modipuram							
Black rice –lentil – vegetable cowpea	56.6	58.0	65.9	68.1	55.7	58.9	60.5
Finger millet – barley – *sesbania* rostrata green manure	56.5	53.9	57.5	60.4	51.3	50.5	55.0
Okra – vegetable pea – *sesbania* aculeata green manure	42.6	42.6	47.1	49.0	44.3	45.8	45.2
Black gram – tomato – *sunhemp* green manure	44.7	45.4	49.1	53.1	46.1	48.4	47.8
Mean	50.1	50.0	54.9	57.7	49.4	50.9	
Pantnagar							
Basmati rice - Wheat	26.8	24.7	21.7	21.6	24.7	24.7	24.0
Basmati rice – Mustard	27.6	25.4	18.9	19.9	25.8	25.6	23.9
Basmati rice – Vegetable pea (4 rows vegetable pea + 2 rows coriander)	24.6	24.8	19.9	19.8	26.8	24.4	23.4
Basmati rice – Potato	28.3	27.9	19.7	21.8	23.8	25.7	24.5
Mean	26.8	25.7	20.1	20.8	25.3	25.1	
Raipur							
Soybean-maize (sweet corn)	22.6	21.4	22.7	23.0	19.0	17.9	21.1
Soybean- french bean	22.8	21.7	22.7	23.4	19.3	18.0	21.3
Soybean-tomato	21.8	20.6	21.3	23.0	18.6	17.9	20.5
Soybean-cabbage	21.3	20.2	21.2	22.0	18.3	17.2	20.0
Mean	22.1	21.0	22.0	22.9	18.8	17.8	
Narendrapur							
Basmati rice-broccoli-*sesbania* green maunre	58.2	51.5	59.7	53.8	62.0	51.5	56.1
Rice-mustard-green gram	70.9	76.9	76.9	76.9	74.7	70.2	74.4
Rice-frenchbean-green gram	63.5	61.2	70.2	65.7	56.7	65.7	63.8
Rice-vegetable pea-sesame	57.5	63.5	67.9	66.5	62.7	59.7	63.0
Mean	62.5	63.3	68.7	65.7	64.0	61.8	
Sardarkushinagar							
Groundnut - wheat - green gram	18.5	17.6	17.1	16.8	19.3	20.4	18.3
Green gram - coriander - vegetable cowpea	16.5	16.2	16.0	17.6	19.6	17.6	17.3
Green gram - fennel - fennel continue	19.6	19.3	17.9	19.3	20.4	19.6	19.4
Mean	18.2	17.7	17.0	17.9	19.8	19.2	
Thiruvananthapuram							
Cassava-vegetable cowpea	31.18	48.9	15.83	31.89	44.17	51.26	37.21
Cassava-groundnut	68.5	39.45	18.66	17.79	50.08	24.33	36.47
Taro-blackgram	59.76	68.26	18.19	16.53	55.27	29.05	41.18
Taro-greengram	70.86	39.21	17.72	18.42	12.05	75.35	38.94
Mean	57.58	48.96	17.60	21.16	40.39	45.00	

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

Locations/Treatments	Available Phosphorus (kg ha^{-1})						
	Organic (as per NPOP standards)		Inorganic		Towards organic (Integrated)		Mean
	100 % organic (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]	100 % inorganic package (No organic manures)	State recommendations or farmers package	50% Organic package +50% Inorganic package	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	
Bajaura							
Frenchbean-cauliflower-frenchbean	249	257	137	189	249	255	222
Fallow-cauliflower-tomato	252	257	139	198	261	261	228
Black gram-cauliflower- summer squash	254	238	136	187	264	257	223
Lady finger-pea	241	236	135	188	250	244	216
Mean	249	247	137	190	256	254	
Bhopal							
Soybean-durum wheat	691	713	654	613	687	683	674
Soybean- mustard	695	685	661	653	678	670	674
Soybean- chickpea	697	675	652	628	709	648	668
Soybean- linseed	725	672	611	603	678	701	665
Mean	702	686	645	624	688	676	
Calicut							
Ginger-Fallow	290.2	251.4	186.3		260.7	239.8	
Turmeric-Fallow	676.6	546.3	485.69		456.3	622.8	
Dharwad							
Pigeonpea +greengram (2:4)	373a	381a	364a	348a	384a	371a	370a
Pigeonpea +soybean (2:4)	384a	364a	349a	381a	355a	371a	367a
Pigeonpea +groundnut (2:4)	398a	351a	362a	365a	385a	373a	372a
Cotton +greengram (1:1)	388a	380a	344a	353a	363a	366a	366a
Cotton +soybean (1:1)	392a	385a	349a	359a	349a	367a	367a
Mean	387a	372a	354a	361a	367a	370a	
Jabalpur							
Basmati rice – durum wheat-green manure	269	247	243	249	252	259	253
Basmati rice – chickpea - maize fodder	265	256	247	254	249	252	254
Basmati rice – berseem (fodder and seed)	265	255	251	259	258	265	259
Basmati rice – vegetable pea-sorghum (fodder)	271	259	254	262	262	268	263
Mean	268	254	249	256	255	261	

Ludhiana							
Basmati rice-chickpea-green manure	155.1	152.8	146.2	140.2	147.2	140.8	147.1
Basmati rice-wheat-green manure	158.6	155.9	147.6	146.7	150.7	149.8	151.6
Kharif moong-wheat-summer moong	152.8	147.0	142.8	146.2	145.9	147.5	147.0
Sesame-lentil	148.0	149.8	140.4	140.2	144.7	145.5	144.8
Mean	153.6	151.4	144.3	143.3	147.1	145.9	
Modipuram							
Black rice –lentil – vegetable cowpea	226.5	179.8	190.8	279.6	179.8	181.1	206.3
Finger millet – barley – *sesbania* rostrata green manure	166.8	183.7	220.6	285.1	190.0	208.8	209.2
Okra – vegetable pea – s*esbania* aculeata green manure	196.0	184.0	180.0	200.0	191.0	170.0	186.8
Black gram – tomato – *sunhemp* green manure	179.0	182.0	198.0	208.0	189.0	190.0	191.0
Mean	192.1	182.4	197.4	243.2	187.4	187.5	
Pantnagar							
Basmati rice - Wheat	232.7	236.6	233.8	233.7	234.6	237.6	234.8
Basmati rice – Mustard	233.8	234.5	235.8	234.9	235.7	235.9	235.1
Basmati rice – Vegetable pea (4 rows vegetable pea + 2 rows coriander)	234.9	233.1	236.4	232.9	235.7	230.4	233.9
Basmati rice – Potato	235.4	233.6	234.3	233.9	237.7	236.8	235.3
Mean	234.2	234.5	235.1	233.9	235.9	235.2	
Raipur							
Soybean-maize (sweet corn)	356.1	403.6	388.8	330.1	416.3	391.6	381.1
Soybean- french bean	366.3	370.0	397.1	403.8	392.3	388.5	386.3
Soybean-tomato	414.0	394.0	375.9	362.2	394.1	365.1	384.2
Soybean-cabbage	382.1	378.8	358.5	379.7	356.5	415.3	378.5
Mean	379.6	386.6	380.1	369.0	389.8	390.1	
Narendrapur							
Basmati rice-broccoli-*sesbania* green maunre	245.5	249.1	255.5	254.5	248.2	246.5	249.9
Rice-mustard-green gram	244.8	247.5	248.9	254.0	243.1	247.1	247.6
Rice-frenchbean-green gram	234.4	244.1	244.9	246.5	233.5	232.4	239.3
Rice-vegetable pea-sesame	229.9	227.3	244.8	245.4	226.4	232.3	234.4
Mean	238.7	242.0	248.5	250.1	237.8	239.6	
Sardarkushinagar							
Groundnut - wheat - green gram	186.9	177.9	164.3	180.6	184.2	181.5	179.2
Green gram - coriander - vegetable cowpea	184.2	178.8	171.6	163.4	186.9	169.8	175.8
Green gram - fennel - fennel continue	181.5	185.1	163.4	171.6	180.6	173.4	175.9
Mean	184.2	180.6	166.5	171.9	183.9	174.9	
Thiruvananthapuram							
Cassava-vegetable cowpea	194.98	106.85	195.33	147.17	132.05	140.56	152.8
Cassava-groundnut	182.66	168.77	198.13	150.98	136.64	103.82	156.8
Taro-blackgram	181.78	104.72	232.62	142.24	176.18	156.58	165.7
Taro-greengram	201.6	169.46	223.55	151.31	161.95	149.3	176.2

Table 7.2.8: Influence of methods of organic, inorganic and integrated package on soil available micronutrients (Iron and Manganese) at the end of cropping cycle at different locations

Management practice	Soil Available Iron (ppm)							Soil Available Manganese (ppm)						
	Organic		Inorganic		Integrated (towards organic)		Mean	Organic		Inorganic		Integrated (towards organic)		Mean
	100 % organic (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]	100 % inorganic package (No organic manures)	State recommendations or farmers package	50% Organic package +50% Inorganic package	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		100 % organic (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]	100 % inorganic package (No organic manures)	State recommendations or farmers package	50% Organic package +50% Inorganic package	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	
Bajaura														
Frenchbean-cauliflower-frenchbean	16.4	14.3	9.3	11.6	16	13.8	13.6	11.9	10.7	7.4	9.0	13.5	11.0	10.6
Fallow-cauliflower-tomato	16.8	13.7	10.6	12.4	15.5	14.4	13.9	12.8	10.9	7.5	9.8	13.4	11.1	10.9
Black gram-cauliflower-summer squash	19.1	15.5	9.8	12.7	18.5	16.3	15.3	12.0	9.1	7.0	8.8	12.0	10.9	10.0
Lady finger-pea	15.5	15.1	10	11.9	18.1	15.7	14.4	12.1	11.1	7.5	9.6	11.8	11.1	10.5
Mean	17.0	14.7	9.9	12.2	17.0	15.1		12.2	10.5	7.4	9.3	12.7	11.0	
Calicut														
Ginger-Fallow	32.65	41.46	29.31		23.17	25.24		20.82	19.55	17.78		22.63	21.59	
Turmeric-Fallow	50.51	49.05	43.75		47.15	49.55		20.62	19.74	19.18		18.96	19.26	
Dharwad (mg/kg)														
Pigeonpea +greengram (2:4)	10.68a	10.00ab	7.68b	8.04ab	9.22ab	9.78ab	9.07a	14.60a	13.50a-d	11.50de	13.30a-e	12.70a-e	12.50a-e	13.02a
Pigeonpea +soybean (2:4)	10.20ab	9.63ab	8.00ab	7.96ab	9.19ab	9.44ab	9.23a	14.50a	12.60a-e	12.00b-e	12.00b-e	11.60c-e	12.75a-e	12.58a
Pigeonpea +groundnut (2:4)	10.62a	8.24ab	7.88ab	9.95ab	8.07ab	8.51ab	8.88a	13.80a-d	13.40a-e	13.60a-d	12.50a-e	13.20a-e	12.90a-e	13.23a
Cotton +greengram (1:1)	9.64ab	9.64ab	8.56ab	8.56ab	9.20ab	8.78ab	9.06a	13.25a-e	13.50a-d	11.80b-e	12.30a-e	12.90a-e	13.30a-e	12.84a
Cotton +soybean (1:1)	9.08ab	10.12ab	7.98ab	8.64ab	8.66ab	9.34ab	8.97a	13.75a-d	14.00ab	11.90b-e	11.10e	13.90a-c	13.20a-e	12.98a
Mean	10.04a	9.53ab	8.02b	8.63ab	8.87ab	9.17ab		13.98a	13.40ab	12.16bc	12.24bc	12.86bc	12.93b	

Modipuram														
Black rice –lentil – vegetable cowpea	30.20	43.70	33.90	29.20	38.60	36.90	35.42	11.40	13.50	10.50	10.30	11.10	11.00	11.30
Finger millet – barley – *sesbania* rostrata green manure	26.80	24.50	14.60	12.80	17.10	14.90	18.45	13.10	12.30	11.00	10.50	11.70	11.10	11.62
Okra – vegetable pea – *sesbania* aculeata green manure	23.90	22.70	19.70	19.80	23.40	22.40	21.98	11.30	9.90	11.90	14.00	12.30	10.60	11.67
Black gram – tomato – *sunhemp* green manure	18.90	16.50	14.10	13.70	15.40	14.70	15.55	14.50	12.80	11.30	10.30	12.00	11.20	
Mean	24.95	26.85	20.58	18.88	23.63	22.23		12.58	12.13	11.18	11.28	11.78	10.98	
Pantnagar														
Basmati rice - Wheat	32.68	32.61	32.62	32.59	32.65	32.65	32.63	8.24	8.24	8.21	8.22	8.23	8.24	8.23
Basmati rice – Mustard	32.71	32.81	32.61	32.61	32.66	32.71	32.69	8.21	8.23	8.20	8.20	8.22	8.21	8.21
Basmati rice – Vegetable pea (4 rows vegetable pea + 2 rows coriander)	32.71	32.61	32.61	32.61	32.65	32.71	32.65	8.21	8.20	8.19	8.21	8.21	8.20	8.20
Basmati rice – Potato	32.81	32.61	32.61	32.81	32.61	32.61	32.68	8.21	8.24	8.18	8.20	8.20	8.22	8.21
Mean	32.73	32.66	32.61	32.66	32.64	32.67		8.22	8.23	8.20	8.21	8.22	8.22	
Sardarkushinagar														
Groundnut - wheat - green gram	5.9	6.88	4.76	4.28	4.76	5.74	5.39	12.06	12.36	9.90	10.36	10.90	10.56	11.02
Green gram - coriander - vegetable cowpea	5.42	3.62	3.96	3.96	5.26	4.6	4.47	12.32	9.82	9.38	8.64	10.00	10.16	10.05
Green gram - fennel - fennel continue	3.62	5.08	2.82	3.62	4.12	6.56	4.30	9.04	9.86	8.02	8.40	8.70	10.20	9.04
Mean	4.98	5.19	3.85	3.95	4.71	5.63		11.14	10.68	9.10	9.13	9.87	10.31	
Thiruvananthapuram														
Cassava-vegetable cowpea	22.68	23.47	20.28	23.71	26.18	30.57	24.48							
Cassava-groundnut	27.12	21.92	25.57	12.15	26.55	29.43	23.79							
Taro-blackgram	34.75	25.69	19.57	19.16	26.84	29.32	25.89							
Taro-greengram	22.81	25.38	24.56	22.84	26.20	28.20	25.00							
Mean	26.84	24.12	22.50	19.47	26.44	29.38								

Table 7.2.9: Influence of methods of organic, inorganic and integrated package on soil available micronutrients (Zinc and Copper) at the end of cropping cycle at different locations

Management practice	Soil Available Zinc (ppm)							Copper						
	Organic		Inorganic		Integrated (towards organic)		Mean	Organic		Inorganic		Integrated (towards organic)		Mean
	100 % organic (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]	100 % inorganic package (No organic manures)	State recommendations or farmers package	50% Organic package +50% Inorganic package	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		100 % organic (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]	100 % inorganic package (No organic manures)	-State recommendations or farmers package	50% Organic package +50% Inorganic package	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	
Frenchbean-cauliflower-frenchbean	11.9	10.7	7.4	9.00	13.50	11.00	10.58	2.24	1..81	1.08	1.61	2.44	2.28	1.93
Fallow-cauliflower-tomato	12.8	10.9	7.5	9.80	13.40	11.10	10.92	3.23	1.93	1.12	1.77	3.83	2.54	2.40
Black gram-cauliflower-summer squash	12.0	9.1	7.0	8.80	12.00	10.90	9.97	1.44	1.27	1.08	1.17	1.79	1.58	1.39
Lady finger-pea	12.1	11.1	7.5	9.60	11.80	11.10	10.53	3.59	2.24	1.10	1.58	3.97	2.58	2.51
Mean	12.20	10.5	7.4	9.30	12.68	11.03		2.63	1.81	1.10	1.53	3.01	2.25	
Calicut														
Ginger-Fallow	0.83	0.6	0.38		0.45	1.16		1.21	1.53	1.00		0.85	1.04	
Turmeric-Fallow	3.29	3.06	1.06		2.37	3.41		8.02	8.18	7.04		8.09	4.80	
Dharwad (mg.kg)														
Pigeonpea +greengram (2:4) intercropping system	0.80ab	0.82ab	0.73b	0.76b	0.81ab	0.81ab	0.79a	2.26c-k	2.24d-l	2.03h-l	2.04g-l	2.54a-e	2.65a-d	
Pigeonpea +soybean (2:4) intercropping system	0.89ab	0.84ab	0.76b	0.75b	0.78ab	0.75b	0.80a	2.57a-e	2.54a-e	2.24d-l	1.91kl	2.35a-i	2.01i-l	
Pigeonpea +groundnut (2:4) intercropping system	0.92a	0.86ab	0.71b	0.70b	0.83ab	0.86ab	0.81a	2.74a	2.28b-k	1.92j-l	1.97i-l	2.49a-f	2.45a-g	

Cotton +greengram (1:1) intercropping system	0.8ab	0.83ab	0.73b	0.76b	0.79ab	0.85ab	0.79a	2.46a-f	2.66a-c	2.01i-l	2.00i-l	2.44a-h	2.33a-j	
Cotton +soybean (1:1) intercropping system	0.78ab	0.74b	0.71b	0.72b	0.76b	0.80ab	0.75b	2.45a-g	2.51a-f	1.84l	2.68ab	2.10f-l	2.20e-l	
Mean	0.84a	0.82ab	0.73c	0.74bc	0.79ab	0.81ab		2.50a	2.45a	2.01b	2.12b	2.38a	2.33a	
Modipuram														
Black rice –lentil – vegetable cowpea	3.06	3.35	1.30	1.45	2.07	2.43	2.28	4.02	4.98	3.47	3.96	4.39	4.44	4.21
Finger millet – barley – *sesbania* rostrata green manure	3.72	3.68	3.00	2.07	3.55	3.13	3.19	3.84	3.68	3.13	3.00	3.47	3.22	3.39
Okra – vegetable pea – *sesbania* aculeata green manure	2.13	2.27	1.44	1.66	2.43	2.04	2.00	2.13	3.72	1.44	3.20	2.16	3.31	2.66
Black gram – tomato – *sunhemp* green manure	4.01	3.11	2.66	3.10	2.18	3.22	3.05	4.00	3.31	3.07	3.72	3.29	3.34	3.46
Mean	3.23	3.10	2.10	2.07	2.56	2.71		3.50	3.92	2.78	3.47	3.33	3.58	
Pantnagar														
Basmati rice - Wheat	1.07	1.05	1.08	1.07	1.09	1.08	1.07	3.98	3.97	3.96	3.97	3.98	3.99	3.98
Basmati rice – Mustard	1.06	1.09	1.06	1.07	1.06	1.06	1.07	3.98	3.96	3.94	3.95	3.97	3.97	3.96
Basmati rice – Vegetable pea (4 rows vegetable pea + 2 rows coriander)	1.05	1.07	1.09	1.09	1.08	1.08	1.08	3.99	3.98	3.93	3.94	3.99	3.98	3.97
Basmati rice – Potato	1.06	1.10	1.05	1.07	1.08	1.07	1.07	3.99	3.99	3.93	3.93	3.99	3.98	3.97
Mean	1.060	1.078	1.070	1.075	1.078	1.073		3.985	3.975	3.940	3.948	3.983	3.980	
Sardarkushinagar														
Groundnut - wheat - green gram	0.62	0.54	0.7	0.54	0.42	0.48	0.55	0.76	0.84	0.58	0.5	0.8	0.84	0.72
Green gram - coriander - vegetable cowpea	0.52	0.3	0.52	0.38	0.16	0.22	0.35	1.04	0.8	0.58	0.54	0.88	0.66	0.75
Green gram - fennel - fennel continue	0.7	0.76	0.5	0.66	0.56	0.7	0.65	0.72	0.66	0.5	0.5	0.58	0.62	0.60
Mean	0.61	0.53	0.57	0.53	0.38	0.47		0.84	0.77	0.55	0.51	0.75	0.71	
Thiruvananthapuram														
Cassava-vegetable cowpea	2.74	4.28	2.88	3.87	3.70	4.90	3.73	2.52	2.60	2.33	2.89	3.05	3.29	2.78
Cassava-groundnut	2.95	3.23	3.23	3.04	3.37	3.26	3.18	2.76	2.89	2.72	1.96	3.12	3.12	2.76
Taro-blackgram	5.46	3.55	3.29	3.84	4.30	5.67	4.35	3.38	2.63	3.00	2.87	3.49	3.60	3.16
Taro-greengram	5.72	3.62	5.47	5.98	3.84	7.02	5.28	3.31	3.10	3.56	3.62	3.52	4.16	3.55
Mean	4.22	3.67	3.72	4.18	3.80	5.21		2.99	2.81	2.90	2.84	3.30	3.54	

Influence of organic inorganic and towards organic management packages on N, P, K and micronutrients uptake (Table 7.2.10 & 7.2.13)

Bajaura: Effect of organic, inorganic and towards organic nutrient management practices, uptake of major nutrients N, P & K revealed that majority of the crops uptake the maximum N, P, K under inorganic practice with farmers package. Similarly, total N uptake (162 kg/ha) and K uptake (128kg/ha) was higher in black gram-cauliflower- summer squash system towards organic, whereas P uptake (54 kg/ha) was maximum in okra-pea with application of 100% inorganic input under state recommendation /farmers practice. Uptake of micronutrients, Fe, Mn, Zn and Cu was recorded highest also in black gram-cauliflower- summer squash system under towards organic management practice and values were 1860 g/ha, 891 g/ha, 828 g/ha and 318 g/ha, respectively.

Calicut: Among all the management practices, major nutrient uptake of N, P and K in turmeric rhizome was found to be higher under organic either with application 100% input through organic or 50% organic+ NF practice. Uptake of micronutrient i.e. iron and zinc recorded higher under towards organic, manganese found to be higher under inorganic while copper recorded higher under organic management practice.

Pantnagar: Among all the management practices, Uptake of N & K in basmati rice recorded higher under organic management practices-I which is 9.5 and 5.3% higher than the towards organic management-II while P was higher under towards organic which is 6.8% lower over towards organic management practice. Similarly, basmati rice-mustard recorded higher N, P and K uptake among the systems.

Udaipur: In general, total N, P & K uptake found to be higher either by organic package or towards practice with application of 50% organic+50% inorganic input management. During *kharif* under organic management practice, uptake of N by maize 6.12% lower than the towards organic-II while soybean uptake 6.6% higher N than towards organic. Black gram and sweet corn found to be at par for N uptake. Likewise maize and sweet corn uptake 4.33 and 5.3% lower P but blackgram and soybean crop remove 2.1 and 6.7% more P from soil. Removal of K from the soil about 20% lower in maize while blackgram, sweet corn and soybean remove 2.7, 2.8 and 13.9% higher K than towards organic under organic management practices. Similarly, during *rabi*, wheat, chickpea and fenugreek recorded higher uptake of N, P and K from the soil. Under organic management practice, Uptake of N (5.9, 8.2 and 8.6%), P (2.3,2.4 & 2.6% and K (9.3, 4.9 & 8.2%) higher for wheat, chickpea and fenugreek respectively than the towards organic.

Table 7.2.10: Influence of organic, inorganic and integrated package on N uptake of crops and cropping systems

Locations/Treatments	Organic (as per NPOP standards)						Inorganic						Towards organic (Integrated)					
	100 % organic (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]			100 % inorganic package (No organic manures)			State recommendations or farmers package			50% Organic package +50% Inorganic package			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		
	Kharif	*Rabi*	Summer	*Kharif*	*Rabi*	Summer	*Kharif*	*Rabi*	Summer	*Kharif*	*Rabi*	Summer	*Kharif*	*Rabi*	Summer	*Kharif*	*Rabi*	Summer
Bajaura (kg/ha)																		
Frenchbean-cauliflower-frenchbean	31.80	43.00	28.90	30.70	43.20	27.60	26.30	27.10	21.50	33.80	55.20	29.10	31.60	53.60	27.90	30.40	52.60	27.20
Fallow-cauliflower-tomato		47.00	40.60		45.50	45.10		34.90	54.70		59.80	74.00		59.50	52.50		58.40	52.60
Black gram-cauliflower-summer squash	19.20	36.40	94.50	19.40	35.40	91.50	18.70	29.00	87.70	19.40	44.70	96.80	19.30	45.30	96.90	19.10	42.90	95.70
Lady finger-pea	32.10	21.50		33.50	22.30		32.60	19.00		36.30	23.90		35.40	23.20		33.60	22.20	
Calicut																		
Ginger-Fallow	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Turmeric-Fallow	2.05			1.96			1.99						1.98			2.13		
Pantnagar																		
Basmati rice - Wheat	77.7			64.6			72.0			67.8			76.2			70.3		
Basmati rice – Mustard	77.8			66.5			65.8			74.4			76.2			68.8		
Basmati rice – Vegetable pea (4 rows vegetable pea + 2 rows coriander)	81.9			69.1			64.8			74.5			81.5			74.9		
Basmati rice – Potato	76.0			67.1			71.9			72.5			79.6			72.1		
Udaipur																		
Maize + blackgram (2:2)–wheat (*durum*)–sesbania (GM)	66.08	96.76		60.02	94.19		76.16	104.71		61.38	103.66		85.32	108.27		70.39	91.44	
Blackgram – wheat (*Triticum aestivum)*	33.33	103.83		30.42	101.24		37.72	112.55		31.18	102.43		47.46	116.17		33.48	98.07	
Sweet corn + blackgram (2:2)–chickpea	89.49	73.71		80.67	70.36		102.85	81.69		85.24	78.76		115.21	85.68		89.52	68.14	
Soybean – fenugreek	61.14	96.04		56.82	93.26		66.36	98.79		66.41	98.56		80.96	109.05		57.37	88.45	

Table 7.2.11: Influence of inorganic, inorganic and integrated on P uptake of crops at different locations

Locations/Treatments	Organic Management (as per NPOP standards)						Inorganic Management						Towards organic (Integrated Crop Management)					
	100 % organic (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]			100 % inorganic package (No organic manures)			State recommendations or farmers package			50% Organic package +50% Inorganic package			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		
	Kharif	*Rabi*	Summer	*Kharif*	*Rabi*	Summer	*Kharif*	*Rabi*	Summer	*Kharif*	*Rabi*	Summer	*Kharif*	*Rabi*	Summer	*Kharif*	*Rabi*	Summer
Bajaura (unit in percent)																		
Frenchbean-cauliflower-frenchbean	15.4	11.2	13.1	14.3	10.8	12.1	11.5	5.4	9.1	16.9	13.6	13.5	15.7	13.4	12.9	14.6	12.9	11.8
Fallow-cauliflower-tomato		12.2	20.5		11.8	19.7		6.9	16.4		14.4	26.4		14.5	26.7		14.4	24.8
Black gram-cauliflower-summer squash	3.6	8.7	17.6	3.4	8.3	18.4	3.1	5.7	12.7	4.1	10.4	20.1	3.9	11.0	20.9	3.8	10.2	19.2
Lady finger-pea	26.9	16.1		27.1	18.0		24.2	10.5		32.8	21.5		31.6	20.8		29.3	18.3	
Calicut																		
Ginger-Fallow	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Turmeric-Fallow	0.55			0.55			0.45						0.51			0.48		
Pantnagar																		
Basmati rice - Wheat	22.6			23.9			24.6			27.3			27.1			23.9		
Basmati rice – Mustard	23.2			23.9			26.1			26.8			28.2			23.7		
Basmati rice – Vegetable pea (4 rows vegetable pea + 2 rows coriander)	24.0			23.3			24.3			22.4			29.0			28.0		
Basmati rice – Potato	24.6			23.3			27.1			23.2			26.9			25.7		
Udaipur																		
Maize + blackgram (2:2)–wheat (*durum*)–sesbania (GM)	12.82	30.62		11.80	30.84		13.48	34.40		11.70	31.36		15.09	34.75		13.40	30.37	
Blackgram – wheat (*Triticum aestivum)*	4.85	31.19		4.33	30.55		5.44	34.09		4.82	31.24		6.84	34.91		4.75	30.50	
Sweet corn + blackgram (2:2)–chickpea	14.44	14.24		12.76	13.97		16.67	16.34		12.67	13.58		19.53	17.06		15.25	13.90	
Soybean – fenugreek	6.87	15.48		6.35	15.31		7.47	16.62		7.08	15.99		8.84	17.96		6.44	15.09	

Table 7.2.12: Influence of inorganic, inorganic and integrated on K uptake of crops at different locations

Locations/Treatments	Organic Management (as per NPOP standards)						Inorganic Management						Towards organic (Integrated Crop Management)					
	100 % organic (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]			100 % inorganic package (No organic manures)			State recommendations or farmers package			50% Organic package +50% Inorganic package			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		
	Kharif	*Rabi*	Summer	*Kharif*	*Rabi*	Summer	*Kharif*	*Rabi*	Summer	*Kharif*	*Rabi*	Summer	*Kharif*	*Rabi*	Summer	*Kharif*	*Rabi*	Summer
Bajaura (unit in percent)																		
Frenchbean-cauliflower-frenchbean	28.0	55.5	24.9	27.6	56.4	23.6	23.6	37.3	22.0	27.9	59.9	25.3	25.8	58.0	24.0	24.9	56.7	23.0
Fallow-cauliflower-tomato		56.6	39.4		56.1	40.4		39.8	30.7		63.0	43.3		63.2	42.0		62.4	40.6
Black gram-cauliflower-summer squash	18.3	51.0	47.5	18.5	49.9	48.1	14.8	34.4	39.1	19.7	55.3	53.0	19.5	55.4	53.1	19.2	53.2	53.1
Lady finger-pea	45.1	15.5		46.3	16.8		37.6	10.1		43.9	21.2		46.9	20.2		44.7	17.6	
Calicut																		
Ginger-Fallow																		
Turmeric-Fallow	2.84			2.72			2.54						2.17			2.57		
Pantnagar																		
Basmati rice - Wheat	71.4			63.4			73.5			70.6			73.2			65.5		
Basmati rice – Mustard	70.4			59.8			63.2			69.6			71.4			61.6		
Basmati rice – Vegetable pea (4 rows vegetable pea + 2 rows coriander)	74.1			64.5			62.3			68.0			75.4			72.6		
Basmati rice – Potato	71.2			66.9			68.0			66.8			75.4			73.0		
Udaipur																		
Maize + blackgram (2:2)–wheat (*durum*)–sesbania (GM)	69.52	138.12		64.67	132.69		77.79	146.20		67.79	142.86		89.35	150.13		86.73	126.33	
Blackgram – wheat (*Triticum aestivum)*	16.33	134.20		14.89	128.26		18.41	145.77		17.73	145.50		22.18	151.04		15.90	124.75	
Sweet corn + blackgram (2:2)–chickpea	77.17	70.55		69.24	68.94		83.63	79.19		72.23	69.23		93.79	82.84		75.04	67.27	
Soybean – fenugreek	32.49	52.28		29.87	51.27		35.03	54.60		34.08	54.73		40.63	59.83		28.53	48.33	

Table 7.2.13.1: Influence of organic, inorganic and integrated nutrient management on micronutrients iron (Fe) uptake by different crops in cropping systems

Locations/ Treatments	Organic (as per NPOP standards)						Inorganic						Towards organic (Integrated)					
	100 % organic (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]			100 % inorganic package (No organic manures)			State recommendations or farmers package			50% Organic package +50% Inorganic package			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		
	Kharif	*Rabi*	Summer	*Kharif*	*Rabi*	Summer	*Kharif*	*Rabi*	Summer	*Kharif*	*Rabi*	Summer	*Kharif*	*Rabi*	Summer	*Kharif*	*Rabi*	Summer
Bajaura (g/ha)																		
Frenchbean-cauliflower-frenchbean	684.0	462.0	610.0	663.0	462.0	587.0	525.0	220.0	440.0	696.0	523.0	614.0	661.0	559.0	598.0	632.0	515.0	578.0
Fallow-cauliflower-tomato		536.0	739.0		523.0	757.0		285.0	489.0		612.0	770.0		637.0	796.0		622.0	800.0
Black gram-cauliflower- summer squash	85.0	454.0	1058.0	88.0	433.0	1003.0	65.0	239.0	652.0	95.0	503.0	1147.0	94.0	518.0	1248.0	91.0	477.0	1199.0
Lady finger-pea	405.0	316.0		403.0	317.0		320.0	169.0		458.0	346.0		458.0	368.0		446.0	321.0	
Calicut (uptake unit in g/ha)																		
Ginger-Fallow	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Turmeric-Fallow	560.8			494.8			693.4						657.2			770.9		

Table 7.2.13.2: Influence of organic, inorganic and integrated nutrient management on micronutrients Manganese (Mn) uptake by different crops in cropping systems

Locations/Treatments	Organic (as per NPOP standards)						Inorganic						Towards organic (Integrated)					
	100 % organic (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]			100 % inorganic package (No organic manures)			State recommendations or farmers package			50% Organic package +50% Inorganic package			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		
	Kharif	*Rabi*	Summer	*Kharif*	*Rabi*	Summer	*Kharif*	*Rabi*	Summer	*Kharif*	*Rabi*	Summer	*Kharif*	*Rabi*	Summer	*Kharif*	*Rabi*	Summer
Bajaura (g/ha)																		
Frenchbean-cauliflower-frenchbean	151.0	223.0	139.0	160.0	252.0	147.0	112.0	95.0	101.0	166.0	238.0	144.0	138.0	246.0	143.0	150.0	253.0	134.0
Fallow-cauliflower-tomato		232.0	376.0		239.0	405.0		131.0	254.0		306.0	406.0		313.0	412.0		322.0	407.0
Black gram-cauliflower-summer squash	21.0	213.0	529.0	23.0	217.0	539.0	13.0	105.0	290.0	24.0	234.0	584.0	23.0	250.0	614.0	24.0	247.0	620.0
Lady finger-pea	243.0	173.0		256.0	186.0		180.0	93.0		269.0	201.0		273.0	219.0		270.0	202.0	
Calicut (uptake unit in g/ha)																		
Ginger-Fallow	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Turmeric-Fallow	173.92			192.64			297.19						214.08			201.92		

Table 7.2.13.3: Influence of organic, inorganic and integrated nutrient management on micronutrients Zince (Zn) uptake by different crops in cropping systems

Locations/Treatments	Organic (as per NPOP standards)						Inorganic						Towards organic (Integrated)					
	100 % organic (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]			100 % inorganic package (No organic manures)			State recommendations or farmers package			50% Organic package +50% Inorganic package			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		
	Kharif	*Rabi*	Summer	*Kharif*	*Rabi*	Summer	*Kharif*	*Rabi*	Summer	*Kharif*	*Rabi*	Summer	*Kharif*	*Rabi*	Summer	*Kharif*	*Rabi*	Summer
Bajaura (g/ha)																		
Frenchbean-cauliflow-er-frenchbean	182.0	231.0	161.0	172.0	227.0	162.0	97.0	95.0	88.0	166.0	257.0	155.0	161.0	265.0	143.0	161.0	271.0	150.0
Fallow-cauliflower-tomato		241.0	238.0		231.0	327.0		119.0	205.0		284.0	336.0		292.0	357.0		300.0	353.0
Black gram-cauliflower-summer squash	24.0	198.0	472.0	23.0	202.0	520.0	14.0	100.0	304.0	24.0	208.0	563.0	24.0	233.0	571.0	25.0	230.0	579.0
Lady finger-pea	161.8	111.9		155.6	110.2		90.2	53.3		169.3	128.6		175.3	132.9		167.4	111.7	
Calicut (uptake unit in g/ha)																		
Ginger-Fallow	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Turmeric-Fallow	76.67			71.03			72.56						77.39			67.89		

Table 7.2.13.4: Influence of organic, inorganic and integrated nutrient management on micronutrients Copper (Cu) uptake by different crops in cropping systems at Bajaura

Locations/Treatments	Organic (as per NPOP standards)						Inorganic						Towards organic (Integrated)					
	100 % organic (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]			100 % inorganic package (No organic manures)			State recommendations or farmers package			50% Organic package +50% Inorganic package			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		
	Kharif	*Rabi*	Summer	*Kharif*	*Rabi*	Summer	*Kharif*	*Rabi*	Summer	*Kharif*	*Rabi*	Summer	*Kharif*	*Rabi*	Summer	*Kharif*	*Rabi*	Summer
Bajaura (g/ha)																		
Frenchbean-cauliflower-frenchbean	76.8	160.1	73.8	70.4	113.4	65.5	44.4	40.9	37.0	64.7	97.0	57.5	65.6	122.3	63.0	57.6	117.0	59.3
Fallow-cauliflower-tomato		114.3	135.3		114.4	116.2		50.6	73.4		118.0	121.8		135.0	129.1		120.2	137.0
Black gram-cauliflower-summer squash	10.3	94.6	177.6	10.5	90.3	167.2	5.4	47.3	78.2	8.1	90.2	149.3	10.2	113.1	194.7	10.1	109.3	194.3
Lady finger-pea	74.6	139.5		70.5	135.0		41.8	41.7		72.7	127.0		74.0	129.0		73.5	124.9	
Calicut (uptake unit in g/ha)																		
Ginger-Fallow	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Turmeric-Fallow	21.17			21.92			10.17						11.69			15.86		

Soil microbial population as influenced by the different management practices (Table 7.2.14.1 & 14.2)

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} CFU/g)), and actinomycetes (23.33 10^{12} 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 – s*esbania* 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.

Table 7.2.14.1: Rhizosphere microbial population (Bacteria and Fungi micro-organisms) in soil as influenced by the different nutrient practices and cropping systems

Locations/Treatments	Bacteria (x10^6 cfu/g)							Fungi (x10^6 cfu/g)						
	Organic		Inorganic		Integrated		Mean	Organic		Inorganic		Integrated		Mean
	100 % organic (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]	100 % inorganic package (No organic manures)	State recommendations or farmers package	50% Organic package +50% Inorganic package	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		100 % organic (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]	100 % inorganic package (No organic manures)	State recommendations or farmers package	50% Organic package +50% Inorganic package	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	
Bajaura	(log cfu/g)													
Frenchbean-cauliflower-frenchbean	23.1	25.9	14.3	17.8	19.2	23.6	20.7	21.2	24.0	15.6	19.8	19.2	23.1	20.5
Fallow-cauliflower-tomato	22.1	26.6	14.2	17.9	20.5	26.9	21.4	19.8	25.2	14.8	20.0	18.9	22.2	20.2
Black gram-cauliflower-summer squash	20.5	26.9	14.1	17.5	18.7	23.0	20.1	19.8	25.0	14.9	19.7	20.0	25.2	20.8
Lady finger-pea	23.1	28.6	14.2	18.0	18.9	24.0	21.1	20.1	24.0	15.0	18.9	19.3	25.8	20.5
Mean	22.2	27.0	14.2	17.8	19.3	24.4		20.2	24.6	15.1	19.6	19.4	24.1	
Dharwad	(CFU x 10^6)							(CFU x 10^4)						
Pigeonpea +greengram (2:4) intercropping system	113	109	59.5	55.5	62.5	61.5	76.83	7.50	11.00	6.50	6.00	7.50	8.50	7.83
Pigeonpea +soybean (2:4) intercropping system	110	111	63.5	49	87	58	79.75	16.50	21.00	7.50	10.00	12.00	10.00	12.83
Pigeonpea +groundnut (2:4) intercropping system	81	95.5	60	27	62.5	39.5	60.92	13.50	21.00	11.00	7.50	7.50	5.50	11.00
Cotton +greengram (1:1) intercropping system	125.5	81	46.5	46	64	65.5	71.42	24.50	14.00	8.50	8.50	13.00	8.50	12.83

Cotton +soybean (1:1) intercropping system	92	70	47.5	38.5	77	55	63.33	10.50	9.50	8.50	5.50	11.00	9.50	9.08
Mean	104.3	93.3	55.4	43.2	70.6	55.9		14.50	15.30	8.40	7.50	10.20	8.40	
Jabalpur														
Basmati rice – durum wheat-green manure	41.44	41.12	41.23	41.21	40.98	41.53	41.3	42.89	42.78	42.62	42.56	43.00	43.12	42.83
Basmati rice – chickpea - maize fodder	41.39	41.25	41.31	41.38	41.00	41.72	41.3	42.75	41.98	42.00	42.12	42.98	43.00	42.47
Basmati rice – berseem (fodder and seed)	41.50	41.35	41.28	41.00	41.35	41.30	41.3	42.15	41.77	42.14	42.88	43.00	42.79	42.46
Basmati rice – vegetable pea- sorghum (fodder)	41.38	41.30	41.34	41.30	41.23	41.00	41.3	41.82	42.00	42.10	42.00	42.12	42.78	42.14
Mean	41.43	41.26	41.29	41.22	41.14	41.39		42.40	42.13	42.22	42.39	42.78	42.92	
Narendrapur				**(10^{12} CFU/g)**						**(10^{4} CFU/g)**				
Basmati rice-broccoli-*sesbania* green maunre	16.70	16.33	11.13	10.63	14.57	17.07	14.4	19.67	12.67	13.33	14.00	15.00	17.00	15.3
Rice-mustard-green gram	13.60	12.80	8.00	7.17	10.23	12.23	10.7	17.67	14.67	8.00	9.33	17.00	19.00	14.3
Rice-frenchbean-green gram	10.57	11.80	9.63	9.57	11.87	11.57	10.8	10.00	10.67	14.33	8.33	8.00	7.67	9.8
Rice-vegetable pea-sesame	19.10	17.67	11.57	7.97	18.73	19.90	15.8	17.00	18.33	15.33	9.00	9.33	14.00	13.8
Mean	14.99	14.65	10.08	8.83	13.85	15.19		16.08	14.08	12.75	10.17	12.33	14.42	
Sardarkushinagar														
Groundnut - wheat - green gram	230.56	130.44	16.03	57.74	101.11	84.77	103.44	24.03	20.22	2.45	6.12	14.12	10.97	12.99
Green gram - coriander - vegetable cowpea	187.58	155.24	9.71	46.37	88.36	68.25	92.59	17.35	11.41	1.84	3.18	10.34	7.37	8.58
Green gram - fennel - fennel continue	267.36	233.21	22.68	74.36	196.35	137.57	155.26	33.27	26.18	1.24	4.55	11.24	8.97	14.24
Mean	228.50	172.96	16.14	59.49	128.61	96.86		24.88	19.27	1.84	4.62	11.90	9.10	
Thiruvananthapuram				**(x 10^{6})**						**(x 10^{4})**				
Cassava-vegetable cowpea	140.7	248.3	39.3	25.3	18.3	456.0	154.7	5.33	5.33	2.00	22.00	9.33	27.67	11.94
Cassava-groundnut	36.3	26.0	19.0	8.3	15.3	103.0	34.7	12.33	12.00	6.33	20.00	9.33	10.00	11.67
Taro-blackgram	10.7	28.3	60.7	489.3	49.3	10.7	108.2	20.00	5.33	16.00	8.00	3.33	17.33	11.67
Taro-greengram	313.3	117.3	8.3	78.7	327.3	20.0	144.2	25.00	4.67	20.67	3.33	5.33	6.00	10.83
Mean	125.3	105.0	31.8	150.4	102.6	147.4		15.67	6.83	11.25	13.33	6.83	15.25	

Table 7.2.14.2: Rhizosphere microbial population (Actinomycetes and phosphate solubilizing micro-organisms) in 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 (as per NPOP standards)		Inorganic		Towards organic (Integrated)		Mean	Organic (as per NPOP standards)		Inorganic		Towards organic (Integrated)		Mean
	100 % organic (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]	100 % inorganic package (No organic manures)	State recommendations or farmers package	50% Organic package +50% Inorganic package	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		100 % organic (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]	100 % inorganic package (No organic manures)	State recommendations or farmers package	50% Organic package +50% Inorganic package	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	
Bajaura	Soil Phosphatase enzyme (µg/g/hr)													
Frenchbean-cauliflower-frenchbean	21.4	24.6	13.9	18.3	18.9	23.5	20.1	23.6	26.8	17.4	20.9	21.8	24.2	22.5
Fallow-cauliflower-tomato	20.5	26.4	13.8	18.7	19.2	24.6	20.5	24.0	25.8	17.2	21.5	22.7	25.6	22.8
Black gram-cauliflower-summer squash	22.4	23.7	12.2	19.6	20.8	21.6	20.1	26.3	26.5	17.5	20.2	21.6	25.7	23.0
Lady finger-pea	20.2	23.2	14.1	18.9	19.7	24.5	20.1	24.5	25.7	18.1	20.8	22.0	24.7	22.6
Mean	21.1	24.5	13.5	18.9	19.7	23.6		24.6	26.2	17.6	20.9	22.0	25.1	
Dharwad	(CFU x 10^5)							(CFU x 10^4)						
Pigeonpea +greengram (2:4) intercropping system	33.0	49.0	23.5	19.0	35.0	22.5	30.3	30.0	29.0	29.5	19.5	25.0	27.5	26.8
Pigeonpea +soybean (2:4) intercropping system	27.5	25.0	21.0	20.0	35.5	25.0	25.7	48.5	38.5	28.0	20.5	33.0	27.0	32.6
Pigeonpea +groundnut (2:4) intercropping system	36.0	43.5	34.5	25.0	29.0	21.0	31.5	35.0	42.5	25.0	21.5	38.0	21.0	30.5
Cotton +greengram (1:1) intercropping system	23.0	27.5	16.0	14.0	35.0	24.0	23.3	39.0	31.5	20.5	21.0	26.5	27.0	27.6

Cotton +soybean (1:1) intercropping system	33.5	40.5	19.0	13.5	26.5	20.0	25.5	39.5	36.0	18.5	11.0	29.5	27.0	26.9
Mean	30.6	37.1	22.8	18.3	32.2	22.5		38.4	35.5	24.3	18.7	30.4	25.9	
Basmati rice – durum wheat-green manure	12.89	12.76	12.65	12.56	12.92	12.56	12.72							
Basmati rice – chickpea - maize fodder	12.75	12.68	12.70	12.82	12.62	12.92	12.75							
Basmati rice – berseem (fodder and seed)	12.72	12.85	12.79	12.62	12.83	12.65	12.74							
Basmati rice – vegetable pea- sorghum (fodder)	12.98	12.55	12.82	12.58	12.73	12.85	12.75							
Mean	12.84	12.71	12.74	12.65	12.78	12.75								
							(10^8 CFU/g)							
Basmati rice-broccoli-*sesbania* green maunre	24.00	23.67	16.67	11.33	19.33	27.33	20.4							
Rice-mustard-green gram	25.33	23.67	15.33	10.67	16.67	25.00	19.4							
Rice-frenchbean-green gram	20.33	17.33	15.33	13.00	14.00	18.67	16.4							
Rice-vegetable pea-sesame	18.00	18.67	11.67	11.67	15.67	22.33	16.3							
Mean	21.92	20.83	14.75	11.67	16.42	23.33								
Sardarkushinagar														
Groundnut - wheat - green gram	57.24	41.38	1.24	13.98	32.18	17.64	27.28							
Green gram - coriander - vegetable cowpea	54.17	40.38	2.66	11.91	24.28	15.39	24.80							
Green gram - fennel - fennel continue	64.25	57.01	4.27	14.87	41.28	28.34	35.00							
Mean	58.55	46.26	2.72	13.59	32.58	20.46								
Thiruvananthapuram														
Cassava-vegetable cowpea	11.33	1.67	11.33	17.00	7.00	2.00	8.39							
Cassava-groundnut	2.67	2.33	17.33	24.67	3.33	3.67	9.00							
Taro-blackgram	5.00	3.33	3.33	4.33	3.67	7.00	4.44							
Taro-greengram	3.33	8.00	7.00	2.67	3.67	4.67	4.89							
Mean	5.58	3.83	9.75	12.17	4.42	4.34								

Effect of different management practices (organic, inorganic and towards) on quality aspects of produce (Table 7.2.15)

Bajaura: Quality parameters protein, TSS (^{0}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 (^{0}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 (^{0}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.

Table 7.2.15: Influence of organic, inorganic and integrated package on quality of crops at different locations

Locations	Crops	Quality parameter	Organic Management (as per NPOP standards)		Inorganic Management		Towards organic (Integrated Crop Management)	
			100% Organic	50% nutrients through organic + NF]	100% inorganic management	State recommendations or farmers package	50% Organic +50% Inorganic nutrients management	25% nutrients through organic +25% nutrients through inorganic + NF
Bajura	French bean (*kharif*)	Protein (%)	14.0	14.s2	13.4	14.0	14.0	14.3
	French bean (*summer*)		14.2	14.1	13.2	14.4	14.4	14.3
	Black gram		14.1	14.0	13.2	14.1	14.3	14.2
	Pea		20.3	20.2	20.0	20.5	20.2	20.4
	Tomato	TSS (^{0} Brix)	5.4	5.2	4.1	5.4	5.4	5.4
	Pea		14.4	14.0	12.6	14.0	14.2	14.0
	Tomato	Vitamin C (mg/100g)	34.2	33.8	30.0	32.2	34.8	35.2
	Cauliflower		47.0	45.1	41.9	45.0	46.6	45.7
Bhopal	Soybean	Oil (%)	18.07	18.09	18.17	18.16	18.16	18.07
		Protein (%)	35.9	35.2	35.8	35.8	36.0	35.1
		Methionine (g/16gN)	1.78	1.76	1.78	1.78	1.79	1.75
		Tryptophan (g/16gN)	1.85	1.83	1.85	1.86	1.87	1.82
Calicut	Ginger	Oil (%)	2.10	1.87	1.90		1.87	1.97
		Oleoresin content (%)	4.30	4.43	4.40		4.10	4.27
	Turmeric	Oil (%)	5.20	5.44	5.18		5.44	5.59
		Oleoresin (%)	9.93	11.14	11.76		11.59	10.93
		Curcumin (%)	3.98	4.21	4.39		4.23	4.45
Coimbatore	Brinjal	Titrable Acidity (%)	0.34	0.33	0.24	0.28	0.28	0.30
		Ascorbic acid (mg/100g)	15.19	14.77	13.46	14.55	14.13	14.50
	Chilli	TSS (°Brix)	5.84	5.62	4.66	5.23	5.42	5.54
		Ascorbic acid (mg/100g)	125.23	127.46	116.97	123.58	120.47	123.72
	Tomato	TSS (°Brix)	5.61	5.57	5.47	5.53	5.49	5.53
		Titrable acidity (%)	0.68	0.70	0.65	0.67	0.65	0.68
		Ascorbic acid (mg/100g)	34.70	34.51	31.17	32.42	31.62	32.38
Ranchi	Rice	Protein (%)	9.31	9.44	9.13	9.12	9.22	9.14
		Moisture (%)	14.44	14.20	14.16	13.96	14.20	14.10
	Wheat	Protein (%)	11.27	11.28	11.41	11.10	11.39	11.37
		Moisture (%)	10.16	10.13	10.39	10.25	10.29	10.28

Influence of organic, inorganic and integrated management packages on economics of different crops and cropping systems Table (7.2.16 to 19)

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 7.2.16. Influence organic, inorganic and integrated production systems on gross return of different crops and cropping system at different locations

Location/cropping systems	Gross returns (Rs/ha)						
	Organic (as per NPOP standards)		Inorganic		Towards organic (Integrated)		Mean
	100 % organic (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]	100 % inorganic package (No organic manures)	State recommendations or farmers package	50% Organic package +50% Inorganic package	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	-
Bajaura							
Frenchbean-cauliflower-frenchbean	595938	591500	359300	510100	492050	480500	5,04,898
Fallow-cauliflower-tomato	536500	548250	309400	498600	490600	485800	4,78,192
Black gram-cauliflower- summer squash	616025	614575	374910	563680	553940	536700	5,43,305
Lady finger-pea	471500	487125	297200	440400	429400	395400	4,20,171
Mean	5,54,991	5,60,363	3,35,203	5,03,195	4,91,498	4,74,600	
Bhopal							
Soybean-durum wheat	146052	118503	96684	99901	122036	90534	1,12,285
Soybean- mustard	123097	102092	94118	92254	106638	73453	98,609
Soybean- chickpea	122511	105187	89230	85803	105791	77727	97,708
Soybean- linseed	144128	126871	104970	105534	119276	96253	1,16,172
Mean	1,33,947	1,13,163	96,251	95,873	1,13,435	84,492	
Calicut							
Ginger-Fallow	3,59,097	3,39,547	2,98,271		3,55,885	3,36,512	3,37,862
Turmeric-Fallow	4,08,800	3,89,200	4,22,800		4,34,000	3,80,800	4,07,120
Coimbatore							
Brinjal - pearl millet-green manure (*dhaincha*) -	4,38,301	4,16,861	3,36,684	4,19,145	3,77,148	3,47,115	3,89,209
Chillies - barnyard millet-green manure (*dhaincha*)	4,24,537	3,90,319	2,99,608	3,99,325	3,46,905	3,27,684	3,64,730

Tomato -finger millet-green manure (*dhaincha*)	4,84,495	4,40,849	3,50,820	4,91,622	4,12,705	3,66,794	4,24,548
Mean	4,49,111	4,16,010	3,29,037	4,36,697	3,78,919	3,47,198	
Dharwad							
Pigeonpea +greengram (2:4) intercropping system	77458	65358	70943	81918	73473	60910	71,677
Pigeonpea +soybean (2:4) intercropping system	81537	71629	69602	80964	74201	63016	73,492
Pigeonpea +groundnut (2:4) intercropping system	91792	86151	80903	89693	84057	74972	84,595
Cotton +greengram (1:1) intercropping system	53827	46368	56784	62845	54502	44733	53,177
Cotton +soybean (1:1) inter-cropping system	52405	50928	54061	60939	58114	48905	54,225
Mean	71,404	64,087	66,459	75,272	68,869	58,507	
Jabalpur							
Soybean- wheat	149130	145427	134577	88723	136876	126076	1,30,135
Soybean-mustard-green gram	224595	189119	235984	143608	189790	188178	1,95,212
Soybean-berseem (fodder and seed)	250658	216060	299242	192118	268059.5	252224	2,46,394
Soybean-lentil- sorghum (fodder)	180352	166962	195562	135691	177347	164583	1,70,083
Mean	201184	179392	216341	140035	193018	182765	
Ludhiana							
Basmati rice-chickpea-green manure	220289	206220	149459	154983	168204	178382	1,79,590
Basmati rice-wheat-green manure	215179	224200	200705	205413	182009	201822	2,04,888
Kharif moong-wheat-summer moong	216637	201561	178502	174494	173302	172774	1,86,212
Sesame-lentil	136763	120146	117210	110914	101257	117928	1,17,370
Mean	197217	188032	161469	161451	156193	167727	
Pantnagar							
Basmati rice - Wheat	345685	298220	272317	276330	305473	248223	2,91,041
Basmati rice – Mustard	364671	319020	284285	289077	314600	268333	3,06,664

Basmati rice – Vegetable pea (4 rows vegetable pea + 2 rows coriander)	413394	356511	275294	289184	320840	289358	3,24,097
Basmati rice – Potato	227190	202293	162734	165375	183969	165398	1,84,493
Mean	337735	294011	248658	254992	281221	242828	
Raipur							
Soybean-maize (sweet corn)	579098	516460	430067	499101	385349	336350	457737
Soybean- french bean	283501	257953	205512	228247	190784	171033	222838
Soybean-tomato	714012	657162	558758	618828	472935	430095	575298
Soybean-cabbage	675933	624279	512338	557153	450490	437568	542960
Mean	563136	513964	426669	475832	374889	343762	
Ranchi							
Rice -wheat	171503	169354	136199	124548	121834	100296	137289
Rice -onion	412167	404432	311211	297291	289566	224033	323117
Rice -potato	410309	371692	278149	238818	172434	160786	272031
Rice -okra	277468	277833	215056	202953	192915	137641	217311
Mean	317862	305828	235154	215903	194187	155689	
Umiam							
Bhindi-Carrot	659832	563865	600750	-	612265	-	609178
Bhindi-Potato	577736	511140	906385	-	522749	-	629503
Bhindi-Tomato	586030	561370	576590	-	362410	-	521600
Bhindi-Frenchbean	429741	514950	509160	-	475575	-	482357
Mean	563335	537831	648221	-	493250	-	
Ajmer							
Cow pea + maize (4:2) - coriander + cabbage (2:1)	166400	166460	178900	200840	153940	191080	176270
Cow pea + maize (4:2) - fennel + cabbage (2:1)	236260	244700	270980	287800	225800	277340	257147
Cow pea - fennel	188160	192640	207360	217480	187020	211640	200717
Cow pea - coriander	117840	119660	120880	128880	111340	126020	120770
Mean	177165	180865	194530	208750	169525	201520	
Narendrapur							
Rice (Gobindobhog)-broccoli-*sesbania* green maunre	1,26,276	1,22,428	80,184	76,820	79,136	86,416	95210

Rice (Shatabdi) -mustard-green gram	2,23,588	2,14,407	1,31,562	1,31,249	1,45,704	1,36,308	163803
Rice (Shatabdi) -french-bean-green gram	4,35,057	4,44,319	2,89,851	2,96,366	2,98,708	3,06,379	345114
Rice (Shatabdi) -vegetable pea-sesame	2,98,879	2,92,692	1,87,053	1,82,429	2,09,929	1,90,828	226968
Mean	2,70,950	2,68,461	1,72,163	1,71,716	1,83,369	1,79,983	
Sardarkrushinagar							
Groundnut - wheat - green gram	234609	200438	186095	212635	198304	161371	1,98,909
Green gram - coriander - vegetable cowpea	211546	168974	159848	191182	167028	133405	1,71,997
Green gram - fennel - fennel continue	78452	67971	46202	73897	74501	60178	66,867
Mean	1,74,869	1,45,794	1,30,715	1,59,238	1,46,611	1,18,318	
Udaipur							
Maize + blackgram (2:2)–wheat (*durum*)–*sesbania* (GM)	2,13,675	2,03,449	2,26,187	2,32,806	2,39,505	94,800	2,01,737
Blackgram – wheat (*Triticum aestivum)*	1,72,369	1,65,335	1,83,264	1,90,063	1,96,348	1,55,408	1,77,131
Sweet corn + blackgram (2:2)–chickpea	2,13,744	2,01,793	2,20,937	2,29,204	2,40,728	1,88,708	2,15,852
Soybean – fenugreek	1,07,226	1,01,384	1,16,110	1,20,834	1,26,510	95,612	1,11,279
Mean	1,76,754	1,67,990	1,86,625	1,93,227	2,00,773	1,33,632	

Table 7.2.17. Influence organic, inorganic and integrated production systems on cost of cultivation of different crops and cropping system at different locations

Location/cropping systems	Cost of cultivation (Rs/ha)						
	Organic (as per NPOP standards)		Inorganic		Towards organic (Integrated)		Mean
	100 % organic (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]	100 % inorganic package (No organic manures)	State recommendations or farmers package	50% Organic package +50% Inorganic package	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	
Bajaura							
Frenchbean-cauliflower-frenchbean	261856	254106	231082	266092	249224	259471	2,53,639
Fallow-cauliflower-tomato	208390	199140	171865	211865	190894	188839	1,95,166
Black gram-cauliflower-summer squash	258685	251335	218213	269713	252628	261172	2,51,958
Lady finger-pea	162815	158565	148105	175705	163562	169157	1,62,985
Mean	2,22,937	2,15,787	1,92,316	2,30,844	2,14,077	2,19,660	
Bhopal							
Soybean-durum wheat	64928	61295	61743	63174	62844	59013	62166
Soybean- mustard	56976	54871	54978	54868	55945	53971	55268
Soybean- chickpea	54444	53092	52494	52540	53508	52068	53024
Soybean- linseed	57214	55331	55166	55115	55955	54364	55524
Mean	58,391	56,147	56,095	56,424	57,063	54,854	
Calicut							
Ginger-Fallow	1,83,996	1,91,296	1,45,100		1,56,034	1,75,600	1,70,405
Turmeric-Fallow	1,82,499	1,71,712	1,48,208		1,63,989	1,73,109	1,67,903
Coimbatore							
Brinjal - pearl millet-green manure (*dhaincha*) -	1,94,351	1,73,057	1,59,462	2,19,662	1,75,245	1,64,117	1,80,982
Chillies - barnyard millet-green manure (*dhaincha*)	2,01,581	1,79,743	1,58,828	2,42,688	1,85,673	1,73,203	1,90,286

Tomato -finger millet-green manure (*dhaincha*)	2,52,228	2,10,384	1,85,841	2,75,947	2,26,775	1,98,468	2,24,941
Mean	2,16,053	1,87,728	1,68,044	2,46,099	1,95,898	1,78,596	
Dharwad							
Pigeonpea +greengram (2:4)	32714	29915	22587	29330	26280	30460	28,548
Pigeonpea +soybean (2:4)	34714	31915	24587	31330	28280	32460	30,548
Pigeonpea +groundnut (2:4)	38714	35915	28587	35330	32280	36460	34,548
Cotton +greengram (1:1)	40250	35237	22400	33965	25816	36852	32,420
Cotton +soybean (1:1)	44250	39237	26400	37965	29816	40852	36,420
Mean	38,128	34,444	24,912	33,584	28,494	35,417	
Jabalpur							
Soybean- wheat	80382	75558	73792	69535	78035	76805	75,685
Soybean-mustard-green gram	102138	99090	97689	91210	100862	98875	98,311
Soybean-berseem (fodder and seed)	84527	84079	84757	80850	85590.5	81596	83,567
Soybean-lentil- sorghum (fodder)	98792	97404	94343	88509	97516	95288	95,309
Mean	91460	89033	87645	82526	90501	88141	
Karjat							
Rice-brinjal	297056	249595	212875	206574	263895	236413	2,44,401
Rice-chickpea	143127	122019	107943	103159	134382	119811	1,21,740
Rice-field bean	150743	129873	115797	111489	141760	127189	1,29,475
Rice- onion (white)	261464	214717	178705	173002	227706	199985	2,09,263
Mean	213098	179051	153830	148556	191936	170850	
Ludhiana							
Basmati rice-chickpea-green manure	100320	108540	85432	90320	95643	91360	95,269
Basmati rice-wheat-green manure	96743	99658	75930	86987	85498	82400	87,869
Kharif moong-wheat-summer moong	121860	130476	92876	92360	104590	94587	1,06,125
Sesame-lentil	63308	61295	56320	56470	49345	58390	57,521
Mean	95558	99992	77640	81534	83769	81684	
Modipuram							
Black rice –lentil – vegetable cowpea	72580	81285	63987	63987	66854	76937	70,938

Finger millet – barley – *sesbania* rostrata green manure	82300	87430	54007	60574	73156	82408	73,313
Okra – vegetable pea – *sesbania* aculeata green manure	92500	97330	68665	78572	83245	91803	85,353
Black gram – tomato – *sunhemp* green manure	112300	118080	90569	96915	104121	112491	1,05,746
Mean	89920	96031	69307	75012	81844	90910	
Pantnagar							
Basmati rice - Wheat	92598	91723	77610	75605	94000	84094	85,938
Basmati rice – Mustard	82021	75021	62845	60840	78621	70101	71,575
Basmati rice – Vegetable pea (4 rows vegetable pea + 2 rows coriander)	90731	87481	84461	82456	88394	83065	86,098
Basmati rice – Potato	88195	82995	75553	73548	84667	88347	82,218
Mean	88386	84305	75117	73112	86421	81402	
Raipur							
Soybean-maize (sweet corn)	138095	172360	99948	101948	119029	121858	125540
Soybean- french bean	68456	77371	60238	62236	64363	75297	67993
Soybean-tomato	167634	156019	123357	125357	145506	144938	143802
Soybean-cabbage	129222	117607	84204	86204	106723	106341	105050
Mean	125852	130839	91936	93936	108905	112109	
Ranchi							
Rice -wheat	84700	70800	66300	58650	63658	50240	65,725
Rice -onion	136050	125880	117630	100780	119860	95450	1,15,942
Rice -potato	150709	134900	119050	98050	120380	110029	1,22,186
Rice -okra	100152	92300	73900	62084	83800	79469	81,951
Mean	117903	105970	94220	79891	96925	83797	
Umiam							
Bhindi-Carrot	268925	239473	246392	-	238408		248300
Bhindi-Potato	250445	219478	229500	-	201854		225319
Bhindi-Tomato	238145	211512	220090	-	201543		217823
Bhindi-Frenchbean	204415	188678	187530	-	171408		188008
Mean	240483	214785	220878	-	203303		

Ajmer							
Cow pea + maize (4:2) - coriander + cabbage (2:1)	64525	50865	52896	45031	40938	53438	51282
Cow pea + maize (4:2) - fennel + cabbage (2:1)	81685	60525	63532	51471	45136	57636	59998
Cow pea - fennel	81685	60525	63532	51471	45136	57636	59998
Cow pea - coriander	64525	50865	52896	45031	40938	53438	51282
Mean	73105	55695	58214	48251	43037	55537	
Almora							
Grain Amaranth-Wheat + Lentil	88794	81594	45446		69003		71,209
Fingermillet + Black Soybean-wheat + Toria	86641	79441	43293		66851		69,056
Mean	87,718	80,517	44,369		67,927		
Narendrapur							
Rice (Gobindobhog)-broccoli-*sesbania* green maunre	67950	60784	56134	56134	62042	57830	60145
Rice (Shatabdi) -mustard-green gram	116760	100160	80045	80045	98403	90981	94399
Rice (Shatabdi) -frenchbean-green gram	187668	148568	115008	115008	149838	129653	140958
Rice (Shatabdi) -vegetable pea-sesame	132008	115408	94571	94571	113390	106199	109358
Mean	1,26,097	1,06,230	86,440	86,440	1,05,918	96,166	
Sardarkrushinagar							
Groundnut - wheat - green gram	1,11,341	1,05,093	90,021	1,01,686	1,00,681	1,06,011	1,02,472
Green gram - coriander - vegetable cowpea	84,071	81,873	77,813	87,811	80,941	82,506	82,503
Green gram - fennel - fennel continue	74,800	66,268	42,309	67,363	68,909	58,370	63,003
Mean	90,071	84,411	70,048	85,620	83,510	82,296	
Udaipur							
Maize + blackgram (2:2)–wheat (*durum*)–*sesbania* (GM)	1,35,266	1,28,943	1,40,585	1,43,055	1,47,311	1,22,659	1,36,303
Blackgram – wheat (*Triticum aestivum)*	69,926	67,487	44,820	54,865	57,399	48,209	57,118
Sweet corn + blackgram (2:2)–chickpea	1,03,106	95,356	67,581	77,626	85,366	73,433	83,745
Soybean – fenugreek	57,790	64,054	57,575	65,873	65,801	52,224	60,553
Mean	91,522	88,960	77,640	85,355	88,969	74,131	

Table7.2.18: Influence organic, inorganic and integrated production systems on net return of different crops and cropping system at different locations

Location/cropping systems	Net Return (Rs/ha)						
	Organic (as per NPOP standards)		Inorganic		Towards organic (Integrated)		Mean
	100 % organic (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]	100 % inorganic package (No organic manures)	State recommendations or farmers package	50% Organic package +50% Inorganic package	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	
Bajaura	334082	337394	128218	244008	242826	221029	2,51,260
Frenchbean-cauliflower-frenchbean	328110	349110	137535	286735	299706	296961	2,83,026
Fallow-cauliflower-tomato	357340	363240	156697	293967	301312	275528	2,91,347
Black gram-cauliflower-summer squash	308685	328560	149095	264695	265838	226243	2,57,186
Lady finger-pea	3,32,054	3,44,576	1,42,886	2,72,351	2,77,421	2,54,940	
Mean							
Bhopal	81124	57208	34941	36727	59192	31521	50,119
Soybean-durum wheat	66121	47221	39140	37386	50693	19482	43,341
Soybean- mustard	68067	52095	36736	33263	52283	25659	44,684
Soybean- chickpea	86914	71540	49804	50419	63321	41889	60,648
Soybean- linseed	75,557	57,016	40,155	39,449	56,372	29,638	
Mean							
Calicut	1,75,101	1,48,251	1,53,171		1,99,851	1,60,912	1,67,457
Ginger-Fallow	2,26,301	2,17,488	2,74,592		2,70,011	2,07,691	2,39,217
Turmeric-Fallow							
Coimbatore	243949	2,43,803	1,77,222	1,99,483	2,01,903	1,82,998	208226.33
Brinjal - pearl millet-green manure (*dhaincha*) -	222956	2,10,576	1,40,780	1,56,637	1,61,232	1,54,481	174443.67
Chillies - barnyard millet-green manure (*dhaincha*)	232268	2,30,464	1,64,979	2,15,675	1,85,930	1,68,325	199606.83
Tomato -finger millet-green manure (*dhaincha*)	2,33,058	2,28,281	1,60,994	1,90,598	1,83,022	1,68,601	

Mean							
Dharwad	44744	35443	47193	30450	48356	52588	43,129
Pigeonpea +greengram (2:4)	46823	39714	45921	30556	45015	49634	42,944
Pigeonpea +soybean (2:4)	53078	50236	51777	38512	52316	54363	50,047
Pigeonpea +groundnut (2:4)	13577	11131	28686	7881	34384	28880	20,757
Cotton +greengram (1:1)	8155	11691	28298	8053	27661	22974	17,805
Cotton +soybean (1:1)	33,275	29,643	40,375	23,090	41,546	41,688	
Mean							
Jabalpur	68,748	69,869	60,785	19,188	58,841	49,271	54,450
Soybean- wheat	1,22,457	90,029	1,38,295	52,398	88,928	89,303	96,902
Soybean-mustard-green gram	1,66,131	1,31,981	2,14,485	1,11,268	1,82,469	1,70,628	1,62,827
Soybean-berseem (fodder and seed)	81,560	69,558	1,01,219	47,182	79,831	69,295	74,774
Soybean-lentil- sorghum (fodder)	1,09,724	90,359	1,28,696	57,509	1,02,517	94,624	
Mean							
Karjat	3,49,166	3,04,580	3,85,693	1,53,068	2,71,927	2,33,309	2,82,957
Rice-brinjal	78,030	62,061	50,819	36,847	41,605	38,883	51,374
Rice-chickpea	83,908	72,338	59,626	41,996	47,559	35,891	56,886
Rice-field bean	3,68,752	2,18,270	2,75,416	1,67,069	3,00,450	1,99,323	2,54,880
Rice- onion (white)	2,19,964	1,64,312	1,92,889	99,745	1,65,385	1,26,852	
Mean							
Ludhiana	119969	97680	64027	64663	72561	87022	84,320
Basmati rice-chickpea-green manure	118436	124542	124775	118426	96511	119422	1,17,019
Basmati rice-wheat-green manure	94777	71085	85626	82134	68712	78187	80,087
Kharif moong-wheat-summer moong	73455	58851	60890	54444	51912	59538	59,848
Sesame-lentil	1,01,659	88,040	83,830	79,917	72,424	86,042	
Mean							
Modipuram	-1,043	-26,148	-10,027	-9,127	-12,354	-30,617	-14,886
Black rice –lentil – vegetable cowpea	68,972	21,215	86,406	86,408	62,244	8,180	55,571
Finger millet – barley – *sesbania* rostrata green manure	1,82,328	1,43,464	1,55,868	1,36,873	1,25,218	93,185	1,39,489

Okra – vegetable pea – *sesbania* aculeata green manure	2,26,673	1,63,924	2,40,062	2,42,979	2,22,504	1,32,758	2,04,817
Black gram – tomato – *sunhemp* green manure	1,19,233	75,614	1,18,077	1,14,283	99,403	50,877	
Mean							
Pantnagar	2,53,087	2,06,497	1,94,707	2,00,725	2,11,473	1,64,129	205103
Basmati rice - Wheat	2,82,650	2,43,999	2,21,440	2,28,237	2,35,979	1,98,232	235090
Basmati rice – Mustard	3,22,663	2,69,030	1,90,833	2,06,728	2,32,446	2,06,293	237999
Basmati rice – Vegetable pea (4 rows vegetable pea + 2 rows coriander)	1,38,995	1,19,298	87,181	91,827	99,302	77,051	102276
Basmati rice – Potato	249349	209706	173540	181879	194800	161426	
Mean							
Raipur	441003	344100	330119	397153	266319	214492	332198
Soybean-maize (sweet corn)	215045	180582	145274	166011	126421	95736	154845
Soybean- french bean	546378	501143	435401	493471	327429	285157	431497
Soybean-tomato	546711	506672	428135	470949	343767	331227	437910
Soybean-cabbage	437284	383124	334732	381896	265984	231653	
Mean							
Ranchi	86,803	98,554	69,899	65,898	58,176	50,056	71564
Rice -wheat	2,76,117	2,78,552	1,93,581	1,96,511	1,69,706	1,28,583	207175
Rice -onion	2,59,600	2,36,792	1,59,099	1,40,768	52,054	50,757	149845
Rice -potato	1,77,316	1,85,533	1,41,156	1,40,869	1,09,115	58,172	135360
Rice -okra	199959	199858	140934	136012	97263	71892	
Mean							
Umiam	390907	324392	354358	-	373857	-	360879
Bhindi-Carrot	327291	291662	676885	-	320895	-	404183
Bhindi-Potato	347885	349858	356500	-	160867	-	303778
Bhindi-Tomato	225326	326272	321630	-	304167	-	294349
Bhindi-Frenchbean	322852	323046	427343	-	289947	-	
Mean							
Ajmer	101875	115595	126004	155809	113002	1,37,642	1,24,988
Cow pea + maize (4:2) - coriander + cabbage (2:1)	154575	184175	207448	236329	180664	2,19,704	1,97,149
Cow pea + maize (4:2) - fennel + cabbage (2:1)	106475	132115	143828	166009	141884	1,54,004	1,40,719
Cow pea - fennel	53315	68795	67984	83849	70402	72,582	69,488

Cow pea - coriander	104060	125170	136316	160499	126488	1,45,983	
Mean							
Almora	64,200	55,800	17,800		37,700		43,875
Grain Amaranth-Wheat + Lentil	48,800	37,600	12,900		31,400		32,675
Fingermillet + Black Soybean-wheat + Toria	56,500	46,700	15,350		34,550		
Mean							
Narendrapur	58326	61644	24050	20686	17094	28586	35,064
Rice (Gobindobhog)-broccoli-*sesbania* green maunre	106828	114247	51517	51204	47301	45327	69,404
Rice (Shatabdi) -mustard-green gram	247389	295751	174842	181358	148870	176726	2,04,156
Rice (Shatabdi) -frenchbean-green gram	166871	177284	92482	87858	96540	84629	1,17,611
Rice (Shatabdi) -vegetable pea-sesame	1,44,853	1,62,231	85,723	85,276	77,451	83,817	
Mean							
Sardarkrushinagar	123268	95345	96074	110949	97623	55360	96,437
Groundnut - wheat - green gram	127475	87101	82035	103371	86087	50899	89,495
Green gram - coriander - vegetable cowpea	3652	1703	3893	6534	5592	1808	3,864
Green gram - fennel - fennel continue	84,798	61,383	60,667	73,618	63,101	36,022	
Mean							
Thiruvananthapuram							
Cassava-vegetable cowpea	2,09,563	4,58,347	2,29,311	2,06,584	2,59,242	1,02,438	
Cassava-groundnut	4,02,071	3,61,417	4,40,553	3,66,450	3,55,612	5,81,956	
Taro-blackgram	-59,363	-1,62,509	-3,467	55,893	-1,12,388	-1,26,841	
Taro-greengram	94,680	66,657	1,55,508	82,168	99,905	-2,09,700	
Mean							
Udaipur	1,32,578	1,68,066	1,56,630	1,69,268	1,40,174	1,40,198	1,51,152
Maize + blackgram (2:2)–wheat (*durum*)–*sesbania* (GM)	1,22,931	1,41,896	1,25,483	1,36,733	1,20,049	1,17,126	1,27,370
Blackgram – wheat (*Triticum aestivum)*	1,15,996	1,39,556	1,30,738	1,39,458	1,06,401	1,09,297	1,23,574
Sweet corn + blackgram (2:2)–chickpea	76,093	77,833	74,930	76,661	78,351	71,703	75,929
Soybean – fenugreek	1,11,900	1,31,838	1,21,945	1,30,530	1,11,244	1,09,581	
Mean							

Table7.2.19: Influence organic, inorganic and integrated production systems on return per rupee invested of different crops and cropping system at different locations

Location/cropping systems	Net Return per Rupee Invested						
	Organic (as per NPOP standards)		Inorganic		Towards organic (Integrated)		Mean
	100 % organic (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]	100 % inorganic package (No organic manures)	State recommendations or farmers package	50% Organic package +50% Inorganic package	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	
Bajaura							
Frenchbean-cauliflower-frenchbean	1.28	1.33	0.55	0.92	0.97	0.85	0.98
Fallow-cauliflower-tomato	1.57	1.75	0.80	1.35	1.57	1.57	1.44
Black gram-cauliflower-summer squash	1.38	1.45	0.72	1.09	1.19	1.05	1.15
Lady finger-pea	1.90	2.07	1.01	1.51	1.63	1.34	1.58
Mean	1.53	1.65	0.77	1.22	1.34	1.20	
Bhopal							
Soybean-durum wheat	1.25	0.93	0.57	0.58	0.94	0.53	0.80
Soybean- mustard	1.16	0.86	0.71	0.68	0.91	0.36	0.78
Soybean- chickpea	1.25	0.98	0.70	0.63	0.98	0.49	0.84
Soybean- linseed	1.52	1.29	0.90	0.91	1.13	0.77	1.09
Mean	1.29	1.02	0.72	0.70	0.99	0.54	
Calicut							
Ginger-Fallow	0.95	0.77	1.06		1.28	0.92	1.00
Turmeric-Fallow	1.24	1.27	1.85		1.65	1.20	1.44
Coimbatore							
Brinjal - pearl millet-green manure (*dhaincha*) -	1.26	1.41	1.11	0.91	1.15	1.12	1.16
Chillies - barnyard millet-green manure (*dhaincha*)	1.11	1.17	0.89	0.65	0.87	0.89	0.93
Tomato -finger millet-green manure (*dhaincha*)	0.92	1.10	0.89	0.78	0.82	0.85	0.89
Mean	1.09	1.23	0.96	0.78	0.95	0.95	

Dharwad							
Pigeonpea +greengram (2:4)	1.37	1.18	2.09	1.04	1.84	1.73	1.54
Pigeonpea +soybean (2:4)	1.35	1.24	1.87	0.98	1.59	1.53	1.43
Pigeonpea +groundnut (2:4)	1.37	1.40	1.81	1.09	1.62	1.49	1.46
Cotton +greengram (1:1)	0.34	0.32	1.28	0.23	1.33	0.78	0.71
Cotton +soybean (1:1)	0.18	0.30	1.07	0.21	0.93	0.56	0.54
Mean	0.92	0.89	1.62	0.71	1.46	1.22	
Jabalpur							
Soybean- wheat	0.86	0.92	0.82	0.28	0.75	0.64	0.71
Soybean-mustard-green gram	1.20	0.91	1.42	0.57	0.88	0.90	0.98
Soybean-berseem (fodder and seed)	1.97	1.57	2.53	1.38	2.13	2.09	1.94
Soybean-lentil- sorghum (fodder)	0.83	0.71	1.07	0.53	0.82	0.73	0.78
Mean	1.21	1.03	1.46	0.69	1.15	1.09	
Karjat							
Rice-brinjal	1.18	1.22	1.81	0.74	1.03	0.99	1.16
Rice-chickpea	0.55	0.51	0.47	0.36	0.31	0.32	0.42
Rice-field bean	0.56	0.56	0.51	0.38	0.34	0.28	0.44
Rice- onion (white)	1.41	1.02	1.54	0.97	1.32	1.00	1.21
Mean	0.92	0.83	1.08	0.61	0.75	0.65	
Ludhiana							
Basmati rice-chickpea-green manure	1.20	0.90	0.75	0.72	0.76	0.95	0.88
Basmati rice-wheat-green manure	1.22	1.25	1.64	1.36	1.13	1.45	1.34
Kharif moong-wheat-summer moong	0.78	0.54	0.92	0.89	0.66	0.83	0.77
Sesame-lentil	1.16	0.96	1.08	0.96	1.05	1.02	1.04
Mean	1.09	0.91	1.10	0.98	0.90	1.06	
Modipuram							
Black rice –lentil – vegetable cowpea	-0.01	-0.32	-0.16	-0.14	-0.18	-0.40	-0.20
Finger millet – barley – *sesbania* rostrata green manure	0.84	0.24	1.60	1.43	0.85	0.10	0.84
Okra – vegetable pea – s*esbania* aculeata green manure	1.97	1.47	2.27	1.74	1.50	1.02	1.66

Black gram – tomato – *sunhemp* green manure	2.02	1.39	2.65	2.51	2.14	1.18	1.98
Mean	1.20	0.70	1.59	1.38	1.08	0.47	
Pantnagar							
Basmati rice - Wheat	2.73	2.25	2.51	2.65	2.25	1.95	2.39
Basmati rice – Mustard	3.45	3.25	3.52	3.75	3.00	2.83	3.30
Basmati rice – Vegetable pea (4 rows vegetable pea + 2 rows coriander)	3.56	3.08	2.26	2.51	2.63	2.48	2.75
Basmati rice – Potato	1.58	1.44	1.15	1.25	1.17	0.87	1.24
Mean	2.83	2.50	2.36	2.54	2.26	2.03	
Raipur							
Soybean-maize (sweet corn)	3.19	2.00	3.30	3.90	2.24	1.76	2.73
Soybean- french bean	3.14	2.33	2.41	2.67	1.96	1.27	2.30
Soybean-tomato	3.26	3.21	3.53	3.94	2.25	1.97	3.03
Soybean-cabbage	4.23	4.31	5.08	5.46	3.22	3.11	4.24
Mean	3.46	2.96	3.58	3.99	2.42	2.03	
Ranchi							
Rice -wheat	1.02	1.39	1.05	1.12	0.91	1.00	1.08
Rice -onion	2.03	2.21	1.65	1.95	1.42	1.35	1.77
Rice -potato	1.72	1.76	1.34	1.44	0.43	0.46	1.19
Rice -okra	1.77	2.01	1.91	2.27	1.30	0.73	1.67
Mean	1.64	1.84	1.49	1.69	1.02	0.88	
Umiam							
Bhindi-Carrot	1.45	1.35	1.44	-	1.57	-	1.45
Bhindi-Potato	1.31	1.33	2.95	-	1.59	-	1.79
Bhindi-Tomato	1.46	1.65	1.62	-	0.80	-	1.38
Bhindi-Frenchbean	1.10	1.73	1.72	-	1.77	-	1.58
Mean	1.33	1.52	1.93	-	1.43	-	
Ajmer							
Cow pea + maize (4:2) - coriander + cabbage (2:1)	1.58	2.27	2.38	3.46	2.76	2.58	2.50
Cow pea + maize (4:2) - fennel + cabbage (2:1)	1.89	3.04	3.27	4.59	4.00	3.81	3.43
Cow pea - fennel	1.30	2.18	2.26	3.23	3.14	2.67	2.47
Cow pea - coriander	0.83	1.35	1.29	1.86	1.72	1.36	1.40
Mean	1.40	2.21	2.30	3.28	2.91	2.60	

Almora							
Grain Amaranth-Wheat + Lentil	0.72	0.68	0.39		0.55		0.59
Fingermillet + Black Soybean-wheat + Toria	0.56	0.47	0.30		0.47		0.45
Mean	0.64	0.58	0.34		0.51		
Narendrapur							
Rice (Gobindobhog)-broccoli-*sesbania* green maunre	0.86	1.01	0.43	0.37	0.28	0.49	0.57
Rice (Shatabdi) -mustard-green gram	0.91	1.14	0.64	0.64	0.48	0.50	0.72
Rice (Shatabdi) -frenchbean-green gram	1.32	1.99	1.52	1.58	0.99	1.36	1.46
Rice (Shatabdi) -vegetable pea-sesame	1.26	1.54	0.98	0.93	0.85	0.80	1.06
Mean	1.09	1.42	0.89	0.88	0.65	0.79	
Sardarkrushinagar							
Groundnut - wheat - green gram	1.11	0.91	1.07	1.09	0.97	0.52	0.95
Green gram - coriander - vegetable cowpea	1.52	1.07	1.05	1.18	1.06	0.62	1.08
Green gram - fennel - fennel continue	1.33	1.26	1.08	1.5	1.46	1.09	1.29
Mean	1.32	1.08	1.07	1.26	1.16	0.74	
Thiruvananthapuram							
Cassava-vegetable cowpea	1.52	2.14	1.89	1.76	1.77	1.25	1.72
Cassava-groundnut	2.34	2.11	2.75	2.43	2.13	2.74	2.42
Taro-blackgram	0.89	0.85	0.92	0.96	0.75	0.77	0.86
Taro-greengram	1.17	1.12	1.46	1.23	1.22	0.61	1.14
Mean	1.48	1.56	1.76	1.60	1.47	1.34	
Udaipur							
Maize + blackgram (2:2)–wheat (*durum*)–*sesbania* (GM)	0.98	1.30	1.11	1.18	0.95	1.14	1.11
Blackgram – wheat (*Triticum aestivum)*	1.76	2.10	2.80	2.49	2.09	2.43	2.28
Sweet corn + blackgram (2:2)–chickpea	1.13	1.46	1.93	1.80	1.25	1.49	1.51
Soybean – fenugreek	1.32	1.22	1.30	1.16	1.19	1.37	1.26
Mean	1.29	1.52	1.79	1.66	1.37	1.61	

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^2. 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 (Table 7.2.2.1. & 2)

Performance of maize: Seven 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 higher grain yield (51.3 q/ha) followed by Girija (4910 kg/ ha), L-315 (4850 kg/ha) and Palampur Sankar Makka-II (4800 /ha). However, number of cobs per hectare were recorded maximum in case of Girija (39688). The fresh weight of cob (67.1q/ ha) was observed maximum in varitety Bajaura Makka. Further, plant height (258.6cm), cob length (18.9cm), cob diameter (4.7cm) and number of rows per cob (15.1) were observed maximum in variety Early Composite, L-315, Palampur Sankar

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

Varieties/ hybrids	Plant height (cm)	Number of cobs/ ha	Fresh weight of cobs (q)/ha	Cob length (cm)	Cob diameter (cm)	No. of rows/ cob	Moisture (%)	1000 Grain weight (g)	Grain yield (q/ha)	Net Returns (RS. / ha)	B:C ratio
Early Composite	258.6	39200	59.7	18.1	4.2	14.7	15.3	229.0	4300	58243	1.60
Girija	250.3	39688	63.3	18.3	4.5	14.7	18.5	327.7	4910	71517	1.96
Bajaura Makka	237.3	39318	67.1	18.6	4.3	15.1	16.0	330.3	5130	76357	2.10
Palampur Sankar Makka II	207.8	37281	64.3	18.8	4.7	14.9	18.4	294.3	4800	69097	1.90
L-317	212.2	39630	60.9	16.4	4.4	14.8	16.0	268.3	4580	64330	1.76
L-315	217.0	38785	64.0	18.9	4.5	14.7	16.5	302.0	4850	70270	1.93
CD (P= 0.05)	215.01	NS	2.41	0.39	NS	NS	0.38	6.01	354	7795	0.22

Performance of wheat: Six varieties of wheat were evaluated for their performance under organic conditions during *Kharif*. The data revealed that all the varieties showed significant differences for the different traits. The variety HPW-368 recorded significantly higher grain yield (34.2 q/ha) followed by HPW-373 (32.0 q/ha), HPW-349 (30.9 q/ha). All the traits such as number of tillers per m2 (94.7) and 1000grain weight (46.4g) was found significantly higher in variety HPW-368.Further, the maximum net returns (Rs. 1,11,066 /ha) and B:C (3.07) was found maximum in variety HPW-368.

Table 7.2.2.2. Yield attributes and yield of wheat (*rabi*) under organic condition at Bajaura

Varieties/hybrids	Grain yield (kg/ha)	Number of tillers/ m^2	1000-grains weight (g)	Net returns (RS. /ha)	B:C
HPW-368	3420	94.7	46.4	111066	3.07
HS-507	2970	82.3	42.0	91389	2.53
HS-562	2930	83.7	40.0	89938	2.49
HPW-349	3090	89.7	43.8	96934	2.68
HPW-373	3200	88.0	46.0	101275	2.80
HPW-360	2440	67.7	32.4	68833	1.90
CD (P= 0.05)	416	9.26	4.13	17835	0.49

*Hybrids

Best performing maize variety Bajaura Makka

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

Bhopal (Table 7.2.2.3 & 4)

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: Among the varieties of groundnut grown under similar organic nutrient source and doses, the cultivar GPBD-5 out performed in terms of yield followed by GJG-17, DH-86, DH-256, ICGV-16697, GG-20, DH-232, DH-101, JL-24, ICGV-16690, DH-245 and GJGHPS-1. Seed yield of GPBD-5 (1989 kg ha^{-1}) was found significantly higher than others.

Table 7.2.2.3: Yield attributes yields and quality of groundnut under organic management at Bhopal

Variety	Plant height (cm)	Pods/ plant	Seeds/pod	Pod yield (kg/ha)	Total Biomass (kg/ha)
ICGV-16697	39.9	26.3	2.3	1624	3380
GJG-17	43.1	32.7	2.7	1962	4819
DH-256	40.9	31.4	2.3	1749	3978
GJGHPS-1	35.0	23.0	2.0	1507	3302
GG-20	36.8	25.8	2.0	1673	3526
ICGV-16690	41.1	26.4	2.3	1676	3458
DH-86	38.4	27.0	1.7	1847	3698
DH-101	35.6	22.8	2.0	1664	4690
GPBD-5	44.0	35.3	3.0	1989	5092
JL-24	39.7	30.6	2.0	1640	4324
DH-245	36.3	24.0	2.0	1589	3751
DH-232	39.3	26.4	2.0	1667	3918
CD (P= 0.05)	3.4	4.5	NS	238	461

Performance of Mustard: Performance of different varieties of mustard was evaluated for their yield response to screen out promising varieties for organic management practices for central India. Plant height of different varieties were not significantly affected under similar nutrient management under organic farming; however, different yield attributing parameter such as siliqua/ plant, seeds/siliqua, test weight and yields significantly differ under organic nutrient management. Among the varieties of mustard grown under similar organic nutrient source and doses, the cultivar ARAVALI out performed in terms of seed yield followed by CS-52, DRMR-IJ – 31, PM-22, PGN-229, NRCDR-2, PUSA MAHAK, DRMR-150-35, MAYA, NRCHB-101 NRCDR-601, and RH-749. Seed yield of ARAVALI (1144 kg ha^{-1}) and total biomass (4580 kg ha^{-1}) was found significantly higher than others.

Best performing variety of groundnut and mustard crop GPBD-5 and Aravali

Table 7.2.2.4: Yield attributes, yield and quality of different mustard varieties/hybrids under organic management at Bhopal

Variety	Plant height (cm)	Siliqua/ plant	Seeds/ siliqua	Test weight (g)	Seed yield (kg ha^{-1})	Total biomass yield (kg ha^{-1})
DRMR-IJ - 31	145	234	11.0	6.2	1098	4147
NRCDR-2	138	216	10.3	5.5	961	3660
NRCHB-101	134	207	10.3	5.7	853	3114
DRMR-150-35	138	209	11.7	5.7	910	3663
NRCDR-601	131	206	10.0	5.5	793	3397
RH-749	130	196	9.7	6.2	758	3367
ARAVALI	147	245	13.0	6.4	1144	4580
PUSA MAHAK	141	205	12.0	6.1	926	3499
CS-52	143	240	12.7	6.2	1110	4355
MAYA	137	211	12.0	5.7	885	3770
PM-22	141	219	10.7	5.5	966	3910
PGN-229	142	229	11.0	6.1	928	3772
CD (P= 0.05)	NS	29	1.7	0.4	160	780

Calicut (Table 7.2.2.5)

Among the varieties significantly higher yield was recorded by Suguna (59.10 t/ha) followed by Pragati (56.30 t/ha). Significant difference in oil, oleoresin and curcumin content in turmeric varieties was observed under organic management (100%). Among the varieties significantly higher oil content was noticed in varieties Shobha (6.40%) followed by Varna (5.87%) and Kanthi. Among the varieties Suguna (12.47%) was superior in oleoresin content and least was recorded in Sona (7.73 %) on comparison with other varieties. The variety Prabha (5.87%) recorded maximum curcumin followed by Prathibha (5.71%) and Kedaram (5.5%).

Table 7.2.2.5: Response of different management systems on yield and quality of turmeric at Calicut

Varieties	Yield (t/ha)	Oil content (%)	Oleoresin content (%)	Curcumin (%)
Prathibha	27.46	4.27	10.20	5.71
Aleppey Supreme	20.47	4.80	10.97	5.45
Varna	17.60	5.87	8.03	2.66
Shoba	12.30	6.40	7.93	2.78
Sona	15.05	5.47	7.73	2.52
Kanthi	16.25	5.60	8.63	2.82
Suvarna	19.35	5.70	9.17	2.48
Suguna	59.10	4.67	12.47	4.58
Sudarsana	51.60	4.53	10.83	4.85
Kedaram	32.75	4.87	12.43	5.50
Prabha	29.40	5.27	9.03	5.86
Pragati	56.30	4.93	11.75	4.48
Mean	29.80	5.20	9.93	3.98
(CD=0.05)	3.13	0.39	0.98	0.34

Best performing variety Suguna of turmeric at Calicut

Coimbatore (Table 7.2.2.6 & 7)

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

Performance of rice: All the traits showed significant difference among rice varieties evaluated under organic condition. Among the twelve traditional rice cultures grown organically, significantly the highest plant height at harvest was recorded in Anaikomban (147.5 cm), while Poonkar been smallest (108.0 cm). Variation in productive tillers (numbers/hill) recorded in range from 13.4 to 24.4. Kuzhiadichan had the maximum productive tillers (24.4 numbers/hill) while Poonkar had least numbers of productive tillers/ hill (13.4). The highest panicle length of 26.9 cm was recorded in Anaikomban, It was followed by Kuzhiadichan (25.6 cm), Poonkar (24.9 cm), Illuppaipoo samba (24.6 cm) which were comparable with each other. Garudan samba recorded significantly the lowest panicle length of 21.2 cm. Grain yield difference was observed significantly among the rice varieties ranged from 1859 to 4534 kg/ha. Kuzhiadichan recorded highest grain yield (4534 kg/ha) while Poonkar had lowest grain yield (1859 kg/ha). Anaikomban recorded highest straw yield of 11177 kg/ha followed by Garudan samba 0f 9780 kg/ha. Rice variety Improved White Kuzhiadichan fetched the highest net return of Rs.1,80,035/ha followed by Anaikomban (Rs.1,56,676/ha). Lowest net return per hectare was observed in rice variety Poonkar (Rs.37,912/ha). Likewise benefit cost ratio was also obtained with Improved Kuzhiadichan of 3.37.

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

Varieties	Plant height at harvest (cm)	Productive tillers/hill (Nos.)	Panicle length (cm)	No. of filled grains panicle^{-1}	Grain yield (kg/ha)	Straw yield (kg/ha)	Gross return (Rs./h)	Net return (Rs./h)	B:C ratio
Athur Kichili samba	121.8	18.9	22.9	219.6	3475	9690	202820	126965	2.67
Garudan samba	131.8	20.0	21.2	201.3	3646	9780	211640	135785	2.79
Illuppaipoo samba	122.6	16.9	24.6	185.6	2676	8399	158997	83142	2.10
Milagu samba	123.4	19.5	22.0	162.4	4099	8222	229616	153761	3.03
Poonkar	108.0	13.4	24.9	115.5	1859	6939	113867	37912	1.50
Sorna masuri	123.7	19.9	21.8	224.4	4055	8617	228601	152746	3.01
Thuaiya malli samba	122.5	18.6	23.3	253.8	3355	8398	192944	117089	2.54
Thanga samba	121.7	17.3	21.5	168.4	2455	8552	148406	72551	1.96
Kuzhiadichan	134.3	24.4	25.6	182.8	4534	9730	255890	180035	3.37
Kullakar	131.3	17.1	21.8	152.6	3972	8534	224202	148347	2.96
Anaikomban	147.5	21.6	26.9	213.8	3980	11177	232531	156676	3.07
Thulasi vasa samba	122.4	16.5	23.8	158.8	3049	8082	176696	100841	2.33
CD (P=0.05)	10.25	2.48	1.98	7.79	431.24	1089.12			

Out of the twelve traditional varieties evaluted for their reaction to thrips, the minimum per cent damage (4.17) was recorded in Poonkar, followed by Athur Kichili samba (4.25) whereas the maximum damage of 7.10 per cent observed in the Anaikomban. Regarding leaf folder damage at 40 DAT, Kuzhiadichan registered the lowest damage of 0.13 per cent as against the maximum of 2.40 per cent damage in Sorna masuri. With respect to stem borer damage, Anaikomban registered the lowest damage (0.14 per cent), followed by Milagu samba, as against 0.63 per cent in Kuzhiadichan

Table 7.2.2.7: effect of Insect-pest incidence on traditional varieties of rice at Coimbatore

Traditional varieties	Thrips damage (%)	Leaf folder damage at 40 DAT (%)	Stem borer damage (%)
Athur Kichili samba	4.25	0.99	0.46
Garudan samba	6.04	1.78	0.39
Illuppaipoo samba	5.88	0.80	0.51
Milagu samba	4.73	2.61	0.16
Poonkar	4.17	1.08	0.47
Sorna masuri	6.52	2.40	0.27
Thuaiya malli samba	5.29	0.66	0.30
Thanga samba	4.53	0.64	0.36
Kuzhiadichan	6.61	0.13	0.63
Kullakar	6.31	0.75	0.20
Anaikomban	7.10	0.22	0.14
Thulasi vasa samba	5.24	1.59	0.17

Rice and green gram varieties at Coimbatore

Dharwad (Table 7.2.2.8 & 9)

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

Performance of soybean-wheat: Soybean varieties recorded ranged between 999 to 1615 kg/ha as soybean variety DSB-34 recorded higher yield and MACS 1188 as lower performer in term of yield/ha. Similarly, DSb 23 recorded higher net return (Rs/ha) and B:C ratio. In case of wheat, among the different varieties UAS BW-11421 and UAS DW-30337 performed better in term of grain yield. Cost of cultivation during rabi for wheat recorded of Rs. 24790/ha but net return could not achieve due to lower yield.

Performance of groundnut-sorghum: Significant differences for groundnut and sorghum varieties for yield were observed. Among the groundnut varieties, Dh-245 recorded maximum seed yield of 2380 kg/ha, whereas DBG-4 produced lowest yield of 1550 kg/ha under organic condition. Among sorghum varieties, SPV-2217 recorded maximum grain yield (1640 kg/ha) which was significantly higher to other varieties whereas M-35-1 recorded minimum grain yield (1020 kg/ha). Cost of cultivation of groundnut and sorghum recorded of Rs. 57285 and 26265/ha respectively. In term of net return (Rs./ha), and B:C ratio similar trend was observed as Dh 245 of groundnut and SPV-2217 of sorghum recorded higher net return and B:C ratio

Table 7.2.2.8: Yield of groundnut and sorghum cultivars under organic condition at Dharwad

	Yield (kg/ha)	Cost of cultivation (Rs.ha)	Net return (Rs./ha)	B:C ratio
Soybean genotypes				
DSb-21	1044	36145	5074	1.14
JS-93-05	1201	36145	11281	1.31
MACS 1188	999	36145	3321	1.09
DSb-23	1540	36145	24672	1.68
DSb-34	1615	36145	27657	1.77
CD (P=0.05)	40.6			
Wheat genotypes				
UAS-347	935	24790	-4868	0.80
UAS BW-11421	1067	24790	-3888	0.84
UAS BW-11587	989	24790	-5674	0.77
UAS DW-30337	1037	24790	-3283	0.87
UAS DW-30508	949	24790	-4731	0.76
CD (P=0.05)	34.0			

Table 7.2.2.9: Yield of groundnut and sorghum cultivars under organic condition at Dharwad

	Yield (kg/ha)	Cost of cultivation (Rs.ha)	Net return (Rs./ha)	B:C ratio
Groundnut genotypes				
Dh-256	2113	57285	59987	2.05
DBG-3	1718	57285	38175	1.67
DBG-4	1550	57285	28740	1.50
Dh-245	2380	57285	74805	2.31
Girnar-4	1760	57285	59987	1.71
CD (P=0.05)	184.7			
Sorghum genotypes				
DSV-4	1415	26265	12756	1.49
SPV-2831	1360	26265	11235	1.43
M-35-1	1020	26265	1878	1.07
SPV-2217	1640	26265	18966	1.72
SPV-2468	1580	26265	17311	1.66
CD (P=0.05)	141.9			

Soybean and wheat varieties at Dharwad

Best performing groundnut and wheat variety at Dharwad

Jabalpur (Table 7.2.2.10 & 11)

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

Performance of soybean varieties: The seed and haulm yield of different soybean varieties under organic nutrient management system varied significantly. Soybean variety JS 20-69 resulted in significantly highest seed yield of 1171 kg/ha followed by JS 20-116 (1090 kg/ha) being at par to J S 20-69 (1016.67 kg/ha). The lowest yield was recorded with NRC 136 and RVS 76. Soybean varieties JS 20-69, JS 20-116 and JS 20-98 attained higher values of yield attributing characters particularly number of branches, seeds/pod, pods/plant and seed index which ultimately resulted in higher seed. (Table 7.2.2.10).

Performance of chickpea varieties: Maximum seed yield of chickpea (1846 kg ha^{-1}) was recorded with the variety JG 12 which was closely followed by JG 16 (1543 kg ha^{-1}) and JG 322 (1512 kg ha^{-1}). Variety JG 11 recorded lowest seed yield of 796 kg ha^{-1}. The growth and yield attributes of different chickpea varieties differed significantly, which in turn resulted in significant variation in the grain yield. However, the number branches /plant, seeds/pod and pods/plant in variety JG 12, JG 16 and JG 322 were significantly more than the other varieties (Table 7.2.2.11).

Economics of different varieties of soybean and chickpea: The cost of cultivation of soybean varieties under organic nutrient management was Rs. 31524 ha^{-1}. The maximum net returns of Rs 37512 ha^{-1} and B:C ratio of 2.18 were obtained with the variety JS 20-69 followed by JS 20-116 of Rs 33742 ha^{-1} and 2.07, respectively. The cost of chickpea production under organic system was Rs. 35327 ha^{-1}. Among different varieties, JG 12 gave maximum net monetary returns of Rs 89851/ha/year and the B;C ratio of 3.54 which was closely followed by the variety JG 16 (Rs. 69599 ha^{-1} and 2.97).and JG 322 (Rs. 68007 ha^{-1} and 2.93), respectively.

Table 7.2.2.10: Yield attributes and yield of soybean varieties under organic farming at Jabalpur

Soybean varieties	Plant height (cm)	Branches/ plant	Leaf area index	Seeds/ pod	Pods/ plant	Test weight (g)	Seed Yield (kg/ha)	Haulm Yield (kg/ha)	Harvest Index (%)	Cost of cultivation (Rs./ha)	Net return (Rs./ ha)	B:C ratio
NRC 86	54.7	5.4	5.42	2.9	54.2	6.16	808	1853	30.4	31524	16292	1.51
NRC 128	58.0	4.2	4.92	2.4	30.9	3.6	276	579	32.8	31524	-15403	0.51
NRC 130	53.0	3.6	4.39	2.7	29.3	4.83	370	781	32.5	31524	-9899	0.68
NRC 136	52.3	4.6	4.72	2.6	32.7	4.46	252	728	25.7	31524	-16668	0.47
JS 20 - 29	57.3	4.3	5.12	2.8	43.3	5.65	566	1158	32.7	31524	785.50	1.02
JS 20 - 34	39.2	3.8	3.88	2.7	34.0	6.39	296	889	25.2	31524	-13154	0.58
JS 20 - 69	64.1	5.4	6.38	3.0	74.3	7.26	1171	2613	31.0	31524	37512	2.18

Soybean varieties	Plant height (cm)	Branches/ plant	Leaf area index	Seeds/ pod	Pods/ plant	Test weight (g)	Seed Yield (kg/ha)	Haulm Yield (kg/ha)	Harvest Index (%)	Cost of cultivation (Rs./ha)	Net return (Rs./ ha)	B:C ratio
JS 20-98	51.0	4.7	5.55	2.7	44.6	6.13	1017	2510	28.8	31524	29316	1.92
JS 20 -116	63.7	5.2	5.73	2.7	72.3	6.34	1090	2680	29.5	31524	33742	2.07
RVS 18	51.1	4.0	4.47	2.4	31.3	4.17	235	593	28.4	31524	-17387	0.44
RVS 24	54.4	4.4	5.27	2.6	41.4	6.78	700	1298	34.2	31524	8685	1.27
RVS 76	54.0	4.2	4.92	2.3	32.2	4.18	263	735	26.3	31524	-15451	0.50
CD (P=0.5)	54.7	5.4	5.42	2.9	54.2	6.16	808	1853	30.4			

Table 7.2.2.11: Yield attributes and yield of chickpea varieties under organic farming at Jabalpur

Chickpea varieties	Plant height (cm)	Branches /plant	Seeds/ pod	Pods/ plant	Test weight (g)	Seed Yield (kg/ha)	Haulm Yield (kg/ha)	Harvest Index (%)	Cost of cultivation (Rs./ha)	Net return (Rs./ha)	B:C ratio
JG 218	38.8	2.6	1.22	39.2	20.62	873	1958	30.9	35327	25158	1.71
JG 11	38.3	2.6	1.11	37.7	28.53	796	1910	30.3	35327	20193	1.57
JG 12	43.7	3.8	1.89	56.1	19.71	1846	2998	38.4	35327	89851	3.54
JG 14	40.0	2.7	1.22	40.6	24.64	994	2104	32.2	35327	33301	1.94
JG 16	43.7	3.7	1.78	54.0	22.13	1543	2624	38.4	35327	69599	2.97
JG 24	66.5	3.2	1.44	45.3	29.68	1172	2300	34.3	35327	45138	2.28
JG 36	40.5	2.8	1.33	42.3	17.54	1022	2198	31.8	35327	35384	2.00
JG 63	42.0	3.2	1.55	47.9	23.65	1236	2330	35.6	35327	49293	2.40
JG 30	41.0	2.9	1.33	43.3	31.06	1071	2203	32.8	35327	38521	2.09
Indira chana	42.4	3.1	1.44	44.1	32.55	1127	2203	33.9	35327	42091	2.19
JG 322	48.0	3.4	1.56	53.7	19.19	1519	2599	36.9	35327	68007	2.93
JAKI 9218	42.0	2.7	1.22	40.2	29.5	941	2061	31.4	35327	29942	1.85
CD (P=0.5)	2.6	0.6	3.31	NS	NS	161.02	496	-			

Best performing variety of soybean (JS 20-69) and chickpea (JG12) under organic farming at Jabalpur

Karjat (Table 7.2.2.12 & 13)

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.

Performance of rice varieties: Fifteen varieties of rice 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. Variation for grain yield among the rice varieties ranged from 3071 to 4610 kg/ha. Among the rice varieties grouped in four categories, rice variety Sahyadri-4 (early maturing), Sahyadri-3 (mid-late maturing), Sahyadri-5 (late maturing) and karjat-3 which is popular among farmers recorded significantly higher grain yield (4353, 4600, 4610 and 4126 kg/ha respectively) over rest of varieties but these are statistically on par to each other Ratnagiri-1 recorded lowest yielded (30.71 q/ha) among the rice varieties (Table 7.2.2.12).

Performance of cowpea varieties: Significantly higher seed yield (1334 kg/ha) of groundnut recorded in Konkan Sadabahar followed by Phule Sonali, Phule Pandhari and Phule Vithai but these are statistically on par to each other. The variation in other varieties of groundnut from 717 to 1334 kg/ha. Panvel Red produced lower yield among the varieties (Table 7.2.2.12).

Table 7.2.2.12: Evaluation of response for different varieties of rice and cowpea on yields at Karjat

Kharif				*Rabi*		
Rice varieties		**Grain yield (kg ha^{-1})**	**Straw yield (kg ha^{-1})**	**Cowpea varieties**	**Seed yield (kg ha^{-1})**	**Stover yield (kg ha^{-1})**
Early	Karjat - 4	3177	4309	GC-2	869	1279
	Karjat-7	3304	4516	GC-3	848	1668
	Ratnagiri-1	3071	4417	GC-4	1123	1347
	Sahyadri-4	4353	5970	GC-5	1267	2067
Mid-late	Karjat-5	3674	4599	GC-6	1165	1551
	Karjat-6	3268	4110	Phule Pandhari	1285	2002
	Palghar-1	3404	4398	Phule Vithai	1234	2067
	Sahyadri-3	4600	6081	Phule Sonali	1288	2082
Late	Ratnagiri-2	3632	4977	Pusa Falguni	747	1073
	Ratnagiri-3	3557	4716	PCP-1131	975	1565
	Karjat-8	3573	4259	Dalkhan Local	1211	1169
	Sahyadri-5	4610	6171	Konkan Sadabahar	1334	1413
Grown by Farmers	Karjat-3	4126	4658	Konkan Safed	1216	2024
	Jaya	3359	4401	Panvel Local	934	1497
	Karjat-2	3363	4158	Panvel Red	717	2152
CD (P=0.05)		213	472	CD (P=0.05)	154	231

System equivalent yield and economics of rice-cowpea system (Table 7.3.13): Significantly higher rice equivalent yield (REY 10941 kg/ha), net return (Rs. 1,14,079/ha) and benefit cost ratio (1.75) were recorded with system Sahyadri-5 (rice) in *kharif* and Konkan Sadabahar (groundnut) in *rabi* compared to other varieties evaluated in the system. Lowest system equivalent yield and net return was recorded in rice (karjat-2) - groundnut (Panvel red) of 7005 kg/ha and Rs. 18,263/ha respectively.

Table 7.2.2.13. System equivalent yield and economics of rice-cowpea system under organic management at Karjat

Rice	Cowpea	System's equivalent yield (kg ha^{-1})	Gross returns (Rs. ha^{-1})	Net returns (Rs. ha^{-1})	B:C ratio
Karjat - 4	GC-2	7371	178735	27115	1.18
Karjat-7	GC-3	7475	181260	29640	1.20
Ratnagiri-1	GC-4	8296	201180	49330	1.32
Sahyadri-4	GC-5	10450	253421	102185	1.68
Karjat-5	GC-6	9111	220935	69085	1.45
Karjat-6	Phule Pandhari	9232	223885	72265	1.48
Palghar-1	Phule Vithai	9193	222933	71313	1.47

Rice	Cowpea	System's equivalent yield (kg ha^{-1})	Gross returns (Rs. ha^{-1})	Net returns (Rs. ha^{-1})	B:C ratio
Sahyadri-3	Phule Sonali	10802	261958	110722	1.73
Ratnagiri-2	Pusa Falguni	7338	177935	26085	1.17
Ratnagiri-3	PCP-1131	8262	200357	48737	1.32
Karjat-8	Dalkhan Local	9162	222184	70564	1.47
Sahyadri-5	Konkan Sadabahar	10941	265315	114079	1.75
Karjat-3	Konkan Safed	9831	238401	86551	1.57
Jaya	Panvel Local	7818	189593	37743	1.25
Karjat-2	Panvel Red	7005	169883	18263	1.12
CD (*P=0.05*)		746			

Ludhiana (Table 7.2.2.14 & 15)

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 (Table 7.2.2.14): Basmati rice variety Basmati 386 attained the highest plant height (145.2 cm) which was statistically at par with Basmati 370 and significantly higher than the other varieties (7.3.8.1). The lowest plant height was observed in Punjab Basmati 4 (103.5 cm), which was statistically at par with RYT 3677, RYT 3522 and RYT 3722 but significantly lower than all the other varieties. The highest number of effective tillers/m2 (370) were recorded in genotype RYT 3727 which were significantly higher than all the other varieties/genotypes. The Basmati 370 recorded the lowest number of effective tillers/m^2 (270.3). The highest panicle length (30 cm) was observed in RYT 3727. The highest number of grains per panicle (62.3) was observed in Pusa basmati 1509, which was significantly higher than all the other varieties. Thousand-grain weight was not significantly affected with different varieties/genotypes.

Basmati rice grain yields varied from 1720-3730 kg/ha with a maximum per cent variation of 55.5. Basmati genotype RYT 3727 recorded the highest grain yield (3730 kg/ha), which was statistically at par with RYT 3727, RYT 3993, RYT 3998, RYT 4069, Punjab basmati 4, Punjab basmati 3, Punjab basmati 2, Punjab basmati 5, Punjab basmati 7 but significantly higher than all the other varieties. The lowest grain yield (1720 kg/ha) was recorded with Basmati 370 and it was statistically at par with Basmati 386. Among the recommended varieties, Pusa Basmati 1509 gave the highest grain yield (3630 kg/ha).

Table 7.2.2.14: Performance of basmati rice varieties under organic management at Ludhiana

Rice varieties	Plant height (cm)	Effective tillers/m^2	Panicle length (cm)	Grains/ panicle	1000-grains weight (g)	Grain yield (kg/ha)	Straw yield (kg/ha)
Punjab Basmati 7	115.2	323.0	27.9	57.7	25.9	35.3	63.4
Punjab Basmati 5	114.4	321.7	25.9	57.3	24.8	30.7	61.8
Punjab Basmati 4	103.5	331.0	28.4	60.0	26.9	34.2	63.5
Punjab Basmati 3	113.0	327.3	27.3	57.7	26.7	33.5	63.8
Punjab Basmati 2	118.2	317.0	26.6	57.0	25.6	32.8	63.6
Basmati 386	145.2	270.3	24.4	55.7	24.6	18.7	55.6
Basmati 370	143.8	272.0	25.4	53.0	23.3	17.2	51.3
CSR 30	131.9	307.0	25.4	54.2	23.7	21.4	60.5
Pusa Basmati 1121	116.4	333.3	27.5	61.0	27.0	28.8	63.1
Pusa Basmati 1509	106.7	324.7	29.1	62.3	27.4	36.3	66.2
Pusa Basmati 1718	113.4	320.0	27.2	59.1	25.9	34.5	63.3
RYT 3649	111.2	342.0	27.5	62.1	28.7	35.4	67.2

Rice varieties	Plant height (cm)	Effective tillers/m^2	Panicle length (cm)	Grains/ panicle	1000-grains weight (g)	Grain yield (kg/ha)	Straw yield (kg/ha)
RYT 3727	118.2	370.0	30.0	50.9	28.6	37.3	59.6
RYT 3993	120.8	360.3	29.4	53.8	28.9	36.5	58.1
RYT 3998	121.5	358.3	29.5	53.0	28.9	36.0	56.2
RYT 4069	126.6	355.0	29.6	54.6	28.6	35.5	57.7
CD (P=0.05)	4.6	7.1	2.7	4.8	NS	5.9	5.1

Performance of wheat varieties (Table 7.2.2.15): Significant differences were observed among the varieties for plant height, effective tillers and grain yield. The highest plant height (121.7 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 Unnat PBW 550 (89.5 cm) and it was significantly lower than all the other wheat varieties. The number of effective tillers was maximum in Unnat PBW 550 (282.0) which was at par with BWL 3498 but significantly higher than all other varieties/cultivars. Spike length was the highest in Unnat PBW 550 and Bansi gold (9.3 cm) but the differences among all the varieties were non-significant. The highest thousand-grain weight (43.1 g) was observed in Unnat PBW 550, but the differences among all the varieties were non-significant.

Table 7.2.2.15: Performance of wheat varieties under organic management at Ludhiana

Wheat varieties	Plant height (cm)	Effective tillers/m^2	Spike length (cm)	Grains/spike	1000-grains weight (g)	Grain yield (kg/ha)	Straw yield (kg/ha)
PBW 1 Zn	101.1	263.7	9.1	33.1	37.0	2070	3900
C 306	121.7	248.0	8.9	37.9	39.5	2350	4630
BWL 3500	98.5	244.7	9.2	38.3	40.3	2780	4670
PBW 175	99.1	243.3	8.9	38.0	39.5	2460	4740
PBW 660	96.9	273.7	6.1	39.9	40.3	3030	4860
BWL 3498	104.8	279.0	9.1	41.0	41.7	3010	5460
Unnat PBW 343	93.7	270.0	9.1	39.7	40.6	2730	5190
Unnat PBW 550	89.5	282.0	9.3	44.0	43.1	3200	5520
PBW 1 Chapati	93.4	272.0	8.8	37.4	39.2	2390	4650
Bansi Gold	96.5	242.3	9.3	34.2	36.4	2340	4230
Kandi Area Landmark	93.7	235.0	9.0	43.6	35.3	2140	3740
Punjab Shingar	94.1	248.3	8.9	44.2	32.9	2340	4160
CD (P=0.05)	5.9	6.5	NS	4.1	NS	400	470

The wheat grain yield varied from 2070-3200 kg/ha among different varieties and the maximum percent variation was 35.3. The highest grain yield (3200 kg/ha) was observed in PBW 550 and it was statistically at par with Unnat PBW 660 and BWL 3498 but was significantly higher than all the other varieties. The lowest grain yield was recorded with PBW 1 Zn (2070 q/ha). Straw yield was the highest in Unnat PBW 550 (5520 kg/ha), which was statistically at par with BWL 3498 and Unnat PBW 343 but significantly higher than all the other varieties.

Modipuram (Table 7.2.2.16 & 17)

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 (19133 kg/ha) was recorded under Pusa Hara Baigan variety followed by Kashi Uttam (17975 kg/ha) and Hybrid F1 143 (15530 kg/ha) varieties. Cost of cultivation was similar among different varieties and highest net return was found under Pusa Hara Baigan followed by Kashi Uttam and Hybrid F1 143 varieties.

Table 7.2.2.16: Yield and economics of different brinjal varieties under organic farming at Modipuram

Maize varieties/ hybrids	Yield (kg/ha)	Cost of cultivation (Rs/ha/annum)	Gross return (Rs/ha/annum)	Net Returns (Rs/ha/annum)
Hybrid F1-143	15530	89299	194120	104821
Hybrid F1 Kritika	14522	89299	181528	92229
Hybrid 992	13131	89299	164144	74845
Hybrid Navkiran	15394	89299	192431	103132
Bharat 798	14540	89299	181750	92451
Hybrid F1 Pragti	7237	89299	90463	1164
Kashi Uttam	17975	89299	224690	135391
Pusa Uttam	7037	89299	87963	-1336
Pusa Hara Baigan	19133	89299	239167	149868

Performance of vegetable pea varieties: Among the tested varieties of mustard, highest yield (5542 kg/ha) was recorded under Prachi 10 variety followed by PS 1100 (4945 kg/ha) (Table 5). Cost of cultivation was similar among different varieties and highest net return was found under Prachi 10 variety followed by PS 1100 and PS 10 varieties (Table 7.2.2.17).

Table 7.2.2.17 Performance and economics of Veg. pea varieties/hybrids under organic farming

Varieties	No. of pods/ plant	10 pod weight (g)	Pod length (cm)	No. of seeds/ pod	Pod yield (kg/ha)	Cost of Cultivation (Rs/ha)	Gross return (Rs/ ha)	Net returned (Rs/ha)
PB 89	14.3	40.8	8.6	7.1	3886	39650	97139	57489
Improved king 50	13.8	37.2	8.5	6.9	1594	39650	39843	193
PS 10	13.3	40.1	8.2	6.7	4097	39650	102435	62785
Mahima 3636	13.7	35.5	9.0	7.0	3067	39650	76676	37026
Pusa Prabal	13.3	37.0	7.8	6.6	2058	39650	51458	11808
Prachi 10	15.8	39.1	7.4	7.2	5542	39650	138546	98896
Kashi Nandini	14.3	44.2	7.5	6.5	1618	39650	40444	794
PSM 3	14.3	46.7	7.4	5.5	3423	39650	85583	45933
Kashi Uday	13.4	32.2	7.8	6.1	1502	39650	37556	-2094
Bioseed Pea 10	14.0	43.9	8.4	6.9	3491	39650	87269	47619
Pusa Pragati	13.9	33.4	7.8	5.9	1613	39650	40324	674
PS 1100	15.1	40.1	8.2	7.0	4945	39650	123620	83970
CD (P=0.05%)	0.96	8.72	NS	0.94	603.9	-	-	-

Pant Nagar (Tables 7.2.2.18 – 7.2.2.21)

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 (Table 7.2.2.18): Significant variation was observed among the rice varieties for all the traits. Plant height of different rice varieties ranged from 100 to 157 cm. Kala namak recorded tallest varieties while CGZR-1 been smallest. Number of effective tillers/m^2 was in range from 214-293 and variety PSD-27 (293) recorded highest effective tillers/m^2 whereas, PSD-25 produced lowest effective tiller/m^2 (214). Among different varieties, grain weight/panicle ranged from 1.56 to 2.89 g and significantly higher grain weight/panicle was observed in Pant Sugandha Dhan-25 (2.89 g) being at par with HKR-47. Though 1000-grains weight among the rice varieties was found higher in PD-24 (26.6 g) which was at par with HKR-47 (25.4 g) however, higher grain yield of rice was observed significantly with HKR-47 (5464 kg/ha), however, lowest grain yield was recorded in Kesho Pohu (2973 kg/ha).

Relative economics of different rice varieties under organic mode of cultivation: Relative economics of different rice varieties under organic mode of cultivation showed that maximum net returns (Rs. 1,57,262/ha) and B: C ratio (3.96) was obtained

with HKR-47 followed by PR-121 (Rs. 1,48,972/ha and 3.81, respectively).

Table 7.2.2.18. Response for yield attributes and yield of rice varieties under organic cultivation at Pantnagar

Rice varieties/	Plant height (cm)	Effective tillers/m²	Grain weight/ panicle (g)	1000-grains weight (g)	Grain yield (kg/ ha)	Straw yield (kg/ha)	Harvest Index	Net returns (Rs/ha)	B:C ratio
Tilak Chandan	143	239	1.76	20.3	3458	4224	0.45	80033	2.51
Hansraj	143	241	1.66	20.6	3305	3827	0.46	74140	2.40
Kala Namak	157	249	1.63	13.1	3421	3979	0.46	78627	2.48
Kesho Pohu	111	244	1.56	23.7	2973	3697	0.45	61363	2.16
HKR-47	111	257	2.60	25.4	5464	5926	0.48	157262	3.96
PR-121	115	257	2.42	24.4	5248	5925	0.47	148972	3.81
PD-24	117	249	2.51	26.6	5206	6029	0.46	147337	3.78
NDR-359	103	269	2.31	22.5	5194	5946	0.47	146881	3.77
PSD-25	134	214	2.89	22.8	4923	5655	0.47	136462	3.57
PSD-27	103	293	2.06	23.5	5003	5804	0.46	139542	3.63
CGZR-1	100	252	2.10	21.2	4138	4792	0.46	106232	3.00
Zinco Rice	115	258	1.78	20.7	3358	3946	0.46	76193	2.44

Nutrient uptake by different rice varieties (Table 7.2.2.19)**:** Significant difference in N, P, K and S uptake were observed among different rice varieties under organic cultivation. The variation of nutrients uptake by the different varieties of rice found in range between 59.3 to 103.9 kg/ha for N, 22.3 – 39.8 kg/ha for P, 60.3 – 103.6 kg/ha for K and 14.7 – 27.6 kg/ha for S. Nitrogen uptake among rice varieties was found to be significantly higher in Type-3 (103.9 kg/ha) which was at par with pusa-1509 (102.8 kg/ha). P uptake was significantly higher in Pusa Sugandha-5 (39.8 kg/ha) which was at par with Taraori (38.3 kg/ha). K uptake was significantly higher in Taraori (103.6 kg/ha) which found at par with Pant Basmati-1 (102.9 kg/ha). Sulphur uptake among rice varieties was found to be significantly higher in Pusa-1509 (27.6 kg/ha) it was at par with Taraori (27.3 kg/ha).

Table 7.2.2.19: Total N, P, K and S uptake in different varieties of rice under organic mode of cultivation.

Treatments	N uptake (kg/ha)	P uptake (kg/ha)	K uptake (kg/ha)	S uptake (kg/ha)
Tilak Chandan	74.8	24.2	69.4	15.4
Hansraj	68.0	22.6	65.2	14.7
Kala Namak	69.9	22.3	66.3	15.8
Kesho Pohu	59.3	22.3	60.3	15.5
HKR-47	101.4	35.2	100.8	25.5
PR-121	101.7	39.8	102.0	24.7
PD-24	100.9	38.3	103.6	27.3
NDR-359	101.9	35.0	102.9	26.0
PSD-25	103.9	33.0	94.8	25.0
PSD-27	102.8	35.0	98.8	27.6
CGZR-1	87.4	31.2	82.7	21.1
Zinco Rice	71.0	24.5	65.4	17.7

Performance of wheat varieties (Table 7.2.2.20)**:** Plant height at harvest of different wheat varieties ranged from 81 to 105 cm, tallest variety was being Sonalika, (105 cm) followed by UP- 2565 (97 cm) while smallest was recorded with WH-1105 (81 cm). Spikes/m² of wheat varieties were in range from 216 to 264. Test weight (1000-grains weight) of different wheat varieties recorded in range from 25.3 to 37.3 g. Grain yield of different wheat varieties recorded in range from 2232 to 3324

kg/ha. Highest grain yield was noticed in HD-2967 (3324 kg/ha) and lowest recorded with WH-1142 (2232 kg/ha). Economic analysis of different wheat varieties revealed that highest net returns (Rs. 39558/ha) & B:C ratio (1.94) were observed under the variety UP-2903 followed by Sonalika (Rs. 37791/ha and 1.90, respectively).

Table 7.2.2.20: Response for yield attributes and yields of wheat varieties under organic management at Pantnagar

Wheat varieties	Plant height (cm)	spikes/ m^2	grain wt./ spike(g)	1000-grain wt. (g)	Grain yield (kg/ ha)	Straw yield kg/ ha)	Harvest Index	Net returns (Rs/ha)	B:C ratio
UP 2855	84	264	0.78	26.2	3205	3716	0.46	36652	1.88
HD2967	95	216	0.59	34.4	3324	3750	0.47	26837	1.64
UP 2565	97	235	0.64	29.4	2902	3375	0.46	24913	1.59
DBW 62150	92	223	0.63	32.4	2764	3248	0.46	37123	1.89
UP 2903	95	240	0.68	27.4	3252	3716	0.47	39558	1.94
WH 1142	96	264	0.78	37.3	2232	2556	0.47	29232	1.70
WH 1105	81	253	0.77	32.4	2944	3497	0.46	21654	1.52
Black wheat	94	233	0.64	30.7	2804	3341	0.46	25855	1.62
Sonalika	105	245	0.68	37.2	3224	3743	0.46	37791	1.90
C-306	97	216	0.63	25.3	2726	3249	0.46	34493	1.82
UP-262	96	220	0.65	37.4	2593	3010	0.46	12820	1.31
WB-2	93	256	0.72	33.6	3117	3520	0.47	30252	1.72
CD (P=0.05)									

Nutrients uptake by different wheat varieties (Table 7.2.2.21)**:** Among different wheat varieties, highest uptake of nitrogen was recorded HD2967 (66.6 kg/ha) which was at par with UP-2855 (65.4 kg/ha), sonalika (64.7 kg/ha), and UP 2903 (64.2 kg/ha) whereas phosphorus uptake among different wheat varieties recorded maximum with UP-2855 followed by HD2967 and Sonalika. Potassium uptake was recorded highest also with HD2967 (57.7 kg/ha) followed by UP-2855 (54.9 kg/ha) and minimum found with WH 1142 (36.5 kg/ha). Although sulphur uptake (23.9 kg/ha) was found highest with UP 2903 followed by sonalika (22.0 kg/ha) and minimum found with WH 1142 (15.9 kg/ha).

Table 7.2.2.21: Total N, P, K and S uptake in different wheat varieties under organic mode of cultivation

Treatments	N uptake (kg/ha)	P uptake (kg/ha)	K uptake (kg/ha)	S uptake (kg/ha)
UP 2855	65.4	504.2	54.9	21.6
HD2967	66.6	452.3	57.7	21.2
UP 2565	59.0	430.1	50.6	20.6
DBW 62150	57.1	394.6	46.3	21.3
UP 2903	64.2	438.3	54.5	23.9
WH 1142	45.1	245.1	36.5	15.9
WH 1105	61.0	424.1	49.9	20.7
Black wheat	58.5	384.3	49.7	19.3
Sonalika	64.7	475.8	54.4	22.0
C-306	54.3	289.6	46.2	16.7
UP-262	52.8	330.2	45.0	19.2
WB-2	63.6	403.1	50.7	21.5

Raipur (Table 7.2.2.22 – 7.2.2.24)

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

Table 7.2.2.22: Response of different traditional and improved scented varieties of rice under organic production system

Varieties	Plant height at harvest (cm)	Tillers hill^{-1} at harvest	No. of filled grains / panicle	Panicle length (cm)	Test weight	Grain yield (kg/ha)	Straw yield kg/ha	Harvest Index	Net return (Rs/ha)	B:C ratio
Chinni Kapoor	193.8	11.5	77.7	27.63	24.70	23.54	58.0	29.3	19718	1.41
Lokti Machhi	171.7	12.1	149.0	25.78	14.10	25.19	66.8	27.4	25166	1.53
Tulsi Manjiri	190.9	11.7	126.7	32.58	18.10	22.65	71.7	24.3	19527	1.41
Amrit Bhog	202.1	10.8	135.0	30.77	18.20	23.14	58.4	28.5	18771	1.39
Samund Chini	198.0	11.9	153.0	31.07	16.30	25.26	50.8	43.9	22922	1.48
Lohandi	165.9	11.7	66.3	21.86	19.67	23.18	51.4	31.8	17809	1.37
Aatma Sheetal	172.8	11.4	152.7	28.68	15.90	23.02	57.6	28.7	18336	1.38
Tarunbhog Selection 1	162.9	11.4	105.3	22.65	19.60	28.17	57.1	33.6	31145	1.65
Chhattisgarh Sugandhitbhog	101.4	12.5	128.7	22.73	21.20	34.24	53.0	39.3	41822	1.81
Indira SugandhitDhan 1	139.9	11.3	143.0	21.05	20.20	33.53	51.4	39.9	39805	1.77
CG Devbhog	86.0	10.2	103.0	21.47	23.90	37.00	44.3	46.5	47410	1.92
Sugandhmati	99.4	10.1	103.0	22.54	26.80	34.20	41.8	45.1	40022	1.77
Zinco rice MS	96.8	10.9	71.7	21.23	25.10	31.06	40.1	43.9	31928	1.62
Protezin	98.3	9.8	94.0	21.71	31.60	32.21	33.9	49.1	33875	1.65
CG Madhuraj 55	135.9	9.4	116.3	25.23	32.90	31.50	56.5	36.6	35498	1.69
CD (P = 0.05)	14.86	1.05	5.83	3.13	1.39	3.33	2.72	1.56	-	-

Performance of rice varieties (Table 7.2.2.22): Among the different traditional short grain aromatic rice varieties, variety Amrit bhog was taller (202.10cm) which is at par with Samund chini, Chinni kapoor and Tulsi manjari . As regards to number of filled grains panicle^{-1}, highest recorded in Samund chini which was comparable to Lokti Machhi, while panicle length was higher in Tulsi manjari followed by Samund chini. The test weight was lower in Lokti Machhi, Samund chini and Aatma Sheetal. Among the improved scented rice varieties, plant height was significantly higher in Tarun bhog selection-1 which is tall in nature, while other varieties, were dwarf in nature. The maximum number of filled grains panicle^{-1} and panicle length was observed in Indira Sugandhit Dhan-1 and C.G. Sugandhit Bhog, while test weight was lower in Tarun bhog selection-1. In tall traditional aromatic rice varieties, Samund chini produced the highest yield followed by Lokti machhi gave similar yields to the tune of 2526 kg ha^{-1} to 2519 kg ha^{-1}. Among the improved scented rice varieties the highest grain yield of scented rice was recorded in C.G. Devbhog (3700 kg ha^{-1}) Which was significant at par with C.G. Sugandhit Bhog (3424 kg ha^{-1}) and Sugandhmati (3420 kg ha^{-1}) which were significantly superior over rest of the varieties. Among the fortified rice varieties the highest grain yield of was recorded in Protezin followed by CG Madhuraj 55 and Zinco rice MS.

Performance of rice varieties Lokti Machhi, Zinco rice and Protezin at Raipur

Field view of chickpea varieties at Raipur under organic condition

Table: 7.2.2.23 Response of different improved varieties of chickpea under organic production system at Raipur

Variety	Plant height at harvest (cm)	No. of branches at harvest	No. of pods/ plant at harvest	No. of nodules/ plant	Yield (kg/ha)	Stover yield (kg/ha)	Harvest Index	Yield stability index	Net return (Rs/ha)	B:C ratio
Vaibhav	41.33	20.87	45.78	41.33	1196	1512	44.43	0.76	49486	2.72
JG-226	39.47	16.13	42.84	39.47	1053	1303	44.68	0.66	40132	2.40
Jaki	41.87	18.80	44.39	41.87	1153	1431	44.62	0.63	46674	2.63
RG2009-01	40.20	21.10	48.43	40.20	1311	1506	46.53	0.69	56992	2.99
RG2009-16	39.93	16.80	44.14	39.93	1132	1423	44.31	0.71	45307	2.58
RG2003-28	40.33	20.33	45.22	40.33	1166	1578	42.47	0.54	47553	2.66
Vishal	44.40	20.07	44.54	44.40	1162	1477	44.03	0.65	47260	2.65
JG-16	42.07	22.80	49.64	42.07	1363	1663	45.32	0.80	60410	3.10
Vijay	45.20	23.80	54.29	45.20	1424	1730	45.13	0.66	64382	3.24
Daftari-21	36.87	15.39	42.32	36.87	1004	1268	44.32	0.65	36910	2.29
JG-14	42.73	23.53	50.58	42.73	1397	1679	45.34	0.76	62624	3.18
CD (P=0.05)	3.17	1.50	6.54	3.97	156.5	279	4.50	-	-	-

Performance of chickpea varieties (Table 7.2.2.23)**:** Plant height of chickpea was higher under Vijay variety which was statistically at par with Vishal and JG-14. Number of branches plant^{-1} at harvest was significantly higher in Vijay which were comparable with JG-16 and JG-14 etc. Number of pods plant^{-1} were also higher under Vijay followed by JG-16 which was at par with each other. As regards to number of nodules plant^{-1} the highest number of nodules was recorded in variety Vijay followed by JG-16 and JG-14. Seed yield of chickpea was also affected significantly due to different chickpea varieties grown under organic farming. Significantly higher seed yield was obtained from variety Vijay (1424 kg ha^{-1}) which was statistically on par with RG 2009-01, JG-14 and JG -16 chickpea varieties and mean data of Seven years in respect to seed yield of chickpea indicate that variety, Vaibhav, RG 2009-01 and and JG-16 performed equally good under organic farming. As regards to stover yield variety Vijay recorded the highest stover yield which was at par with vaibhav and JG-16 and JG -14. Net return was maximum in Vijay (Rs 64382 ha-1) followed byJg-14 (Rs 62624 ha-1) and JG-16 (Rs 60410 ha-1). The B: C ratio was higher in Vijay (3.24) followed by JG-14 (3.18) and JG-16 (3.10).

Soil nutrient status in: Soil organic carbon, available nitrogen, phosphorus in soil after harvest of chick pea crop did not influence significantly on availability of these nutrients in soil. The ranged for organic carbon recorded in ranged between 0.45 to 0.48%, whereas, the ranged for available N was from 201 to 210 kg/ha, available P from 16.63 to 17.95 kg/ha and K were in range from 332 to 337 kg/ha respectively. Varieties vishal, Daftari-21 and JG-14 hold the highest OC (0.48%).

Table: 7.2.2.24 Organic carbon and available N, P & K status after harvest of different improved varieties of chickpea

Varieties	Organic Carbon (%)	Available N (Kg ha^{-1})	Available P (Kg ha^{-1})	Available K (Kg ha^{-1})
Vaibhav	0.46	203	17.95	333
JG-226	0.47	206	16.88	337
Jaki	0.46	210	17.49	333
RG2009-01	0.47	204	17.31	335
RG2009-16	0.47	201	17.72	335
RG2003-28	0.47	205	16.93	334
Vishal	0.48	206	17.45	335
JG-16	0.45	202	16.76	337
Vijay	0.46	205	17.18	336
Daftari-21	0.48	202	16.63	332
JG-14	0.48	203	17.27	335
CD (P=0.05)	NS	NS	NS	NS

Ranchi (Table 7.2.2.25 – 7.2.2.28)

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

Table 7.2.2.25: Yield attributing characters of rice varieties under organic management at Ranchi

Rice varieties	Plant height (cm)	Effective tillers/m^2	Grains/ panicle	1000 grain weight (g)	Grain yield of rice (kg/ha)	Straw yield (kg/ha)
BVD203	95.0	210.00	46.3	22.8	1575	4290
IR64	68.7	246.00	53.7	22.9	2210	3703
IR36	91.3	218.33	51.7	24.5	1950	3692
MTU 1010	78.5	217.33	50.7	23.2	1870	4730
Sahbhagi Dhan	75.5	236.33	50.3	20.9	1693	1943
Khandgiri	79.7	239.00	35.0	22.5	1150	2724
Govind Bhog	111.5	235.00	41.7	18.7	1153	2859
BVS-1	93.9	228.67	40.0	20.0	1733	3061
Naveen	78.3	213.33	32.3	23.6	1238	3996
Lalat	71.7	221.00	30.0	23.5	1283	1998
BVD203	95.0	210.00	46.3	22.8	1575	4290
CD (P=0.05)	13.4	19.96	10.4	1.5	180	921

Performance of rice varieties (Table 7.2.2.25): Significant differences was observed for yield and yield contributing characters among rice varieties. The rice variety Govind bhog recorded the highest plant height (111.5 cm) and lowest plant height was recorded with rice variety IR 64 (68.7 cm). IR-64 recorded maximum number of Effective tillres/m2, length of panicle, filled grains/panicle while 1000-grains weight was recorded maximum in IR 36 (24.5 g). The maximum straw yield of rice (4730 kg/ha) was obtained with variety MTU1010 which was significantly superior over BVD 203 (4290 kg/ha), Naveen (3996 kg/ha) and IR-64 (3703 kg/ha) and been at par with rest of the vartities. The maximum grain yield of rice (2210 kg/ha) was obtained with rice variety IR-64 which was significantly superior over all the rice varieties.

Performance of wheat varieties (Table 7.2.2.26): Variation for yield attributes and yield were found to be significant among the wheat verities except grains/spike and 1000-grains weight. Number of tiller m^{-2} was in ranged between 170- 194, number of grains/spike was between 29.0 - 34.0 and the variation in 1000-grains weight of the wheat was in ranged between 36.60 -44.94g. Number of grains/spike (40.6) and 1000-grains weight (48.3 g) was higher in K-1006 owing to higher grain yield (1677 kg/ha) while lower grain yield was recorded in HI-1563 (779 kg/ha).

Table 7.2.2.26: Yield and yields attributing characters of wheat varieties under organic management at Ranchi

Wheat varieties	Effective tillers/m^2	Grains/spike	1000-grains weight (g)	Grain yield (kg/ha)	Straw Yield (kg/ha)
K-1006	194	34	44.94	1677	2643
DBW-187	171	32	40.53	1418	2155
DBW-14	184	32	42.54	1399	2028
DBW-252	170	30	41.94	1307	1933
HD-9232	179	30	42.37	1231	1889
JKW-261	172	31	37.11	1179	1941
DBW-107	191	33	36.33	1016	1731
HD-2967	190	33	40.34	910	1556
BG-3	180	31	36.60	1215	2092
HI-1563	185	29	38.71	779	1488
CD (P=0.05)	7.74	NS	NS	175	821

Systems equivalent yield and economics of different varieties of rice and wheat (Table 7.2.2.27): Different combinations of rice and wheat varieties evaluated in system mode and system equivalent yield (rice equivalent) found to be significant. Maximum systems equivalent yield of 3741 kg/ha recorded with combination rice (IR-64) – wheat (DBW-187). Similarly, combination IR-64 resulted in significantly higher net return (Rs. 34402/ha) and B:C ratio (1.14) over other varieties.

Table 7.2.2.27: Systems equivalent yield, net returns and B:C ratio of different varieties of rice and wheat

Cropping system	Net return of rice crop (*kharif*)	Benefit cost ratio of rice	Systems equivalent yield (kg/ha)
Rice (B.V.D. 203) – wheat (K-1006)	19995	0.66	3387
Rice (IR-64) – wheat (DBW-187)	34402	1.14	3741
Rice (IR-36) – wheat (DBW-14)	27875	0.93	3460
Rice (M.T.U. 1010) – wheat (DBW-252)	28470	0.95	3228
Rice (Sahbhagi dhan) – wheat (HD-9232)	17077	0.57	3021
Rice (Khandgiri) – wheat (JKW-261)	11205	0.37	2425
Rice (Govind bhog) – wheat (DBW-107)	11632	0.39	2249
Rice (B.V.S.-1) – wheat (HD-2967)	2087	0.69	2717
Rice (Naveen – wheat (BG-3)	10835	0.36	2550
Rice (Lalat) – wheat (HI-1563)	6965	0.23	2185
CD (P=0.05)			411.3

Soil nutrient status at the end of cropping cycle (Table 7.2.2.28): There was improvement in soil pH, organic carbon, available N, P and K among varieties of rice and wheat from their initial values. Soil pH was significantly improved (5.40) in rice (Lalat) –wheat (HI-1563) system of their initial value of 5.40. Among the different combinations of rice and wheat varieties, rice (Sahbhagi dhan) – wheat (HD-9232) recorded maximum value of organic carbon 0.48% to their initial value. Availability of N in the soil after completion of cropping cycle was higher in rice (IR-64) – wheat (DBW-187) of 283.65 kg/ha to their initial value. However, availability P and K in the soil was found to be higher in combination of rice and wheat variety i.e. rice (Govind bhog) – wheat (DBW-107) for Phosphorus and treatment - Rice (IR-36) Wheat (DBW-14) for potassium.

Table 7.2.2.28: Soil nutrient status at the end cropping cycle at Ranchi

Cropping system	pH	OC (%)	After harvest of *rabi* crops		
			Available N (kg/ha)	Available P (kg/ha)	Available K (kg/ha)
T1- Rice (B.V.D. 203) -Wheat (K-1006)	5.25	0.39	260.4	17.4	145.52
T2 - Rice (IR-64) – Wheat (DBW-187)	5.29	0.41	283.6	17.9	119.0
T3 – Rice (IR-36) Wheat (DBW-14)	5.28	0.35	245.6	24.1	162.7
T4 - Rice (M.T.U. 1010) – Wheat (DBW-252)	5.28	0.41	261.9	19.1	128.7
T5 - Rice (Sahbhagi dhan) – Wheat (HD-9232)	5.34	0.48	244.0	19.5	118.9
T6 - Rice (Khandgiri) – Wheat (JKW-261)	5.27	0.43	243.9	17.3	106.0
T7 - Rice (Govind bhog) – Wheat (DBW-107)	5.36	0.45	250.3	27.2	102.7
T8 - Rice (B.V.S.-1) – Wheat (HD-2967)	5.36	0.43	245.3	26.5	74.8
T9 - Rice (Naveen – Wheat (BG-3)	5.36	0.43	254.6	18.3	97.6
T10 -Rice (Lalat) –Wheat (HI-1563)	5.40	0.44	246.23	24.9	88.1
CD (P=0.05 %)	NS	NS	7.6	4.7	6.5
Initial	5.40	0.38	258.4	17.4	185.5

Umiam (Table 7.2.2.29)

Performance of crops: 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. The highest pod yield of groundnut among the 12 lines is recorded in TPG 41 (2370 kg/ha) followed by TG37A (2350 kg/ha). The highest grain yield among the 12 varieties of rapeseed recorded in PM-25 (1160 kg/ha) followed by YSH (1140 kg/ha) and lower grain yield of rapeseed was recorded under PT-303 (650 kg/ha).

Table 7.2.2.29. Yield of groundnut and mustard cultivars at Umiam

Groundnut		Rapeseed	
Varieties	Pod Yield (kg/ha)	Varieties	Yield (kg/ha)
TPG 41	2370	PM-25	1160
TG37A	2350	NRCNB	1100
ICGS76	2180	PT-303	0650
ICGV00350	2070	BHAWARI	0720
JL501	2100	DRMR	1060
GIRNAR	1850	Ragini	0850
GJG31	1720	Binoy	0790
GG7	1650	PM-28	1080
ICGV91114	2260	PM-26	0870
KADIRI 9	2190	YSH	1140
GPVD 5	2030	TL-15	0820
GJG18	201	Topeshwari	0800

Ajmer (Table 7.2.2.30--7.2.2.33)

The total eight varieties each of green gram, cluster bean during *kharif* and coriander, fennel during *rabi* were evaluated under organic cultivation.

Green gram (Table 7.2.2.30)**:** There is significant difference in its performance in terms of growth and seed yield. Among the varieties, MUM-2 was recorded higher plant height (79.20 cm) followed by RMG-975 (78.73 cm) whereas, lower plant height was observed in IPM-02-3 (66.93 cm). In case primary branches, number of pods, number of seeds per pod, seed yield per hectare and biomass per hectare was found higher in the variety MUM-2 followed by RMG-975 and lowest seed yield is found in the variety GANGA-1 (453.33 kg ha-1) and lowest harvest index is found in variety RMG-492 (21.96).

Cluster bean (Table 7.2.2.31): In cluster bean plant height at harvest was highest in RGC-1066 (134.40 cm) followed by RGC-986 (128.53) whereas; lowest plant height (116.60 cm) was recorded in the variety RGC-12-1. RGC-1038 variety perform well in all the parameters such as primary branches (12.87), number of pods per plant (61.0), number of seeds per pod (9.13), seed yield per hectare (1566.67 kg), biomass yield per hectare (3426.67 kg) and harvest index (31.37) followed by RGC-1055. Lowest performance in terms of seed yield per hectare (731.67 kg), biomass yield per hectare (3436.67 kg/ha) and harvest index (17.56) was observed in variety RGC-986.

Table 7.2.2.30: Performance of green gram varieties under organic management practices during *Kharif* at Ajmer

Treatment	Plant height at harvest (cm)	No. of primary branches Plant^{-1}	No. of pods/ plant	No. of seeds pod^{-1}	Seed yield (kg/ha)	Biomass yield (kg/ha)	Harvest index
RMG-975	78.7	5.6	28.4	12.3	637	1845	25.7
RMG-62	71.9	4.7	23.6	11.3	497	1583	23.9
MSG-118	68.3	5.1	22.1	10.5	563	1767	24.2
RMG-492	71.5	4.1	20.9	11.5	492	1747	22.0
SML-668	70.9	4.6	23.7	11.7	460	1380	25.1
GANGA-1	75.5	4.3	26.9	11.4	453	1370	24.9
IPM-02-3	66.9	4.7	22.7	11.7	485	1492	24.4
MUM-2	79.2	5.7	30.3	12.5	645	1848	25.9
CD(P=0.05)	8.2	1.0	3.5	1.1	70.4	185.7	3.3

Table 7.2.2.31: Performance of cluster bean varieties under organic management practices during *Kharif* at Ajmer

Treatment	Plant height at harvest (cm)	No. of primary branches Plant^{-1}	No. of pods/ plant	No. of seeds pod^{-1}	Seed yield (kg/ha)	Biomass yield (kg/ha)	Harvest index
RGC-936	123.3	7.1	41.3	8.7	1300	3305	28.3
RGC-1001	111.3	6.8	45.6	8.3	1350	3682	26.8
RGC-1003	123.7	6.5	43.7	8.1	1342	3732	26.4
RGC-1038	128.4	12.9	61.0	9.1	1567	3427	31.4
RGC-986	128.5	6.5	41.9	8.1	732	3437	17.6
RGC-1055	126.5	9.9	58.0	9.5	1508	3327	31.2
RGC-1066	134.4	0.0	42.5	9.0	1303	3357	28.0
RGC-12-1	116.6	7.1	39.0	8.3	1265	3202	28.3
CD(P=0.05)	13.1	2.0	7.9	1.0	176.9	334.5	3.1

Best performing variety of green gram RMG-975

Best performing variety of cluster bean RGC-1038

Coriander (Table 7.2.2.32)**:** There is significant difference in terms of growth and seed yield. In coriander, At harvest Azad Dhania-1 was recorded higher plant height (115.47 cm) followed by ACr-1 (111.73 cm) whereas, lower plant height was observed in RCr-435 (80.67 cm). In case primary branches, secondary branches, number of umbels, number of umbellets, seed yield per hectare was found to be higher in the variety Azad dhania-1 (1723kg/ha) followed by ACr-1 (1691.67 kg/ha) and Hissar Anand (1533kg/ha).

Fennel (Table 7.2.2.33)**:** In fennel crop, plant height at harvest was highest in GF-12 (185.13 cm) variety followed by AF-1(181.33 cm) whereas; lowest plant height (159.60 cm) was recorded in the variety GF-02. Among the varieties, variety GF-12 outperformed for all the parameters such as primary branches (10.53), secondary branches (20.13), umbels per plant (32.47), umbellets per umbel (26.53) and seed yield per hectare (3067 kg) followed by AF-1 (3033 kg/ha). Lowest seed yield per hectare (2517 kg/ha) was observed in variety RF-101.

Table 7.2.2.32: Performance of coriander varieties under organic management practices during *rabi* at Ajmer

Treatment	Plant height (cm) at harvest	No. of primary branches plant^{-1}	No. of secondary branches plant^{-1}	No. of umbel plant^{-1}	No. of umbellate / umbel	Seed yield (kg/ha)
ACr-1	111.7	8.9	19.9	37.1	6.9	1692
Azad Dhania-1	115.5	9.1	20.3	38.1	6.9	1723
RCr- 435	80.7	7.7	13.9	35.1	6.4	1417
RCr- 436	86.2	7.0	14.0	32.0	5.6	1393
RCr- 446	89.7	6.6	15.2	31.1	5.7	1525
RCr- 684	91.8	8.0	16.3	33.5	6.1	1408
Hissar Sugandha	96.3	7.5	17.3	28.9	6.3	1450
Hissar Anand	95.8	7.9	17.4	31.4	6.3	1533
CD(P=0.05)	9.53	0.94	2.26	5.56	0.7	191.0

Table 7.2.2.33: Performance of fennel varieties under organic management practices during *rabi* at Ajmer

Treatment	Plant height (cm) at harvest	No. of primary branches plant^{-1}	No. of secondary branches plant^{-1}	No. of umbel plant^{-1}	No. of umbellate/ umbel	Seed yield (kg/ha)
AF-1	181.3	9.9	19.7	30.5	26.1	3033
RF-101	163.9	7.7	14.8	26.9	21.3	2517
Co-1	167.5	7.4	15.5	25.9	23.7	2650
Rajendra Saurabha	163.6	6.3	14.4	25.4	23.9	2767
GF-12	185.1	10.5	20.1	32.5	26.5	3067
RF-281	166.0	7.3	16.8	26.9	21.8	2850
RF-125	163.2	7.5	16.9	27.4	22.7	2667
GF-02	159.6	6.7	15.0	25.7	23.7	2833
CD(P=0.05)	13.6	1.3	2.4	3.1	3.2	339.1


Best performing variety of coriander Azad dhania-1 and Acr-1


Best performing variety of fennel GF-12-1 and AF-1

Gangtok (Table 7.2.2.34 - 7.2.2.36)

Varietal performance of maize and buckwheat under organic management

Maize (Table 7.2.2.34 35): Yield attributes and yield of maize cultivars influenced significantly under organic management condition. Maximum plant height at flowering stage was recorded with Seti makkai (307.17 cm) which is statistically similar with Baiguini makkai (298.93) but significantly superior over other remaining cultivars. Significantly higher dry matter accumulation at tasseling stage was found under Rato makkai (82.83 g plant^{-1}) as compared to other cultivars. Highest value of leaf area index (4.71) was recoded under Vivek Sankul-35 which was statistically at par with Rato makkai, Baiguini makkai but significantly higher than other cultivars. Maximum cob length (16.63 cm) was recorded under RCM 1-1 which was statistically at par with Rato makkai, Baiguni makkai but significantly higher than other cultivars. Significantly higher value of cob girth (14.70 cm) was registered under Vivek sankul-31 compared to other cultivars, but it was remained statistically at par with Vivek Sankul-35 and Vivek Sankul-375. Maximum number of grains row^{-1} (37.93) was observed under Kalo makkai which was statistically at par with Rato makkai, Vivek Sankul-31 but significantly higher than other cultivars. Significantly higher value of grain yield (4100 kg ha^{-1}) was observed under Vivek Sankul-35 as compared to other cultivars but remained statistically at par with Vivek Sankul-31 and Seti makkai.

Economics of different cultivars of maize influenced significantly under organic management condition reveald that maximum gross returns (79.4 (₹×103 ha^{-1}), net return (₹×36.3 ha^{-1}), returns rupee^{-1} invested (1.84) and PE (10.9 kg/ha/365) was observed in maize variety Vivek sankul-35 as compared to other cultivars which was statistically at par with Vivek sankul-31, Seti makkai, and significantly higher than other remaining cultivars.

Table 7.2.2.34. Evaluation of maize composite under organic management condition at Gangtok

Cultivars	Plant height at flowering stage (cm)	Dry matter accumulation at tasselling (g plant^{-1})	LAI at Silking stage	Days to 50% tasselling	Cob length (cm)	Cob girth (cm)	No. of rows cob^{-1}	No. of grains row^{-1}	Grain yield (kg ha^{-1})
Seti Makkai	307.2	73.8	3.3	76.2	15.4	12.6	12.8	31.9	3950
Pahenlo Makkai	239.5	52.1	3.5	71.5	15.3	12.9	12.8	35.4	3630
Rato Makkai	280.5	82.8	4.5	75.3	16.0	12.8	12.4	37.6	3430
Baiguni Makkai	298.9	45.2	4.6	74.6	15.6	12.8	12.8	32.9	3550
Kalo Makkai	261.6	48.3	3.7	70.6	14.0	11.8	10.1	37.9	3120
Satheya	266.4	47.1	3.9	66.2	13.4	12.0	10.9	28.9	3310
RCM 1-1	221.4	48.0	3.9	69.3	16.6	11.9	11.8	30.8	3840
RCM 1-3	227.4	46.5	3.7	71.4	15.0	12.7	12.7	28.1	3880
RCM 75	233.8	50.9	4.2	15.0	12.9	12.8	33.2	33.4	3800
Vivek Sankul-31	151.6	24.0	3.6	66.0	13.6	14.7	12.9	35.8	4060
Vivek Sankul-37	159.0	25.8	4.0	65.7	11.4	13.5	13.7	32.0	3920
Vivek Sankul-35	140.2	32.8	4.7	65.2	11.5	14.6	14.6	31.9	4100
CD (P=0.05)	27.8	3.1	0.1	2.7	1.2	1.6	2.0	3.0	400

Table 7.2.2.35: Economics of different cultivars of maize at Gangtok

Cultivars	Gross return (₹x103 ha^{-1})	Net Return (₹x103 ha^{-1})	Return rupee^{-1} invested	PE (kg/ ha/365)	Profitability Rs/ha/day	LUE (%)
Seti Makkai	76.6	33.4	1.78	10.5	91.6	34.3
Pahenlo Makkai	68.4	25.3	1.59	9.4	69.2	33.2
Rato Makkai	66.2	23.0	1.53	9.1	63.1	33.9
Baiguni Makkai	67.4	24.3	1.56	9.2	66.5	31.5
Kalo Makkai	64.2	21.1	1.49	8.8	57.8	36.9
Satheya	63.9	20.7	1.48	8.7	56.8	35.6
RCM 1-1	72.0	28.8	1.67	9.9	78.9	36.9
RCM 1-3	74.0	30.8	1.71	10.1	84.5	36.7
RCM 75	69.1	26.0	1.60	9.5	71.1	38.6
Vivek Sankul-31	78.1	35.0	1.81	10.7	95.8	37.3
Vivek Sankul-37	75.1	32.0	1.74	10.3	87.7	35.0
Vivek Sankul-35	79.4	36.3	1.84	10.9	99.3	35.6
CD (P=0.05)	8.03	3.93	0.19	1.10	21.99	1.35

Buckwheat (Table 7.2.2.36)**:** Grain yield and economics of buckwheat cultivars were influenced significantly. Among the buckwheat varieties, IC 49671 tooks 126.3 days to maturity while IC 104727 took 109 days as minimum days to maturity. Differences among the buckwheat varieties for yield ranged from 920 to 2190 kg/ha. Maximum grain yield (2190 kg ha^{-1})

was recorded under Local Meethay which was statistically at par with IC-109433, IC109729, IC49671 but significantly higher than remaining cultivars. Highest gross return (84.3 ₹×10^3 ha^{-1}), net return (40.7 ₹×10^3 ha^{-1}) $rupee^{-1}$ invested (1.94), PE (5.8 kg/ha/365), profitability (111.6 ₹/ha/day) and LUE (35.1%) was recorded under IC 109433 which was statistically at par with IC 49671 but significantly superior over all remaining cultivars.

Table 7.2.2.36. Evaluation of varietal Buckwheat under organic management condition at Gangtok

Variety	Days to Maturity	Grain yield (t ha^{-1})	Gross Return (₹×10^3 ha^{-1})	Net Return (₹×10^3 /ha^{-1})	Return $rupee^{-1}$ invested	PE (kg/ha/365)	Profitability (₹/ha/day)	LUE (%)
Local Meethay	111.4	2190	75.2	31.7	1.73	5.2	86.7	30.4
Local Teethay	113.5	1250	73.1	29.6	1.68	5.0	81.1	32.1
IC 104727	109.0	1180	75.7	32.1	1.74	5.2	88.0	29.6
IC 36805	119.7	1330	71.0	27.5	1.63	4.9	75.3	34.2
IC 109729	117.1	1930	47.2	21.9	1.86	3.2	59.9	32.1
IC 15393	111.2	1320	63.5	23.9	1.61	4.4	65.6	31.5
IC 109433	122.4	2140	84.3	40.7	1.94	5.8	111.6	33.2
IC 49671	126.3	1930	82.9	39.4	1.90	5.7	107.9	34.2
IC 2018742	119.3	1270	70.4	26.9	1.62	4.8	73.6	32.9
PRB -1	122.0	920	59.5	24.9	1.72	4.1	68.2	32.9
VL- Ugal	124.3	980	42.5	12.2	1.40	2.9	33.4	34.2
Sangla B-1	116.3	1030	51.5	21.2	1.70	3.5	58.1	31.5
CD @ 5 %			4.81	4.73	0.12	0.33	12.80	1.14

Field view of buck wheat at Gangtok

Sardarkrushinagar (Table 7.2.2.37 – 7.2.2.40)

Eight verities of each crop in groundnut-wheat-green gram system were grown for their performance under organic farming.

Groundnut (Table 7.2.2.37)**:** Yield attributes, yield and economics of different groundnut varieties showed significant variations among groundnut varieties except plant height at harvest was non-significant. Yield attributing characters plant height (54.6cm), number of branches/plants (5.27), number of pods/plants (23.4), pod weight/plant (10.10 g) resulted in significantly higher pod yield (1627 kg/ha), haulm yield (2207 kg/ha), net return (66642₹/ha) and benefit cost ratio (2.27) were recorded in GJG 17 (S) which was at par with GG 20 (SS) in case of pod yield. Economic performance of GJG 17 (S) recorded the best as compare to other variety under organic condition in, at the same time as GG 5 (B1) variety of groundnut performed lowest in yield (1114 kg/ha) and economics parameter under organic package of practices.

Table 7.2.2.37: Yields attributes and yield of different groundnut varieties under organic farming at SK Nagar.

Groundnut Varieties	Plant height (cm)	Number of branches/ plants	Number of pods/ plants	Pod weight/ plant	Pod yield (kg/ha)	Haulm yield (kg/ha)	Gross return (Rs/ha)	Net return (Rs/ha)	B:C Ratio
GJG-HPS-1(S)	48.4	5.0	21.3	9.1	1247	1713	91497	38979	1.74
GG- 20 (SS)	52.0	5.2	22.2	9.3	1410	1898	103224	50705	1.97
GG-7 (B)	45.6	4.7	19.0	8.5	1145	1537	83771	31253	1.60
TG-37 (A) (B)	51.1	5.1	21.9	9.7	1333	1759	97331	44813	1.85
GJG-9 (B)	47.5	4.9	21.3	8.8	1185	1682	87345	34827	1.66
GG-5 (B1)	45.3	4.6	18.3	8.1	1114	1559	81955	29436	1.56
GJG-17 (S)	54.6	5.3	23.4	10.1	1627	2207	119160	66642	2.27
KDG-123 (B)	47.7	4.9	21.7	8.9	1238	1682	90691	38172	1.73
CD (P=0.05)	NS	8.9	0.8	4.3	219	302	-	-	-

Wheat (Table 7.2.2.38)**:** Among different variety of wheat, effective tillers per meter row length, spike length, grain yield and straw yield showed significant variation whereas plant height, no. of grains/spike and 100-seed weight found to be non-significant. Plant height among the wheat varieties ranged from 72.60 to 75.40 cm and recorded tallest in GW 1139 while smallest is HI4898. In case of grain yield, straw yield and economics performance, wheat variety GW 451 variety outperformed better and recorded highest grain yield (3565 kg/ha), straw yield (4456 kg/ha), gross return (1,11,846 ₹/ha), net return (44,039 ₹/ha) and NRPRI (1.65) as compared to other wheat variety. Variety G-322 is the least performer variety in term of yield which recorded 2530 kg/ha.

Table 7.2.2.38: Yield attributes and yield of different wheat varieties during *rabi* at SK Nagar

Wheat Varieties	Plant height at harvest (cm)	Effective tiller/ meter row	Spike length (cm)	No. of grains/ spike	Test weight (100 (gm)	Grain yield (kg/ ha)	Straw yield (kg/ha)	Gross return (Rs/ha)	Net return (Rs/ha)	B:C Ratio
GW 451	74.5	3.1	9.1	31.7	34.5	3565	4456	111846	44039	1.65
GW 366	73.9	2.7	7.0	30.3	31.0	2604	3843	83468	15660	1.23
GW 322	72.7	2.6	7.0	28.7	29.4	2530	3507	80415	12607	1.19
GW 273	74.3	3.0	8.1	26.7	33.1	3102	4109	98015	30208	1.45
GW496	74.1	3.0	8.1	28.3	33.8	3380	4259	106140	38333	1.57
GDW 1255	74.1	2.7	7.6	25.7	31.7	2854	4132	91244	23436	1.35
GW1139	75.4	2.8	7.8	24.3	31.3	2771	3935	88350	20542	1.30
HI 8498	72.6	2.4	6.6	26.7	30.7	2676	3912	85659	17851	1.26
CD(P=0.05)	NS	8.71	0.86	NS	NS	775	864	-	-	

Green gram (Table 7.2.2.39)**:** Number of pods/plants, number of seeds/pod, seeds yield and stover yield of green gram showed significant variation for different green gram varieties. Among the green gram varieties, Meha recorded tallest plant (43.6 cm) while PDM 139 is the smallest variety. No of branches ranged between 2.6 to 4.0 nos. and found to be non-significant. Significantly higher number of pods/plant (25.5), number of seeds/pod (7.7), seed yield (756 kg/ha) and stover yield (1065 kg/ha) were recorded in GM 4 as compare to other variety. Similarly, economic performance of GM 4 is also better as compare to other variety under organic condition which recorded gross return (43958 ₹/ha), net return (15628 ₹/ha) and NRPRI (1.55), even as IPM 410-3 variety of green gram performed as lowest in yield and economics.

Table 7.2.2.39: Yield attributes and yield of different green gram varieties during summer at SK Nagar

Green gram Varieties	Plant height at harvest (cm)	Number of branches plant^{-1}	Number of pods plant^{-1}	Number of seeds pod^{-1}	1000 seed weight (g)	Seed yield (kg/ha)	Stover yield (kg/ha)	Gross return (Rs/ha)	Net return (Rs/ha)	B:C Ratio
GM 4	40.6	4.1	25.5	7.7	33.7	756	1065	43958	15628	1.55
Meha	43.6	4.4	20.6	6.3	31.2	614	972	36134	7804	1.28
K 851	40.1	2.8	19.5	5.7	30.3	611	941	35849	7519	1.27
PDM 139	36.5	4.3	18.3	5.0	26.3	568	824	33111	4781	1.17
IPM 410-3	34.3	3.3	16.3	4.3	24.0	562	753	32503	4173	1.15
GM 5	40.5	2.6	21.4	6.7	31.3	713	978	41344	13014	1.46
PKVAKM 4	37.1	4.1	18.7	5.3	29.7	608	938	35674	7345	1.26
BGS 9	37.5	3.2	18.4	5.3	27.8	583	861	34069	5740	1.20
CD (P=0.05)	NS	NS	0.65	4.54	NS	160.7	140	-	-	

Soil fertility status at the end of the crop sequence (Table 7.2.2.40)**:** All the soil characteristics was improved from their initial value. At the end of cropping cycle, soil organic carbon found in range from 0.226 –0.252%. Crops combination GJG-HPS-1(S) – GW 451–GM 4 recorded maximum soil organic carbon of 0.252% which was 32.63% higher to its initial value. Among the different combinations of groundnut, wheat, green gram, highest availability of N (172 kg/ha) in the soil was with treatment T_4 and T_8, available P (19.60 kg/ha) was higher in treatment T_3, while available K (179.9 kg/ha) recorded under T_8 treatment. Maximum water holding capacity (32.21%) was observed under treatment combination T1 GJG-HPS-1(S) – GW 451–GM 4.

Table 7.2.2.40: Soil properties after end of crop cycle (groundnut- wheat- green gram) under organic farming at SK Nagar

Groundnut-wheat-green gram	SOC (%)	N (kg/ha)	P (kg/ha)	K (kg/ha)	EC (dSm^{-1})	pH	MWHC (%)	BD (gm/cc)
T_1 GJG-HPS-1(S)–GW 451–GM 4	0.252	171.4	18.85	168.0	0.137	7.72	32.21	1.417
T_2 GG- 20 (SS) –GW 366–Meha	0.238	164.1	19.04	178.8	0.132	7.99	31.26	1.428
T_3 GG-7 (B) –GW 322–K-851	0.226	167.2	19.60	167.2	0.141	7.81	31.17	1.422
T_4 TG-37 (A) (B) –GW 273–PDM 139	0.233	172.5	17.55	169.5	0.125	7.96	30.78	1.419
T_5 GJG-9 (B) –GW496– IPM 410-3	0.226	165.1	17.64	166.5	0.127	8.09	31.16	1.429
T_6 GG-5 (B1) –GDW 1255–GM 5	0.238	166.2	19.23	172.5	0.130	7.99	29.98	1.426
T_7 GJG-17 (S) –GW1139– PKVAKM 4	0.233	163.1	17.64	177.0	0.126	8.02	30.76	1.421
T_8 KDG-123 (B) –HI 8498 –BGS 9	0.240	172.5	18.57	179.9	0.129	7.92	31.06	1.427
Initial	0.190	147.0	10.92	170.0	0.090	7.14	26.62	1.480

Best performing groundnut variety GJG 17, wheat variety GW 451 and green gram variety GM 4 at SK nagar

Thiruvananthapuram (Table 7.2.2.41)

Twelve varieties of cassava evaluated suitable for organic management practices with varying duration and nutrient requirements. Tuber yield of cassava varieties ranged between 0.955 to 1.278 kg/plant and 11.79 to 20.51 t/ha. Among the varieties, Sree Reksha (CR-24-4) outperformed better which recorded 20.51 t/ha yield, Rs. 583305/ha of net return and 3.46 of benefit cost ratio Which is at par to Sree Pavithra. next best performing variety closely followed by H-165 (17.58 t ha^{-1}).

Table 7.2.2.41: Response for yield and net return of cassava varieties under organic management

Varieties	Tuber yield		Net income (Rs/ha)	Benefit cost ratio
	Kg $plant^{-1}$	t ha^{-1}		
H-226	1.278	15.78	394071	2.66
H-165	1.424	17.58	466075	2.97
Sree Athulya	1.048	12.94	280394	2.18
Sree Swarna	1.358	16.76	433430	2.83
Sree Jaya	1.027	12.68	270090	2.14
Sree Vijaya	1.268	15.65	388785	2.64
Kalpaka	1.149	14.18	330293	2.39
Vellayani Hraswa	0.955	11.79	234725	1.99
Sree Pavithra	1.483	18.31	495215	3.09
Sree Visakham	1.001	12.36	257306	2.09
Sree Reksha (CR-24-4)	1.661	20.51	583305	3.46
M-4	1.221	15.07	365846	2.54
CD (0.05)	0.210	2.596	-	-

Udaipur (Table 7.2.2.42–7.2.2.44)

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 maize**:** Among the twelve varieties of maize grown under organic farming, variety Pratap Hybrid Maize3 outperformed significantly better in term of weight of grains/cob, test weight and grain yield of 112.4, 257 and 5895 kg/ha respectively. Other best performing varieties such as, Sugar-75 among sweetcorn varieties, VL Amber among popcorn and Navjot among local varieties showed comparative better performance for yield attributes and yield. In term of maize equivalent yield, gross return and net return, Sugar -75 recorded significantly higher maize equivalent yield (8481 kg/ha), gross return (193722) and net return (114902) whereas, VL Amber recorded highest net return per rupee invested of 1.8. compared to other varieties. Other varieties grown for maize grain, PHM-3 being the best for MEY, GR and NR likewise, sugar 75 among sweet corn, PM-3 among baby corn, VL amber among popcorn and Navjot among local performed better for equivalent and economics

Table 7.2.2.42: Evaluation of response of different varieties of maize on yield attributes and yield at Udaipur

Varieties	Number of cobs/plant	Number of grain rows / cob	Number of grains/row	Number of grains/cob	Weight of grain/cob (g)	Test weight (g)
Maize (Grain)						
Pratap QPM Hybrid–1	2.0	16.0	31.5	504.2	96.4	191.1
PM – 9	2.0	16.0	30.0	481.9	94.6	194.8
Pratap Hybrid Maize–3	2.0	14.0	31.0	435.1	112.4	257.0
Sweet corn						
Sugar 75	2.0	16.0	31.8	510.7	47.3	91.9
Madhula	1.0	16.0	27.0	432.4	26.7	61.6
MAHY-103	2.0	14.0	29.0	406.6	26.0	63.8
Baby corn						
PM- 3	3.0	0.0	0.0	0.0	0.0	0.0
PM- 5	2.0	0.0	0.0	0.0	0.0	0.0
Pop corn						
VL Amber	2.0	14.0	37.0	518.8	70.8	136.0
Amber	2.0	14.0	31.0	434.1	37.8	86.9
Local varieties						
Navjot	2.0	14.0	30.0	423.3	75.5	175.5
Farmers selection	1.0	14.0	28.0	392.1	74.6	190.0
CD (P=0.05)	0.21	1.41	3.0	88.7	22.5	16.1

Table 7.2.2.43: Yield, equivalent yield and economics of different varieties of maize grown under organic farming at Udaipur

Varieties	Economic Yield (kg/ha)	Fodder yield (kg/ha)	MEY (kg/ha)	Gross return (Rs/ha)	Net return (Rs/ha)	Net return per rupee invested
Maize (Grain)						
Pratap QPM Hybrid – 1	5610	7625	5610	142673	86803	1.55
PM – 9	4375	5680	4375	109906	54036	0.97
Pratap Hybrid Maize – 3	5895	8270	5895	151235	95365	1.71
Sweet corn						
Sugar 75	5230	72220	8481	193722	114902	1.46
Madhula	4020	5480	6519	148548	69728	0.88
MAHY-103	4465	5985	7241	164474	85654	1.09
Baby corn						
PM- 3	1440	1995	3269	70655	15035	0.27
PM- 5	1275	1665	2895	62042	6422	0.12
Pop corn						
VL Amber	3120	*4495*	7083	153965	98905	1.80
Amber	1745	2410	3962	85581	30521	0.55
Local varieties						
Navjot	4205	6050	4205	108648	53328	0.96
Farmer's selection	3855	5320	3855	98450	43130	0.78
CD (P=0.05)	438.6	607.5	570.5	13560.5	13560.5	0.22

Performance of wheat varieties: Five varieties of each *Triticum aestivum* and *duram* and two varieties of local wheat was evaluated under organic management. Among the *Triticum aestivum* HI-1531 perform better and recorded higher yield, gross return, net return and NRPRI of 4720 kg/ha, Rs. 178240/ha, Rs. 132620/ha and 2.91 respectively. Similarly, among the duram varieties, Hi 8713 gave significantly higher yield net return and NRPRI of 5636 kg/ha, Rs. 164683/ha and 3.53 respectively. Varity c-306 recorded higher yield, net return and NRPRI among the local wheat varieties.

Table 7.2.2.44: Yield attributes and yield of wheat varieties grown under organic farming at Udaipur

Varieties	Number of spikelet/ ear	Ear length (cm)	Number of grains/ ear	Test weight (g)	Grain yield (kg/ha)	Straw yield (kg/ha)	Gross return (Rs ha^{-1})	Net return (Rs ha^{-1})	Net return per rupee invested
Triticum aestivum									
HI-1531	18.65	7.80	47.00	48.30	4418	6340	163002	117382	2.57
MP-3288	17.00	10.55	49.00	47.50	4720	7520	178240	132620	2.91
Raj-3765	18.00	8.50	45.00	49.20	3520	6620	138490	92870	2.04
Raj-4037	15.00	8.10	38.00	51.20	4120	5900	151930	106310	2.33
Raj-4120	14.20	8.20	42.00	50.20	3800	6700	147050	101430	2.22
Triticum durum									
HI-8627	17.60	7.65	54.00	51.00	4520	8350	177005	130385	2.80
HI-8663	17.80	7.30	50.00	48.50	5520	8500	206830	160210	3.44
HI-8713	19.20	7.80	55.0	50.00	5636	8700	211303	164683	3.53
MPO-1215	16.60	7.10	41.00	53.00	4370	7000	165230	118610	2.54
HI-1500	17.80	8.60	44.00	45.80	3710	5700	138940	92320	1.98
Wheat (Local)									
Lok-1	15.20	7.80	38.00	45.70	3650	6620	142260	97140	2.15
C-306	16.40	10.00	44.00	47.00	4150	6300	155000	109880	2.44
CD (P=0.05)	1.67	0.85	4.47	4.953	425.6	718.1	16228.6	16228.6	0.35

Maize variety Pratap QPM Hybrid – 1

Maize variety PM-3

Maize sweet corn variety Sugar-75

Maize popcorn variety Amber popcorn

Wheat variety HI-8663

HI 8713

Best performing maize and wheat varieties at Udaipur

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: 4; Ajmer and Udaipur (Rajasthan), Almora (Uttarakhand) and Gangtok (Sikkim).

Centre wise results for each centre are presented below

Ajmer

Evaluation of Integrated Pest Management (IPM) modules against sucking pests infesting in coriander and fennel

Treatments dewtails of IPM module

Modules	Treatment combinations	Modules	Treatment combinations
M-1	T_1 Sanitation T_2 Sticky trap 25 no./ha. T_3 Neem guard 3 ml/lit.	M-4	T_1 Datura leaf extract 10ml/lit. T_2 Cow urine + butter milk (fermented) 50% T_3 *Verticillium lecanii* 5g/lit.
M-2	T_1 Field sanitation T_2 NSKE 5ml/lit T_3 Ker extract 10 ml/lit.	M-5	T_1 Neem oil 3 ml/lit. T_2 Castor leaf extract 10ml/lit. T_3 Tumba fruit extract 10ml/lit.
M-3	T_1 Garlic extract 10 ml/lit T_2 Azadirachtin 0.03% EC @ 5ml/lit T_3 Tumba fruit extract 10ml/lit.	M-6	Untreated Control

I) **Effect of different organic IPM modules for management of aphid and thrips in coriander and fennel** (Table 7.2.3.1)**:**

Six organic based IPM modules (including control) evaluated to test their relative efficiency against aphid and thrips on coriander and fennel. Significant differences among the IPM modules were observed. The maximum per cent reduction of aphid and thrips population was recorded in module M-3 (garlic extract 10 ml/lit + *azadirachtin* 0.03% EC @ 5ml/lit + tumba fruit extract 10ml/lit.), Maximum percent reduction (72.79 and 69.81%) of aphids was on coriander similarly, module 3 also effective for management of thrips infestation on fennel which reduced 74.36 and 76.6% infestation respectively. In case of yield of seed spice i.e. coriander and fennel followed the same trend and recorded significantly higher yield with module M3 of 2150 and 2460 kg/ha respectively which is statistically at par to module M2 which recorded of 2100 and 2250 kg/ha in coriander and fennel respectively. Lowest yield recorded with module M6 i.e. untreated check. Yield of coriander was increased with module 3 by 20.8, 22.9, 9.7 and 41.0% over to module M1, M4, M5 and M6 (Untreated Control) respectively and yield of fennel recorded higher by 34.9, 21.2, 33.3 and 59.7% against module M1, M4, M5 and M6 (check) respectively.

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

IPM module	Yield (kg/ha)		% reduction of aphid population		% reduction of thrips population	
	Coriander	Fennel	Coriander	Fennel	Coriander	Fennel
M1	1780	1824	64.94	63.39	58.25	62.71
M2	2100	2250	71.05	72.96	67.05	74.63
M3	2150	2460	72.79	74.36	69.81	76.66
M4	1750	2030	62.83	68.32	61.96	70.58
M5	1965	1845	68.90	64.37	58.00	60.59
M6	1525	1540	-			
CD (P=0.05)	75.9	67.3	1.47	1.34	1.12	2.00

ii) **Evaluation of plant extracts and bio-pesticides against sucking pests on coriander under organic production system** (Table 7.2.3.2): Eight plant extracts and bio-pesticides were evaluated for management of sucking pests on coriander. All the botanical extracts recorded significant effect for population of thrips, aphids and white fly. Among the different botanical extracts and bio-pesticides, application of *Nimbecidine* 0.03EC- 5ml/lit (T6) resulted in significantly higher percent of reduction of sucking pest such as thrips, aphids and white fly (67.8, 72.15 and 68.96% respectively). Plant extracts treatments T7, & T4 was the next best performer in term of percent reduction of population of thrips, aphids and white flies but on par to each other.

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

Plant extracts and bio-pesticides	Per cent reduction in population		
	Thrips	Aphids	White fly
T1- Lantana camera leaf extract-10%	46.00	47.75	51.62
T2- Chrysanthemum leaf extract-10%	48.50	45.05	51.55
T3- Datura leaf extract-10%	50.56	59.36	57.34
T-4 Neem leaf extract – 10%	61.75	60.47	63.94
T5- Castor leaf extract-10%	47.20	51.80	48.19
T6- Nimbecidine 0.03EC- 5ml/lit. (Standard check)	67.80	72.15	68.96
T7- Verticillium lecani- 5g/lit.	63.35	69.78	53.66
T8-Cow urine -20%	52.68	43.13	67.06
T9- Control	-	-	-
CD (P=0.05)	1.72	1.98	1.64

Udaipur

Evaluation of organic management practices for control of fall army worm (*Spodoptera frugiperda*) in sweet corn

The experiment was conducted to study the effect of different organic management practices for control of fall army worm (*Spodoptera frugiperda*) in sweet corn during *kharif* 2021 in randomized block design with 3 replication.

Treatment details and descriptions

T_1	Absolute control
T_2	Scout your sweet corn crop daily to be able to detect it early + spray of 5% neem leaf extract 15 days should be sprayed in early in morning or late in evening because pest feed at night + use of pheromone mass trap + Pull out weak plant + clear your corn field farm debris and weeds.
T_3	T2 + Dusting of silica powder on foliage of sweet corn plant @ 15kg/ha
T_4	T2 + Dusting of silica powder on foliage of sweet corn plant @ 25kg/ha
T_5	T2 + Application of silicon granules in whorls of sweet corn plants @ 100kg/ha
T_6	T2 + Application of silicon granules in whorls of sweet corn plants @ 125kg/ha
T_7	T2 + Dusting of silica powder on foliage of sweet corn plant @ 15kg/ha + Application of silicon granules in whorls of sweet corn plants @ 100kg/ha
T_8	T2 + Dusting of silica powder on foliage of sweet corn plant @ 15kg/ha + Application of silicon granules in whorls of sweet corn plants @ 125kg/ha
T_9	T2 + Dusting of silica powder on foliage of sweet corn plant @ 25kg/ha + Application of silicon granules in whorls of sweet corn plants @ 100kg/ha
T_{10}	T2 + Dusting of silica powder on foliage of sweet corn plant @ 25kg/ha + Application of silicon granules in whorls of sweet corn plants @ 125kg/ha

Results (Table 7.2.3.3): Significant difference was observed among the different bio-pesticides or concoctions for management of fall army worm in sweet corn. Among the treatments T10 i.e. T2 + Dusting of silica powder on foliage of sweet corn plant @ 25kg/ha + application of silicon granules in whorls of sweet corn plants @ 125kg/ha performed significantly better and recorded lowest infestation (24.1%) which was statistically at par to T7, T8 and T9 but significantly lower than the T1, T2, T3, T5 and T6. Yield attributing characters such as, plant height, cob length, number of grains/ row/cob, resulted in significantly higher green cob yield (3880 kg/ha), green fodder yield (10750 kg/ha, gross return (Rs. 171225/ha) and net return (Rs. 129815/ha) along with highest benefit cost ratio of 3.13. Treatment T9 i.e. (T2 + Dusting of silica powder on foliage of sweet corn plant @ 25kg/ha + application of silicon granules in whorls of sweet corn plants @ 100kg/ha) being the next best performing treatment followed by T8 in term of percent infestation of fall army worm, yield and economics.

Table 7.2.3.3: Effect of bio-pesticides for control of fall army worm in sweet corn

Treatments	% infestation of FAW	Plant height (cm)	Cob length (cm)	Nos. of grains/ rows/ cob	Green cob yield (kg/ha)	Green fodder yield (kg/ha)	Gross return (Rs/ha)	Net return (Rs/ha)	B:C ratio
T_1	36.35	179.0	17.7	22.7	2430	6800	107580	67940	1.71
T_2	30.40	183.0	18.4	24.7	2800	7840	123984	83524	2.06
T_3	28.00	186.0	20.2	30.4	3220	9060	142806	102226	2.52
T_4	27.25	194.0	20.8	31.5	3290	9200	145620	104960	2.58
T_5	28.80	185.0	19.6	28.5	3070	8380	134838	93778	2.28
T_6	30.00	184.0	19.5	26.6	2920	8200	129420	88235	2.14
T_7	26.50	208.0	21.4	33.4	3320	9260	146826	105646	2.57
T_8	25.70	217.0	21.7	33.2	3480	9440	152544	111214	2.69
T_9	25.00	221.0	22.3	35.2	3660	10370	162687	121427	2.94
T_{10}	24.10	225.0	22.5	36.6	3880	10750	171225	129815	3.13
CD (P=0.05)	2.71	18.6	8.3	2.87	304	850	13440	6436	0.23

Scout crop daily + spray of 5% neem leaf extract 15 days spray + use of pheromone mass trap + Pull out weak plant + clear your corn field farm debris and weeds.

T2 + Application of silicon granules in whorls of sweet corn plants @ 100kg/ha

T2 + Dusting of silica powder on foliage of sweet corn plant @ 15kg/ha + Application of silicon granules in whorls of sweet corn plants @ 100kg/ha

T2 + Dusting of silica powder on foliage of sweet corn plant @ 15kg/ha + Application of silicon granules in whorls of sweet corn plants @ 125kg/ha

Field view of evaluation of organic management practices for control of fall army worm (*Spodoptera frugiperda)* in sweet corn at Udaipur

Almora

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

Laboratory evaluation of botanicals and bio-pesticides against pest of soybean (Table 7.2.3.4): Application of 10% extract of *Melia azedarach*, *nimbicidine* 3 mL/L and *Beauveria bassiana* 3g/L provided at par reduction of the sucking bug population however, Cartap hydrochloride 1g/L resulted in significantly reduced the sucking pest in soybean followed by Nimbecidine 3 mL/L and parthenium leaf extract 5% provided reduction of 55.3 and 26.7%, respectively at 96 hours after treatment under laboratory condition. *Melia azadirach* extract 5% recorded lowest mortality. Among the pest management modules tested in field condition, bio-pesticide *Cartap hydrochloride* @ 1g/L provided lowest mortality of 0.23. Whereas, *Parthenium extract 5%, Melia azedarach 5%* and *Beauveria bassiana* 3g/L recorded 12.32, 10.61 and 11.28% mortality after 8 days of treatment under field condition.

Table 7.2.3.4: Effect of organics management (different bio-pesticides) for soybean sucking bug

Plant extract and Concentration	Per cent mortality in soybean under lab condition				Per cent mortality in soybean under field condition				
	24 HAT	48 HAT	72 HAT	96 HAT	PTC	2 DAT	5 DAT	8 DAT	Average
T-1 Melia azadirach extract 5%	3.33	6.67	10	16.67	15.90	11.87	10.87	9.10	10.61
T-2 Melia azadirach extract 10%	0.00	6.67	3.33	20.00	14.00	10.67	8.10	6.27	8.35
T-3 Nimbecidine 3 mL/L	6.67	10.00	50.0	53.33	11.63	8.10	6.20	5.13	6.48
T-4 Beauveria bassiana 3g/L	10.00	20.00	23.3	23.33	20.97	15.60	9.63	8.60	11.28
T-5 Parthenium extract 5%	3.33	10.00	20.0	26.67	10.47	14.63	11.37	10.97	12.32
T-6 Cartap hydrochloride 1g/L	80.00	100.0	100.0	100.00	14.37	0.40	0.20	0.10	0.23
T-7 Control	0.00	0.00	0	6.67	24.97	18.50	14.00	13.70	15.40

HAT- hours after treatment, PTC-pretreatment count, DAT- days after treatment

soybean sucking bug (*Chauliops choprai*)

Effect of botanicals and bio-agents on toria aphids in laboratory and field conditions (Table 7.2.3.5)**:** Among the different botanicals and bio-pesticides, bio insecticide *Acetamiprid* @ 0.25 g/l resulted in significantly higher control the aphids on Toria (98.3%) followed by application of *Nimbicidine* @ 3ml/l which controlled of 72.7% aphid infestation under laboratory condition. Effect of botanicals and bioagents on toria aphids in field conditions showed significant difference. Among the treatments for management of aphids in toria, application of bio-insecticide- *Acetamiprid* @ 0.25 g/l found to be most effective which controlled 90.7% aphid infestation. Application of Nimbicidine @ 3ml/l was the next best performing botanicals and bio-agents which recoded 52.7% infestaion.

Table 7.2.3.5: Effect of botanicals and bio-agents on toria aphids in laboratory and field conditions

Treatments	Per cent pest reduction under laboratory test	Per cent pest reduction under field test
Chitinolytic bacteria UKCH83	25.7	16.0
Chitinolytic Bacillus thuringiensis	22.7	12.0
Botanical extract from Pine @5%	33.0	25.7
Nimbicidine @ 3ml/l	72.7	52.7
Biocontrol agent- Beauveria @ 3g/L	33.3	41.3
Biocontrol agent- Metarhizium @ 3g/L	44.3	35.7
Insecticide- Acetamiprid @ 0.25 g/l	98.3	90.7

Treatments	Per cent pest reduction under laboratory test	Per cent pest reduction under field test
Alternaria alternata strain VLH1	38.0	-
lady bird beetle predator	13.0	-
Syrphid (Hoverfly) as predator	8.7	-
Control	3.7	6.7
CD (P=0.05)	3.7	5.0

Coimbatore

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

Treatment details:

Crop	Details
Cotton	Studies on the effect of cow urine based extracts of ginger, garlic and green chilli for the management of major insect pests T_1 : Ginger extract 5 % T_2 : Garlic extract 5 % T_3 : Green chili extract 5 % T_4 : Ginger extract 5 % + Garlic extract 5 % + Green chili extract 5 % T_5 : Cow urine alone 5 % T_6 : Neem Seed Kernel Extract 5 % (Standard check) T_7 : Untreated check (Water spray)
Maize	Studies on the effect of herbal leaf extracts for the management of fall army worm in maize T_1 : Agniasthra 10 % T_2 : Cow dung - Cow urine extract 10 % T_3 : Five leaf herbal extract 10 % T_4 : Lantana - Calotropis extract 10 % T_5 : Arappu - Butter milk extract 10 % T_6 : 3G extract 10 % T_7 : Cow urine alone 10 % T_8 : Neem Azal (1 %) 2ml/lit T_9 : Thiodicarb 75 % WP 2g/lit T_{10} : Untreated check (Water spray)

Results (Table 7.2.3.6)**:**

Field experiment was conducted to evaluate organic management practices for the management of major insect-pest in cotton and fall armyworm control in maize. Seven indigenous botanical extracts and cow urine concentration was evaluated for management of insect-pest in cotton and ten herbal leaf extracts used for management of fall army worm in maize. Organic Integrated Pest & Disease Management module (OIPDM) were also evaluated for bhindi, brinjal, tomato and chili for control of sucking pest. Among the cow urine based extracts of ginger, garlic and green chilli for the management of major insect pests in cotton, the reduction in pest incidence of 62.8, 52.7, 55.4 and 68.2% higher in the treatment consisting extracts of ginger, garlic and green chilli @ 5% with the yield of 1416 kg/ha for control of leafhoppers, thrips, whiteflies and aphids respectively. Similarly, effect of herbal leaf extracts for the management of fall army worm in maize found to be significantly higher 48.6% among all treatments with the higher yield of 4357 kg/ha.

In bhendi, brinjal, tomato and chilli, organic IPDM module treated plots recorded maximum reduction in pest incidence. The yield of hindi, brinjal, tomato and chili (11847, 19141, 21306 and 13865 respectively) was also higher in the OIPDM module treated plots compared to other treatments.

Table 7.2.3.6: Effect of organic management practices for insect pest 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 %	62.80	1416
	Thrips		52.70	
	Whiteflies		55.40	
	Aphids		68.20	
Maize	Fall armyworm	Ginger, garlic and green chilli extract @ 5 %	48.60	4357
Bhendi	Leafhoppers	OIPDM module	78.40	11847
	Aphids		82.60	
	Whiteflies		64.20	
Brinjal	Shoot and fruit borer	OIPDM module	67.80	19141
	Brown Leafhoppers		64.40	
Tomato	Thrips	OIPDM module	74.30	21306
	Whiteflies		76.50	
Chilli	Aphids	OIPDM module	81.20	13865
	Thrips		64.30	
	Whiteflies		72.60	

Gangtok

Organic insect pest management in maize-based cropping system (Table 7.2.3.7)

Efficacy of the bio-pesticides against infestation of army worm and stem borer in maize crop were tested. Among all the tested bio-pesticides, Spinosad 45 SC showed the best performing bio-pesticides for management of insect-pest in maize which recorded lowest insect score (1.06), lowest borer damage before and after spray (5.20 and 3.71%) and controlled damage as highest of 78.5% and found to be best bio pesticide for control of stem borer. The lowest disease incidence

Damages caused by Army fall worm in maize crop

was also observed with Spinosad 45 SC @ 0.3 ml/l (15.7%) which is about 70% lower than the control. *Beauveria bassiana* @ 7 g/l been the next best performer which recorded lower insect score (1.51), damage before and after spray (7.86 and 4.92%), damage control 72.81% and disease incidence of 21.68%. With application of Spinosad 45 SC @ 0.3 ml/l, yield of maize recorded significantly higher of 3160 kg/ha followed by using of *Beauveria bassiana* @7 g/l which recorded 2850 kg/ha yield.

Table 7.2.3.7: Effect of bio pesticide on insect pest and management in maize-based cropping system

Treatments	Stem borer infestation (%)					TLB
	Insect Score (0-9 scale)	% Damage before spray	% Damage after spray	% Damage control	Grain yield (t/ha)	Disease incidence (%)
Neem oil (1500 ppm @ 4 ml/l	3.32	8.62	5.58	68.12	1940	39.54
Beauveria bassiana @ 7 g/l	1.51	7.86	4.92	72.81	2850	21.68
Metarhizium anisopliae @5 ml/l	3.18	8.18	5.62	69.52	2220	24.41
Petroleum oil based agrospray @ 10 ml/l	4.66	9.45	6.46	65.26	1320	41.42
Petroleum oil based hortis-pray @ 10 ml/l	2.36	7.06	5.33	70.90	2460	23.45
Bacillus thuringiensis @ 2 g/l	4.08	9.10	6.17	66.82	1840	40.12
Spinosad 45 SC @ 0.3 ml/l	1.06	5.20	3.71	78.52	3160	15.66
Control	6.02	8.72	19.84	-	220	52.1
LSD 0.05	0.85	1.02	0.64	-	280	-

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) and Gangtok (Sikkim), Coimbatore (Tamil Nadu)

Centre wise results for each centre are presented below

Ajmer

Results

i) **Management of *Sclerotium* rot of coriander** (Table 7.2.4.1)**:** Four treatments comprising soil solarization (21 days), *Trichoderma* (soil & seed application), neem and castor cake @ 0.5 t/ha each was evaluated for management of *Sclerotium* rot in coriander. Significant variation among the different treatments were recorded but soil solarisation (21 days), *Trichoderma* (soil & seed application) and neem cake (0.5 t/ha) recorded statistically on par to each other. Among the all treatments, effect of soil solarization (21 days) on *Sclerotium* rot was found most effective (PDI, 3.5) followed by *Trichoderma* (soil & seed app) (PDI, 5.00), Numbers of weed/m2 were recorded significantly lower (39.0) with soil solarization followed by in neem cake (103) while the maximum weed /m2 (133.0) recorded with control. Similarly, the maximum yield of coriander (762 kg/ha) was recorded with the treatments Soil solarization 21 days in summer followed by application of Neem cake (0.5 t/ha) of 724 k/ha

Table7.2.4.1: Effect of different treatments on *Sclerotium* rot and powdery mildew of coriander

Treatments	*Sclerotium* Rot (PDI)	Yield kg/ha	No. Weeds /M^2
Soil solarization (21 days)	3.75	762	39.00
Trichoderma (Soil & Seed App)	5.00	719	118.00
Neem cake (0.5 t/ha)	5.75	726	103.00
Castor cake (0.5 t/ha)	7.50	611	109.00
Control	10.50	447	133.00
CD at 0.05%	2.34	29.0	9.03

ii) **Management of *Ramularia* blight in fennel and powdery mildew in coriander** (Table 7.2.4.2): Five treatments comprising foliar spray of neem oil (0.5%), castor oil (0.5%), garlic extract (0.5%), onion extract (0.5%) and control were evaluated for management of *Ramularia* blight in fennel and powdery mildew in coriander. Among all the treatments with respect to *Ramularia* blight, garlic extract was found most effective in term of per cent disease incidence (1.9) followed by neem oil (PDI, 3.0) similarly, the disease incidence of powdery mildew was reduced also with application of Garlic extract (0.5%) of PDI 5.3 which was statistically b on par to neem oil, castor oil and onion extract. Among the different treatment for management of *Ramularia* blight in fennel and *powdery mildew* in coriander, the maximum yield of fennel and coriander (2280 and 785 kg/ha respectively) was also recorded with botanical extract i.e. garlic extract (0.5%) followed by castor oil (1780 & 702 kg/ha respectively). Application of Garlic extract (0.5%) for management of *Ramularia* blight and powdery mildew found to be more effective by 242 and 49.5% over control respectively.

Table 7.2.4.2: Influence of different treatments on *Ramularia* blight, powdery mildew disease and seed yield of fennel and coriander

Treatments	Fennel		Coriander	
	Ramularia blight (per cent disease incidence)	Yield (kg/ha)	Powdery mildew (per cent disease incidence)	Seed yield (kg/ha)
Neem oil (0.5%)	3.00	1830	5.50	746
Castor oil (0.5%)	4.10	1780	5.80	702
Garlic extract (0.5%)	1.90	2280	5.30	785
Onion extracts (0.5%)	3.30	1690	7.30	603
Control	6.50	1530	10.50	436
CD (P=0.05)	1.13	37	2.68	40.0

Coimbatore

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

- In bhendi, the OIPDM module with foliar spray of *azadirachtin* 10,000 ppm @ 2 ml per litre, fermented buttermilk with *Bacillus subtilis* @ 0.5 % followed by foliar application of *panchagavya* 3 % performed better in reducing the incidence of yellow vein clearing disease (72.6 % reduction over control) with the maximum yield of 11847 kg/ha.
- In brinjal, the OIPDM module with foliar spray of *azadirachtin* 10,000 ppm @ 2 ml per litre, fermented buttermilk with Bacillus subtilis @ 0.5 % followed by foliar application of *panchagavya* 3 % recorded the maximum reduction in the incidence of little leaf diseases (86.4 % reduction over control) with the maximum yield of 19141 kg/ha.
- In tomato, the OIPDM module with foliar spray of Bacillus subtilis @ 0.5 % was effective against leaf blight (58.7 % reduction over control) which resulted in higher yield of 21306 kg/ha.
- In chilli, the OIPDM module with foliar spray of *azadirachtin* 10,000 ppm @ 2 ml per litre, fermented buttermilk with Bacillus subtilis @ 0.5 % followed by foliar application of *panchagavya* 3 % performed better in reducing the incidence of yellow leaf curl disease (74.8 % reduction over control) and the yield was also higher (13865 kg/ha) in the IPDM module.

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	72.6	11847
Brinjal	Little leaf disease (MLO)	OIPDM	86.4	19141
Tomato	Early blight (Fungal)	OIPDM	58.7	21306
Chilli	Yellow leaf curl disease (Virus)	OIPDM	74.8	13865

Gangtok

Effect of locally available botanicals, commercially available bio control agents and organically permitted fungicides against diseases of large cardamom

Botanicals, bio-control agents and organically permitted fungicides was evaluation against management of major diseases i.e. chirkey disease, *Chirke* virus (*Maclura virus*), *Foorkey* disease, Bushy dwarf virus (*Nano virus*), leaf blight disease complex associated with group of pathogenic fungi including *Colletotrichum* spp, *Pestaliopsis* spp, *Fusarium spp, Pestalotia* spp. Under study, both in vitro and in vivo trials were undertaken to evaluate the efficacy.

Treatments used against the diseases under in vivo studies

Treatment	Concentration
T1 Garlic	2.50%
T2 Common mugwort (*Artemisia vulgaris*)	2.50%
T3 Needlewood (*Schima wallichii*)	2.50%
T4 Commercial neem based formula (Azadirachtin 1500 ppm) @ 0.15%	0.30%
T5 *Trichoderma viride*	6.50%
T6 *Pseudomonas fluorescens*	0.50%
T7 Copper oxychloride 50% WP	0.25%
T8 Copper hydroxide 75% WP	0.25%
T9 Bordeaux Mixture	0.25%
T10 Sulphur 80% WP	0.10%
T11 Control	-

Methods: The above mentioned treatments were applied at every 15-20 days interval during the period from October–April along with proper integration of cultural practices like removal of old tillers, phytosanitation, nutrient management and moisture conservation. During May-September, the treatments were applied every 25-30 days causing minimum disturbance to the fruit setting process. Other one, in vitro studies were carried out against the leaf blight pathogen isolated and purified on Potato Dextrose Agar (PDA) media. Among the several pathogens identified in leaf blight complex, *Pestalotiopsis* spp., culture was used to conduct the in-vitro assay using dual culture and poison food technique. The treatments were mixed in the PDA using the poison food technique and 2 mm pathogen discs were placed in the centre of the Petri plate to evaluate the growth of pathogen mycelia. In addition to the treatments described earlier, in vitro assay was carried out for a *Trichoderma* strain isolated (ICAR-TV7) and purified from the native *rhizosphere* soil. Mycelium discs (2 mm diameter size each) of pathogen and antagonist ICAR-TV7 were dissected from five days old cultures. These were placed 5cm away from each other in opposite direction on PDA. The plates inoculated with pathogen only were served as control.

Table 7.2.4.4: Inhibition of pathogen growth against the treatments under *in vitro* condition

Treatment		Mean growth of pathogen mycelia (mm)	Percentage recovery over control
T_1	Garlic (*Allium sativum*) 2.5%	23.2	72.4
T_2	Common Mug wort (*Artemisia vulgaris*) 2.5%	26.4	69.6
T_3	Needle wood (*Schiima wallichii*) 2.5%	19.6	77.4
T_4	Neem based formula (Azadirachtin 1500ppm)	12.00	84.9
T_5	*Trichoderma viride*6.5%	20.5	75.2
T_6	ICAR-TV7	13.4	84.6
T_7	*Pseudomonas fluorescens* 0.5%	37.2	56.4
T_8	Copper oxychloride 50% WP	33.2	60.2
T_9	Copper hydroxide 75% WP	66.00	21.3
T_{10}	Bordeaux Mixture	83.67	0.55
T_{11}	Sulphur 80% WP	13.07	83.2
T_{12}	Control	86.6	0.00
	CD (0.05%)	6.38	-

Result: Among the treatments, significant difference was observed. The maximum recovery of disease over control of 84.9% was observed in neem based compound *(Azadirachtin* 1500 ppm*)* and ICAR-TV7 (84.6%) followed by sulphur 80%

WP of 83.25%. Among the botanicals, Garlic (Allium sativum) 2.5% and *Trichoderma viride*.5% treatment and neem based formula inhibited the insect vector involved in the spread of disease with its antibiotics and growth promoting role enhanced the host defence. The results of the *in vitro* studies were also in accordance to the *in-vivo* studies and mentioned in Table 7.2.4.4. Among the treatments, the best performance was showed by neem based formulation with only 12.00 mm growth of pathogen followed by sulphur 80% WP 13.07 mm of growth. The least performance was shown by Bordeaux mixture and copper hydroxide 75% WP with maximum pathogen growth of 83.67 mm and 66.0 mm, respectively and maximum percentage recovery over control was reported in commercial neem based formula (Azadirachtin 1500ppm) with 84.9 % followed by ICAR-TV7 with 84.6 % and the minimum percentage recovery over control was 0.55 % in Bordeaux mixture.

Effect of different botanicals on the yield and disease incidence of large cardamom (Table 7.2.5)**:** It was found that the application of *Trichoderma viride* and *Pseudomonas fluorescens* preformed the best among all the treatments (Table7.2.4.4). The number of flowers was recorded to be highest with application of *Pseudomonas fluorescens* with 9 flowers/plants followed by *Trichoderma viride* with 8 flowers/plants. Similarly in case of total number of tillers, mature tillers these were also found in *Trichoderma viride and Pseudomonas fluorescens* of 22 & 21 and 19 & 17 respectively. Likewise the immature tillers were found to be more in case of Garlic with 9 immature followed by *Pseudomonas fluorescens* of 5. The fresh weight of the tillers were more in *Trichoderma viride* followed by (Artemisia vulgaris) 2.5% and Garlic (Allium sativum) 2.5%. Dry weight was more in Trichoderma viride and Garlic (Allium sativum) 2.5%. The recovery (%) were also recorded which was found to be maximum in case of copper oxychloride with 88.6% followed by *Pseudomonas fluorescens* with 87.4%. Number of seeds/fruit were maximum in neem based formula (Azadirachtin 1500 ppm) of 22.8, followed by *Trichoderma viride* (21.1). Among the treatments, minimum disease incidence was recorded in neem based formula (*Azadirachtin* 1500 ppm) which is 26% followed by Garlic (*Allium sativum*) with 30% disease incidence.

Leaf blight

leaf streak

Foorkey Infection

Chirkey infection Incidence of major diseases in large cardamom

Table 7.2.4.5: Effect of different botanicals on the yield and disease incidence of large cardamom

Treatment details	No. of fowers/ plant	Total number of tillers	No. of mature tillers	No. of immature tillers	Fresh weight (g)	Dry weight (g)	Recovery %	No. of seeds/ fruit	Disease free tillers	Disease infected tillers	Disease incidence %
Garlic (*Allium sativum*) 2.5%	6	22	13	9	302	53	82.5	18.6	15	7	30
Common Mug wort (*Artemisia vulgaris*) 2.5%	6	14	12	3	305	45	84.4	13.2	9	6	38
Needle wood (*Schima wallichii*) 2.5%	5	16	12	3	264	46	81.6	12.8	10	6	36
Neem based formula (*Azadirachtin* 1500 ppm)	6	14	11	2	246	46	80.4	22.8	10	4	26
Trichoderma viride	8	22	19	3	315	53	82.4	21.1	13	7	35
Pseudomonas fuoresces	9	21	17	5	201	27	87.4	10.3	10	10	43
Copper oxychloride 50% WP	5	15	13	3	234	25	88.6	16.2	11	7	41
Copper hydroxide 75% WP	4	17	14	3	152	24	84.3	14.3	10	9	44
Bordeaux Mixture	5	16	13	2	135	36	72.2	12.4	8	9	54
Sulphur 80% WP	7	15	12	3	218	42	79.8	20.4	10	4	26
Control	5	19	17	5	136	22	82.5	11.1	8	15	66
CD (P=0.05)											

7.2.5 Development of scientific organic package for large cardamom

Objective

- Standardization of organic source of nutrients in large cardamom for yield maximization

Year of start: 2015-16

Location: Gangtok (Sikkim)

A. Standardization of organic nutrient management package for large cardamom

Among the different organic nutrient's management in the large cardamom, number of mature tillers/bush (4.18) recorded significantly higher with the application of FYM @10 kg + VC @2.5 kg/clump +Bio fertilizer which was on par with input management of FYM @7.5 kg + VC @ 2.5 kg/clump + BF (4.06). The dry weight of capsules per clump and the productivity of the large cardamom i.e., 19.96 g and 416 kg/ha recorded significantly higher when vermicompost was applied @ 10 kg/clump+ bio-fertilizer which was on par with VC @7.5 kg/clump + BF (18.86 & 409 kg/ha respectively). The soil organic carbon, available N, P and K showed significant variation among the different organic nutrient management package and recorded highest with application of vermicompost @ 10 kg/clump + biofertilizer (1.24%, 362, 24.6 and 218 kg/ha) followed by VC @7.5 kg/clump + BF and FYM @ 10 kg + VC @ 2.5 kg/clump + Bio-fertilizer (Table 7.2.5.1)

Table 7.2.5.1: Effect of organic nutrient management package on large cardamom

Treatments	Mature tillers/bush	Dry wt. of capsules/ clump (g)	Productivity (kg/ha)	SOC (%)	Available N (kg ha^{-1})	Available P(kg ha^{-1})	Available K (kg ha^{-1})
FYM @ 5 kg/clump + BF	3.08	14.78	330	1.12	316	22.4	209
FYM @7.5 kg/ clump + BF	3.16	15.96	316	1.14	326	22.8	210
FYM @ 10 kg/ clump + BF	3.38	16.38	345	-1.18	325	22.6	212
FYM @ 5 kg + VC @ 2.5 kg/clump + BF	3.98	16.44	370	1.17	335	22.4	210
FYM @7.5 kg + VC @2.5 kg/clump + BF	4.06	18.06	390	1.22	342	23.4	211
FYM @10 kg + VC @2.5 kg/clump +BF	4.18	18.86	403	1.23	347	24.2	213
VC @ 5.0 kg/clump + BF	2.76	17.62	397	1.13	330	21.4	210
VC @7.5 kg/clump + BF	3.13	18.94	409	1.18	356	22.2	217
VC @10 kg/clump + BF	3.14	19.96	416	1.24	362	24.6	218
Control	1.04	5.38	103	0.95	228	15.2	182
LSD (P=0.05)	0.26	0.54	22.1	0.07	9.33	1.49	9.37

B. Response of large cardamom (growth parameters and yield) to soil and foliar application of micronutrients

Among the soil treatment through micronutrients, available nutrients i.e. boron, zinc and molybdenum, vegetative buds (immature tiller, mature tiller & vegetative buds) significantly increased with maximum dose of boron, zinc and molybdenum of 3.0, 2.0 and 10.0 kg/ha respectively when applied in the soil. Similarly, foliar application of micronutrients with the maximum dose 0.3% boron, 0.5% of zinc and 0.2% molybdenum resulted in significantly increased the nos of immature tiller, mature tiller & vegetative buds (Table 7.2.5.2).

Table 7.2.5.2: Effect of soil and foliar application of micronutrients in response of large cardamom (growth and yield parameters)

Treatments		Dose	Available nutrients (mg kg^{-1})	Immature tiller (Nos.)	Mature tiller (Nos.)	Vegetative buds (Nos.)
Soil application			Sep-20- Aug -21	Sep-20- Aug -21	Sep-20- Aug -21	Sep-20- Aug -21
T1	Boron	1.0 kg/ha	0.155	3.19	3.05	2.41
		2.0 kg/ha	0.167	3.25	3.16	2.44
		3.0 kg/ha	0.169	3.32	3.24	2.53
T2	Zinc	1.0 kg/ha	3.31	2.89	2.93	2.37
		1.5 kg/ha	3.49	3.16	3.11	2.40
		2.0 kg/ha	3.70	3.03	3.00	2.38
T3	Molybdenum	5.0 kg/ha	0.119	2.77	3.00	2.27
		7.5 kg/ha	0.124	2.84	3.10	2.33
		10.0 kg/ha	0.125	3.09	3.15	2.41
Foliar application						
T1	Boron	0.10%	0.176	3.64	3.40	2.79
		0.20%	0.178	3.76	3.46	2.78
		0.30%	0.181	3.80	3.56	2.77
T2	Zinc	0.10%	3.58	3.69	3.34	2.68
		0.25%	3.71	3.77	3.38	2.69
		0.50%	3.77	2.84	3.24	2.62
T3	Molybdenum	0.05%	0.117	2.00	3.12	2.57
		0.10%	0.119	2.17	3.16	2.66
		0.20%	0.124	1.66	2.12	1.80
T7	Control	Control	1.08	0.62	0.64	0.56
LSD (P=0.05)			0.33	0.36	0.49	0.30

Maximum Immature tillers under the foliar application treatment of boron @ 30%

Maximum vegetative buds under the foliar application treatment of boron @ 30%

C. Organic disease management in large cardamom

Effect of different botanicals on the yield and disease incidence of large cardamom

The evaluation of the botanicals, bio-control agents and organically permitted fungicides against the three major diseases included chirkey disease caused by Large Cardamom, Chirke Virus (*Maclura virus*), Foorkey disease caused by Cardamom, Bushy Dwarf virus (*Nano virus*), leaf blight disease caused by complex group of pathogenic fungi *Colletotrichum spp, Pestaliopsis* spp*, Fusarium spp, Pestalotia spp*. Were under taken in the trial, both *in vitro* and *in vivo* to evaluate the efficacy of the treatments.

Methods and Results (Table 7.2.5.3 & 4)**:** Treatments were applied at every 15-20 days interval during the period of October-April along with proper integration of cultural practices like removal of old tillers, phyto-sanitation, nutrient management and moisture conservation. During May- September, the treatments were applied every 25-30 days causing minimum disturbance to the fruit setting process. A positive correlation was also observed between the treatments and the yield parameters of the plants. *Pseudomonas fluorescens* application had performed the best among all the treatments (Table 8). The number of flowers was recorded to be highest in case of *Pseudomonas fluorescens* with 9 flowers/plants followed by *Trichoderma viride* with 8 flowers/plants. Similarly in case of total number of tillers, the highest tillers were found in *Trichoderma viride* and Garlic with total of 22 numbers of tillers followed by 21 tillers in *Pseudomonas fluorescens* application. The maximum mature tillers were recorded in *Trichoderma viride* and *Pseudomonas fluorescens* with 19 and 17 matured tillers respectively. Likewise, the immature tillers were found to be more in case of Garlic with 9 followed by *Pseudomonas fluorescens* with 5. The fresh weight of the tillers was more in *Trichoderma viride* with 315 gm followed by (*Artemisia vulgaris*) 2.5% with 305 gm and Garlic (*Allium sativum*) 2.5% with 302 gm and the dry weight was more in *Trichoderma viride* and Garlic (*Allium sativum*) 2.5% with 53 gm. The recovery (%) were also recorded which was found to be maximum in case of copper oxychloride with 88.6 % followed by Pseudomonas fluorescens with 87.4 %, the number of seeds/fruits were maximum in Commercial neem based formula (Azadirachtin 1500 ppm) (22.8), followed by *Trichoderma viride* (21.1). Maximum disease free tillers were recorded in Garlic (*Allium sativum*) 2.5% with 15 number of tillers followed by *Trichoderma viride* with 13 number of tillers. Minimum disease infected tillers were recorded in Neem based (Azadirachtin 1500 ppm) and Sulphur 80% WP with 4 numbers of tillers followed by Artemisia vulgaris 2.5% and Needle wood (Schima wallichii) 2.5% with 6 numbers of tillers. It was recorded that the minimum disease incidence was recorded in Commercial neem based formula (Azadirachtin 1500 ppm) and sulphur 80% WP with 26 % followed by Garlic (*Allium sativum*) with 30 % disease incidence.

The *in vitro* studies were carried out against the leaf blight pathogen isolated and purified on Potato Dextrose Agar (PDA) media. Among the several pathogens identified in leaf blight complex, *Pestalotiopsis* spp. culture was used

Table 7.2.5.3: Effect of treatments on the yield parameters and disease incidence of large cardamom under field conditions

Treatment details	No. of flowers/ plant	Total number of tillers	No. of mature tillers	No. of immature tillers	Fresh weight (g)	Dry weight (g)	Recovery %	No. of seeds/ fruit	Disease free tillers	Disease infected tillers	Disease incidence %
T1: Garlic (*Allium sativum*) 2.5%	6	22	13	9	302	53	82.5	18.6	15	7	30
T2: Common Mug wort (*Artemisia vulgaris*) 2.5%	6	14	12	3	305	45	84.4	13.2	9	6	38
T3: Needle wood (*Schima wallichii*) 2.5%	5	16	12	3	264	46	81.6	12.8	10	6	36
T4: Commercial neem-based formula (Azadirachtin 1500 ppm)	6	14	11	2	246	46	80.4	22.8	10	4	26
T5: *Trichoderma viride* 6.5%	8	22	19	3	315	53	82.4	21.1	13	7	35
T6: *Pseudomonas fluorescens* 0.50%	9	21	17	5	201	27	87.4	10.3	10	10	43
T7: Copper oxychloride 50% WP 0.25%	5	15	13	3	234	25	88.6	16.2	11	7	41
T8: Copper hydroxide 75% WP 0.25%	4	17	14	3	152	24	84.3	14.3	10	9	44
T9: Bordeaux mixture 0.25%	5	16	13	2	135	36	72.2	12.4	8	9	54
T10: Sulphur 80% WP 0.10%	7	15	12	3	218	42	79.8	20.4	10	4	26
T11: Control	5	19	17	5	136	22	82.5	11.1	8	15	66
CD (0.05%)	2.33	NS	NS	2.76	110	18.76	-	4.86	4.80	3.56	12.9

to conduct the *in vitro* assay using dual culture and poison food technique. The treatments were mixed in the PDA using the poison food technique and 2 mm pathogen discs were placed in the centre of the Petri plate to evaluate the growth of pathogen mycelia. In addition to the treatments described earlier, *in vitro* assay was carried out for a *Trichoderma* strain isolated (ICAR-TV7) and purified from the native rhizosphere soil. Mycelium discs (2 mm diameter size each) of pathogen and antagonist ICAR-TV7 were dissected from five days old cultures. These were placed 5 cm away from each other in opposite direction on PDA. The plates inoculated with pathogen only were served as control. Three replicates for each treatment were kept and then incubated at 27±2°C for 7 days. Assessment of antagonistic ability of BCAs was done through dual culture assay technique and the per cent growth inhibition was calculated using following formula.

$$I\% = (C-T)/C \times 100$$

Where, I = Inhibition of pathogen growth, C = Pathogen Colony diameter in control,
T =Pathogen colony diameter in dual culture.

The results of the *in vitro* studies were also in accordance to the *in-vivo* studies and mentioned in Table 7.2.5.4. Among the treatments the best performance was showed by neem based formulation with only 12.00 mm growth of pathogen followed by sulphur 80% WP 13.07 mm of growth. The least performance was shown by Bordeaux mixture and copper hydroxide 75% WP with maximum pathogen growth of 83.67 mm and 66.0 mm, respectively and maximum percentage recovery over control was reported in Commercial neem based formula (Azadirachtin 1500ppm) with 84.9 % followed by ICAR-TV7 with 84.6 % and the minimum percentage recovery over control was 0.55 % in Bordeaux mixture.

Table 7.2.5.4: Inhibition of pathogen growth against the treatments under *in vitro* condition

Treatment details	Mean growth of pathogen mycelia (mm)	Percentage recovery over control
T1: Garlic (*Allium sativum*) 2.5%	23.2	72.4
T2: Common Mug wort (*Artemisia vulgaris*) 2.5%	26.4	69.6
T3: Needle wood (*Schima wallichii*) 2.5%	19.6	77.4
T4: Commercial neem-based formula (Azadirachtin 1500 ppm)	12.00	84.9
T5: *Trichoderma viride* 6.5%	20.5	75.2
T6: ICAR-TV7	13.4	84.6
T7: *Pseudomonas fluorescens* 0.50%	37.2	56.4
T8: Copper oxychloride 50% WP 0.25%	33.2	60.2
T9: Copper hydroxide 75% WP 0.25%	66.00	21.3
T10: Bordeaux mixture 0.25%	83.67	0.55
T11: Sulphur 80% WP 0.10%	13.07	83.2
T12: Control	86.6	0.00
CD (0.05%)	6.38	

Foorkey

Leaf blight

leaf streak

Inter culture operation and spraying of botanicals, bio control agents and organically permitted fungicides

D. Organic insect pest management in large cardamom

Result: Insects that cause infestation in Large Cardamom are Leaf caterpillars, Tea Mosquito bug, Shoot fly, Stem borer and Root mealy bug. The experiment was conducted to evaluate the efficacy of biopesticides for Organic insect pest management in large cardamom. All the treatments showed effective results to control insect pests over the control. However, Spinosad 45 SC @ 0.3 ml/l was found to be the most effective to control all the pests (70.14 % to 80.84 % reduction of infestation over control) followed by neem oil (1500 ppm) @ 4 ml/l (61.26 to 73.12 % reduction of infestation over control) and petroleum agrospray @ 10 ml/l (56.44 % to 72.11 % reduction of infestation over control).

Table 7.2.5.5: Effect of Bio-pesticides on insect of large cardamom

Treatments	Dose	Percent reduction in damage over control				
		Leaf caterpillar damage	Tea Mosquito bug damage (%)	Shoot fly damage (%)	Root mealy bug incidence (%)	Stem borer damage (%)
Neem oil (1500 ppm)	4 ml/l	73.12	66.34	59.28	*	61.26
Beauveria bassiana	7 g/l	40.64	9.92	51.08	*	51.14
Metarhizium anisopliae	5 ml/l	43.42	7.22	40.88	*	40.34
Petroleum oil based agro-spray	2ml/lit	58.14	68.32	42.88	*	43.14
Petroleum oil based horti spray	10 ml/l	50.82	72.11	50.68	*	56.44
Bacillus thuringiensis	2 g/l	46.36	10.06	55.28	*	57.14
Spinosad 45 SC	0.3 ml/l	80.84	75.42	71.98	*	70.14
CD (P=0.05)		4.48	4.36	5.64	*	9.24

Different types of Leaf caterpillar infestation in Large Cardamom

Different types of Leaf caterpillar infestation in Large Cardamom

7.2.6: Evaluation and Validation of Natural Farming Practices under different Agro-Ecological Regions

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 initiated from *kharif* 2020. Studies were undertaken at 20 locations covering 16 states.

A total 154 natural farming farmers located in 31 blocks under 27 districts covering 8 States were surveyed under geo-referenced characterization for natural farming farmers. Average land holding size is 0.99 ha. Cow, goat poultry are the major livestock maintained by the farmers. *Jeevamrit, Ghanjeevamrit, Beejamirt, Neemastra,, Bramhastra and Dasparni extract* 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.

Physicochemical and biological characterization of inputs components which are used for preparing the concoctions and final product such as *Beejamrit, Ghanjeevamrit, Jeevamrit* also other inputs such *as Agniaster, Neemaster* and *Brahmaster* were characterized at Calicut, Coimbatore, Ludhiana, Narendrapur, and Udaipur. Details presented in chapter 7.1.3

Titled of experiment: Evaluation of Natural Farming Practices in different agro ecologies

Detail of treatments: Treatments: 9, Replications: 3, Design: RBD, Plot size: Minimum 100 m^2 /treatment/ replication.

Treatments	Details
T_1	Control (No addition of any inputs except labour for operations including weeding)
T_2	Complete NF (1. Beejamrit +Ghanjeevamrit + Jeevamrit; 2. Crop residue mulching; 3. Intercropping; 4. Whapasa)
T_3	NF without 1 (Beejamrit + Ghanjeevamrit + Jeevamrit)
T_4	NF without 2 (crop residue mulching)
T_5	NF without 3 (intercropping)
T_6	NF without 4 (Whapasa, irrigating in alternate rows and during noon)
T_7	AI-NPOF package
T_8	Integrated Crop Management (50 % nutrient application through organic manures and 50% nutrient application through inorganic sources with use of Neemaster, agniaster, Brahmaster and dashparni ark for pest management)
T_9	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: 19 with 8 major commonly practiced cropping systems were undertaken. Location wise details of cropping systems and mulching material are as under

Locations	Cropping system	Mulching material
Ajmer, Udaipur and SK Nagar	Cowpea +Maize fodder (4:2) — Fennel + Cabbage (2:1)	Stover of fennel during *kharif* and leaves of fennel during *rabi*
Modipuram, Ludhiana and Pantnagar	Maize +Cowpea (fodder) (2:1) at 60 cm—Vegetable pea at 30 cm	Rice straw @ 5 t/ha in both the seasons
Bhopal, Jabalpur, Raipur	Soybean +Maize (4:1) at 30 and 60 cm — Wheat +Mustard (8:2) at 22.5 cm.	Mustard residue mulch during *kharif* and soybean residue mulch in *rabi*
Karjat and Ranchi	Rice + *daincha*—Maize+ Cowpea (fodder)	Azolla in *kharif* Rice straw in *rabi*
Coimbatore, Dharwad	Cotton (MCU-13) +Green gram (DGGV 2) (1:1) at 60 cm—*Rabi* sorghum +chickpea (1:1) at 45 cm.	Maize stover @ 5 t/ha in both the seasons
Calicut, Umiam	Turmeric +Cowpea (1:1)—Green gram	Dried coconut leaves / other plants as per availability
Bajaura, Gangtok, Almora	Soybean+ Maize for grain (2:1) — Vegetable pea+ Green Coriander (2:1)	Wheat straw during *kharif* & maize straw during *rabi*
Thiruvananthapuram	Cassava +Vegetable cowpea (1:1) at 90 x 90 cm —Green gram	Residue mulching @ 5 t/ha as per availability

The results of each center are presented and discussed (Table 7.2.6.1 & 7.2.6.5)

Ajmer: Cow pea + maize - coriander + fenugreek cropping system were evaluated. Complete natural farming recorded system equivalent yield of 1912 kg/ha. Under complete natural farming, soil organic carbon recorded numerically higher (0.27%) compared to control (0.26%). Complete natural farming recorded net return of Rs. 82,093 with cost of cultivation of Rs. 25,640. Natural farming resulted in reduction in cost of cultivation by 60.73% and 50.52% over organic and integrated crop management respectively.

Cow pea + maize under complete NF

Cowpea sole crop under AINPOF

Coriander under complete NF

Coriander under AINP-OF

Udaipur: Cowpea + maize - fennel + cauliflower cropping system were evaluated. Under complete natural farming system equivalent yield recorded 7337 kg/ha. Soil organic carbon (0.71%) was recorded with complete natural farming which higher over control (0.67%) however it was 4.05% lower than organic. Complete natural farming recorded net return of Rs. 1,74,362/ha with cost of cultivation of 81,805 /ha. Natural farming resulted in reduction in cost of cultivation by 17.62% organic package.

Complete NF

AI-NPOF package

Complete NF

AI-NPOF package

Sardarkrushinagar: Cowpea +maize -fennel+ cauliflower cropping system were evaluated. Under complete natural farming, system equivalent yield of 1379 kg/ha. Under complete natural farming soil organic carbon was recorded 1.32% which was 20% higher over control (1.10%). Complete natural farming recorded net return of Rs. 23,668/ha with cost of cultivation of 38,457/ha which found to be a negative in term of return.

Fennel+ cauliflower under natural farming package

Bird view of Natural Farming experiment at SK Nagar

Almora: Soybean + maize - vegetable pea + green coriander systems were evaluated. Complete natural farming recorded system equivalent yield of 7920 kg/ha. Soil organic carbon recorded 0.87% under complete natural farming which is 6.1% higher over control but 29.84% was decreased over organic package (NF-4). Complete natural farming practice recorded

net return of Rs 2,65,436/ha with cost of cultivation of 1,09,033. Natural farming resulted in reduction in cost of cultivation by 0.45% over organic package.

Bajaura: Complete natural farming recorded system equivalent yield of 5814 kg/ha. Soil organic carbon (0.85%) recorded under complete natural farming which is 28.7% higher over control. Complete natural farming practice recorded net return of Rs 2,56,403/ha with cost of cultivation of 87,000 in soybean+ maize - vegetable pea + green coriander systems. Natural farming resulted in reduction in cost of cultivation about 5.7 % over organic.

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

Vegetable pea+ green coriander comparison among NF, AI-NPOF & ICM during *rabi* (Bajaura)

Gangtok: Complete natural farming recorded system equivalent yield of 8039 kg/ha. Soil organic carbon (1.17%) recorded under complete natural farming which was 31.4% higher compared to control (0.89%). Complete natural farming practice recorded of Rs 2,65,900 /ha with cost of cultivation of 1,20,230 in soybean+ maize - vegetable pea + green coriander systems. Natural farming resulted in increased significantly in cost of cultivation by 45.4% over organic.

Bhopal: Soybean+ maize - wheat + mustard recorded system equivalent yield of 5297 kg/ha. Net return of Rs. 39,895/ha recorded in complete natural farming with cost of cultivation of Rs.52,343/ha. Complete natural farming practice resulted in reduction in cost of cultivation by 35.4 and 38.7% over organic and integrated crop management (ICMCP) practice respectively.

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

Performance wheat under complete NF, AINP-OF and ICM (Bhopal)

Raipur: Soybean + maize - wheat + mustard systems were evaluated. Complete natural farming practice recorded system equivalent yield of 2720 kg/ha. Complete natural farming recorded soil organic carbon of 0.64% which is 12.2% higher over control. Net return of Rs. 55,274/ha recorded in complete natural farming with cost of cultivation of Rs.79,015 /ha. Complete natural farming practice resulted in reduction in cost of cultivation by 5.9% over organic practice and increase in cost of cultivation by 8.3% over integrated crop management (ICMCP) practice.

Soybean+ maize (Raipur)

Wheat+ mustard (Raipur)

Coimbatore: Cotton + green gram - sorghum + chickpea cropping system was evaluated. Complete natural farming practice recorded system equivalent yield of 2730 kg/ha. Complete natural farming recorded soil organic carbon of 0.71% which was 14.5% higher over control. Net return of Rs. 85,662/ha recorded in complete natural farming with cost of cultivation of Rs.78,210/ha. Complete natural farming practice resulted in reduction in cost of cultivation by 46.2 and 48.1% over organic and integrated crop management (ICMCP) practice respectively.

Dharwad: Complete natural farming practice recorded system equivalent yield of 670 kg/ha. Complete natural farming recorded soil organic carbon of 0.88% which was 15.7% higher over control. Net return of Rs. 29,516/ha recorded under complete natural farming with cost of cultivation of Rs.44,122/ha in cotton + green gram - sorghum + chickpea cropping system. Complete natural farming practice resulted in reduction in cost of cultivation by 29.1 and 21.3% over organic practice and integrated crop management (ICMCP) respectively.

Performance of cotton crop under complete natural farming, AINP-OF and ICM at Dharwad

Performance of *Rabi* Sorghum crop under complete natural farming, AINP-OF and ICM at Dharwad

Umiam: Turmeric + cowpea - green gram cropping system were evaluated. Under complete natural farming system equivalent yield recorded 11400 kg/ha. Complete natural farming recorded net return of Rs. 1,27,700 /ha with cost of cultivation of 65,644/ha. Natural farming resulted in reduction in cost of cultivation by 26.6 and 34.0% over organic practice and integrated crop management (ICMCP) respectively.

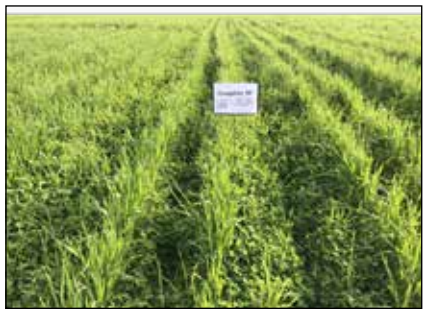
Karjat: Rice + dhaincha - sweetcorn + cowpea cropping system was evaluated. Complete natural farming practice recorded system equivalent yield of 8735 kg/ha. Complete natural farming recorded soil organic carbon of 1.03% which was 3% higher over control but about 1.9% lower than organic package. Net return of Rs. 12,741/ha recorded in complete natural farming with cost of cultivation of Rs.1,56,716 /ha. Natural farming resulted in reduction in cost of cultivation by 29.0 and 18.0% over organic practice and integrated crop management (ICMCP) respectively.

Performance of rice + *dhaincha* and sweetcorn + cowpea under natural farming (Karjat)

Ranchi: Rice-sweet corn cropping system was evaluated. Complete natural farming practice recorded system equivalent yield of 5676 kg/ha. Complete natural farming recorded soil organic carbon of 0.62% which was significantly higher by 37.7% over control. Net return of Rs. 94,284/ha recorded in complete natural farming with cost of cultivation of Rs.58,500/ha. Complete natural farming practice resulted in reduction in cost of cultivation by 23.5 and 27.5% over organic and integrated crop management (ICMCP) practice respectively.

Ludhiana: Maize + cowpea - wheat + chickpea cropping system was evaluated. Complete natural farming practice recorded system equivalent yield of 3500 kg/ha. Complete natural farming recorded soil organic carbon of 0.40% which was about 4.7% lower over control. Net return of Rs. 24,802/ha with cost of cultivation of Rs.52,360/ha recorded in complete natural farming. Complete natural farming practice resulted in reduction in cost of cultivation by 48.6 and 16.0% over organic and integrated crop management (ICMCP) practice respectively.

Performance of maize +cowpea crop under complete natural farming



Performance of wheat + chickpea under AINP-OF and ICM at Ludhiana

Modipuram: Complete natural farming practice recorded system equivalent yield of 3247 kg/ha. Complete natural farming recorded soil organic carbon of 0.55% which was 7.8% higher over control (0.41%). Net return of Rs. 11,614/ha with cost of cultivation of Rs.72,480/ha recorded in complete natural farming from maize + cowpea - wheat + chickpea cropping

system. Complete natural farming practice resulted in reduction in cost of cultivation by 32.07 and 22.9% over organic and integrated crop management (ICMCP) practice respectively.

Performance of wheat +chickpea under complete NF, AINP-OF and ICM at Modipuram

Thiruvananthapuram: Cassava - cowpea cropping system was evaluated. Complete natural farming practice recorded system equivalent yield of 47019 kg/ha. Complete natural farming recorded soil organic carbon of 0.93% which was 3.1% lower over control (0.86%). Net return of Rs. 6,98,901/ha with cost of cultivation of Rs.2,41,470/ha recorded in complete natural farming. Complete natural farming practice resulted in reduction in cost of cultivation by 29.7 and 27.8% over organic and integrated crop management (ICMCP) practice respectively.

Table7.2.6.1: Yield of main crop and inter crop as influenced by different natural farming practices at different locations

Centres	Crops/ treatments	Control	Complete NF		NF-1 (without -Beejamrit + Ghanjeevamrit + Jeevamrit)		NF-2 (without- crop residue mulching)		NF-3 (without inter- cropping)	NF-4 (without- Whapasa, irrigating in alternate rows and during noon)		AI-NPOF package	Integrated Crop Management + NF based pest control methods (ICMNF)	Integrated Crop Manage- ment + chemical pesticides (ICMP)	CD (P=0.05)	
Main sole crop			Main crop	Inter crop	Main crop	Inter crop	Main crop	Inter crop	Main sole crop	Main crop	Inter crop	Main sole crop	Main sole -crop	Main sole crop	Main crop	Inter crop
Ajmer	Vegetable cowpea + maize	214	371	1756	362	1722	381	1766	395	386	1973	452	524	538	92.0	
	Coriander + fenugreek	86	247	638	204	653	274	615	106	293	743	248	271	319		
Udaipur	Vegetable cowpea +maize	1146	1023	9673	961	6600	990	9000	1610	1011	9670	1720	1780	1875		
	Fennel + cauliflower	1250	991	4280	888	2410	942	3210	1461	953	3820	1916	1971	2011		
S K Nagar	Vegetable cowpea + maize	106	259	4861	180	2563	194	3439	294	227	5572	367	397	407	220.0	
	Fennel + cabbage	93	119	4861	79	3902	109	4332	149	136	5258	417	407	437		
Almora	Soybean + maize	1685	1704	1620	1773	1657	1742					2059	1859	2004		
	Gardenpea + green coriander	8248	8081	988	8024	984	8176					11012	11970	10861		
Bajaura	Soybean+ maize	1160	2010	2600	1280	2290	1740	2480	1700	1700	2370	2530	2860	2920		
	Green pea+ green coriander	5240	6760	1260	5640	820	6250	1080	6490	6370	1060	8340	9350	9460		
Gangtok	Soyabean + maize	1650	2140	3616	1883	3260	1920	3316	2080	198	3383	2680				
	Vegetable pea + coriander	5760	6073	526	5940	446	5923	440	6043	6006	4722	7126				
Bhopal	Soybean+ maize	533	711	2437	622	2078	607	2224	688	653	2274	746	794	816		
	Wheat + mustard	2265	3038	1577	2490	1337	2520	1368	2925	2670	1471	4042	4940	5198		

Centres	Crops/ treatments	Control	Complete NF		NF-1 (without -Beejamrit + Ghanjeevamrit + Jeevamrit)		NF-2 (without- crop residue mulching)		NF-3 (without inter-cropping)	NF-4 (without- Whapasa, irrigating in alternate rows and during noon)		AI-NPOF package	Integrated Crop Management + NF based pest control methods (ICMNF)	Integrated Crop Manage-ment + chemical pesticides (ICMP)	CD (P=0.05)	
Main sole crop			Main crop	Inter crop	Main crop	Inter crop	Main crop	Inter crop	Main sole crop	Main crop	Inter crop	Main sole crop	Main sole -crop	Main sole crop	Main crop	Inter crop
Raipur	Soybean + maize	1316	672	4425	659	3716	638	3630	1417	668	4371	2281	1979	1881		
	Wheat + mustard	1658	1043	358	875	266	577	214	2219	913	350	2932	3382	3423		
Coimbatore	Cotton + green gram	691	887	457	672	316	695	286	1361	906	432	1895	2478	2214		
	Sorghum + chick pea	714	1024	362	735	248	602	205	1878	1010	320	2510	2619	2695		
Dharwad	Cotton + greengram	85	159	9	89	11	152	9	158			178	179	244		
	Rabi sorghum + chickpea	709	851	285	799	247	835	264	841			1078	1119	1187		
Umiam	Turmeric + cowpea	9600	11400	-	-	-	-	-	-	-	-	21960	20810	20110		
	Green gram	-	-	-	-	-	-	-	-	-	-	-	-	-		
Karjat	Rice-*dhaincha*	1711	2086		1801		2082		2138		2025	3728	4087	4028		
	Sweetcorn + cowpea (grain)	4814	5692	82	4808	81	5629	82	6839	5319	79	9963	11028	10865		
Ranchi	Rice	2165	2896		2394		2635		2620	2165		2925	3255	3094	247.9	
	Sweet corn	2065	2612	140	2438	130	2568	135	2411	2111	115	3714	5803	6266		
Ludhiana	Maize + cowpea	1950	1810	8530	1260	8120	1470	10230	1490	1910	11520	3320	4450	4490		
	Wheat + chickpea	1570	1130	330	990	340	1080	430	1650	1220	600	3020	3810	3850		
Modipuram	Maize + fodder cowpea	2896	-	1179	-	1118	-	1238	-	-	1256	6045	7370	7771	971.2	
	Wheat + chckpea	1715	1481	303	1298	195	1155	209	1678	1718	210	2680	4296	4175	419.3	
Thiruvantha-puram	Cassava - cowpea	29563	32906	3036	34442	2275	34173	3019	37459	41405	2369	46455	43666	45491	10231.0	
	Green Gram	204	328		256		311		324	300		271	289		NS	

Table 7.2.6.2: System equivalent yield of various cropping systems as influenced by different natural farming practices at different locations

Centres	Cropping system	Control	Complete NF	NF-1 (without -Beejamrit + Ghanjeevamrit + Jeevamrit)	NF-2 (without-crop residue mulching)	NF-3 (without -inter cropping)	NF-4 (without-Whapasa, irrigating in alternate rows and during noon)	AI-NPOF package	Integrated Crop Management + NF based pest control methods (ICMNF)	Integrated Crop Manage-ment + chemical pesticides (ICMP)	CD (P= 0.05)
Ajmer	Cow pea + maize - Coriander + fenugreek	300	1912	1864	1930	501	2151	700	795	857	106.7
Udaipur	Cowpea + maize - fennel + cauliflower	3439	7337	5316	6388	4289	6948	5233	5394	5563	
S K Nagar	Cowpea + maize - fennel + cabbage	289	1379	988	1150	578	1457	1080	1095	1182	73.8
Almora	Soybean + maize - veg. pea + green coriander	7020	7920	8110	6640	6640	8330	8520	8050	7670	930
Bajaura	Soybean+ maize - veg. pea+ green coriander	3406	5814	4475	5275	4481	5251	6104	6867	6974	
Gangtok	Soybean + maize - veg. pea + green coriander	5696	8039	7285	7384	5871	7640	7307	-	-	
Bhopal	Soybean+ maize - Wheat + mustard	1722	5297	4471	4577	2224	4845	2868	3388	3545	
Raipur	Soybean + maize - Wheat + mustard	2145	2720	2337	2084	2526	2628	3747	3670	3593	129.2
Coimbatore	Cotton + green gram - sorghum + chickpea	1405	2730	1971	1788	3239	2668	4405	5097	4909	
Dharwad	Cotton + greengram - rabi sorghum + chickpea	346	670	556	635	-	474	574	590	680	38.26
Umiam	Turmeric + cowpea - green gram	9600	11400	-	-	-	-	21960	20810	20110	
Karjat	Rice + *dhaincha* - sweetcorn + cowpea	5817	8735	7501	8680	9442	8268	14650	13394	13220	
Ranchi	Rice - sweetcorn + cowpea	4350	5676	5144	5365	5166	4414	6855	9298	9660	
Ludhiana	Maize + Cowpea - Wheat + chickpea	3400	3500	2800	3200	3400	3900	6600	7900	8000	1700
Modipuram	Maize + fodder cowpea - Wheat + chckpea	4093	3247	2632	2524	2179	3229	7375	8261	8342	
Thiruvantha-puram	Cassava - cowpea (TEY)	30787	47019	45077	48118	39403	52685	48081	45399	47210	11478

Table7.2.6.3: Soil organic carbon in various cropping systems as influenced by different natural farming practices at different locations

Centres	Cropping system	Control	Complete NF	NF-1 (without -Beejamrit + Ghanjeevamrit + Jeevamrit)	NF-2 (without-crop residue mulching)	NF-3 (without - inter cropping)	NF-4 (without-Whapasa, irrigating in alternate rows and during noon)	AI-NPOF package	Integrated Crop Management + NF based pest control methods (ICMNF)	Integrated Crop Manage-ment + chemical pesticides (ICMP)	CD (P= 0.05)
Ajmer	Cow pea + maize - Coriander + fenugreek	0.26	0.27	0.26	0.28	0.26	0.28	0.3	0.28	0.29	0.26
Udaipur	Cowpea + maize - fennel + cauliflower	0.67	0.71	0.68	0.68	0.69	0.67	0.74	0.71	0.72	0.67
S K Nagar	Cowpea + maize - fennel + cabbage	1.10	1.32	1.22	1.20	1.20	1.25	1.44	1.30	1.39	1.10
Almora	Soybean + maize - veg. pea + green coriander	0.82	0.87	0.84	0.93	0.93	1.24	1.15	1.12	1.01	0.82
Bajaura	Soybean+ maize - veg. pea+ green coriander	0.66	0.85	0.82	0.84	0.85	0.85	1.01	0.98	0.96	0.66
Gangtok	Soybean + maize - veg. pea + green coriander	0.89	1.17	1.02	0.95	1.13	1.07	1.34	-	-	0.89
Bhopal	Soybean+ maize - wheat + mustard	not reported									
Raipur	Soybean + maize - wheat + mustard	0.57	0.64	0.58	0.57	0.60	0.62	0.64	0.62	0.60	0.57
Coimbatore	Cotton + green gram - sorghum + chickpea	0.62	0.71	0.68	0.67	0.71	0.73	0.75	0.68	0.67	0.62
Dharwad	Cotton + greengram - Rabi sorghum + chickpea	0.76	0.88	0.78	0.86	0.86	-	1.02	0.92	0.94	0.76
Umiam	Turmeric + Cowpea - green gram	1.12	1.32	1.29	1.19	1.23	-	1.57	1.43	1.48	1.12
Karjat	Rice + dhaincha - sweetcorn + cowpea	1.00	1.03	1.02	1.02	1.02	1.02	1.05	1.05	1.05	1.00
Ranchi	Rice - sweetcorn + cowpea	0.45	0.62	0.53	0.60	0.58	0.46	0.48	0.46	0.53	0.45
Ludhiana	Maize + Cowpea - Wheat + chickpea	0.42	0.4	0.43	0.41	0.42	0.42	0.43	0.42	0.41	0.42
Modipuram	Maize + fodder cowpea - Wheat + chckpea	0.51	0.55	0.54	0.48	0.52	0.54	0.59	0.56	0.55	0.51
Thiruvantha-puram	Cassava - cowpea	0.96	0.93	0.93	0.81	0.94	0.97	0.98	0.93	0.90	0.96

Table7.2.6.4: Cost of cultivation of cropping systems as influenced by different natural farming practices at different locations

Centres	Cropping system	Control	Complete NF	NF-1 (without -Beejamrit + Ghanjeevamrit + Jeevamrit)	NF-2 (without- crop residue mulching)	NF-3 (without - inter- cropping)	NF-4 (without- Whapasa, irrigating in alternate rows and during noon)	AI-NPOF package	Integrated Crop Management + NF based pest control methods (ICMNF)	Integrated Crop Management + chemical pesticides (ICMP)
Ajmer	Cow pea + maize - Coriander + fenugreek	28490	25640	24100	25640	25430	25640	65285	51271	51821
Udaipur	Cowpea + maize - fennel + cauliflower	44500	81805	66252	78605	60336	81805	99300	75895	76295
S K Nagar	Cowpea + maize - fennel + cabbage	38235	38457	36105	36472	36405	42307	63947	54469	46072
Almora	Soybean + maize - veg. pea + green coriander	77085	109033	85904	89715	89715	135335	109531	115231	90277
Bajaura	Soybean+ maize - veg. pea+ green coriander	78100	87000	84900	84500	85550	85550	92310	90030	91030
Gangtok	Soybean + maize - veg. pea + green coriander	74760	120230	106130	111430	84600	122230	82690	-	-
Bhopal	Soybean+ maize - wheat + mustard	52668	52343	47941	51369	49560	50665	81065	82815	85492
Raipur	Soybean + maize - wheat + mustard	50555	79015	57435	62815	81335	79765	83969	76167	72907
Coimbatore	Cotton + green gram - sorghum + chickpea	85390	78210	72910	78210	76290	78210	145390	150723	150723
Dharwad	Cotton + greengram - Rabi sorghum + chickpea	31392	44122	39486	43804	41600	-	62304	52886	56118
Umiam	Turmeric + Cowpea - green gram	59716	65644	60740	56060	55576	60629	89542	100598	99548
Karjat	Rice + dhaincha - sweetcorn + cowpea	144956	156716	145936	151240	160974	156954	220789	192123	191323
Ranchi	Rice - sweetcorn + cowpea	50500	58500	57210	55300	53500	53505	76500	78100	80700
Ludhiana	Maize + Cowpea - Wheat + chickpea	50910	52360	43000	49360	47410	52360	101980	54570	62340
Modipuram	Maize + fodder cowpea - Wheat + chckpea	54800	72480	57450	56480	67830	72480	106700	94101	94101
Thiruvantha-puram	Cassava - cowpea	210850	241470	200050	231870	231670	241470	343800	332498	334498

Table7.2.6.5: Net return (Rs./ha) of cropping systems as influenced by different natural farming practices at different locations

Centres	Cropping system	Control	Complete NF	NF-1 (without -Beejamrit + Ghanjeevamrit + Jeevamrit)	NF-2 (without-crop residue mulching)	NF-3 (without -inter-cropping)	NF-4 (without-Whapasa, irrigating in alternate rows and during noon)	AI-NPOF package	Integrated Crop Management + NF based pest control methods (ICMNF)	Integrated Crop Management + chemical pesticides (ICMP)
Ajmer	Cow pea + maize - Coriander + fenugreek	28490	25640	24100	25640	25430	25640	65285	51271	51821
Udaipur	Cowpea + maize - fennel + cauliflower	44500	81805	66252	78605	60336	81805	99300	75895	76295
S K Nagar	Cowpea + maize - fennel + cabbage	38235	38457	36105	36472	36405	42307	63947	54469	46072
Almora	Soybean + maize - veg. pea + green coriander	77085	109033	85904	89715	89715	135335	109531	115231	90277
Bajaura	Soybean+ maize - veg. pea+ green coriander	78100	87000	84900	84500	85550	85550	92310	90030	91030
Gangtok	Soybean + maize - veg. pea + green coriander	74760	120230	106130	111430	84600	122230	82690	-	-
Bhopal	Soybean+ maize - wheat + mustard	52668	52343	47941	51369	49560	50665	81065	82815	85492
Raipur	Soybean + maize - wheat + mustard	50555	79015	57435	62815	81335	79765	83969	76167	72907
Coimbatore	Cotton + green gram - sorghum + chickpea	85390	78210	72910	78210	76290	78210	145390	150723	150723
Dharwad	Cotton + greengram - Rabi sorghum + chickpea	31392	44122	39486	43804	41600	-	62304	52886	56118
Umiam	Turmeric + Cowpea - green gram	59716	65644	60740	56060	55576	60629	89542	100598	99548
Karjat	Rice + dhaincha - sweetcorn + cowpea	144956	156716	145936	151240	160974	156954	220789	192123	191323
Ranchi	Rice - sweetcorn + cowpea	50500	58500	57210	55300	53500	53505	76500	78100	80700
Ludhiana	Maize + Cowpea - Wheat + chickpea	50910	52360	43000	49360	47410	52360	101980	54570	62340
Modipuram	Maize + fodder cowpea - Wheat + chckpea	54800	72480	57450	56480	67830	72480	106700	94101	94101
Thiruvantha-puram	Cassava - cowpea	210850	241470	200050	231870	231670	241470	343800	332498	334498

7.2.7: 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_1	Farmers package
T_2	AI-NPOF package
T_3	NF practice (Beejamrit, Ghanjeevamrit, Jeevamrit, Neemaster, Brhamaster and Dashparni ark)
Number of farmers: Minimum 8	

Centre wise results of each centres are presented below. Treatments are same for all locations and minimum 8 farmers coved under the programme.

Bajaura: Tomato-cauliflower cropping system was undertaken in Hat and Bajaura villages located in Banjar block of District Kullu Himachal Pradesh, covering 3 farmers. Natural farming practices resulted in reduction in yield of tomato and cauliflower by 22.3 & 18.4% over organic (AINP-OF package) and 31.6 and 34.7% lower than the farmers practice respectively. Natural farming practice resulted in reduction in cost of cultivation by 4.4 and 6% over organic (AI-NPOF Package) and it was 20.7 and 15.6% lower than the farmers practice. Maximum net return for tomato was obtained under farmers practice and recorded by 64.4 and 202% higher than NF practice and AINPOF respectively, likewise, cauliflower obtained 51 and 18.9% more net return with farmers package over to NF practice and AI-NPOF package.

Mean yield, cost of cultivation and net return of tomato and cauliflower under different management practice at Bajaura

Treatments	Tomato (*kharif*)			Cauliflower *(Rabi)*		
	Yield (kg/ha)	Cost of cultivation (Rs/ha)	Net return (Rs/ha)	Yield (kg/ha)	Cost of cultivation (Rs/ha)	Net return (Rs/ha)
Farmers Package (50% of RDF of NPK+20 t FYM/ha)	14400	52750	234250	13600	44750	227250
AI-NPOF package	12100	46550	194850	11400	37750	191050
Natural Farming Practice (Beejamrit, Ghanjeevamrit, Jeevamrit, Neemaster, Brhamaster and Dashparni ark)	9400	44500	142500	9300	35500	150500

Coimbatore: Groundnut–fodder sorghum cropping system was undertaken in villages of Pethikuttai, Pallarpalayam, Mooduthurai, Allapalayam, Ambothi, Karuppanur,Vadakalur, Ottakamandalam, Konarpalayam, Pillaiyappampalayam, Allapalayam located in Karamadai and Annur block of district Coimbatore, Tamil Nadu. Total 16 farmers were covered. Natural farming practice recorded yield of groundnut and sorghum fodder of 2048 and 16830 kg/ha which is 25.8 and 17.3% higher than farmers practice but recorded 11.9 and 9.3% lower than the AI-NPOF package. Lowest cost of cultivation

recorded under farmers practice of Rs. 45528 and 16850/ha for groundnut and sorghum fodder respectively which is 6.1 and 7.6% lower than the farmers practice respectively but it was higher by 14 and 18.3% higher over AI-NPOF package. Highest net return was obtained with AINP-OF package which is 23.9 and 6.7% higher than the NF practice for groundnut and sorghum fodder respectively

Yield, cost of cultivation and net return of groundnut and sorghum fodder under different management practice at Coimbatore

Treatments	Groundnut			Sorghum fodder		
	Dry pod yield (kg/ha)	Cost of cultivation (Rs/ha)	Net returns (Rs/ha)	Yield (kg/ha)	Cost of cultivation (Rs/ha)	Net returns (Rs/ha)
Farmers package	1628	45528	90352	14350	16850	33375
AI-NPOF package	2324	55273	137787	18560	21582	43378
Natural Farming practice (Beejamrit, Ghanjeevamrit, Jeevamrit, Neemaster, Brhamaster and Dashparni ark)	2048	48472	121218	16830	18245	40660

One day training programme

Input distribution

Field visit of farmers

Field visit and data collection

Gangtok: Maize+ soybean - vegetable pea+ corriander cropping system was undertaken in the villages of Timpyem located in Rumtek-Martam block in East District of Meghalaya. Total 5 farmers were covered. Natural Farming practice recorded yield of rice (2620 kg/) which is 4.7% lower than the farmer practice but wheat yield is 140 and 21.9% higher than farmers practice and AINPOF respectively. Reduction in yield of rice recorded by 25.1% with AINP-OF package compare to NF practice. In rice, Natural Farming practice recorded cost of cultivation Rs. 32500/ha which is significantly lower by 15.6 over AINP-OF but found to be higher by 6.6% over farmers practice. In wheat, cost of cultivation with NF practice recorded highest among the management practice and found to be higher about 6.6 and 11.8% over to AINP-OF and farmers practice respectively. Net return of rice and wheat under NF practice recorded of Rs 82500 and 122500/ha respectively. Net return with NF in rice was 28.3% higher but in wheat reduction was observed by 19.7%.

Yield, cost of cultivation and net return of tomato and cauliflower under different management practice at Gangtok

Treatments	Rice			Wheat		
	Grain yield (kg/ha)	Cost of cultivation (Rs/ha)	Net returns (Rs/ha)	Grain yield (kg/ha)	Cost of cultivation (Rs/ha)	Net returns (Rs/ha)
Farmers package	2760	30500	35500	930	44260	108000
AI-NPOF package	3500	38500	64300	1830	46600	152500
Natural Farming practice (Beejamrit, Ghanjeevamrit, Jeevamrit, Neemaster, Brhamaster and Dashparni ark)	2620	32500	82500	2230	49500	122500

Ranchi: Rice-wheat cropping system was undertaken in the villages of Sakarpada, Jhingi, totambi, Byassi, Silagain, Huhuri, Ulihatu located in Mander,Chanho, Arki block in Ranchi and Khunti district of Jharkhand. Total 20 farmers were covered. In rice, grain yield and net return under NF practice recorded 1250 kg/ha and Rs 20500/ha which is significantly lower than the AINPOF package of 16.7 and 36.9% respectively but net return from rice crop recorded higher by 8.6%. In wheat, same trend was observed and reduction was recorded with NF practice about 34.4, 32.8 and 37% for yield, cost of cultivation and net return respectively over AINP-OF package.

Yield, cost of cultivation and net return of tomato and cauliflower under different management practice at Ranchi

Treatments	Rice			Wheat		
	Grain yield (kg/ha)	Cost of cultivation (Rs/ha)	Net returns (Rs/ha)	Grain yield (kg/ha)	Cost of cultivation (Rs/ha)	Net returns (Rs/ha)
Farmers package	1000	18500	20500	850	21500	9550
AI-NPOF package	1500	32500	26000	1600	33500	19300
Natural Farming practice (Beejamrit, Ghanjeevamrit, Jeevamrit, Neemaster, Brhamaster and Dashparni ark)	1250	20500	28250	1050	22500	12150

Thiruvananthapuram: Cassava + vegetable cowpea-green gram cropping system was undertaken covering 20 farmers in the village of Ezhamkulam, Adoor, Pathanamthitta located in block Kazhakkuttam inThiruvananthapuram district of Kerala. Distributed of planting material and inputs for OFTs on natural farming under SCSP held at Ezhamkulam, Adoor, Pathanamthitta, Kerala on 27 August 2022. Training was organized on preparation of *Beejamrit, Jeevamrit and Ghanjeevamrit*, 25 farmers participated in the training. Distribution of organic inputs and planting material for demonstration of organic farming in elephant foot yam at Parakkode, Pathanamthitta, Kerala (10 tons of corms distributed to 35 farmers).

Distribution of organic inputs and planting material and training under SCSP programme at Thiruvananthapuram

Udaipur: Maize-wheat cropping system was undertaken at 6 villages namely Birothi, Basiwada, Judli, Dabla, Rohimala, Aanjroli & Doljiin Jhadole block in Udaipur district of Rajasthan. Total 6 farmers were covered. Among the management practices, Natural Farming practice recorded yield of maize and wheat (1700 and 3000 kg/ha respectively) which is 21.4 and 25% higher than farmers package whereas reduction in yield of maize and wheat recorded by 25.4 and 20% over AINP-OF package respectively. Natural Farming practice recorded cost of cultivation of Rs. 28690 and 28460/ha which is significantly lower by 28.9 and 23.6% for maize and wheat respectively over AINP-OF but found to be higher by 33 and 34.5% over farmers practice. Net return under NF practice recorded of Rs. 18230 and 65590/ha for maize and wheat respectively which is 13.5 and 19% lower than the AINP-OF package but 10.1 and 20.1% higher over farmers practice.

Yield, cost of cultivation and net return of maize and wheat under different management practice at Udaipur

Treatments	Maize			Wheat		
	Grain yield (kg/ha)	Cost of cultivation (Rs/ha)	Net returns (Rs/ha)	Grain yield (kg/ha)	Cost of cultivation (Rs/ha)	Net returns (Rs/ha)
Farmers package	1400	21390	16560	2400	21160	54590
AI-NPOF package	2280	40361	21079	3750	37235	80965
Natural Farming practice (Beejamrit, Ghanjeevamrit, Jeevamrit, Neemaster, Brhamaster and Dashparni ark)	1700	28690	18230	3000	28460	65590






Input distribution seed planter, hand sprayer, plastic drum, storage bin and solar light at Udaipur

Umiam: Rice and maize based cropping system was undertaken in the villages Mynsain, Pynthor and Umden Umbathiang in Ri Bhoi district of Meghalaya. Total 8 farmers were covered. AINPOF package recorded significantly higher rice equivalent yield, cost of cultivation and net return in rice and maize based cropping systems

Treatments	Rice followed by potato			Maize followed by frenchbean		
	Rice equivalent yield (kg/ha)	Cost of cultivation (Rs/ha)	Net returns (Rs/ha)	Rice equivalent yield (kg/ha)	Cost of cultivation (Rs/ha)	Net returns (Rs/ha)
Farmers package	7665	63540	89760	7094	87185	54690
AI-NPOF package	12435	85230	163470	8600	74480	97520

Programme 7.3: Development of Integrated Organic Farming System Model

7.3: 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: (9) Calicut, Thiruvananthapuram (Kerala), Coimbatore (Tamil Nadu), Gangtok (Sikkim), Ludhiana (Punjab), Pantnagar (Uttarakhand), SK Nagar (Gujrat), Udaipur (Rajasthan) and Umiam (Meghalaya). Centres Ludhiana (Punjab) and Pantnagar (Uttarakhand) did not report the results.

Year of start: 2013-14

Results of each centre is described below

Calicut and Thiruvananthapuram (Kerala)

Calicut

The plot with spices, fodder and vegetables combination was evaluated at Chelavoor farm under IOFS model. The crops were black pepper, turmeric, fodder grasses (CO-3, CO-4), Tapioca, Banana, cowpea, Coconut, were planted and established. Two cows and their calves were maintaining. Turmeric 1250 kg, Banana 600 kg, Tapioca 800 kg and vegetable cowpea 244 kg, coconut 2120 nos. were harvested. Fodder grass fed to the cows that are maintained at ICAR-IISR farm and balance was sold. Net profit of Rs 2,58,245 was received from one-acre IOFS model. Employment generated Man days/year is 626 (Table 7.4.1). Maximum income shares 60.97% was came from livestock followed by horticulture (19.38%) and cropping systems (17.18%)

Table 7.3.1: Area, yield and income from IOFS 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		2120 nos.	32	67840	17.18
	Fodder (Co3, Co4, DHN6, Congo Signal	0.06		325	2.2	650	
	Turmeric	0.04		1250	30	37500	
	Total	0.36	90			105990	
Livestock (2 Cows)	Milk			6546.8 L	60	392808	60.97
	Total	0.01	2.5			392808	

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		600 Kg	40	2400	
	Tapioca	0.005		800 Kg	25	20000	
	Veg cow pea	0.0025		244 Kg	40	97607	
	Total	0.03	7.5			1,20,007	19.38
Grand Total						6,18,835	100
Total Expenditure (Rs)						3,60,560	
Net Profit (Rs)						**2,58,245**	
Employment generation Man days/year						626	

Thiruvananthapuram

Net returns of Rs. 1,71,277 was achieved from tuber crop-based farming system, tuber equivalent yield of 20.2 tons obtained from IOFS model involving tuber crops from an area of 75 cents. Total 5515 liter/kg milk yield was recorded. The % share of area and income of the various components of IOFS is given in Table 7.3.2 and 7.3.6.

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	1.02
	Cassava + amaranthus	5	7	2.51
	Banana + (amaranthus – elephant foot yam)	10	13	2.34
	Vegetables (bhindi, amaranthus, cucumber, cluster beans, sword bean, winged bean, brinjal)	20	27	6.86
Fruit crops	Pineapple	5	7	0.32
Fodder crops	Hybrid Napier grass	5	7	15.52
Dairy unit	5 cows + 4 calf	10	13	71.06
Hedge crops	Agathi (*Sesbania* sp.)	3	4	3.72
Hedge tree	Moringa	2	3	NIL
Pest repellent crops	Lemon grass	3	4	0.37
Nutrient recycling unit	Vermi compost unit	2	3	Just started

Table 7.3.3: Income generation from crop components

Name of Crop	Total yield (kg)	Tuber equivalent yield (kg)	Income generated (Rs.)
Bhindi	86.82	75.97	3039.70
Amaranthus	325.20	406.50	16260.00
Cucumber	130.25	81.41	3256.25
Vegetable cowpea	45.28	90.56	3622.40
Salad cucmber	30.25	22.69	907.50
Cluster bean	30.28	22.71	908.40
Winged bean	10.25	7.69	307.50

Name of Crop	Total yield (kg)	Tuber equivalent yield (kg)	Income generated (Rs.)
Agathi (Sesbania sp.)	250.00	750.00	30000.00
Banana	162.80	203.50	8140.00
Maize	120.00	90.0	3600.00
Taro	76.80	115.20	4608.00
Elephant foot yam	126.85	142.71	5708.25
Brinjal	148.00	148	5920.00
Sword bean	35.50	26.625	1065.00
Pineapple	65.25	65.25	2610.00
Cassava	380.00	380.00	15200.00
Hybrid napier grass	25000.00	3125.00	125000.00
Lemon grass	600.00	75.00	3000.00
Total		**5828.8**	**233152**

Table 7.3.4: Income generation from animal components

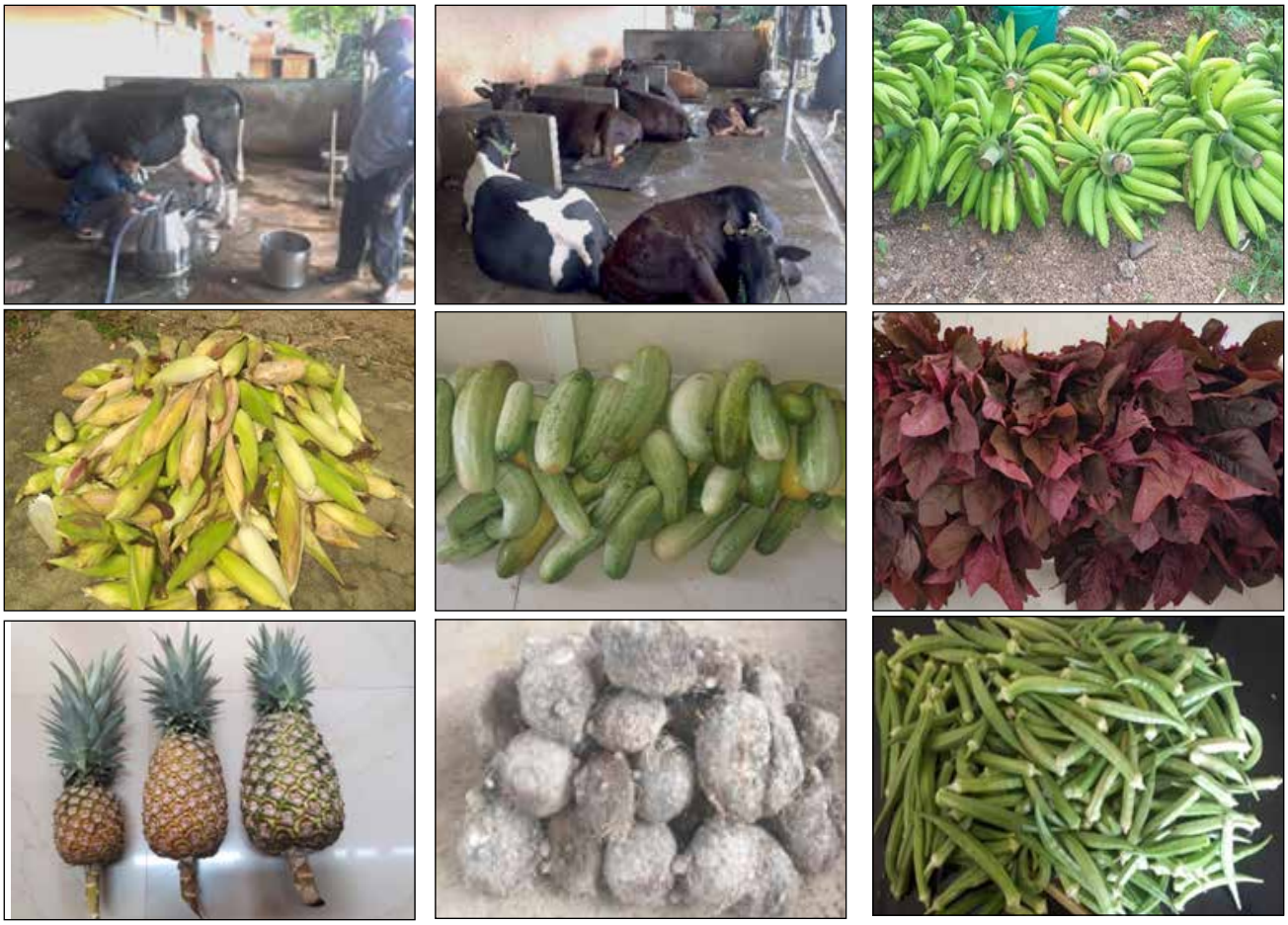
Name of produce	Quantity produced (litre/kg)	TEY (kg)	Revenue generated (Rs.)
Milk	5515	7445.50	297810
Cow dung	43655	1091.38	43655
Cow urine	23090	5772.25	230890
Total		**14309.13**	**572355**

Table 7.3.5: Cost incurred from components

Item	Crop component (Rs.)	Animal component (Rs.)
Labour	216000	180000
Input	29050	209180
Total	**245050**	**389180**

Table 7.3.6: Economics of IOFS model

Production from IOFS on equivalent basis (t) (Mention the base crop)	20.14 tonnes from 0.3 ha
Gross income (Rs.)	8,05,507
Gross cost (Rs.)	6,34,230
Net income (Rs.)	**1,71,277**
B:C Ratio	1.27
Energy input (MJ)	30402
Energy output (MJ)	112771



Different component of IOFS model at Thiruvananthapuram

Coimbatore (Tamil Nadu):

Components of IOFS model at Coimbatore

Modules	Area (ha)	% share of area
Cropping systems: 1. Bhendi - maize - green manure (*Dhaincha*)	0.14	35
2. Cotton – sorghum - green manure (*Dhaincha*)		
3. Fodder : CO (CN) 5 & Desmanthus viragatus	0.06	15
Dairy: (Jersey cross breed - 2 nos. + 2 calves)	0.008	2
Pest repellent plants: (44 plant species)	0.008	2
Boundary plantations: Coconut (East coast tall), Teak (Local), Banana (Poovan and Karpoora-vazhi), Annual moringa (PKM 1), Curry leaf, *Glyricidia*	0.02	5
Compost: (Cow dung pit - 1 No., Compost pit - 1 No. and Silpaulin vermicompost units - 4 Nos.)	0.004	1
Agroforestry (15 tree species)	0.016	4
Bee keeping (4 Indian bee - *Apis cerana indica* hives)	0.004	1
Total	0.40	100

A one-acre IOFS model for irrigated upland ecosystem was established at farm of Tamil Nadu Agricultural University, Coimbatore with the objectives of suitability and profitability of the model for small and marginal farmers of Tamil Nadu. The system includes crop components, dairy, perennial horticultural crops, agro-forestry, pest repellent cafeteria, residue recycling unit and beekeeping. The green manure crop was raised during summer and incorporated in-situ at 50% flowering. The fodder harvested from the IOFS model was used as feeding material to the cattle. The dung collected from the cattle was used as manure to the model field. The insect pests of this model were managed through various kinds of cow urine based herbal extracts by utilizing the pest repellent cafeteria. The glyricidia, perennial leguminous plants maintained at the borders of the model act as bio fencing, the green biomass harvested from the plants were used for cattle feed and green leaf manure. The biomass of the agro forestry and perennial border corps were used as green leaf manure and as a residue for compost preparation. All the crop production and protection measures were followed as per the Crop Production Guide of TNAU. In this IOFS model, 70 percent of area was allotted for crop component and 30 percent of area for dairy and other supporting activities. Annual crops were raised on system-based approach comprising of two cropping systems viz., green manure (*Dhaincha*) - okra - maize and green manure (Dhaincha) - cotton - sorghum each with an allotted area. The crops like okra and cotton were raised during *kharif* and crops like maize and sorghum were raised during *rabi*. Bhendi variety hybrid CO (Bh) 4, maize variety hybrid COH(M) 6, cotton variety Surabhi and sorghum variety CO-30 was undertaken in the system as bhendi-maize and cotton sorghum. Seeds were treated with bio-fertilizers and bio-control agents, nutrient requirement of crop was met through vermicompost and foliar application of *Panchagavya* (3%) at fifteen days intervals.

System productivity in term of cotton equivalent was recorded higher with bhendi-maize-*dhaincha* of 727 kg as compared to cotton-sorghum-*dhaincha* cropping system which recorded CEY of 438 kg. Among the systems, there was 66% higher system productivity in bhendi-maize-dhaincha cropping system over cotton-sorghum-dhaincha. Through crop component, an income of Rs.33,415 was obtained. Two numbers of Jersey cross bred were maintained at IOFS model and produced 1129 litre of milk and realised of Rs. 67,770 as gross return. Fodder obtained from crop component (maize and cumbu Napier) is being fed to the animals. Annually 13.32 tonnes of cow dung and 9782 litres of urine were obtained from livestock which were applied to the crops to boost the yield. From this manure 86.2 kg of N, 36.4 kg of P_2O_5 and 115.6 kg of K_2O with the value of Rs.6346 was saved. Recycling of the on-farm resources such as crop residues and litters collected from the IOFS model were converted into compost, from these units on an average 3560 kg of compost per annum was produced of the value of Rs. 6380. Fodder grass cumbu napier CO (CN) 5 and desmanthus (*Deamanthus varigatus*) was raised in the IOFS model field, harvested 25.1 tonnes at regular intervals and being fed to the NPOF cattle. Various perennial boundary plants viz., coconut, banana, annual moringa and curry leaf was integrated properly with farm enterprises. The yield of the boundary crops were expressed in coconut equivalent basis. In this system on an average 986 nuts per year was obtained with the average cost of Rs.10.17 per nut. The annual gross income realized of Rs.20,470 with the cost of cultivation of Rs.4347 and Rs 16,126 was obtained as net income generation from boundary plantation. From this IOFS model, gross income of Rs. 2,09,877 was obtained with total cost of the Rs. 1,50,161 per annum and the net return of Rs.59,716 was realized with BCR of 1.4 (Table 7.4.7).

Table 7.4.7: Component wise area, yield and income of IOFS model at Coimbatore

Components	Yield (kg)			Gross return (Rs.)	Cost of cultivation (Rs.)	Net return (Rs.)
	Crop 1	Crop 2	Cotton equivalent yield			
Bhendi – Maize - *dhaincha*	1659	610	727	63685	39112	24573
Cotton - sorghum - *dhaincha*	198	433	438	38655	29813	8842
Fodder grass (Cumbu Napier Hybrid CO (CN) 5), and legume fodder *Desmanthus*	17.4 tonnes					
Dairy (milk price @ Rs 60/l)	1129 litre			67,710	74369	-6659
Value of recycling from livestock module (dung, cow urine etc.)						6346

Components	Yield (kg)			Gross return (Rs.)	Cost of cultivation (Rs.)	Net return (Rs.)
	Crop 1	Crop 2	Cotton equivalent yield			
Crop residue composting	Value of compost produced under IOFS model					6380
Boundary Plantation: Production on coconut equivalent basis)	Yield of the boundary crops were expressed in coconut equivalent basis. In this system on an average 936 nuts per year was obtained with the average cost of Rs.8.9 per nut			20473	4347	16126
Total nos. of man-days	533					
Economics				2,09,877	1,50,161	59,716
Net income per rupee invested						1.40
Energy Input (MJ)						58601
Energy Output (MJ)						87453
Sustainable Value Index						0.12

Gangtok (Sikkim):

Net return of Rs 56,644 was received by crop component from 0.4 ha area, Rs 64,829 was received by dairy (0.05 ha), Rs 7231and 37,291 obtained from fishery and poultry, whereas Rs 6000 was received from vermicomposting. Highest return was recorded from large cardamom of Rs 1,78,000. From this 0.60 ha IOFS model, gross income of Rs. 2,95,869 was obtained with total cost of the Rs. 1,31,349 per annum resulted in net return of Rs. 1,74,420 was realized with BCR of 2.25 (Table 7.4.8). The highest contribution towards the total net return was contributed by large cardemom of the model followed by dairy and crop.

Table 7.3.8: Component wise area, production and economics of IOFS model at Gangtok

Particulars	Area (ha)	Production	Total Cost of Production (Rs)	Gross return (Rs)	Net return (Rs)	B: C ratio
Maize-based cropping system	0.32	-	27860	48480	20620	1.74
Vegetable-based cropping system (open + rain shelter)	0.08	-	33714	69738	36024	2.06
Dairy (1 milch cow + 1 calf)	0.05	2170 lit/year	43671	1085000	64829	2.48
Fishery (Composite)	0.04	24.9 kg/year	2729	9960	7231	3.64
Large cardamom	0.07	10.4 kg/year	3000	208000	178000	6.93
Vermicompost	0.03	16.3 t/ha	5000	1100	6000	2.2
Poultry (25 Vanaraja birds)	0.01	83.4 kg meat / year and 3000 egg/year	15375	37291	21916	2.42
Total	**0.60**		**131349**	**295869**	**174420**	**2.25**

IOFS model at Gangtok

Sardarkrushinagar (Gujarat)

Components of IOFS model at SK Nagar

Module	Components	Area (ha)
Crops	1. Groundnut–wheat–green gram varieties used: TG-37, GW-45 & GM-4	0.24
	2. F.Pearl millet–F. Maize + oat – F. pearl millet varieties used: GFB-2, African tall & kent & GFB-2	0.15
Livestock	Two Cow and 2 calves	0.01
Complimentary enterprises	Boundary plantations: Ardusa, lemon grass, napier grass Repellent plants: Lemongrass, Coriander, Marigold, Onion, Basil, Chrysanthemums, Citronella grass	
Total		0.40

IOFS model comprised different components viz., crops (0.24 ha), green fodder crops (0.15 ha), dairy + vermicompost (0.01 ha) and boundary plantation.

- Integrated Organic Farming Systems (IOFS) model comprised different components *viz*., crops (0.24 ha), green fodder crops (0.15 ha), dairy + vermi compost (0.01 ha) and boundary plantation.
- Total net profit of Rs 19021 was received by crop component from 0.24 ha area, Rs 18501 was received by fodder unit (0.15 ha) and Rs 3820 was received from boundary plantation. Rs 1686 was loss in livestock component due to dry period of cow for long spell.
- Total net profit from all the components of IOFS model including boundary plantation was Rs 39656 from 0.40 hectare area.
- The highest contribution towards the total net return was contributed by crop component of the model. Under the IOFS model, net return per rupee invested (0.26), system productivity (8.15 kg/day) and system profitability (Rs 109./day) was achieved with 83 man-days of employment generation.

Table 7.3.9: Yield and economics of IOFS Model at Sardarkrushinagar (Gujarat)

Farming system components	Total area (ha)	Ground nut equivalent yield (kg)	Gross return (Rs)	Cost (Rs)	Net returns (Rs)
Cropping system 1 Groundnut-Wheat-Green gram	0.24	651	41530	22509	19021
Cropping system 1 Green Fodder : F. Bajra- F. Maize + Oat- F. Bajra	0.15	480	30580	12079	18501
Livestock + Vermicompost	0.01	1780	113511	115196	-1686
Boundary Plantation	-	65	4160	340	3820
Total	0.40	2976	189781	150124	39656
System productivity (Rs/day)	8.15 kg/day				
System profitability (Rs/day)	Rs. 109/day				
Employment generation (Man days)	83 man days				

Table 7.3.10: Energy analysis of one acre Integrated Organic Farming systems Model

Components	Input energy (MJ/ha)	Output energy (MJ/ ha)	Net energy returns (MJ/ha)	Energy use efficiency	Energy productivity (kg/MJ)	Specific energy (MJ/ kg)
Cropping systems	37480	220055	221895	16.26	0.32	80.55
Fodder System	43348	439740	396392	28.60	1.59	6.23
Boundary Plantation	220	101430	101210	462.05	4.08	0.25
Total	81048	761225	719497	506.9	5.99	

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Udaipur (Rajasthan)

An integrated organic farming system model for 0.45 ha comprising of field crops sweet corn + black gram – wheat (0.25 ha) fodder crops maize fodder + cowpea – berseem (0.05 ha) – *sesbania* green manuring, vegetables in 0.10 ha (okra and cauliflower), fruit crop guava (0.04 ha) and compost unit in 0.01 ha were evaluated. Total maize equivalent yield of 6466 kg/ha recorded from the IOFS model. Gross and net return of Rs. 1,22,269 and 76,528 /ha was obtained from the integrated organic farming system model with the cost of Rs. 40,200 with 2.04 NRPRI.

Table 7.3.11: Yield and economics of different components of organic farming system at Udaipur

Farming System components		Area (ha)	Actual yield (kg)	Maize equivalent yield (kg)	Cost of cultivation (Rs)	Gross return (Rs)	Net return (Rs/ha)	Net return per rupee invested
1. Crops								
Kharif	Sweet corn + Black gram	0.25	Sweet corn (420) Black gram (95)	1,143	12,320	27,145	18,425	1.20
Rabi	Wheat		1234	2,385	12,000	48,015	36,015	3.0
2. Fodder								
Kharif	Fodder Maize+ Cowpea	0.05	F. maize (1790) Cowpea (240)	563	5,000	10,416	5,416	1.08
Rabi	Berseem		4,160	1,500	3,780	22,500	18,270	4.95
Zaid	*Sesbania*		Used as green manuring					
3. Vegetable								
Kharif	Okra	0.10	150	243	2200	4496	2296	1.04

Farming System components		Area (ha)	Actual yield (kg)	Maize equivalent yield (kg)	Cost of cultivation (Rs)	Gross return (Rs)	Net return (Rs/ha)	Net return per rupee invested
Rabi	Cauliflower		105	210	2500	3650	1150	0.46
4. Fruits	Guava	0.04	211	422	2400	6047	3647	1.51
	Total			**6,466**	**40,200**	**1,22,269**	**82,069**	
5. Compost unit	NADEP compost	0.01	3000 kg					
	Vermi-compost		8000 kg					
	Compost		2200 kg					
	Vermiwash		130 lit					
	BD 500		1.3 kg					
	BD 501		1.2 kg					

Dairy unit

Compost unit

Horticulture (guava)

Vegetable component

Fodder maize+cowpea

Berseem IOFS component at Udaipur

Umiam (Meghalaya)

The IOFS model is comprised of different enterprises such as cereals (rice and 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, central farm pond, farmyard manure pits and vermicomposting unit (Table 7.3.12). A farm pond of 460 m^2 area with average depth of 1.5 m was part of the IOFS model for life saving irrigation and aquaculture. Climbing vegetables such as bottle gourd, chow-chow, cucumber, ridge gourd etc., were grown on a structure created above water bodies in one side of the pond dyke for vertical intensification. Pumpkin was raised in another side of the pond and allowed to crawl on the ground. The washings from the dairy unit were diverted to fish pond for promoting growth of zooplankton and phytoplankton for fish growth. The solid waste from cow shed was used for FYM making and vermicomposting. The total cost of cultivation was recorded at Rs. 69,462/- per year under the IOFS model with an area of 0.43 ha. A total net return of Rs. 90,360/- per year was achieved under the IOFS model which is about to Rs. 2,09,652/ha and much higher than the region's farmer common practices of rice mono-cropping or improved practice of rice-vegetables cropping system (Table 7). The highest contribution towards the total net return was contributed by crop component of the model followed by dairy and fishery component. The fish production was 170 kg. 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.

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 (Table 7.3.13). 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.

Table 7.3.12: Economics of the IOFS model (area 0.43 ha) at Umiam

Farming System components	Area (ha)	Rice Equivalent Yield (tonnes)	Cost (Rs)	Net returns (Rs)	Net return (Rs/ha)
Crops	0.37	6.05	28,050	65,350	-
Dairy (2 milch cow + 1 calf)	0.004	3.01	22,200	24,414	-
Fishery (Composite)	0.046	1.59	5,650	14,158	-
Nutrient cycling (Vermicompost/FYM/ etc.)	0.007	-	13,562	-13,562	-
Total	0.431	10.65	69,462	90,360	2,09,652
Net income/day	-	-	-	248	574

Table 7.3.13: On-farm nutrient supply balance sheet under IOFS model at Umiam

Components	Nutrient requirement (kg)			On-farm nutrient recycled (kg)			Nutrient Balance (kg)		
	N	P_2O_5	K_2O	N	P_2O_5	K_2O	N	P_2O_5	K_2O
Cereals (Rice, Maize)	21.0	7.5	17.4	6.8	2.5	12.5	-14.4	-5.0	-4.9
Horticultural crops (Vegetables, Fruits)	33.1	11.8	27.6	15.5	3.2	11.0	-17.6	-8.6	-16.6
Dairy	0.0	0.0	0.0	12.6	4.6	7.2	12.6	4.6	7.2
Others (Oilseeds, Pulses, Green manuring crop, fodder, etc.)	12.1	4.3	10.0	30.0	9.5	24.0	17.9	5.2	14.0
Total	66.2	23.6	55.0	64.9	19.8	54.7	-1.3	-3.8	-0.3
Nutrient demand met from the system							98.03%	83.89%	99.45%

Different components under IOFS model at Umiam

Programme 4: Capacity building including policy support to Central and State agencies

7.4.1: 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

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
Kerala	Kozhikode	Chelannur	Chelannur	57	Parapara colony	Turmeric	Turmeric verity Prathiba was cultivated in an area of 1 h while providing turmeric seed rhizomes neem cake, micronutrients, bio capsules etc. For processing the turmeric rhizome, improved turmeric boiler was also supplied (Under the SCSP programme of the institute).
Tamil Nadu	The Nilgiris	Bickatti, Eddakadu	Coonoor	100	Ooty Farmers Producer Group -C	Vegetables, tea and coffee	Interventions Capacity building on • Biofertilzers in organic agriculture • Organic Nutrient Management • Advantages of Organic farming • Organic pest management • Organic certification • Schemes related to Organic Farming Inputs distribution • Knapsack power sprayers
Uttarakhand	Nainital	Dhamar Devi, Giniti Ganw, Hawal Kota, Kalyanpur, Sanzula NarSingh, Nathujala, Bhandari Simal, Mayarampur	Kotabagh	40		Basmati rice and Wheat	
Chhatishgarh	Raipur	Nishada	Aarang	60	Aarug FPO	Scented rice	Linkage with FPO for organic production system and time to time advice for different problems related to organic farming and market.
Meghalaya	Ri Bhoi, Umiam	Mynsain	Bhoirymbong	18		Rice, Maize, Brocolli, Cabbage, Cauliflower, Pea, Carrot, Brinjal, Tumeric, Ginger	

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
Bajaura (Himaclhal Pradesh)	5 districts; Kinnaur, Lahul & Spiti, Chamba, Bilaspur and Hamirpur were found most suitable for carrying out field demonstration on organic farming in farmers' field	Pea, Potato, Apple, Maize, Wheat, Blackgram & Rajmash		All 5 Deputy Director of Agriculture were requested to conduct demonstrations accordingly. The officials of agriculture department have identified farmers to adopt organic and natural farming in potential district of Himachal Pradesh
Coimbatore (Tamil Nadu)	8 districts *viz.,* Ariyalur, Dharmapuri, Karur, Nilgiris, Perambalur, Sivagangai, Thiruvallur and Virudhunagar were identified as potential districts for conversion in to organic districts in the state	Paddy, Maize, Cotton, Sugarcane, Moringa, Banana, Tea, Coffee, Vegetables, Millets, Cashew, Mango		The action plan was shared with the State Department of Agriculture for further action during the discussion meeting for finalizing the organic farming policy of Tamil Nadu under the chairmanship of Chief secretary to Govt. of Tamil Nadu on 15.09.2022
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 2. Bidar 3.Chitradurga 4. Dharwad 5. Gadag. 6. Gulburga 7. Kolar 8. Tumkur 9. Vijayapura 10. Uttara Kannada	Pulses/legumes: (Greengram, Blckgram, Cowpea, Soybean, Pigeonpea, Chickpea) Oilseeds: (Groundnut, Soybean, Safflower) Millets (Foxtail, 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.
Ludhiana (Punjab)	Pathankot and Rupnagar	Wheat, maize, paddy and turmenric		In progress

Location and State	Name of the districts for which action plan prepared	Crops covered	Crops/Commodities covered	Brief progress on preparation of report
Thiruvananthapuram (Kerala)	Coimbatore, Tamil Nadu	Cassava, elephant foot yam	Cassava, elephant foot yam as intercrops in coconut	The productivity, profitability and soil health benefits of organic production of cassava and elephant foot yam as intercrops in coconut has been validated in the extensive on-farm validations undertaken under the aegis of State Horticulture Mission & Coconut Development Board (CDB) in Kerala. Based on these experiences, on-farm trials will be laid out in the hotspots of low nutrient use with prospects for organic farming in the Phase-2 of CDB Project at Coimbatore, Tamil Nadu. After one year, the outcome of these trials will be submitted to the State Agencies for policy support to reduce mineral fertilizers.
Udaipur (Rajasthan)	Chittorgarh	Maize, blackgram, sweetcorn, wheat, tomato, chilli and papaya	Maize, blackgram, sweetcorn, wheat, tomato, chilli and papaya	Status of inputs use in term of fertilizer, pesticide and to use of local animal & plant-based resources have been prepared.
		Rice, Maize, Brocolli, Cabbage, Cauliflower, Pea, Carrot, Brinjal, Tumeric, Ginger		

PUBLICATIONS/HUMAN REOURCE DEVELOPMENT AND WORKSHOPS/MEETINGS 8

8.1 Publications

8.1.1 Research Papers

Ajmer

Lal, G., Shekhawat, N., Yadav, S., Choudhary, M. K. and Bhatiya, M. 2021. Guar gum valuable for pharmacological and pharmaceutical conscious: A review. *Journal of Pharmacognosy and Phytochemistry.* 10(1): 07-13. Naas rating 5.21.

Lal G, Lal S, Chaudhary N, Saxena SN, Choudhary MK & Shekhawat Neha. 2022. Development of garam masala powder using organic seed spices and its storability under different packaging materials. *Journal of Agriculture and Ecology*, 14: 77-83. Naas rating 4.36.

Lal, G., Lal, S., Chaudhary, N., Choudhary, M.K., Meena, S.S. and Kumar, N. (2022). Performance of Green Gram Varieties under Organic Production System. Legume Research. DOI: 10.18805/LR-4970. Naas rating 6.59.

Bajura

D.K. Parmar & Gururdev Singh (2022). Effect of non-chemical management practices on weed control efficiency, weed index, yield and profit of organic vegetable production system of north- western Himalayas. *Indian Journal of weed science. (Under peer review)*

D.K. Parmar, Varun Parmar & Gururdev Singh (2022). Performance of Soybean (*Glycine max*) + Maize (*Zea mays*)-Green pea (*Pisum sativum*) + Green coriander (*Coriandrum sativum*) cropping system under natural, organic and integrated farming. *Indian Journal of Agricultural Research (Under peer review)*

Bhopal

Ramana S., Tripathi A.K., Ajay, Singh AB, Bharti, K, Sahu A., Rajput P.S., Saha J.K., Srivastava S., Dey P., Patra, A.K. (2021) Potential of cotton for remediation of Cdcontaminated soils. Environmental Monitoring and Assessment. 193:186 https://doi.org/10.1007/s10661-021-08976-5. (NAAS rating: 7.90, Impact factor: 1.90).

Chaudhary, R. S., Somasundaram, J., Sinha N. K., Lakaria, B.L., Mohanty, S. R., **Singh, A. B.,** Mohanty, M., Hati, K. M., Singh, R. K. and A. K. Patra (2021). Participatory Soil Quality Assessment Using Low-Cost Tools under Contrasting Management Practices in a Vertisol. Agric Res https://doi.org/10.1007/s40003-021-00598-0

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Kollah, B., Usha A., Parmar, R., Devi, H.M., Atoliya, N., Shinoji, K. C., Patra, A.K., Singh, A.B., Dubey, G.and S. R. Mohanty (2022). How do biochar size fractions and organic fertilizers interactively influence nitrous oxide emission from a tropical vertisol. *Journal of Plant Nutrition and Soil Science.* https://doi.org/10.1002/jpln.202100150.

Singh. A.B., Meena. B.P., Lakaria, B. L., Thakur, J.K., Ramesh, K., Rajput, P.S. and A.K. Patra (2022). Production potential, soil health and economic of soybean (*Glycine max*) linseed (*Linum Usitatissimum*) cropping system s under various nutrient management protocols. Indian Journal of Agronomy 67 (2);102-108.

Coimbatore

Chinnaiah Senthilraja, (2021) Biological and molecular characterization of tomato spotted wilt virus (TSWV) infecting Chrysanthemum in India. Canadian Journal of Plant Pathology https://doi.org/10.1080/07060661.2020.1856190 (NAAS Rating 6.85)

Manimaran, V., M. Suganthy, A. Balasubramanian and P.Pretheepkumar (2021) Studies on population dynamics of major pests of Ailanthus excelsa Roxb. Journal of Environmental Biology 42, 1168-1173 (NAAS Rating 6.56)

Senthilraja Chinnaiah, Malathi Varagur Ganesan, Nakkeeran Sevugapperumal, Suganthy Mariappan, Sivakumar Uthandi, Renukadevi Perumal (2022) A sequel study on the occurrence of Tomato spotted wilt virus (TSWV) in cut-chrysanthemum by DAS-ELISA using recombinant nucleocapsid protein to produce polyclonal antiserum. Journal of Virological Methods 300, 1-9 (NAAS Rating 8.01)

Manickam, S., Suganthy, M., Sunitha, R., Jansirani, R., Krishnan, R. and Ganesh (2022) Evaluation of Traditional Varieties of Rice (*Oryza sativa* L.) for Yield under Organic Production System. Indian Journal of Agricultural Research 10.18805/IJARe.A-5852 (NAAS Rating 5.20)

Manickam S, Suganthy M and Ganesh R (2022) Influence of Different Nutrient Management Practices on Growth, Yield, Quality and Economics of Brinjal (*Solanum melongena*. L). Madras Agric. J. 108 (10-12): 1-6 (NAAS Rating 4.52)

Manickam S, Suganthy M and Ganesh R (2022) Effect of Different Sources of Nutrients on Productivity, Profitability and Quality of Tomato (*Solanum lycopersicum* L.). Madras Agric. J. 109 (1-3): 1-6 (NAAS Rating 4.52)

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Devadharshini, K.P., S.K. Rajkishore, M. Maheswari, Pon. SathyaMoorthy, M. Prasanthrajan, R. Sunitha, R. Abhinayaa and V.S. Reddy Kiran Kalyan (2022) Anti-bacterial Potential of Carbon Dots derived from Coconut Waste. Biological Forum – An International Journal 14(3): 1120-1124 (NAAS Rating 5.11)

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Jabalpur

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Modipuram

Chandra Bhanu, N. Ravisankar, P.C. Ghasal, Jairam Choudhary, Raghuveer Singh, K.J. Raghvendra, A.L. Meena, L. K. Meena, D. Dutta, R.P. Mishra, N. Balasubramani, A. Sadalaxmi, and A.S. Panwar (2021). Knowledge based assessment of Trained Certified Farm Advisors (CFA) on Organic farming. *Indian Journal of Agricultural Sciences 92 (1): 85-90.*

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Siddartha Naik, D. Jain, R. S. Choudhary, Amit Trivedi, Hemant Swami, Hari Singh, S. S. Lakhawat, B. G. Chhipa, Reetu Mehta 2022 Soil Properties and Balance Sheet of Nutrients as Influenced by Different Maize (Zea mays L.) genotypes Grown under Organic Conditions in Southern Rajasthan, Agricultural Mechanization in Asia, Africa and Latin America; 53(02): 5881-5892 NAAS Rating: 6.17.

B. S. Sai Siddartha Naik & Shanti Kumar Sharma & Biswajit Pramanick& Roshan Chaudhary &Sharvan Kumar Yadav & Rupesh Tirunagari& Ahmed Gaber & Akbar Hossain 2022. Silicon in Combination with Farmyard Manure Improves the Productivity, Quality and Nitrogen Use Efficiency of Sweet Corn in an Organic Farming System. Silicon. Online published NAAS Rating: 7.50

Roshan Choudhary, S. K. Sharma, RS Choudhary, SK Yadav, Gajanand Jat, Hari Singh & B. S. S. Siddartha Naik 2022 Effect of silicon fertilization on wheat productivity and profitability in Southern Rajasthan Indian Journal of Agricultural Sciences 92 (4): 500–NAAS Rating: 6.37

B. S. S. Siddartha Naik, SK Sharma, Roshan Choudhary, SK Yadav, Gajanand Jat & Bhawani S. Prajapath 2022. Effect of FYM and silicon on productivity of organic sweet corn (Zea mays saccharata). Indian Journal of Agricultural Sciences. 91 (11): 1660–4. NAAS Rating: 6.37

Bhawani S. Prajapath, M K Kaushik, SK Sharma, Roshan Choudhary, SK Yadav, S N Meena & B. S. S. Siddartha Naik 2022 Effect of active silica on performance of maize (Zea mays) under organic farming. Indian Journal of Agricultural Sciences 91 (10):1519–23. NAAS Rating: 6.37.

S K Sharma, N. Ravishankar, Mahesh Chander, Gajanand Jat, Roshan Choudhary, Raj Kumar Fagodiya & Himanshu Pathak. 2021 Organic agriculture under changing climate scenario Indian Journal of Agronomy 66 (5th special issue): S82-S94. NAAS Rating: 5.55.

Pooja, Roshan Choudhary, Raveena, Anamika Nepali, Deepak Kumar, Somdutt and Gaurav Singh Gurjar 2022 Chlorophyll content at different stages and net return as influenced by doses and stage of silicon application in wheat The Pharma Innovation Journal 11(5): 498-500 NAAS Rating: 5.23.

Shubha MR, Roshan Choudhary, Arvind Verma, SK Sharma, RS Choudhary, Gajanand Jat, DPS Dudi, SK Yadav, RK Jain and Subhash Chandra Mahala 2021 Effect of organic weed management practices on growth parameter, nutrient content and nutrient uptake by baby corn (Zea mays L.) The Pharma Innovation Journal 10(9): 1417-1420. NAAS Rating: 5.23.

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S. K. Sharma, Roshan Choudhary, SK Yadav, RK Jain & Gajanand Jat 2022 Yield & economics of organic, integrated & inorganic crop practices in maize + blackgramThe Pharma Innovation Journal 11(2): 372-374. NAAS Rating: 5.23.

Rajesh Choudhary, Roshan Choudhary, S. K. Sharma, DPD Dudi, SK Yadav, RK Jain, Gajanand Jat, Shivani Meena and A. K. Samota 2022 Effect of Organic Management of Nutrients and Bio-Stimulants on Profitability of wheat. Frontiers in Crop Improvement 10: 1077-1079. NAAS Rating: 5.00.

8.1.2 Popular article/folders/ Palmphlet

Ajmer

Lal S., Meena N.K., Meena, R.D., Choudhary N., Choudhary M. K., Shekhawat Neha, Balai S.R. 2021.Prakratic khethi: Parichai avum beejiya masala faslonutpaadhan m sambhavanae. *Masala surbhi* (1): 13-15.

Lal S., Meena N.K., Saxena S.N., Meena, R.D., Choudhary N., Shekhawat Neha, Choudhary M. K. 2021. Gram masala: mahatav avum prhsanskaran. *Masala surbhi* (1): 37-39.

Ludhiana

Kaur P, Sharma A and Sidhu A S 2021. Unbidden among the desired flora: weed competitive ability and organic farming. *Punjab Advance* 5(8): 40-41.

Aulakh C S, Sidhu A S and Thakur M 2021. Jaivik pramikaran kiven prapat kariye. *Vikas Jagriti* 8(6): 40-41.

Kaul A, Sidhu A S and Sandhu P S 2021. Sauni rutt wich maah ate moongi ugao *Progressive Farming* 57(7): 10.

Sandhu O S, Chaudhary O P and Sidhu A S 2021. Importance of green manuring in improving soil health. *Progressive Farming* 57(4): 14-15.

Sidhu A S, Aulakh C S and Singh S 2022. Organic farming. *Punjab Advance* 4(9): 40-42

Sidhu A S, Aulakh C S and Singh S 2022. Organic basmati rice: Cultivation tips. *Progressive Farming* 58(6): 8

Sidhu A S, Aulakh C S and Bhullar S S 2022. *Basmati di jevik kashat. Changi Kheti* 58(6): 6

Thakur M, Sidhu A S and Aulakh C S 2022. Adopt organic okra-radish-pea cropping system for higher productivity. *Punjab Advance* 3(9): 32-33.

Rani N, Walia S S and Aulakh C S 2022. *Faslan di rehind khuhand ton sone vargi gandoa khad banao. Kheti Sandesh* 243: 4-5 & Ajit daily 20.4.22

Sidhu A S, Aulakh C S and Singh S 2022. *Jaivik kheti utpadan lye mapdand. Vikas Jagriti* 1(9): 38-39.

Aulakh C S and Sidhu A S 2021. Successful cultivation of organic wheat. *Progressive Farming* 57(11): 5-6

Sidhu A S, Aulakh C S and Singh S 2021. *Jevik kanak di safal kashat. Changi Kheti* 57(11):6-7

Singh S and Aulakh C S 2021. *Suchaje kheti tarike apnao, kheti rasain ghatao ate vaadhu kheti lagat bachao. Vikas Jagriti* 4(8): 38-39

Thakur M, Aulakh C S and Sidhu A S 2021. *Sabzian di jevik kheti kiven kariye. Vikas Jagriti* 4(8): 46-47

Sidhu A S, Aulakh C S and Kalra V 2021. How to obtain organic certification. *Jujhar times* (22.12.2021); *The Times of India* (03.01.2022).

S K Nagar

Desai, L.J. Patel, K.M., Patel, P.K., Patel, Kashyap, Patel, Vidhi and Modi Krina (2022) Sanklit Kheti Padhdhti, SDAU publication No. 3:4:981/2020 Pp. 1-8.

Trivandrum

Suja, G. and Jaganathan, D. 2021. Tropical tuber crops-based cropping system for food and nutritional security. *Kerala Karshakan e Journal*, 8(10): 4-10.

Suja, G. 2022. Cultivation of tuber crops-Management tips for higher yield and income. *Karshaka Sree*, 28(2): 34-36.

Suja, G., Byju, G. and Jaganathan, D. 2022. Coconut based cropping systems with climate resilient tuber crops for enhancing farm income A success story from Kollam district of Kerala. *Indian Coconut Journal*, 65(2): 5-9.

Suja, G., Byju, G., Jaganathan, D. and Senthilkumar, K.M. 2022. Coconut based cropping systems with climate resilient tuber crops for enhancing farm income A success story from Kollam district of Kerala. *Krishi Jagran* (Tamil), October 2022: 22-27

8.1.3 Books/ Book Chapter/ Bulletins/Mannual/Annual Report

Bhopal

- Narendra K Lenka, AK Biswas, P Chandran, D Dutta, S Rajendiran, RH Wanjari, AB Singh, BL Lakaria, NK Sinha, AK Vishwakarma, BP Meena, AO Shirale, S Lenka, AK Patra, SK Chaudhari (2022). Soil quality mapping and validation of indexing approach for major production regions of India. Technical Bulletin, ICAR-Indian Institute of Soil Science, Bhopal, India, pp 4-36.
- A K Vishwakarma, B L Lakaria, A O Shirale, A L Kamble, R K Singh, A B Singh, Shinogi K C, K Bharti, Asha Sahu, A K Biswas, A K Patra, Pramendra Parmar, H R Nagar (2021). Conservation Agriculture for Enhanced Yield and Income from soybean-wheat systems: Efforts of ICAR-IISS, Bhopal. Harit Dhara. Volume 4(1) pp 3-6.
- Ashok K. Patra, M.C. Manna, A.B. Singh, Asha Sahu, J.K. Thakur, Asit Mandal, Sudeshna Bhattacharjya, Dolamani Amat, A.K. Tripathi, S.K. Choudhari (2022). Waste to wealth: Innovative composting techniques to improve productivity, soil health and biodiversity. ICAR-Indian Institute of Soil Science, pp.1-46.
- Ashok K. Patra, S.K. Choudhari N, K Sinha and A.B. Singh (2022). The Science of Bhumi Suposhan and Agriculture-the Present situation, Challenges and Future Direction. Bhumi Suposhan. (Akshay Krishi Pariwar), pp.53-175.

Coimbatore

S. No.	Authors	Year	Title of paper / pamphlet / bulletin	Publisher Name	Volume Pages
1-	Manickam, S., R. Jansirani, M. Suganthy, R. Sunitha and V. Vasuki	2021	Organic Agriculture	TNAU Offset Printing Press	106p
2	Manivel, P., R.P. Meena, M.Suganthy,T.Janakiram and Vipin Chaudhary	2021	Pests and Diseases of Medicinal Plants	Westville Publishing House, New Delhi	160p

Jabalpur

- Dr. P. B. Sharma, Dr. Rajendra Prasad Sahu Dr. S.B. Agrawal and Dr. S.K. Vishwakarma 2021. Booklet on Model Farming Systems for Prosperous and Sustainable Livelihood in Eastern and Central Madhya Pradesh Under AICRP-IFS, Jawaharlal Nehru Krishi Vishwa Vidyalaya Jabalpur (M.P.) pp. 35.

Practical Manuals

- Dr. P. B. Sharma, Dr. Rajendra Prasad Sahu, Dr. Neelam bisen and Dr. S.K. Vishwakarma 2021. Practical Manual on Irrigation Water Management pp. 66 is under publication in JNKVV.

Chapter in Book

- Panwar, A.S., N. Ravisankar, M. Shamim, S. Bhaskar, B. P. Bhatt, Raghuveer Singh, A.K. Prusty, Meraj Alam Ansari, Raghavendra, KJ and Poonam Kashyap. 2022. Organic Farming Packages for Major Cropping Systems, Indian Council of Agricultural Research, New Delhi ISBN: 978-93-5566-311-5. Madhya Pradesh Chapter written by P. B. Sharma, S.K. Vishwakarma, Rajendra Prasad Sahu and V.K. Shukla 2022.

Annual Reports-(03)

- Annual Progress Report 2020-21 of Department of Agronomy, JNKVV, Jabalpur.
- Annual Project Report 2020-21 on All India Network Programme on Organic Farming, JNKVV, and Jabalpur.
- Annual Project Report 2020-21 on AICRP on Integrated Farming Systems, JNKVV, Jabalpur.

Ludhiana

- Aulakh C S and Sidhu A S 2022. Organic farming packages for cropping systems of Punjab. In: *Organic Farming Packages for Major Cropping Systems.* Panwar A S, Ravisankar N, Shamim M, Bhaskar S, Bhatt B P, Singh R, Prusty A K, Ansari M A, Raghavendra K J and Kashyap P. Indian Council of Agricultural Research, New Delhi. Pp 36-41.

Udaipur

- S. K. Sharma, Hari Singh, Roshan Choudhary, Gajanand Jat and R. K. Fagodiya 2021. Integrated Farming Systems for Sustainable Agriculture Souvenir 20th National Convention on RCA Alumni Association, RCA, MPUAT Udaipur 35-43.
- A. S. Panwar, N. Ravisankar, S. K. Sharma and G. Suja 2020. Organic and Low Input Agriculture: Gandhian Way Mahatma Gandhi's Vision of Agriculture: Achievements of ICAR, Indian Council of Agricultural Research, New Delhi Pp: 86-96.

S.K. Nagar

- Deepak Kumar, S.K. Arya, Deepti Srivastava, Md. Shamim, L.J. Desai and Manjusha Tyagi. (2021). Impact of major rice bacterial diseases on agriculture and food security published in book name: Bacterial Diseases of Rice and Their Management, Vol-I in the book series "Pathogens of Rice and Their Management published by Apple Academic Press, USA.
- Deepak Kumar, L.J. Desai, Chandrabhanu, Sanjay K. Singh, K.P. Singh, N. Balasubramani, and A. Sadalaxmi. (2021). Pre-harvest management of aflatoxin contamination in groundnut through biocontrol products published in book name Applied Mycology in Agriculture, Food and Industrial Applications, Vol-I. published by Apple Academic Press, USA
- Deepak Kumar, P.N. Singh, Helga Willer, Sushil K. Sharma, U.B. singh, L.J. Desai. (2021). Fungal biofertilizers and biopesticides and their roles in sustainable agriculture, Accepted and will published by Apple Academic Press, USA in book name: Applied Mycology in Agriculture, Food and Industrial Applications, Vol-I.

8.1.4. Paper presented in International/National Seminar/Conferences/ Symposium/ /Workshop.

Ajmer

- Lal, S. Lal, G. Saxena, S.N. Meena, N. K. Meena, R. D. Chaudhary, N. and Choudhary, M.K. (2022) Evaluation of different fennel (*Foeniculum vulgare* Mill) varieties for yield and its attributes under organic production system. In: 2nd Indian Horticulture Summit: Horticulture for Prosperity and Health Security, April 27-29, 2022 at Navsari Agriculture University, Navsari, Gujrat, India Pp. 136.
- Meena, N.K. 2021. Strategic IPM modules for the management of thrips (*Frankliniella schultzei* Trybon) on fennel (*Foeniculum vulgare* Mill.) under organic production system. In book of abstract: National webinar on 'Integrated Pest Management: A Paradism Shift' organized by ICAR-National Research Centre for Integrated Pest Management, LBS Building, Pusa, New Delhi during August 27-28, 2021

Bhopal

- Presented Progress Report of the AI-NPOF Project for the year 2021-22, 16th Annual Group Meeting of AI-NPOF held during on December 3-4, 2021 (Virtual).
- Presented Oral paper on Impact of Nutrient Management Practices on Crop Productivity and Soil Properties in Soybean-Linseed Cropping System in Vertisols – A.B. Singh; B.P. Meena; B.L. Lakaria; J.K. Thakur; Ashok K. Patra in 85th Annual Convention of ISSS held during 16-19 November, 2021.
- Presented Oral paper on Effect of inoculation of heavy metal tolerant endophytic fungi on seedling growth of wheat and maize – Asit Mandal; A.P. RU Ashetti; J.K. Thakur; A.B. Singh; Ashok K. Patra in 85th Annual Convention of ISSS held during 16-19 November, 2021.
- Presented Oral paper deciphering the role of microbial authority in soil carbon fixation – Sudeshna Bhattacharjya; Asha Sahu; A.B. Singh; R.H. Wanjari; A.K. Patra in 85th Annual Convention of ISSS held during 16-19, November 2021.
- Presented Oral paper Long-term fertilization influenced the crop productivity and soil health under diverse sources of nutrients in maize-chickpea cropping system in vertisols – Bharat Prakash Meena; A.K. Biawas; A.B. Singh; R.S. Chaudhary; Ashok K. Patra in 85th Annual Convention of ISSS held during 16-19, November 2021.
- Dr A B Singh had presented lead paper on Waste Management through various efficient composting techniques under Value Added Course on How to handle the waste Generated Nearby us on 17 May, 2021 (via online zoom app), organised by SAGE University Bhopal.
- Dr A B Singh had presented lead paper on Organic Farming and Soil health at IES University Bhopal on 6th December, 2021.
- Dr A B Singh had presented invited paper on Soil organism and Microbial Biodiversities in Organic Farming on 23rd February, 2022, organised online training programme on "Recent Advances in Organic Farming Research" at ICAR-NAARM, Telangana.
- Dr A B Singh had presented oral paper on Soil Health Management through Natural Farming under Conservation Agriculture based Natural Farming on March 27, 2022 at Directorate of Extension Services Gwalior (M.P.)

Jabalpur

- Rajul Soni, Rajendra Prasad Sahu, Shobha Sondhia1 and J.K. Sharma 2021. Effect of pyribenzoxim herbicide on direct-seeded rice. Submitted for Fifth International Agronomy Congress "Agri Innovations to Combat Food and Nutrition Challenges" Organized by Indian Society of Agronomy, New Delhi 110 012, India Professor Jayashankar Telangana State Agricultural University, Hyderabad 500 030, India.

- Annual Group Meeting of AICRP on IFS held in hybrid mode during 18-20 December 2021, ICAR-Indian Institute of Farming System Research, Modipuram, Meerut-250110
- XVI Annual Group Meeting of AINP-OF held in hybrid mode during 3-4 December 2021, ICAR-Indian Institute of Farming System Research, Modipuram, Meerut-250110
- Mass Awareness Campaign on Organic Farming (Madhya Pradesh) Date: May 20, 2021, jointly organized by JNKVV, Jabalpur (MP) and ICAR-Indian Institute of Farming Systems Research, Modipuram. (No. of participants > 250)
- "Mass Awareness campaign on Organic farming" on 06 August 2021, jointly organized by ICAR-Indian Institute of Soil science, Bhopal and ICAR-Indian Institute of Farming Systems Research, Modipuram. (No. of participants **>** 800)
- Online Training Programme on Vermicomposting, Date - 14.03.2022 to 17.03.2022 organized by RCVP Noronha Academy of Administration (MP) No. of participants **>** 65.
- Regional thematic workshop on diversification of crops in MP, UP and Rajasthan in virtual mode on 25th Jan, 2022. JNKVV, Jabalpur
- Workshop on thrust area and curricular research in Agriculture and Agriculture Engineering, Feb 07, 2022. JNKVV, Jabalpur
- Lectures delivered on Management in Organic Farming in NAHEP-CAAST, 11th Aug, 2021, JNKVV, Jabalpur
- Online Training Programme on Organic farming for RAWE students, farmers and staff of JNKVV Date - 21.09.2022 organized by Department of Agronomy, College of Agriculture, JNKVV, Jabalpur. No. of participants > 500.
- Oneday training programme on Organic and natural farming on dated 08.08.2022. Organized by Department of Agronomy, College of Agriculture, JNKVV, Jabalpur. No. of participants > 150.

Ludhiana

- Kaur P, Sachan S, Sharma A and Sidhu A S 2021. Morphological and physiological peek through to unravel weed competitive ability in Iranian wheat landraces under organic conditions. Proc: *International Web Conference on Innovative and Current Advances in Agriculture and Allied Sciences*, July 19-21, 2021 organized by Society for Scientific development in Agricultural & Technology (SSDAT), Meerut, India.
- Thakur M, Aulakh C S, Sidhu A S, Rani N and Kaur P 2021. Performance of Pea (*Pisum sativum* L.) under organic and natural farming practices in North West India. Proc: *Vegetable Research and Innovations for Nutrition, Entrepreneurship and Environment. International Conference* at ICAR-Indian Institute of Vegetable Research, Varanasi from December 14 - 16, 2021, p. 455.

8.2 Participation in Seminars, Conferences, Symposia, workshop etc.

S. No.	Particulars	Date/s	Place	Organizer
1	International seminar on advancing sustainable agriculture systems: What kinds of research partnerships are needed?	11.05.22	Amritsar	Khalsa College Amritsar and FiBL Switzerland.
2	Brainstorming on, 'Meaningful options for ensuring socio- economic prosperity of small and marginal farmers in Punjab.	23.02.22	Ludhiana	ICAR-ATARI
3	Workshop on, 'Transition towards Organic and natural farming'.	03.02.22	Online	Centre for Science and Environment, New Delhi

S. No.	Particulars	Date/s	Place	Organizer
4	XVIth Annual Group Meeting of All India Network Programme on Organic Farming	3 - 4.12.21	Modipuram	ICAR-IIFSR, Modipuram
5	Knowledge sharing workshop on Natural Farming	30.11.21	Online	NITI Ayog, New Delhi
6	Stakeholders meet on New & Renewable Sources of Energy (NRSE)	22.11.21	Chandigarh	Invest Punjab
7	Project review meeting of WOS-B component of KIRAN Division of DST, New Delhi	30.9.21 & 1.10.21	Online	DST, New Delhi
8	Virtual Kisan Mela, Bathinda	29.9.21	Online	PAU Ludhiana
9	Virtual Kisan Mela, Rauni Patiala	22.9.21	Online	PAU Ludhiana
10	Virtual Kisan Mela, PAU Ludhiana	17-18.9.21	Online	PAU Ludhiana
11	Virtual Kisan Mela Gurdaspur and Faridkot	14.9.21	Online	PAU Ludhiana
12	Virtual Kisan Mela, Balowal Saunkhri and Amritsar	8.9.21	Online	PAU Ludhiana
13	Research & Extension Specialists Workshop for *rabi* crops	28.08.21	Online	DA&FW Punjab and PAU Ludhiana
14	Review meeting Biotech-KISAN Project	11.08.21	Online	DBT, New Delhi
15	Webinar on Biostimulant regulations under the FCO 1985	04.08.21	Online	PSFC and DoA&FW Pb
16	Biostimulants regulations under the Fertilizer Control order (FCO) 1985	04.08.2021		Punjab state farmers commission, Mohali
17	Research and extension specialists' workshop for rabi crops	18.08.2021		
18	collaborative on-line training programme, "Organic and natural farming"	24.08.2021 to 26.08.2021		CSKHPKV, Palampur and MANAGE, Hyderabad
19	Knowledge sharing workshop on, "Natural farming"	30.11.2021		NITI Ayog, Government of India
20	16th Annual group meeting of All India Network Programme on Organic Farming (AINPOF)	03.12.2021 to 04.12.2021		
21	40th India International trade fair, 2021	27.11.2021		
22	Agro-conclave (For release of vision of Punjab agriculture)	28.12.2021		DA&FW, government of Punjab
23	3 days training programme on, "Entrepreneurship development programme on certification in organic farming practices"	27.01.2022 to 29.01.2022		ABI, ICAR- NRRI, Cuttak, Odisha
24	International seminar on, "Advancing Sustainable Agriculture System: What kind of research partnerships are needed"	11.05.2022.		Khalsa College, Amritsar and Research Institute of Organic Agriculture (FiBL), Switzerland
25	Research and extension specialists' workshop for soil and water conservation	13.05.2022		PAU, Ludhiana

S K Nagar

- Participated in the International Webinar Conference on "Alternate Cropping Systems for Climate Change and Resource Conservation" from 29 September to 01 October 2021 organised by ICAR-Indian Institute of Farming Systems Research Modipuram.
- Participated in the National Conference on "Integrated Farming Systems: A Tool for Enhancing Income and Nutritional Security organized by the ICAR-Research Complex for Eastern Region, Patna, Bihar from October 5-7, 2021.
- Participated in the Webinar on Analysis of pesticide residues in Food and Agricultural commodities organized AINP on pesticides residues and ICAR Unit-9, AAU, Anand and Centre for Marketing intelligence, NAHEP- CAAST, AAU, Anand on 27th August 2021
- Participated in the "Mass Awareness Campaign on Organic Farming: Gujarat" organized virtually by All India Network Programme on Organic Farming, Centre for Research on Integrated Farming Systems, Sardarkrushinagar Dantiwada Agricultural University, Sardarkrushinagar in collaboration with ICAR-Indian Institute of Farming Systems Research, Modipuram, Meerut (UP) held on 5th August, 2021
- Participated in the National Webinar on "Crop Diversification: A way towards Nutritional Security" which was organized by the ICARResearch Complex for Eastern Region, Patna, Bihar on October 26, 2021.
- Participated in the Virtual National Seminar on "Advances in Sustainable Management of Natural Resources for Food and Nutritional Security "organized by Navsari Agricultural University, Navsari (Gujarat) during August 26-27, 2021.
- Participated in the National seminar on Crop protection under Natural Farming organized by the AAU, Anand on 17th May, 2021.
- Participated in the National National webinar on Organic farming organised by ANGRAU, Telangana on 22- 24/03/2022.
- Dr. Kunjal M. Patel has participated in the National Webinar on Nutraceuticals and Immunity Booster Foods for Combating COVID-19 organized by the Department of Food Science and Nutrition, ASPEE College of Home Science & Nutrition, S. D. Agricultural University, Sardarkrushinagar on 17th May, 2021
- Dr Kunjal M. Patel participated in the oneday online training programme on Familiarity of pesticides residue analysis in Agro products organised by Bio Science Research Centre, SDAU on 13th August 2021.
- Dr K.M. Patel participated in webinar on Strengthening of Agriculture using Basic Science Research organised by CBSH, SDAU on 21st August, 2021
- Dr Kunjal M. Patel participated & presented a research chapter in the poster session in the Fifth International Agronomy Congress organized by the Indian Society of Agronomy at PJTSAU, Hyderabad (India) from 23-27th November 2021.
- Participated in ZREAC (kharif-2022) meet at SSK, Sardarkrushinagar during 27.01.2022.
- Participated as PI and presented research highlights of AI-NPOF project experiments in XVI Group meeting of AI-NPOF project virtually on 03-04, December, 2021.
- Participated as PI and presented research highlights of AICRP on IFS project experiments in Group meeting of AICRP on IFS project virtually on 18-20, Dec. 2021.
- Participated as PI and presented research highlights of AICRP on OFR project experiments in Group meeting of AICRP on IFS project virtually on 18-20, Dec. 2021.

Udaipur

- Dr. S. K. Sharma, PI & Director Research participated and presented a paper entitled "Natural farming in modern time: Changing context and need of hour" in The 9th International Conference on Agriculture 2022 (AGRICO 2022) from 11-12 August, 2022 organized by TIIKM, Sri Lanka.
- Dr. Roshan Choudhary participated and presented a paper entitled "Response of PROM and Biodynamic manure on productivity of organic blackgram" in The 9th International Conference on Agriculture 2022 (AGRICO 2022) from 11-12 August,2022 organized byTIIKM, Sri Lanka.
- Dr. S. K. Sharma, PI & Director Research&Dr. Roshan Choudhary, participated and Paper presentation as poster in Fifth International Agronomy Congress on Agri- Innovations to Combat Food and Nutrition Challenges organized by The Indian Society of Agronomy, New Delhi held at PJTSAU, Hyderabad at PJTSAU, Hyderabad from 23-27 Nov., 2021.

Trivandrum

- Suja, G., Harishma, S.J., Byju, G., Seena Radhakrishnan, A.R., Veena, S.S., Sreekumar, J., Jyothi, A.N., Sunitha, S., Jaganathan, D. and Sheela, M.N. 2022. Organic management fosters yield, income, quality and soil health: Eighteen years of evidence in tropical tuber crops. In: Proceedings of Fifth Organic Asia Congress, Transcending Borders and Generatis for an Organic Asia, held during 13-15 October 2022, Goesan County, South Korea, pp. 42-47.

Lecturers

Ludhiana

S. No.	Name of the Programme, organizers and place	Date	Number/Topic of Lecture	No. of Participants
1	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 from 9 to 13/08/2021	10/08/2021	Organic cultivation of field crops (On-line)	52
2	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 from 9 to13/08/2021	12/08/2021	Organic standards and certification (On-line)	52
3	Three months skill development training course on, "Integrated crop production for young farmers of Punjab" organized by SDC, PAU, Ludhiana from 02/08/2021 to 29/10/2021	17/08/2021	Organic standards and certification (On-line)	45
4	Three months skill development training course on, "Integrated crop production for young farmers of Punjab" organized by SDC, PAU, Ludhiana from 02/08/2021 to 29/10/2021	19/08/2021	Organic cultivation of field crops (On-line)	45

S. No.	Name of the Programme, organizers and place	Date	Number/Topic of Lecture	No. of Participants
5	Training camp for PAU organic farmers club members organized by SDC and School of Organic Farming, PAU, Ludhiana on 20/08/2021	20/08/2021	Mustard cultivation and processing	37
6	Workshop on, "Survey field work and data collection" organized by Department of Public Administration, Punjab University, Chandigarh on 31/08/2021	31/08/2021	Organic farming - Status, scope and opportunities in Punjab	62
7	Workshop on, "Survey field work and data collection" organized by Department of Public Administration, Punjab University, Chandigarh on 31/08/2021	31/08/2021	Group discussion on, "Farm assessment index survey tool"	74
8	Training programme on, "Integrated Farming Systems" organized by School of Organic Farming, PAU under the aegis of Biotech-KISAN project (IFS)	16/09/2021	Role of legumes in Integrated farming systems	25
9	Training programme on, "Integrated Farming Systems" organized by School of Organic Farming, PAU under the aegis of Biotech-KISAN project (IFS)	21/09/2021	Role of organic Integrated farming systems in livelihood security	25
10	Certificate course on, "Entrepreneurship development programme in integrated farming systems, vermicomposting and organic farming" organized by KVK, Patiala	29/09/2021	Organic cultivation of rabi crops (On-line)	38
11	Exposure visit of farmers from KVK Jalandhar to research farm of School of Organic Farming, PAU, Ludhiana on06/10/2021	06/10/2021	Organic production technology field crops	25
12	Exposure visit of farmers from block Mehal kalan, Distt. Barnala to research farm of School of Organic Farming, PAU, Ludhiana arranged by Agriculture department, Barnala on 29/10/2021	29/10/2021	Organic standards and production technology	22
13	Training camp for PAU organic farmers club members organized by SDC and School of Organic Farming, PAU, Ludhiana on 16/11/2021	16/11/2021	Production technology and weed management in organic crops	50
14	Three months skill development training course on, "Integrated crop production for young farmers of Punjab" organized by SDC, PAU, Ludhiana from 03/01/2022 to 31/03/2022	20/01/2022	Organic cultivation of field crops (On-line)	31
15	Training on, "Integrated farming System with special reference to crop livestock integration" organized by KVK, Sangrur from 01/02/2022 to 03/02/2022	01/02/2022	Organic standards and certification	27

S. No.	Name of the Programme, organizers and place	Date	Number/Topic of Lecture	No. of Participants
16	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 from 14/02/2022 to 18/02/2022 SDC PAU, Ludhiana from14/02/2022 to 18/02/2022	14/02/2022	Organic standards and certification	23
17	Training course on, "Organic Farming (Vermicompost and use of biofertilizers 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 from 14/02/2022 to 18/02/2022	14/02/2022	Organic cultivation of field crops	23
18	Training on, "Safe food production in urban areas" organized by School of Organic Farming, PAU, Ludhiana on 28/02/2022	28/02/2022	Agro techniques for organic and safe food production in urban areas	18
19	Training programme on, "Enhancing livelihood security of small and marginal farmers through Integrated farming system approach" organized by School of Organic Farming, PAU, Ludhiana under the aegis of Biotech-KISAN project (IFS) at KVK, Ferozepur	16/03/2022	Improved crop production techniques	150
20	Training programme on,"Enhancing livelihood security of small and marginal farmers through Integrated farming system approach" organized by School of Organic Farming, PAU, Ludhiana under the aegis of Biotech-KISAN project (IFS) at KVK, Moga	15/03/2022	Improved crop production techniques	150
21	Training programme on, "Safe food production practices and certification" organized by School of Organic Farming, PAU, Ludhiana under the aegis of Biotech-KISAN project (IFS) under Azadi Ka Amrit mahostav at village pedhan, block Nabha, district Patiala	22/03/2022	Good agricultural practices (GAP) for field crops	300
22	Educational tour of students from Government College of Education, Jalandhar to School of Organic Farming, PAU, Ludhiana	11/05/2022	Organic farming: concept and relevance	40
23	Seminar on, "Organic and natural farming" organized by ICAR- IIVRI, Varanasi	17/05/2022	Future roadmap for organic and natural farming in Punjab and India	47
24	STC on, "AtamNirbhar Bharat -Challenges and opportunities" organized by NITTTR, Chandigarh from 23/05/2022 to 27/05/2022	24/05/2022	Organic farming for sustainable agriculture (On-line)	105

S. No.	Name of the Programme, organizers and place	Date	Number/Topic of Lecture	No. of Participants
25	Training camp for PAU organic farmers club members organized by SDC and School of Organic Farming, PAU, Ludhiana on 26/05/2022	26/05/2022	Cultivation of pulses in organic farming	55
26	Exposure visit of ELP students of CSKHPKV, Palampur (Department of Organic and Natural Farming) to research area of School of Organic Farming, PAU, Ludhiana	26/05/2022	Organic farming research initiatives at PAU	15
27	Training programme on, "Creating awareness about Natural farming" organized by PAMETI, PAU campus, Ludhiana	10/06/2022	Water management in Natural farming (On-line)	40
28	Training on, "Natural farming in horticultural crops" organized by HTI, Uchani, Karnal, Haryana	14/06/2022	Natural farming in India and its scope	42
29	Training on, "Natural farming in horticultural crops" organized by HTI, Uchani, Karnal, Haryana	14/06/2022	Natural farming: Principles and practices	42
30	Training programme on, "Principles and practices of Natural farming" organized by PAMETI, PAU campus, Ludhiana for Gram Panchyat Pradhans of villages of Punjab	20/06/2022	Natural farming:Prospects and relevance	40
31	Training programme on, "Principles and practices of Natural farming" organized by PAMETI, PAU campus, Ludhiana for Gram Panchyat Pradhans of villages of Punjab	22/06/2022	Natural farming: Prospects and relevance	28
32	Training programme on, "Principles and practices of Natural farming" organized by PAMETI, PAU campus, Ludhiana for Gram Panchyat Pradhans of villages of Punjab	23/06/2022	Natural farming: Prospects and relevance	37
33	Training programme on, "Taking care of dairy animals, chicks and poultry during summers" organized by School of Organic Farming, PAU, Ludhiana under the aegis of Biotech-KISAN project (IFS) at KVK, Ferozepur	23/06/2022	Cultivation of organic fodders	25
34	Training programme on, "Principles and practices of Natural farming" organized by PAMETI, PAU campus, Ludhiana for Gram Panchyat Pradhans of villages of Punjab	26/06/2022	Natural farming: Prospects and relevance	33
35	Training programme on, "Principles and practices of Natural farming" organized by PAMETI, PAU campus, Ludhiana for Gram Panchyat Pradhans of villages of Punjab	28/06/2022	Natural farming: Prospects and relevance	22

S. No.	Name of the Programme, organizers and place	Date	Number/Topic of Lecture	No. of Participants
36	Training camp on, "Role of backyard poultry to boost farmers income" organized by School of Organic Farming, PAU, Ludhiana under the aegis of Biotech-KISAN project (IFS) at KVK, Moga	28/06/2022	Importance of IFS in agriculture	25
37	Training camp on, "Role of backyard poultry to boost farmers income" organized by School of Organic Farming, PAU, Ludhiana under the aegis of Biotech-KISAN project (IFS) at KVK, Ferozepur	28/06/2022	Importance of IFS in agriculture	25
38	Training programme on, "Principlesand practices of Natural farming" organized by PAMETI, PAU campus, Ludhiana for Gram Panchyat Pradhans of villages of Punjab	29/06/2022	Natural farming: Prospects and relevance	31
39	Training programme on, "Principles and practices of Natural farming" organized by PAMETI, PAU campus, Ludhiana for Gram Panchyat Pradhans of villages of Punjab	30/06/2022	Natural farming: Prospects and relevance	48
40	Training programme on, "Principles and practices of Natural farming" organized by PAMETI, PAU campus, Ludhiana for Gram Panchyat Pradhans of villages of Punjab	01/07/2022	Natural farming: Prospects and relevance	22
41	Exposure visit of farmers/trainees of training on, "Market strategies and future aspects of agricultural produce" to research farm of School of Organic Farming arranged by KVK, Barnala	12/07/2022	Effective marketing strategies for organic products	19
42	Training camp on, "Natural farming" organized by RCNOF, Panchkula	15/07/2022	Rationale and implications of Natural farming	58
43	Training on 'Creating awareness about Natural Farming' for Gram Panchayat Pradhans of Punjab. Organized by PAMETI, Ludhiana (Online)	01.07.22	Natural farming: Introduction, principles and relevance	-
44	Training on, 'Creating awareness about Natural Farming' for Gram Panchayat Pradhans of Punjab, Distt- SAS Nagar. Organized by PAMETI, Ludhiana (Online)	29.06.22	Natural farming: Introduction, principles and relevance	-
45	Training on, 'Creating awareness about Natural Farming' for Gram Panchayat Pradhans of Punjab, Distt- SAS Nagar. Organized by PAMETI, Ludhiana (Online)	28.06.22	Natural farming: Introduction, principles and relevance	-
46	Training on, 'Creating awareness about Natural Farming' for Gram Panchayat Pradhans of Punjab, Distt- Jalandhar. Organized by PAMETI, Ludhiana (Online)	27.06.22	Natural farming: Introduction, principles and relevance	-

S. No.	Name of the Programme, organizers and place	Date	Number/Topic of Lecture	No. of Participants
47	Training on, 'Creating awareness about Natural Farming' for Gram Panchayat Pradhans of Punjab, Distt-Fatehgarh Sahib. Organized by PAMETI, Ludhiana (Online)	24.06.22	Natural farming: Prospects and relevance	-
48	Training on, 'Creating awareness about Natural Farming' for Gram Panchayat Pradhans of Punjab, Distt- Ropar. Organized by PAMETI, Ludhiana (Online)	16.06.22	Natural farming: Introduction, principles and relevance	-
49	Training on, 'Creating awareness about Natural Farming' for Gram Panchayat Pradhans of Punjab, Distt- SAS Nagar. Organized by PAMETI, Ludhiana (Online)	10.06.22	Natural farming: Prospects and relevance	-
50	Webinar on quality certification for agricultural and allied products. Organized by PAMETI, Ludhiana	05.05.22	Organic and safe food production & certification	-
51	Training on Good Agricultural Practices (GAP) and certification. Organized by PAMETI, Ludhiana 19-21.4.2022	20.04.22	Organic and safefood production & certification	25
52	Kisan Mela at KVK Moga	28.03.22	Organic farming: Practices, standards & certification	300
53	Training camp on, Improving livelihood security of small and marginal farmers through Integrated Farming System approach. Organized under Biotech-KISAN project at Nidhan Wala, Moga	15.03.22	Certified safe food production	150
54	Training camp on, Improving livelihood security of small and marginal farmers through Integrated Farming System approach. Organized under Biotech-KISAN project at KVK Ferozepur	16.03.22	Certified safe food production	165
55	Training camp for PAU-Organic Farming Club, PAU Ludhiana	26.05.22	Prospects of natural farming in Punjab	30
56	Awareness-cum-training camp on, 'Safe food production practices and certification' at Village Pedhan in Nabha block of Patiala district under Azadi ka Amrit Mahotsav by Biotech-KISAN project	22.03..22	Organic vis-à-vis Safe food production	300
57	Kisan Mela Ballowal Saunkhri (Online)	14.03.22	Organic farming: Panel discussion	-
58	Training camp on, 'Safe food Production in urban areas' Organized by Emmar Welfare Society, SAS Nagar.	28.02.22	Safe food production practices	30
59	Young Farmers Training on Integrated Crop Production (126th batch)	18.01.22	Organic farming: Standards and certification	-

S. No.	Name of the Programme, organizers and place	Date	Number/Topic of Lecture	No. of Participants
60	Webinar on Awareness campaign-cum-Training on Good Agricultural Practices (GAP) in wheat under Azadi ka Amrit Mahotsav. Organized by DBT, New Delhi and School of Organic Farming, PAU Ludhiana (Course Director)	15.09.21	Good Agricultural Practices (GAP) in wheat- Success story at farmers' fileds	200
61	Webinar for PAU- Organic Farmers Club, PAU Ludhiana	20.08.21	Safe food certification system: A new initiative	30

Invited Lectures

S. No.	Name & place of event	Date
1	Natural farming in Punjab. In: Webinar on, 'Promotion of NaturalFarming. 26 May, 2022. NCOF, Ghaziabad	26.05.22
2	Research priorities in organic farming in Punjab. In: International seminar on advancing sustainable agriculture systems: What kinds of research partnerships are needed?	11.05.22

Awards

S.K Nagar

- Best Centre Award (2020-21): Best Centre of All India Network Programme on Organic Farming (AI-NPOF) during 2020-21 under ICAR-Indian Institute of Farming Systems Research, Modipuram, Meerut.
- Best Oral Presentation Award (2021-22) in the Virtual National Seminar on Advances in Sustainable Management of Natural Resources for Food and Nutritional Security organized by NAU, Navsari (Gujarat) during August 26-27, 2021.
- Certification of Appreciation to delivered the expert lecture in National conference on Agriculture in the event of GUJARAT VIGYAN SAMMELAN-2022 organised by Vigyan Bharati

New Recommendations/Technologies developed

Ludhiana

- Retention or incorporation of both paddy and wheat residues in rice-wheat cropping system for 12 years continuously gives more wheat yield (22.68 q/acre) and rice-wheat system productivity (50.88 q/acre) over only paddy straw incorporation or retention. Incorporation or retention of both paddy and wheat residues also improved soil health, which is desirable for sustainable rice-wheat production.
- Continuous incorporation/retention of rice straw improved soil health and rice yield. Whenever, the organic carbon content of the soil comes under high category or after 8 years reduces urea by 20 kg/acre in rice.
- Mechanical weed management in organic wheat
- Methodology of rice straw vermicomposting
- Maize - potato/peas - Spring groundnut cropping system
- Moong - summer moong -wheat cropping system under organic farming
- Okra-radish-pea cropping system under organic farming

8.3. Human Resource Development

8.3.1. Training/workshop /programme conducted:

Bhopal

- Organized 01day Mass Awareness Campaign on Organic Farming, Jointly by ICAR-IISS and ICAR-IIFSR, Modipuram on 06/08/2021(Virtual).
- Organized program on National Nutritional Week during 1-7th September, 2021 by ICAR-IISS Bhopal in collaboration with the Bhopal Chapter of the NAAS.
- Organized 01day farmer's training under "International Year of Millets 2023" at ICAR-IISS, Bhopal on 17/09/2021 (Virtual).
- Organized 01day Farmer's Scientists Interface Programme on "Climate Resilient Varieties, Technologies and Practices" Organized by ICAR-IISS Bhopal on 28/09/2021.
- Organized 05 days training cum exposure visit at ICAR-IISS, Bhopal for the tribal farmers of Dist: Betul during 25-29th October 2021.
- Organized Workshop on Rapid Composting for Sustainable Soil Health on 4th December, 2021 at ICAR-IISS, Bhopal.
- Organized Agricultural Education Day "Halting soil degradation & improving soil health" to College student virtually joined at ICAR-IISS on 03/12/2021.
- Organized 4 No Farmers training each for 03 days in different villages under NICRA project for SC farmers.
- Organized 02 days farmer's training under Soil Health Card at ICAR-IISS, Bhopal during 19-20 January, 2022.
- Organized World Soil Day on farmer scientist interaction meet organised on 04/12/2021 at Village-Khamkheda, Dist Bhopal, (M.P.)
- Organized Farmer training program on 24/03/2022 under "Farmers First Project" at ICAR-IISS, Bhopal.
- Organized Field Day program on 25/03/2022 under "Farmers First Project" at Village-Bhairopura, Bhopal.
- Organized Field Day program on 26/03/2022 under "Farmers First Project" at Village-Khamkheda, Bhopal.
- -Organized 02 Kisan Pathshala (3 days duration each) on "Climate smart agriculture and Soil health" for SC farmers under SCSP project in different villages (Tarasewania, Pipalia Chhaparband, Bagoniya and Jhapadia) of Bhopal district.
- Organized 01 day programme for farmers visited in institute under "Navachar Evam Kheti Ki Unnat Taknik" on 20/03/2022 at ICAR-IISS, Bhopal.

Coimbatore

No. trainings/ workshops/ seminars etc organized	Name of the training	Sponsor	Date	No. of participants
2021-22	Training on Organic Agriculture	NOFRC TNAU	08.03.21	36
	Training on Organic Agriculture	NOFRC TNAU	07.10.21	28
	Training on Organic Agriculture	NOFRC TNAU	07.12.21	34
	Training on Organic Agriculture	NOFRC TNAU	07.02.22	75
	Training on Organic Agriculture	NOFRC TNAU	22.03.22	21

Ludhiana

Sl. No	Name of the training programme	Date & Place	No. of particpants
1	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 9-13, 2021 (Online)	28
2	Awareness camp cum training programme on,"Good Agricultural Practices in Wheat" organized by School of Organic Farming, PAU under the aegis of Biotech-KISAN hub of Department of Biotechnology, Government of India as a part of *Azadi Ka Amrit Mahostav* programme	September 15, 2021 (Online)	125
3	Training programme on, "Integrated Farming Systems" organized by School of Organic Farming, PAU under the aegis of Biotech- KISAN project (IFS)	September 16,2021 KVK, Ferozepur	25
4	Training programme on, "Integrated Farming Systems" organized by School of Organic Farming, PAU under the aegis of Biotech- KISAN project (IFS)	September 21,2021 KVK, Moga	25
5	Coordinated exposure visit of farmers from KVK Jalandhar to research farm of School of Organic Farming, PAU, Ludhiana	October 06, 2021 PAU, Ludhiana	25
6	Coordinated exposure visit of farmers from block Mehal kalan, Distt. Barnala to research farm of School of Organic Farming, PAU, Ludhiana arranged by Agriculture department, Barnala	October 29,2021PAU, Ludhiana	22
7	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 14-18,2022 (Online)	23
8	Training on, "Safe food production in urban areas" organized by School of Organic Farming, PAU, Ludhiana	February 28, 2022 Mohali	18
9	Training camp on, "Importance of Integrated farming systems in improving livelihood security of small and marginal farmers" organized by School of Organic Farming, PAU, Ludhiana under the aegis of Biotech- KISAN project (IFS)	February 10,2022 Village Wada Bhaika, Ferozepur	25

Sl. No	Name of the training programme	Date & Place	No. of particpants
10	Training camp on, "Importance of Integrated farming systems in improving livelihood security of small and marginal farmers" organized by School of Organic Farming, PAU, Ludhiana under the aegis of Biotech- KISAN project (IFS)	February 11,2022 Village Malwal qadim, Ferozepur	25
11	Training camp on, "Importance of Integrated farming systems in improving livelihood security of small and marginal farmers" organized by School of Organic Farming, PAU, Ludhiana under the aegis of Biotech- KISAN project (IFS)	February 14, 2022 Village Bajidpur, Ferozepur	25
12	Training camp on, "Importance of Integrated farming systems in improving livelihood security of small and marginal farmers" organized by School of Organic Farming, PAU, Ludhiana under the aegis of Biotech- KISAN project (IFS)	February 17,2022 Village Karmuwala, Ferozepur	25
13	Training camp on, "Importance of Integrated farming systems in improving livelihood security of small and marginal farmers" organized by School of Organic Farming, PAU, Ludhiana under the aegis of Biotech- KISAN project (IFS)	February 18,2022 Village Shakoor, Ferozepur	25
14	Training camp on, "Importance of Integrated farming systems in improving livelihood security of small and marginal farmers" organized by School of Organic Farming, PAU, Ludhiana under the aegis of Biotech- KISAN project (IFS)	February 21,2022 Village Nurpur sethan, Ferozepur	25
15	Training camp on, "Importance of Integrated farming systems in improving livelihood security of small and marginal farmers" organized by School of Organic Farming, PAU, Ludhiana under the aegis of Biotech- KISAN project (IFS)	February 23,2022 Village Toot, Ferozepur	25
16	Training camp on, "Importance of Integrated farming systems in improving livelihood security of small and marginal farmers" organized by School of Organic Farming, PAU, Ludhiana under the aegis of Biotech- KISAN project (IFS)	February 24,2022 Village Shehzadi, Ferozepur	25
17	Training camp on, "Importance of Integrated farming systems in improving livelihood security of small and marginal farmers" organized by School of Organic Farming, PAU, Ludhiana under the aegis of Biotech- KISAN project (IFS)	February 25,2022 Village Badni gulab singh, Ferozepur	25
18	Training camp on, "Importance of Integrated farming systems in improving livelihood security of small and marginal farmers" organized by School of Organic Farming, PAU, Ludhiana under the aegis of Biotech- KISAN project (IFS)	February 28,2022 Village Rukna mangla, Ferozepur	25
19	Training camp on, "Importance of Integrated farming systems in improving livelihood security of small and marginal farmers" organized by School of Organic Farming, PAU, Ludhiana under the aegis of Biotech- KISAN project (IFS)	February 03,2022 Village Nidhanwala, Moga	25
20	Training camp on, "Importance of Integrated farming systems in improving livelihood security of small and marginal farmers" organized by School of Organic Farming, PAU, Ludhiana under the aegis of Biotech- KISAN project (IFS)	February 07,2022 Village Purane wala, Moga	25

Sl. No	Name of the training programme	Date & Place	No. of particpants
21	Training camp on, "Importance of Integrated farming systems in improving livelihood security of small and marginal farmers" organized by School of Organic Farming, PAU, Ludhiana under the aegis of Biotech- KISAN project (IFS)	February 10,2022 Village Ajitwal, Moga	25
22	Training camp on, "Importance of Integrated farming systems in improving livelihood security of small and marginal farmers" organized by School of Organic Farming, PAU, Ludhiana under the aegis of Biotech- KISAN project (IFS)	February 11,2022 Village Kokri heeran, Moga	25
23	Training camp on, "Importance of Integrated farming systems in improving livelihood security of small and marginal farmers" organized by School of Organic Farming, PAU, Ludhiana under the aegis of Biotech- KISAN project (IFS)	February 14,2022 Village Kokri kalan, Moga	25
24	Training camp on, "Importance of Integrated farming systems in improving livelihood security of small and marginal farmers" organized by School of Organic Farming, PAU, Ludhiana under the aegis of Biotech- KISAN project (IFS)	February 21,2022 Village Budh singh wala, Moga	25
25	Training camp on, "Importance of Integrated farming systems in improving livelihood security of small and marginal farmers" organized by School of Organic Farming, PAU, Ludhiana under the aegis of Biotech- KISAN project (IFS)	February 22, 2022 Village Sadda singh wala, Moga	25
26	Training camp on, "Importance of Integrated farming systems in improving livelihood security of small and marginal farmers" organized by School of Organic Farming, PAU, Ludhiana under the aegis of Biotech- KISAN project (IFS)	February 25, 2022 Village Daultpura ucha, Moga	25
27	Training programme on, "Enhancing livelihood security of small and marginal farmers through Integrated farming system approach" organized by School of Organic Farming, PAU, Ludhiana under the aegis of Biotech-KISAN project (IFS)	March 16, 2022 KVK, Ferozepur	150
28	Training programme on, "Enhancing livelihood security of small and marginal farmers through Integrated farming system approach" organized by School of Organic Farming, PAU, Ludhiana under the aegis of Biotech-KISAN project (IFS)	March 15, 2022 Village Nidhan wala, District Moga	150
29	Training programme on, "Safe food production practices and certification" organized by School of Organic Farming, PAU, Ludhiana under the aegis of Biotech-KISAN project (IFS) under Azadi Ka Amrit mahostav	March 22, 2022 Village Pedhan, block Nabha, district Patiala	300
30	Coordinated education tour of students from Government College of Education, Jalandhar to School of Organic Farming, PAU, Ludhiana	May 11, 2022 PAU, Ludhiana	40
31	Coordinated exposure visit of ELP students of CSKHPKV, Palampur (Department of Organic and Natural Farming) to research area of School of Organic Farming, PAU, Ludhiana	May 26, 2022 PAU, Ludhiana	15

Sl. No	Name of the training programme	Date & Place	No. of particpants
32	Training camp on, "Role of backyard poultry to boost farmers income" organized by School of Organic Farming, PAU, Ludhiana under the aegis of Biotech-KISAN project (IFS)	June 28, 2022 KVK, Moga	25
33	Training camp on, "Role of backyard poultry to boost farmers income" organized by School of Organic Farming, PAU, Ludhiana under the aegis of Biotech-KISAN project (IFS)	June 28, 2022 KVK, Ferozepur	25
34	Coordinated exposure visit of farmers/ trainees of training on, "Market strategies and future aspects of agricultural produce" to research farm of School of Organic Farming arranged by KVK, Barnala	July 12, 2022 PAU, Ludhiana	19
35	Training programme on, "Taking care of dairy animals, chicks and poultry during summers" organized by School of Organic Farming, PAU, Ludhiana under the aegis of Biotech- KISAN project (IFS) at KVK, Ferozepur	June 23, 2022 KVK, Ferozepur	25
36	Training camp on, "Role of backyard poultry to boost farmers income" organized by School of Organic Farming, PAU, Ludhiana under the aegis of Biotech-KISAN project (IFS) at KVK, Moga	June 28, 2022 KVK, Moga	25
37	Training camp on, "Role of backyard poultry to boost farmers income" organized by School of Organic Farming, PAU, Ludhiana under the aegis of Biotech-KISAN project (IFS) at KVK, Ferozepur	June 28, 2022 KVK, Ferozpur	25
38	Training camp for PAU- Organic Farming Club, PAU Ludhiana (Programme Associate Director)	May 26, 2022 Ludhiana	30
39	Awareness-cum-training camp on, 'Safe food production practices and certification' at Village Pedhan in Nabha block of Patiala district under Azadi ka Amrit Mahotsav by Biotech-KISAN project	March 22,2022 Pedhan, Nabha	300
40	Certified safe food production. In: training camp on, Improving livelihood security of small and marginal farmers through Integrated Farming System approach. Organized under Biotech-KISAN project at KVK Ferozepur	March 16, 2022 KVK, Ferozpur	165
41	Training camp on, Improving livelihood security of small and marginal farmers through Integrated Farming System approach. Organized under Biotech-KISAN project at Nidhan Wala, Moga	March 15, 2022 Nidhan Wala, Moga	150
42	Webinar on Awareness campaign-cum-Training on Good Agricultural Practices in wheat under Azadi ka Amrit Mahotsav. Organized by DBT, New Delhi and School of Organic Farming, PAU Ludhiana (Course Director)	September, 15,2021 PAU, Ludhiana	200
43	Training camp for PAU- Organic Farming Club, PAU Ludhiana (Programme Associate Director) (Online)	August 20, 2021 PAU, Ludhiana	30

Sl. No	Name of the training programme	Date & Place	No. of particpants
44	Training Course on 'Organic farming (Vermicompost and use of biofertilizers for enhancing crop yield and soil fertility)' for farmers and farm women'. PAU Ludhiana. SDC, PAU Ludhiana (Technical Course Director)	August 09-13, 2021 (Online)	45

Modipuram

- Entrepreneurship Development through Organic Farming (16-18th August, 2021)
- Upscaling of Organic farming technology and Natural Farming practices through *Bhartiya Prakruthi Krishi Paddhathi* (27-29th July, 2021)
- National webinar on Bio-Decomposer: Wealth from Waste in Farming System (20th July 2021)

8.3.2. List of Radio talk/Television talks/ E-News/ E-Leaflets

Ajmer

- Lal, S. Lal, G. Saxena, S.N. Meena, N.K. Meena, R.D. Chaudhary N. and Chaudhary, M. K. 2022. Fennel varieties identified for cultivation under organic production system. Seed Spices E-News Letter January - February - 2022 Page 01.
- Meena, N.K., Singh, R. and Meena, M.D. 2021. IPM module for effective management of aphid in cumin and coriander to enhance quality yield. ICAR-NRCSS Seed Spices E-Newsletter, 14 (5): 3-4.
- Lal, S., Lal, G., Meena, N.K., Meena, R.D., Chaudhary, N., Saxena, S.N. and Chaudhary, M.K. 2021. Green gram varieties identified for cultivation in organic production system. ICAR-NRCSS Seed Spices E-Newsletter, 14 (5): 2-3.
- Meena, N.K., Lal, G., Meena, R.D., Choudhary, N., Choudhary, M.K. and Saxena, S.N. 2021. Management of fennel (Foeniculum vulgare L.) aphid through organic based IPM modules. ICAR-NRCSS E-Newsletter, 14 (3): 02.
- Organic fennel production 01/2021 under the Mass Awareness Campaign on Organic Farming in English.
- Organic fennel production 01/2021 under the Mass Awareness Campaign on Organic Farming in Hindi

Bhopal

- Given talk on "Kheti me Mradaa Syasthya ke liye Jaivik Kheti" dated 17/07/2021 at Doordarshan Bhopal.
- Given talk on "HELLO GRAMA SABHA-LIVE PHONE IN" dated 17/10/2021 at Prasar Bharati, All India Radio Bhopal.
- Given talk on "Javik Kheti Me Poshak Tatva Prabandhan" dated 22/12/2021 at Doordarshan Bhopal.
- Given talk on "Jaivik Kheti Aur Mrada Swasthya" dated 01/03/2022 at Doordarshan Bhopal.

S K Nagar

Webinar organized by SKnagar

- Dr L.J.Desai worked as Convenors in the Mass Awareness Campaign on "Organic farming" virtually organised by the Centre for Research on Integrated farming System, SDAU, Sardarkrushinagar in collaboration with ICAR-Indian Institute of Farming System Research, Modipuram (UP) on 5th August, 2021

- Dr L.J. Desai delivered Durdarshan talk on IFS model on 08.01.2022.
- Dr K.M. Patel, ARS delivered talk on Khetima vadhare nafo melavava mate sanklit kheti padhdhti apanaavie on YouTube live on 22.06.2021
- Dr K.M. Patel, ARS delivered talk on Integrated Farming System on live Durdarshan on 8.12.2022
- Dr K.M. Patel, ARS delivered talk on Integrated Farming System on BISAG studio at Gandhinagar on 1.11.2021
- Dr K.M. Patel, ARS delivered talk on Uttar Gujaratni nafakarak pak padhdhtio ane tenu mahatv on YouTube live on 02.09.2021
- Dr K.M. Patel, ARS delivered talk on sendriy khetina dhara dhorano ane certification angeni karypadhdhti YouTube live on 05.01.2022
- Dr K.M. Patel, ARS delivered talk on Integrated Farming System on BISAG studio at Gandhinagar on 1.11.2021
- Dr K.M. Patel, ARS delivered talk on Sankalit kheti padhdhti model ane tenu mahatv at online programme organised by Akashvani, Vadodara telecasted on 23.11.2021.

Trivandrum

- Suja, G. 2022. Radio Talk on Importance of tropical tuber crops in food security. Broadcast on 17 October 2022 on the occasion International Poverty Eradication Day, in the Farm & Home Section, All India Radio, Thiruvananthapuram.
- Suja, G. 2022. Expert in the Live Phone-in Programme on Crop management of tuber crops in Krishi Darshan, Doordarshan Kendra, Thiruvananthapuram, 4 March 2022, Krishi Darshan, Doordarshan Kendra, Thiruvananthapuram.

8.3.3. Kisan Gosthis/farmers day/other activities

- Organized Four "Kisan Pathsala" each of three days on climate smart agriculture in the month of February- March 2022.
- As course Co-Directors organized winter school on Advance Biofertilizer Technologies to Improve Nutrient use Efficiency, Soil health and Greenhouse gas mitigation at ICAR-IISS, Bhopal during on 8-28 February, 2022

Celebrated "Annadata Devo Bhava"75 Azadi Ka Amrit Mahotsav: National Workshop on Natural Farming for Sustainable Agriculture & Environmenton 24thApril 2022

National Workshop entitled "Natural Farming for Sustainable Agriculture & Environment" organized on 24th April 2022 at the institute premises to commemorate "Annadata Devo Bhava". The event was celebrated in a hybrid mode as a part of the "AzadiKa Amrit Mahotsav" to commemorate 75 Years of India's Independence. In the inaugural address, Chief Guest Shri Vishnu Khatri, Hon'ble MLA emphasized on the importance of natural farming for sustainable agriculture with reduced input costs and higher premium price for the produce. In his welcome address, Dr. R. Elanchezhian, PS & Organizing Secretary gave a brief introduction and importance of the workshop under current perspectives. Dr. Ashok K. Patra, Director, ICAR-IISS addressed the dignitaries, farmers and online attendees on the significance of natural farming for soil health improvement under future climate change environment. He further emphasized that natural farming are key component to enhance crop productivity for doubling farmers' income.



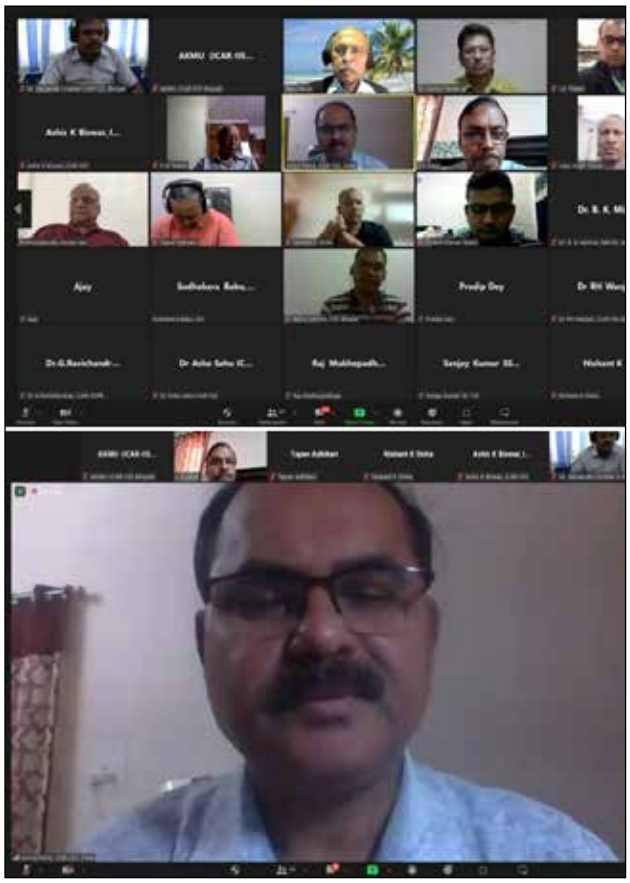
ICAR IISS Bhopal celebrated "Kisan Bhagidari, Prathmikta Hamari" 75 Azadi Ka Amrit Mahotsav Campaign on "Biofortification, Nutrient Grooming and Crop Diversification" on 28thApril 2022

Organized a Workshop entitled **"Kisan Bhagidari, Prathmikta Hamari"** 75 Azadi Ka Amrit Mahotsav Campaign to sensitize farmers about importance of soil health management for sustainable agriculture and human health with special emphasis on "Biofortification, Nutrient Grooming and Crop Diversification" on 28thApril 2022 at the institute premises to commemorate **"Kisan Bhagidari, Prathmikta Hamari"**. The event was celebrated in the institute as a part of the *"Azadi Ka Amrit Mahotsav"* to commemorate *75 Years of India's Independence*. The program was attended by 78 progressive farmers from four villages (Beenapur, Bandikhedi, Khujari and Hinoti sadak). In the inaugural address, Chief Guest Dr. Ashok K




.Patra, Director, ICAR-IISS addressed the farmers on the significance of **"Biofortification, Nutrient Grooming and Crop Diversification** for improving soil health improvement, ensuring good human and livestock health, nutrient grooming for enhanced efficiencies and sustaining productivity under future climate change environment. He further emphasized that crop diversification is a key component to enhance crop productivity for doubling farmers' income.

WORLD ENVIRONMENT DAY 2022



ICAR-Indian Institute of Soil Science, Bhopal celebrated World Environment Day on 5th June, 2022 on the theme 'Only One Earth' to create awareness on preservation and enhancement of habitable environment and organized a lecture by Prof. Ravi Naidu, Director of Global Centre for EnvironmentalRemediation, The University of Newcastle, Australia. Dr. A.K. Patra, Director of Indian Institute of Soil Science, expressedconcern on rising pollution that is threating the existence biodiversity. He specifically mentioned the emerging menace of microplastics that are entering into our precious soil resource though various means and are affecting soil biological health and ecosystem services. Prof. Ravi Naidu delivered his lecture on 'Our polluted soil - why we need to stop destroying the very thing that sustain us'. In his lecture, he emphasized the importance of soil protection from pollution for sustainability of environment. He highlighted that cadmium, arsenic and pesticides are major contaminants in agricultural land, threatening human health through food chain contamination and needs to be controlled. He also appealed IISS Bhopal to join International Network on Soil Pollution (INSOP) of FAO for strengthening the international effort of combating soil pollution. After his presentation, participants interacted with the speaker about various environmental issues impacting quality food production from agricultural land. A total of 57 scientists participated the program.

Soil Health Awareness Week Celebrated at ICAR-IISS, Bhopal on the Occasion of World Soil Day

Soil health awareness week is being celebrated at ICAR-Indian Institute of Soil Science, Bhopal during December 01-07, 2021. This is on the occasion of World Soil Day (WSD) celebrated every year by Food andAgricultural Organization of the United Nationson December 05. This years' theme of WSD is "Halt Soil Salinization, Boost Soil Productivity". A massive March Past was organized by the institute Scientist, Technical and other staff to spread awareness among the public on the importance of soils in human life and protection of this precious resource. On the occasion Dr Ashok K Patra, Director, told that as per FAO about 9% of the soils of the planet earth are affected by salinity or sodicity. In India there is about 6.73 million hectares of salt affected soils and it is increasing. If this is not corrected this will pose threat on the existence of

future generations. He also gave TV and radio talks for mass awareness. On the same day, a farmer- scientist interaction meet was organised at village Khamkheda, Dist Bhopal, (M.P.). The Director of institute, Dr AK Patra, Dr AB Singh, Organizing Secretary, Dr Pradip Dey, Co-Chairman, Dr R Elanchezhian, Convener, Dr AK Vishwakarma Co-Organizing Secretary and scientists of the institute along with staff participated in the program.


8.3.4. Details of M.Sc. and Ph.D degree awarded based on the project work

Jabalpur

Credit hours of Course taught (independent & shared) 2021- 22

Course taught (I & II semester)

Class	Title of course	Course No.	Credit hours.
I semester			
B.Sc. (Agri.) 1st year	Fundamentals of Agronomy		1+1(shared with Dr. M.L. Kewat)
B.Sc.(Hons.)Agri. II- year, 1st Semester 2021-22	Crop Production Technology I (Kharif crops)	-	1+1(Independent)
II semester			
B.Sc.(Hons.)Agri. II- year, 2nd Semester 2020-21	Crop Production Technology II (Rabi crops)	-	1+1(Independent)
B.Sc.(Hons.)Agri. III- year, 2nd Semester 2020-21	Practical Crop Production II (Rabi crops)		0+2(Independent)
B.Sc.(Hons.)Agri. III- year, 2nd Semester 2020-21	Rainfed Agriculture and Sustainable Agriculture	-	1+1 (Shared with Dr. Nisha Sapre)

M. Sc. Students guided

Name of student	Title of thesis
Mr. Jitendra Sisodiya	Effect of IW/CPE ratios on productivity of wheat+mustard intercropping system
Ms. Shritama Bhunia	Influence of varying IW/CPE ratio and nutrient levels on growth and yield of Linseed
Mr. Anil Kumar Patel	Evaluation of response of different varieties of Soybean for organic farming in Kymore Plateau and Satpura Hills Zone
Mr. Manish Nagar	"Evaluation of Different Rabi Crops for Diversification in Rice-Wheat Cropping system"
Ms. Sangita Rawat	"Performance of chickpea varieties under organic nutrient management in Kymore Plateau and Satpura Hills Zone"
Ms. Pinki Mehra	Productivity and grain quality parameters of different varieties of rice

Name of student	Title of thesis
Ms. Richa Singh	Performance of different wheat varieties under organic nutrient management in Kymore Plateau and Satpura Hills Zone.
Mr. Rahul Verma	Evaluation of different crops during *Rabi* for higher productivity and profitability in Madhya Pradesh
Mr. Vishal Patel	Identification of suitable Rabi season crops for different farming systems in Kymore Plateau and Satpura Hills Zone
Ms. Mansi Joshi	Effect of different nutrient management practices on soybean growth and productivity in Kymore Plateau and Satpura Hills Zone
Mr. Lakhan Bhalse	Efficacy of pre-emergence herbicides against weeds in wheat
Ms. Shivangi Raghuwanshi	Bioefficacy of new generation post emergence herbicide against weed flora in transplanted rice
Ms. Sonam Jain	Effect of microbial consortia (*Rhizobium, Trichoderma* and EM) on rhizospheric microbial population, soil properties and production of chickpea in a vertisol
Ms. Akash Birla	Studies on sheath blight of rice incited by *Rhizoctonia solani*

Ph. D Students Guided

Name of student	Title of thesis
Ms. Aparna Sharma	Evaluation of Productivity and grain quality parameters of different rice and wheat varieties
Ms. Anamika Badkul	Influence of varying IW/CPE ratio and nutrient levels on growth and yield of Linseed
Ms. Priya Kochle	Studies on comparative efficiency of organic, chemical and integrated nutrient management practices on soil health and crop productivity under soybean based cropping systems
Mr. Puspendra Singh Yadav	Studies on date of sowing and cuscuta management in berseem
Mr. Vijay Kumar	Diversification and Intensification of different cropping systems for higher productivity and Economics in Central Madhya Pradesh
Mr. Ratan Soni	Effect of various input combinations of organic inputs on productivity, nutrient use efficiency, soil health and economics under rice based organic farming systems

S.K Nagar

PG Guidance 2021-22

SN	Particulars Awarded degree	Period	Completed	
1.	M.Sc. (Agri.) in Agronomy	2021-22	1	1
2	Ph.D. in Agronomy	2021-22	2	5
3	Worked as Co-Advisor of Deepak Kumar (ID No. CFA10GJ1959) participant of CFA(Certified Farm Advisor-Organic Farming) on the research topic of Management of Aflatoxins Contamination in Groundnut through Potent Bio-control Agents under Organic Farming System			

S K Nagar

1	Delivered lecture on Natural Farming to around five hundred farmers of North Gujarat during Natural Farming Conference, Pre-Vibrant Programme, Gujarat on 17th December, 2021 at Auditorium hall, SDAU, Gujarat
2	Delivered talk in National Conference (virtual mode) on Integrated Farming Systems: A Tool for Enhancing Income and Nutritional Security organized by: ICAR- Research Complex for Eastern Region, Patna.
3	Delivered talk on Crop residue & waste management in National webinar on Organic farming organised by ANGRAU, Telangana on 24/03/2022

APPENDIX 9

Details of crops and varieties used in evaluation of organic, inorganic and integrated productions ystems at various locations

Location	Crop	Variety
Bajaura	Black gram (*kharif*)	Palampur- 93
	Lady's Finger (*kharif*)	PLG
	Tomato (*kharif*)	Hybrid 2853
	Cauliflower (*rabi*)	Madhuri
	Pea (*Rabi*)	GS-10
	French bean (kharif & summer)	Falguni
	Tomato (summer)	Hybrid 453
	Summer Squash (summer)	Sunny House
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
	Maize	DWR 2006
	Soyabean	DSB 21
Karjat	Rice	Karjat–4
	Brinijal	Krishna F1

Location	Crop	Variety
	Chickpea	Vijay
	Field bean	Konkan wal-1
	Onion (White)	Alibag local
Jabalpur	Soyabean	JS 20-98
	Wheat	JW 3382
	Lentil	IPL 316
	Berseem	J B - 1
	Mustard	Pusa Agrani
	Green gram	Shikha
	Sorghum fodder	MP Chari
Ludhiana	Basmati rice	Panjab basmati 7
	Sesame	Punjab Til No. 2
	Moong (summer)	SML 832
	Moong *(Kharif)*	ML 2056
	Wheat	*Unnat* PBW343
	Chickpea	PBG 8
	Lentil	LL1373
Modipuram	Basmati rice	PB-6
	Rice	Saket-4
	Maize Grain	Bajaura pop corn/Madhuri sweet corn
	Green cob	Madhuri
	Wheat	HI - 8498
	Okra	Arka Anamika
	Potato	Chipsona-3
	Barley	DWRB-91
	Green gram	Pusa vishal
	Mustard	Pusa bold
Pantnagar	*Sesbania*	Ses pant-1
	Basmati rice	Pusa basmati-1
	Wheat	UP-2572
	Chickpea	Pant kabuli chana-1
	Vegetable Pea	Arkel
	Potato	Kufri jyoti
	Coriander	Harit RS-5
	Sesbania	Pant Ses-1
	Rice	Pusa-1509
	Soybean	PS 1347
	Maize	PSM-3

Location	Crop	Variety
	Pigeon pea	UPAS 120
	Cowpea	PL-3
	Mustard	Toria
Raipur	Soybean	JS – 9752
	Sweet corn	Sugar-75
	Field pea	Pant sabji matar" (PSM 3)
	Cabbage	Godavari F1
	Tomato	Laxmi F1 Hybrid
Ranchi	Rice	Birsamati
	Wheat	K- 9107
	Onion	Arka niketan
	Potato	Kufri Ashoka
	Okra	Aprajita
Umiam	Rice (sunken bed) *kharif*	Megha Aromatic-2, Lampnah, Ngoba, Shahsa-rang-1
	Bhindi	
	Carrot	New Koroda
	Potato	Kufri jyoti
	French bean	Naga local
	Tomato	Rocky
Ajmer	Cabbage	Golden Acre
	Fennel	AF-2
	Coriander	ACr-2
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
	Rajmash (*Rabi)*	SKR-57
	French bean (*Rabi)*	-
	Toria (*Rabi)*	TS-38
Narendrapur	Paddy	Satabdi,Gobindobhog
	Brocolli	Princess
	Vegetable Pea	MS10
	Mustard	B9
	French Beans	Falguni
	Green gram	Samrat

Location	Crop	Variety
	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

ANNEXURES 10

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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 logarithum 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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