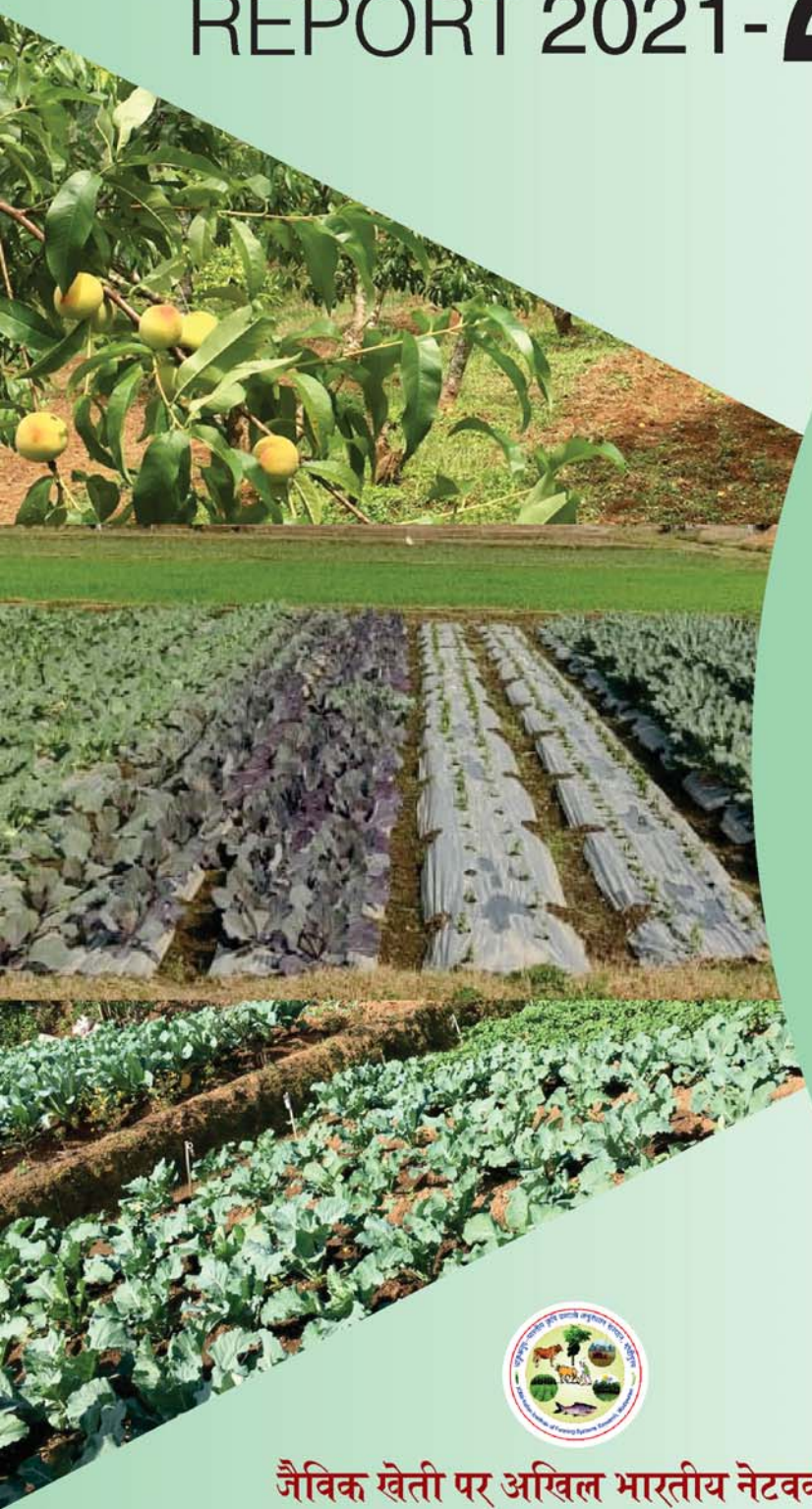
ANNUAL REPORT 2021-22



जैविक खेती पर अखिल भारतीय नेटवर्क कार्यक्रम

All India Network Programme on Organic Farming

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 in 16 states.

ANNUAL REPORT 2021-22

भाकृअनुप
ICAR

ALL INDIA NETWORK PROGRAMME ON ORGANIC FARMING

ICAR-Indian Institute of Farming Systems Research

Modipuram, Meerut – 250 110, India

Correct citation : All India Network Programme on Organic Farming. Annual Report 2021-22, ICAR-Indian Institute of Farming Systems Research, Modipuram, Meerut- 250 110, pp.270+vi

Compiled & Edited : Dr. N. Ravisankar, National PI (AINP-OF)
: Dr. Vipin Kumar, CTO (AINP-OF)
: Dr. Meraj Alam Ansari, Sr. Scientist
: Dr. Gautam Veer Chauhan, RA (AINP-OF)

Data processing : Dr. Vipin Kumar, CTO (AINP-OF)
: Dr. Gautam Veer Chauhan, RA (AINP-OF)

Published by : Dr Sunil Kumar
Director
ICAR-Indian Institute of Farming Systems Research,
Modipuram, Meerut- 250 110, India

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 2021-22 is based on experimental data generated during *kharif*, *rabi* and summer seasons of 2020-21. The other details are relevant up to 31 March 2022.
- 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 (special heritage) university. Results of the study, experiments and demonstrations conducted during 2020-21 at 20 co-operating centres are processed, compiled, and published as Annual Report 2021-22. 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 resource specific 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 as the issues raised and inputs shared were of immense value in taking new initiatives.

I am highly thankful to each one of the scientists and research fellows involved in the scheme at 20 centres for setting the painstaking effort to conduct the field experiments, lab analysis and generating data. The sincere efforts put forth by all the Scientists and staff of Project Coordination Unit for preparing the report are appreciated. I extend my gratitude and appreciation to **Dr Meraj Alam Ansari**, Senior Scientist, **Dr Vipin Kumar**, Chief Technical Officer and **Dr Gautam Veer Chauhan**, Research Associate, Dr **Rahul Kumar**, Senior Research Fellow, **Dr Vidhu Dixit**, Young Professional-I and all others who have helped to shape the report by compiling the data, its statistical analysis, report drafting and proof correction. Administrative assistance to the scheme given by **Mrs. Jailata Sharma**, Personal Assistant, Coordination Unit is also duly acknowledged.

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

N. R. 28/3/2024

(N. Ravisankar)
Project Coordinator, AICRP-IFS &
National Principal Investigator

CONTENTS

ABSTRACT

The salient research findings made during 2020-21 under All India Network Programme on Organic farming is given below

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

Bajaura: Among the crops evaluated in vegetable-based cropping systems for comparative efficiency of organic, inorganic and integrated management, the performance of al crops i.e. French bean, cauliflower, tomato, black gram and summer squash were found to be better under inorganic production system with state recommended package. In case of pea, it was increase 34.43 % under organic with 100% nutrient supplied through organic sources over inorganic. In terms of system equivalent yield (cauliflower equivalent), fallow-cauliflower-tomato resulted in higher cauliflower equivalent yield (22667 kg/ha) among the cropping systems. Cauliflower equivalent yield was increased to the tune of 32.88% under 100% organic compared as compared to 100% inorganic nutrient management.

Bhopal: The yield of soybean was found to be higher with 100% organic practice followed by integrated (50% organic +50 % inorganic) by 27.07 and 16.58% compared to inorganic package respectively. *Rabi* crops such as, wheat, mustard, chickpea and linseed also followed the same trends and recorded maximum yield under 100% organic and increased by 8.60, 11.64, 16.39, and 12.13% for *durum* wheat, mustard, chickpea and linseed respectively over inorganic. In terms of system equivalent yield (soybean equivalent), under 100% organic was found maximum (2634 kg/ha). Among the cropping systems, soybean-linseed recorded higher soybean equivalent yield (2698 kg/ha).

Calicut: Organic package consisting of 100% nutrient supply through organic manure recorded higher yield of Ginger (13900 kg/ha). Yield of turmeric was recorded with integrated management with 25% organic +25% inorganic source + seed/seedling treatment with Beejamrit + Ghanjeevamrit @ 250 kg/ha, Jeevamrit @ 500 litres /ha /time (31300 kg/ha). There is 5.7% difference was found among production system.

Coimbatore: Among the management practices, brinjal, barnyard millet, tomato and finger millet recorded maximum yield under inorganic management practice with state recommendation of 21703, 1950, 25794 and 2856 kg/ha respectively and found to be marginal reduction in yield by 7.79, 5.01, 38.60 and 5.19% respectively with organic compared to inorganic. Chilli and pearl millet registered higher yield towards organic with 50:50% each organic +inorganic nutrient. The yield was increased significantly by 16.73 and 32.17% over inorganic while 7.48 and 15.60 was increased over organic respectively.

Dharwad: Among different combinations of intercropping system, significantly higher pigeon pea seed equivalent yield was recorded under inorganic management package with state recommendation package (1637 kg/ha) in pigeon pea+ groundnut inter cropping system and closely followed by 100% organic treatment (1673 kg/ha).

Jabalpur: The reduction in mean grain yield of basmati rice with organic was recorded to the tune of 18.56% compared to inorganic. The reduction in the yield of wheat, chickpea, and vegetable pea was also found by 64.32, 40.76 and 8.96 % as compared to inorganic production package. Total mean productivity of cropping system in terms of basmati rice equivalent was recorded higher with 100% organic nutrient management (10173 kg/ha). Among crop-sequences, basmati rice- berseem (seed and fodder) led to record maximum basmati rice equivalent yields (10037 kg/ha).

Karjat: Higher mean yield of rice (3195 kg/ha) was recorded with application of 50% each organic and inorganic nutrient under integrated package. Chickpea, field bean and onion also resulted good yield with integrated package (50% each organic and inorganic nutrient) and found to be higher by 30.54, 4.23 and 20.30% over 100% inorganic respectively. Brinjal resulted in higher yield with inorganic package (47341 kg/ha) and reduction in yield of brinjal with organic found to be 8.91%. System productivity in term of rice equivalent yield, rice- brinjal system produced maximum rice equivalent yield (43924 kg/ha) compared to other cropping systems.

Ludhiana: Mean equivalent yield of wheat (9400 kg/ha) was recorded under integrated nutrient management with application of 50% each organic and inorganic nutrient followed by 100% organic (8950 kg/ha) whereas, soybean was recorded higher yield of 1140 kg/ha under organic package with application of 75% N equivalent by organic manure + innovative practice. Chickpea recorded maximum yield (1350 kg/ha) with 100% organic practices followed by integrated package (50% both organic and inorganic) (1300kg/ha). Among the cropping systems, the highest wheat equivalent yield was recorded with *kharif* moong-wheat-summer moong of 11267 kg/ha.

Modipuram: Among the different crop management practices, highest yield of black rice (992 kg/ha), black gram (1150 kg/ha) was recorded under organic production package which was 151.1% higher over inorganic. The yield of finger millet, okra and tomato was recorded highest under inorganic package with state recommendation or farmer package while yield of barley was highest in integrated package with 50% of both organic and inorganic package. The per cent increase in yield of finger millet, okra and tomato under inorganic package with state recommendation or farmer package as compare to organic farming was found to be by 22.75, 11.61 and 36.92 %, respectively. Systems productivity among the various systems, black gram – tomato – *sunhemp* green manure recorded higher rice equivalent yield of 17258 kg/ha. Among the various production package, systems productivity was highest with 100% organic (11479 kg/ha).

Pantnagar: Performance of basmati rice, wheat, and mustard were found to be better under integrated production systems with 50% application of both organic and inorganic. Yield of basmati rice recorded by 14.83% higher with integrated over inorganic while 1.31% over organic. During *rabi*, wheat and mustard recorded higher yield under integrated package and the yield difference between integrated and inorganic found to be by 3.58 and 41.40%, respectively. The highest yield of vegetable pea (6536+938 kg/ha) and potato (18974 kg/ha) was recorded with 100% organic management system. Tuber yield of potato under 100% organic is increase by 23.33 % over inorganic. System productivity in terms of basmati rice equivalent yield recorded higher in integrated package and was increased by 18.33% over inorganic. Among all the cropping systems, higher system productivity was recorded with basmati rice-vegetable pea +coriander (10067 kg/ha).

Raipur: Organic production system resulted in higher soybean mean yield. Other crops such as maize (sweet corn), french bean, cabbage, and tomato resulted higher yield under inorganic practices (state recommendation) and yield reduction in maize (sweet corn), french bean, cabbage, and tomato with organic was found to be 5.13, 4.80, 9.62 and 4.22 % respectively as compared to inorganic. The productivity of cropping system in term of soybean equivalent yield recorded higher under organic management practice and it was increased by 30.99% over inorganic. Soybean-tomato cropping system registered higher soybean equivalent yield (14958 kg/ha).

Ranchi: Organic management practice with 75% organic manure + innovative practice resulted in higher mean yield of rice (3703 kg/ha), the yield was increased by 36.03% than inorganic. Other crops like onion and potato during *rabi* recorded higher yield with organic package. The yield of onion and potato was increased with organic to the tune of 9.87 and 105.76 % respectively over inorganic package. Wheat and okra recorded highest yield (2863 and 8868 kg/ha, respectively) under integrated package with application of 25% organic +25% inorganic source of nutrients + seed/seedling treatment with Beejamrit + application of Ghanjeevamrit @ 250 kg/ha, Jeevamrit @ 500 litres /ha /time. In case of systems equivalent yield, integrated package with application of 25% organic +25% inorganic source of nutrients + seed/seedling treatment with Beejamrit + application of Ghanjeevamrit @ 250 kg/ha, Jeevamrit @ 500 litres /ha /time found to be higher (12668 kg/ha) among the management practice. Among the cropping systems, rice-onion recorded highest rice equivalent yield (14855 kg/ha).

Umiam: Inorganic package recorded maximum mean bhindi yield 12110 kg/ha followed by organic package (11290 kg/ha). Difference between inorganic and inorganic was only 7.26%. The highest yield of carrot (16730 kg/ha) and french bean (14850 kg/ha) was recorded with 100% organic package however the yield of potato (19100 kg/ha) and tomato (6710 kg/ha) was recorded highest in integrated management package with application of 50% both organic and inorganic package.

Ajmer: Performance of cowpea was found better in inorganic package under state recommendation followed by integrated management practice (application of 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). Among nutrient management practice, seed yield coriander + cabbage, fennel + cabbage, fennel and coriander under state recommendation were higher by 18.44, 16.10, 8.08 and 36.84 % respectively over 100% organic package.

Almora: Among crop management systems, organic management package with application of nutrient with 50% organic source + seed/seedling treatment with Beejamrit + application of Ghanjeevamrit @ 250kg/ha, Jeevamrit @ 500 litres /ha /time produced highest yield of grain amaranth (2071 kg/ha), finger millet grain (2898 kg/ha) and wheat (1596 kg/ha) and the increase over 100% inorganic was to the tune of 24.98, 65.03 and 113.1%, respectively.

Gangtok: Organic package resulted in 18.83% higher mean yield of maize as compared to inorganic. Likewise, ginger, soybean, turmeric and black gram gave 92.98, 114.6, 89.31 and 97.92% higher yield with organic over inorganic respectively. During *rabi* french bean, buckwheat, rajmash and toria recorded higher yield to the tune of 80.05, 65.33, 232.56 and 75.86% with organic over inorganic. The maize equivalent yield was recorded highest under Maize + ginger (1.1)- french Bean cropping sytem (10640 kg/ha).

Narendrapur: Basmati rice (1873 kg/ha), broccoli (1362 kg/ha), mustard (1258 kg/ha) and sesame (1600 kg/ha) recorded highest yield under 100% organic management package. However yield of vegetable pea was highest under organic nutrient package consisting of 75% organic+25% innovative practices. Under integrated (50% organic+50% inorganic) management package, french bean and green gram recorded the highest yield. The per cent increase in yield of basmati rice under 100% organic and integrated (50% both organic and inorganic) is 5.76 and 8.45%, respectively over inorganic.

Sardarkrushinagar: Under organic practices, yield of groundnut, wheat, green gram, coriander, fennel and vegetable cowpea recorded drop to the tune of 7.67, 12.40, 22.86, 9.2, 10.84 and 10.14 % respectively over inorganic practice with state recommendation. System equivalent yield (ground nut equivalent) of 3911 kg/ha was recorded highest under organic with application of 100% organic input which is 34.82 % higher than inorganic. Among the cropping systems, ground nut-wheat-green gram resulted in higher ground nut equivalent yield of 4070 kg/ha which gave 3.99 and 115.12 % higher than green gram- coriander- vegetable cowpea and green gram-fennel- fennel continue system, respectively.

Thiruvananthapuram: Tuber yield of cassava and taro was higher by 72.44 % & 138.56 % than inorganic. Likewise, vegetable cowpea and groundnut recorded maximum under organic with 75% organic + innovative practices whereas black gram recorded maximum yield under organic practice. Tuber equivalent yield was found highest under organic production package with 75% organic + innovative practice (25433 kg/ha) followed by integrated management package with application of 25% organic +25 % inorganic + innovative practice (22073 kg/ha).

Udaipur: Maize and sweet corn (2400 & 2610 kg/ha) with inter crop of black gram (225 and 230 kg/ha, respectively), sole black gram (500 kg/ha) and soybean (650 kg/ha) during *kharif* and wheat *durum* and *aestivum* (4150 & 4000 kg/ha) recorded maximum yield either in inorganic or in state recommendation practice. Total productivity among the management practices in term of maize equivalent yield, inorganic production system consisting state recommendation/farmers practice being the highest followed by organic package with 75% organic + innovative practice. Out of four cropping systems, maize + black gram (2:2)–wheat (*durum*)–*sesbania* (GM) cropping system gave maximum maize equivalent yield of 9066 kg/ha.

2. Evaluation of response of different varieties of major crops for Organic Farming

Bajaura: Among the maize varieties, best performing variety i.e., Bajaura Makka recorded significantly higher fresh weight of cobs (6850 kg/ha) and grain yield (5470 kg/ha kg/ha) and net returns followed by Girija which recorded yield (5090 kg/ha), net returns (Rs. 76,652/ha). Among the wheat varieties, HPW-368 recorded maximum grain yield (3030 kg/ha), and net return (Rs.94319/ha) followed by HP-349 which recorded yield (2690 kg/ha), and net returns (Rs. 79367/ha).

Bhopal: Among different varieties of groundnut, the maximum pods/plant (32), Seed/pod (2.3) and pod yield (1983 kg/ha) recorded by the variety GPBD-5. Among different varieties of mustard, maximum siliqua/plant (449), seeds/siliqua (13.7), test weight (6.3g) and seed yield (1988 kg/ha) recorded by the variety Aravali.

Calicut: Among the ginger varieties, Varada recorded higher yield (14770 t/ha), oleoresin content (4.2%) followed by Rajatha which recorded yield (10660 t/ha), oleoresin content (4.0%). Yield of turmeric among the different varieties recorded maximum with Pragati variety (38800 kg/ha) followed by Suguna (37700 kg/ha). Pragati also recorded higher oleoresin content (14.11%) followed by Alappey supreme (11.93%). Curcumin content among the turmeric found to be higher in Sudarsana (6.03%).

Coimbatore: Among different variety of rice, maximum grain yield (5611 kg/ha), recorded by Kuzhiadichan. Straw yield of Kuzhiadichan variety was statistically at par with Athur Kichili samba (7256 kg/ha), Garudan samba (7572 kg/ha), Kullakar (7189 kg/ha) and Anaikomban (7600 kg/ha). Best performance variety of green gram i.e. COGG-17-16 recorded maximum yield (981 kg/ha), followed by COGG-16-10 which recorded 898 kg/ha of yield.

Jabalpur: Among the rice varieties, PS 3 was the leading variety in grain yield (5447 kg/ha) and net return (122328 Rs/ha) followed by PS 4 which recorded grain yield (4865 kg/ha) and net return (99074 Rs/ha). Among the wheat varieties, JW 17 recorded maximum grains / ear head (49), effective tillers/ m^2 (470), test weight (39.87 g) and grain yield (4072 kg/ha), followed by C 306.

Karjat: Best performing variety Sahyadri-5 recorded maximum grain yield (4589 kg/ha) followed by Sahyadri-3 (4546 kg/ha). Among the different varieties of cowpea, maximum seed yield (1285 kg/ha) was recorded by variety Kokan sadabhar which was statistically at par with GC 5 (1245 kg/ha).

Ludhiana: Among different varieties of rice, RYT 3722 and RYT 3722 recorded maximum grain yield of 4080 and 4000 kg/ha respectively. Among different varieties of wheat PBW 766 recorded significantly higher grain yield (38.8 kg/ha) which was statistically at par with Unnat PBW 550 (36.4 kg/ha) and PBW 803 (38 kg/ha).

Modipuram: Among different varieties of vegetable pea, Prachi 10 recorded higher pods/plant, nos. of seed/pod and pod yield (5542 kg/ha) followed by PS 1100 which recorded yield of 4945 kg/ha along with gross return (138546 Rs/ha) and net return (98896 kg/ha).

Pant Nagar: Among different high yielding, bio-fortified and traditional varieties of rice, varieties HKR -47, PSD 27 and Kala Namak, performed better and recorded maximum grain yield of 5155, 4543 and 3464 kg/ha respectively. Among the wheat varieties, Sonalika (2990 kg/ha), C-306 (2647 kg/ha) and black wheat (2638 kg/ha) recorded maximum grain yield under organic production.

Raipur: Among the traditional short grain aromatic rice, variety Karigilas recorded highest test weight (33.17 g) and grain yield (4203 kg/ha followed by Dubraj Sel.01 which recorded of 3516 kg/ha of grain yield. Among Improved scented rice C.G. Sugandhit Bhog recorded maximum panicle length (28.76 cm) and grain yield (5151 kg/ha) followed by Sugandhmati (5025 kg/ha). Among different varieties of chickpea, Vaibhav recorded significantly higher plant height (47.00 cm) number of branches (3.78) nos. of pods/ plant (52.20) and seed yield (1494 Kg/ha). Seed yield of variety Vaibhav was statistically at par with RG2009-01 (1448 kg/ha), RG2009-16 (1414 kg/ha) and JG-130 (1385 kg/ha).

Umiam: Among different varieties of groundnut, maximum yield (2614 kg/ha) was recorded by JL 501 followed by ICGV91114 (2464 kg/ha). Among different varieties of mustard maximum yield was recorded by YSH (1396 kg/ha) followed by Ragini (1300 kg/ha).

Ajmer: Green gram variety Mum-2 and RMG-975 performed significantly better in term of number of primary branches (6.20, 5.73), number of pods/plant (25.3, 24.7) number of seeds/pod (11.9, 11.7), and seed yield 610 and 603 kg/ha respectively. Among the cluster bean varieties, RGC-1038 and RGC 1055 recorded maximum no of pods/plant (60.1, 53.9), no. of seeds/pod (8.6, 8.4), and seed yield (1530 and 1483 kg/ha respectively). During *rabi*, among different varieties of coriander, maximum no. of primary branches/plant (8.87, 8.73), no. of secondary branches/plant (20.07, 19.73), no. of umbel/plant (37.47, 36.40), no. of umbellate/umbel (6.80, 6.73) and seed yield of 1655 and 1636 kg/ha recorded in Azad Dhania-1 and ACr-1 respectively. Among all fennel varieties, GF-12 and AF-1 recorded significantly higher number of primary branches/plant (10.1, 9.8), number of secondary branches/plant (20.0, 19.5), number of umbel/plant (32.3, 30.1), no. of umbellate/umbel (26.1, 25.5) and seed yield (3283, 3233 kg/ha) respectively

Gangtok: Significantly higher grain yield of maize (4070 kg ha^{-1}) and net return (42.9 ¹ $\times 10^3$ 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 and significantly higher than other remaining cultivars. Among the buckwheat varieties, maximum grain yield (2130 kg ha^{-1}) was recorded under IC 109433 which was statistically at par with local Meethay, IC109729, IC49671 (2040, 1920, 1920 kg/ha respectively). Net return was also followed the same trend as yield.

Sardarkrushinagar: Significantly higher pod yield of groundnut (1728 kg/ha) were recorded in GJG-17 which was at par with GG-20 and TG-37. Economic performance of GJG 17 (S) recorded the best performance as compare to other variety under organic condition with net return (81,554 ¹ /ha) and B:C ratio (1.65), at the same time as GG 5 variety of groundnut performed lowest in yield (988 kg/ha) and economics (¹ 24,933/ha) under organic practices. Among the different wheat varieties, maximum wheat yield was recorded in variety GW-451 (3657 kg/ha) which was on par with GW 496 and GW 273 which recorded of 3542 and 3414 kg/ha. Net return of ¹ 38,943 /ha and B:C ratio 0.59 was also obtained in GW 451 and being the best performing varieties as compared to other among the wheat variety. During summer, green gram variety GM-4 recorded highest seed yield (1233 kg/ha) along with net return (40,909 ¹ /ha) followed by GAM-5 which recorded yield of 1205 kg/ha with net return of ¹ 39,370/ha

Thiruvananthapuram: Among the cassava varieties, tuber yield was recorded significantly higher in CR24-4 of 36610 kg/ha. Sree Pavithra been the next best performing variety in term of yield (25930 kg/ha). Variety, Sree Reksha generated higher profit (Rs. 5,07,400 ha^{-1}) followed by Sree Pavithra of Rs. 2,93,867 ha^{-1} as profit**.**

Udaipur: Among the different varieties, Pratap Hybrid Maize-3 recorded significantly higher maize yield (5830 kg/ha) for maize grain, sugar-75 gave significantly higher maize yield (5170 kg/ha) as sweet corn varieties. PM-3 recorded higher yield (1420 kg/ha) in case of baby corn varieties, and VL-Amber observed significantly higher maize yield (3000 kg/ha) as popcorn varieties., Navjot gave significantly higher maize yield (4300 kg/ha) among local varieties. During *rabi*, among wheat duram varieties, HI-8713 recorded significantly higher grain yield (5785 kg/ha), net return (Rs. 1,73,395 /ha) as compared to other varieties. Among *Triticum aestivum* varieties, variety MP-3288 recorded significantly higher grain yield (4615 kg/ha), net return (Rs. 1,28,915 /ha) as compared to other wheat varieties. Among local wheat varieties, variety C-306 recorded significantly higher grain yield (4210 kg/ha) and net return (Rs. 1,10,713/ha) as compared to other local wheat variety.

3. Evaluation and validation 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 1222 kg/ha which is 28.9 and 15.5% increase than organic and integrated crop management + chemical pesticides (ICMCP) respectively. Soil organic carbon in the soil complete natural farming recorded numerically higher (0.27%) compared to control (0.26%). Natural farming resulted in reduction in cost of cultivation by 60.7% and 50.5% over organic and integrated crop management respectively.

Udaipur: Cowpea + maize - fennel + cauliflower cropping system were evaluated. Under complete natural farming system equivalent yield recorded 18318 kg/ha which is 260 and 273% increased than organic and integrated crop management +chemical pesticides (ICMCP) respectively. Soil organic carbon (0.71%) was recorded with complete natural farming which slightly higher over control (0.70%) however it was 2.8% lower than organic. Natural farming resulted in reduction in cost of cultivation by 2.7% organic package.

Sardarkrushinagar: Cowpea +maize -fennel+ cauliflower cropping system were evaluated. Under complete natural farming, system equivalent yield of 2407 kg/ha was recorded which was 39.7 and 44.5% decreased than organic and integrated crop management respectively. Soil organic carbon was recorded with complete natural farming (0.13%) which was 18.2% higher over control (0.11%). Complete natural farming found to be a positive in term of return whereas rest of the practices recorded in negative in term of return.

Almora: Soybean + maize - vegetable pea + green coriander systems were evaluated. Complete natural farming recorded system equivalent yield of 9400 kg/ha which recorded only 40kg/ha higher than organic package while about 10% higher compared to Integrated crop management + chemical pesticides (ICMCP). Soil organic carbon recorded 0.83 under complete natural farming which is 2.5% higher over control but 17.85% was decreased over organic package. Natural farming resulted in reduction in cost of cultivation by 21.8% and 7.02% over organic and integrated crop management respectively.

Bajaura: Complete natural farming recorded system equivalent yield of 6808 kg/ha which is 10.9 and 26.6% increase than organic and integrated crop management +chemical pesticides (ICMP) respectively. Soil organic carbon (0.87%) recorded under complete natural farming which is 26.1% higher over control. Natural farming resulted in reduction in cost of cultivation about 6.0% over organic.

Gangtok: Complete natural farming recorded system equivalent yield of 6253 kg/ha which is 44.6% higher compared to organic package Soil organic carbon (1.51%) recorded under complete natural farming which is numerically higher compared to control (1.50%). Natural farming resulted in reduction significantly in cost of cultivation by 32.0% and 7.02% over organic.

Bhopal: Soybean+ maize - wheat + mustard recorded system equivalent yield of 4478 kg/ha which is 88.4 and 73.8% higher compared to organic package and integrated crop management +chemical pesticides (ICMP) respectively. Soil organic carbon (0.68%) recorded higher by 6.25% under complete natural farming practice over control. Complete natural farming practice resulted in reduction in cost of cultivation by 36.3 and 39.6% over organic and integrated crop management (ICMCP) practice respectively.

Raipur: Complete natural farming practice recorded system equivalent yield of 2199 kg/ha which was found to be 88.4 and 44.1% lower compared to organic package and integrated crop management +chemical pesticides (ICMP) respectively. Complete natural farming recorded soil organic carbon of 0.63% which is 14.6% higher over control. Complete natural farming practice resulted in reduction in cost of cultivation by 40.9 and 33.4% over organic and integrated crop management (ICMCP) practice respectively.

Coimbatore: Cotton + green gram - sorghum + chickpea cropping system was evaluated. Complete natural farming practice recorded system equivalent yield of 2020 kg/ha which was 58.2 and 71.9% lower compared to organic package and integrated crop management +chemical pesticides (ICMP) respectively. Complete natural farming recorded soil organic carbon of 0.69% which was 11.3% higher over control. Complete natural farming practice resulted in reduction in cost of cultivation by 31.1 and 32.0% over organic and integrated crop management (ICMCP) practice respectively.

Dharwad: Complete natural farming practice recorded system equivalent yield of 1468 kg/ha which was 6.1 and 12.5% lower compared to organic package and integrated crop management +chemical pesticides (ICMP) respectively. Complete natural farming practice resulted in reduction in cost of cultivation by 25.6 and 19.2% 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 11448 kg/ha which is 91.8 and 75.7% lower than organic package and integrated crop management +chemical pesticides (ICMCP) respectively. Natural farming resulted in reduction in cost of cultivation by 27.0 and 33.9% over organic practice and integrated crop management (ICMCP) respectively.

Karjat: Rice-cowpea cropping system was evaluated. Complete natural farming practice recorded system equivalent yield of 8378 kg/ha which was 49.1 and 33.8% lower compared to organic package and integrated crop management +chemical pesticides (ICMP) respectively. Complete natural farming recorded soil organic carbon of 1.01% which was at par with control

but about 3% lower than organic package. Net return of Rs. -2974/ha in minus recorded in complete natural farming with cost of cultivation of Rs.1,46,764/ha.

Ranchi: Rice-sweet corn cropping system was evaluated. Complete natural farming practice recorded system equivalent yield of 4451 kg/ha which was 44.7 and 108.6% lower compared to organic package and integrated crop management +chemical pesticides (ICMP) respectively. Complete natural farming recorded soil organic carbon of 0.51% which was significantly higher by 82.1% over control. Complete natural farming practice resulted in reduction in cost of cultivation by 23.5 and 25.1% 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 5014 kg/ha which was 40.3 and 99.0% lower compared to organic package and integrated crop management +chemical pesticides (ICMP) respectively. Complete natural farming recorded soil organic carbon of 0.42% which was about 2.44% higher over control. Complete natural farming practice resulted in reduction in cost of cultivation by 80.4 and 15.7% over organic and integrated crop management (ICMCP) practice respectively.

Modipuram: Complete natural farming practice recorded system equivalent yield of 4748 kg/ha which was 73.2 and 83.7% lower compared to organic package and integrated crop management +chemical pesticides (ICMP) respectively. Complete natural farming recorded soil organic carbon of 0.21% which was 61.9% lower over control (0.41%). Complete natural farming practice resulted in reduction in cost of cultivation by 19.4 and 9.2% 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 45051 kg/ha which was about 3.1 lower compared to organic package but at par to integrated crop management +chemical pesticides (ICMP) of 45491 kg/ha. Complete natural farming recorded soil organic carbon of 0.77% which was 11.7% lower over control (0.86%). Complete natural farming practice resulted in reduction in cost of cultivation by 26.6 and 23.3% over organic and integrated crop management (ICMCP) practice respectively.

4. Development of Integrated Organic Farming System Model

Calicut: Spices, fodder and vegetables combination having crops turmeric, fodder grasses (CO-3, CO-4), tapioca, banana, cowpea, coconut, and livestock as 2 cows and their calves resulted a profit of Rs 2.13 lakhs was from one acre IOFS model established at Calicut. Employment generated Man days/year was 295.

Thiruvananthapuram: Cassava tuber equivalent yield of 20.2 tons and net returns of Rs. 15,030 obtained from a IOFS model involving tuber crops from an area of 75 cents.

Coimbatore: A one acre IOFS model for irrigated upland ecosystem at farm of Tamil Nadu Agricultural University, Coimbatore is established. Two cropping systems *viz.,* green manure (*Dhaincha*) - okra - maize and green manure (*Dhaincha*) - cotton - sorghum an allotted area of 0.35 ac consisting of okra variety hybrid CO (Bh) 4, maize variety hybrid CO 6, cotton variety Surabhi and sorghum variety CO 30 was grown in the system mode. System productivity in term of cotton equivalent was recorded with bhendi-maize-*dhaincha* of 5028 kg/ha to 2685 kg/ha in cotton-sorghum-*dhaincha* cropping system. Through crop component, an income of Rs.26,493 per annum was obtained. From Jersey cross bred (2 nos.) produced 3379 litre of milk which fetched of Rs. 1,68,950 as gross return. Fodder obtained from crop component (maize and cumbu Napier) is being fed to the animals. Annually 12.03 tonnes of cow dung and 9307 litres of cow urine were obtained from livestock which in turn they were applied to the crops to boost the yield. From this manure annually Rs.6196 was saved. Recycling of the on-farm resources such as crop residues and litters collected from the IOFS model were converted into compost with the value of Rs. 4383. The 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.9 per nut. The annual net income realized was Rs.10,692 with the cost of cultivation of Rs.2,792. As a outcome from the IOFS model, gross income of Rs. 2,60,711 was obtained with total cost of the Rs. 1,16,275 per annum and the net return of Rs.1,44,141 was realized.

Sardarkrushinagar: From one acre IOFS model, total gross return (Rs. 2,08,861/-) and net return (Rs. 93,533/-) was obtained. The highest contribution towards the total net return contributed by crop component followed by dairy and fishery component. Under the IOFS model, net return per rupee invested (1.27), system productivity (3.77kg/Acre) and system profitability (Rs 146./day) was achieved.

Udaipur: An integrated organic farming system model for 0.45 ha consisting of field crops in 0.25 ha (sweet corn + black gram during *kharif* and wheat during *rabi*), fodder crops in 0.05 ha. (fodder maize + cowpea during *kharif* and berseem in *rabi* and *sesbania* green manuring during *zaid*), vegetables in 0.10 ha (clusterbean in *kharif* and potato in *rabi*), fruit crop in 0.04 ha (guava) and compost unit in 0.01 ha were evaluated. The l maize equivalent yield of 6209 kg/ha and a net return of Rs. 76,528 /ha was obtained from the farming system model.

Umiam: A total net return of Rs. 76,573/- per year was achieved under the IOFS model with an area of 0.43 ha which is about to Rs. 1,77,663/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 component of the model followed by dairy and fishery component. The fish production was 115 kg.

On farm nutrient recycling in IFOS could produce an amount of 64.9 kg N, 19.8 kg P_2O5 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.

INTRODUCTION

1

The major problems of agriculture are decline in growth rate, factor productivity, farm income, shrinkage in net cultivable area, depleting groundwater table, malnutrition, environmental pollution and increasing cost of production. During pre-green revolution period (up to 1960s) the rate of national agricultural growth was not able to keep pace with population growth and 'ship to mouth' situation prevailed. This was the major factor for introduction and large-scale popularization of the high yielding varieties (HYVs) of crops, which were highly responsive to the chemical fertilizers and water. As a result, the total food grain production increased phenomenally – from mere 50.83 million tonnes in 1950-51 to 330.50 million tonnes in 2022-23 – indicating ~ 6.5 times increase (DES, 2023). This increase can be primarily attributed to large-scale adoption of HYVs, combined with other green revolution technologies (GRTs) in cereal crops, expansion of gross irrigated area (22.56 million ha in 1950-51 to 112.23 million ha in 2019-20) and increase in fertilizer nutrient consumption (0.07 million tonnes in 1950-51 to 29.79 million tonnes in 2021-22) (GoI, 2022). All of them put together have led to substantial increase in the cropping intensity (from 111.07 % in 1950-51 to 151.08 % in 2019-20) and productivity of crops, especially food grains (from 522 kg ha^{-1} in 1950-51 to 2419 kg ha^{-1} in 2021-22, GoI, 2022) culminating into the change the status of India from a food importer to net food exporter in many commodities. 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. 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. 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 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. Per hectare use of total nutrients ($N+P_2O_5+K_2O$) reduced from 160.1 kg in 2020-21 to 146.7 kg in 2021-22 (FAI, 2022). Similarly, per hectare use of chemical pesticides also reduced from 0.65 kg a.i ha^{-1} in 2021-22 to 0.48 kg a.i ha^{-1} in 2022-23 (DPPQS, 2023). This indicates that there is a movement towards agro-ecological farming in India supported by the Government in the form of organic farming (*Parambharagat Krishi Vikas Yojana*, Mission Organic Value Chain development for North-Eastern region), natural farming (*Bharatiya Prakritik Krishi Paddhati*, National Mission on Natural Farming) and integrated nutrient management (Soil health card). 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 agro-ecological practices such as organic and natural farming is considered to be a viable and efficient option while in other areas (input intensive areas), agro-ecological practice of towards organic approach otherwise called as integrated crop management having components of integrated nutrient management, integrated water management, integrated weed management, integrated disease management and integrated insect management would be better in achieving the targets of food production besides ensuring sustainability in agriculture.

Organic farming is not just a production method, but a philosophy of sustainability that minimizes the use of synthetic fertilizers, pesticides, and growth regulators, relying instead on natural processes. This approach is not only about growing food, but also about actively engaging with nature, focusing on biodiversity conservation and environmental sustainability. Government of India focusses on promotion of various alternative production systems to enhance the soil health, reducing chemicals in agriculture, improving the nutrition, enhancing the climate resilience and sustainability. Chemical free farming strategies in India include promotion of organic and natural farming. NITI Aayog in its recommendation stated that India has

scope to replace around one-fourth of area from conventional to Organic and Natural Farming by 2033 while maintaining the balance between growth in demand and supply of agri-food at aggregate level. Package of Practices for organic farming and one acre integrated organic farming system (IOFS) models developed under the scheme are shared with the Central and State agencies in various fora. Organic agriculture is practised in 76 million hectares of agricultural land in 191 countries by 3.7 million farmers. The organic farming market size has grown rapidly in recent years. It is expected to grow from 187 billion USD in 2023 to 208 billion USD in 2024 at a compound annual growth rate (CAGR) of 11.1%. India is in second position with 5.39 m ha of agricultural land under third party certification systems and 0.86 m ha under Participatory Guarantee System of certification. Nearly 50 % of the global organic producers are 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 including geo-tagged characterization of organic 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 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), pulses and oilseeds (blackgram, cowpea, pigeonpea, chickpea, lentil, linseed, green gram, soybean, mustard, sunflower , safflower and groundnut), spices (black pepper, ginger, turmeric, chillies, onion, and garlic), vegetables (potato, okra, baby corn, cowpea, pea, tomato, frenchbean, summer squash, beetroot, carrot, dolichos bean, coriander and cauliflower), cotton and fodder crops (sorghum, maize, cow pea and berseem) in location-specific cropping systems. During 2020-21, following experiments/study were undertaken at different centers:

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

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

Programme 2: Development and Validation of Scientific Package of Practices for Organic and Natural Farming

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

Programme 3: Integrated Organic Farming Systems

- Development of integrated organic farming system model

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

- Value chain development with aggregation model for organic farming
- Preparation of State level action plan for policy support to reduce mineral fertilizers

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..

LOCATION

3

Multi-location experiments were conducted during 2020-21 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			
1.	Bajaura	Himachal Pradesh	CSK HPKVV, Hill Agri. Res. & Extn. Centre, Bajaura, Kullu-175 125
2.	Bhopal	Madhya Pradesh	ICAR-Indian Institute of Soil Science, Nabi Bagh, Berasia Road, Bhopal – 462 038
3.	Calicut	Kerala	ICAR-Indian Institute of Spices Research, P.B. No. 1701, Marikunnu PO, Calicut – 673 012
4.	Coimbatore	Tamil Nadu	Tamil Nadu Agricultural University, Coimbatore – 641 003
5.	Dharwad	Karnataka	University of Agricultural Sciences, Yettinagudda Campus, Krishinagar, Dharwad-580 005
6.	Jabalpur	Madhya Pradesh	Jawaharlal Nehru Krishi Viswa Vidyalaya, Jabalpur-482 004
7.	Karjat	Maharashtra	Dr. Balasaheb Sawant Konkan Krishi Vidypeeth, RARS, Karjat, Dist. Raigad – 410 201
8.	Ludhiana	Punjab	Punjab Agricultural University, Ludhiana-141 004
9.	Modipuram	Uttar Pradesh	ICAR-Indian Institute of Farming Systems Research, Modipuram, Meerut -250 110
10.	Pantnagar	Uttarakhand	G.B. Pant University of Agriculture Sciences & Technology, Pantnagar, Udham Singh Nagar – 263 145
11.	Raipur	Chhattisgarh	Indira Gandhi Krishi Vishwavidyalaya, Raipur-492 012
12.	Ranchi	Jharkand	Birsa Agricultural University, Ranchi – 834 006
13.	Umiam	Meghalaya	ICAR Research Complex for NEH Region, Umiam – 737 102

Centres functioning from 2015-16			
14.	Ajmer	Rajasthan	ICAR-National Research Centre on Seed Spices, Tabiji, Ajmer-305 206,
15.	Almora	Uttarakhand	ICAR-Vivekananda Parvatiya Krishi Anusandhan Sansthan, Almora-263 601
16.	Gangtok	Sikkim	ICAR Research Complex for NEH Region, Sikkim Centre, Tadong, Gangtok -737102
17.		Narendrapur	West Bengal Ramakrishna Mission Vivekananda Educational and Research Institute (RKMVERI), Narendrapur Campus, Kolkata-700103
18.	Sardar Krushinagar	Gujarat	Sardar Krushinagar Dantiwada Agricultural University, Sardar Krushinagar, Banaskantha –385 506
19.	Thiruvananthapuram	Kerala	ICAR-Central Tuber Crops Research Institute, Sreekariyam, Thiruvananthapuram - 695 017
20.	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 AINP-OF, 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)		Relative humidity (%)		
				Max.	Mini.			
Centres functioning from 2004-05								
1.	Bajura	Silty loam	821.4	27.3	10.1	-	31.8^0	77^{0}E
2.	Bhopal	Vertisols	906.2	32.7	20.9	58.8	23°18’	77°24’
3.	Calicut	Clay	4121	31.8	22.0	68.0	11°34’	75°48’
4.	Coimbatore	Sandy clay loam	735.9	31.7	22.7	67.8	11°24’	77°.30’
5.	Dharwad	Clay loam	999.3	35.4	20.6	62.3	15°26’	75°07’
6.	Jabalpur	Vertisoils	1319.8	31.6	17.8	62.2	23°29’	79°40’
7.	Karjat	Clay loam	3110.9	39.7	13.2	56.6	18°92’	77°33’
8.	Ludhiana	Ustochrepts,sandy loam	526.1	30.1	17.6	61.8	30°55’	754°54’
9.	Modipuram	Typic Ustochrept Sandy loam	-	-	-	-	29°4’	77°46’
10.	Pantnagar	Silty clay loam	1591.7	30.1	17.7	69.1	29°	79°30’
11.	Raipur	Ochraquals association, deep black soil	830	33.4	20.8	79.6	21°16’	81°36’
12.	Ranchi	Ultic Palesustalfs, very deep soils	1611.2	30.2	15.7	85.1	-	-
13.	Umiam	Clay loam	2631.9	26.2	15.3	63.6	24°44’	76°48’
Centres functioning from 2015-16								
14.	Ajmer	Sandy loam	450	-	-	-	22°31’	36°01’
15.	Almora	-	-	-	-	-	-	-
16.	Gangtok	-	3570.8	26.92	11.13	66.0	27°32’	88°60’
17.	Narendrapur	-	-	-	-	-	-	-
18.	Sardar Krushinagar	-	931.2	34.31	20.32	61.33	24°-19’	72°-19’
19.	Thiruvananthapuram	-	1297.7	32.29	24.23	91.54	-	-
20.	Udaipur	Clay loam	813.2	32.15	17.08	71.00	24º35’	74º42’

Initial nutrient status of soil

Centres	Bulk density (g cm^{-3})	pH	EC (ds/m)	OC (%)	N (kg/ha)	P (kg/ha)	K (kg/ha)	S (ppm)	Fe (ppm)	Zn (ppm)	Mn (ppm)	Cu (ppm)
Centres functioning from 2004-05												
Bajaura	-	7.20	-	1.40	259.8	74.2	244.9	-	16.1	3.69	11.7	2.60
Bhopal	1.47	7.85	0.50	0.53	154.2	12.8	530.2	4.92	5.52	0.74	9.44	1.32
Calicut	1.32	5.05	0.32	1.42	256.0	10.4	171.0	-	25.0	0.60	3.1	0.58
Coimbatore	1.52	8.50	0.06	0.66	247.0	17.9	495.0	-	29.60	4.50	10.60	2.73
Dharwad	1.28	7.50	0.13	5.87	273.9	28.4	359.6	13.06	9.50	1.46	12.83	0.87
Jabalpur	1.35	7.4	0.51	0.68	264.0	12.60	282.0	-	-	-	-	-
Karjat	1.22	7.02	0.28	1.14	230.0	20.0	327.0	-	-	-	-	-
Ludhiana	-	7.38	-	0.30	286.7	37.1	151.2	-	-	-	-	-
Modipuram	-	-	-	-	-	-	-	-	-	-	-	-
Pantnagar		7.32	0.42	0.49	156.2	15.7	220.9	-	30.64	0.98	6.21	2.97
Raipur		7.67	0.28	0.64	237	13.0	274	-	-	-		
Ranchi		-	-	0.38	-	-	-	-	-	-		
Umiam		-	-	1.32	-	-	-	-	-	-		
Centres functioning from 2015-16												
Ajmer	-	8.13	0.13	0.28	124.60	11.91	336.22	-	-	-	-	-
Almora		-	-	-	-	-	-	-	-	-		
Gangtok	1.32	-	0.31	0.83	230.7	17.09	417.8	23.78	-	-	-	-
Narendrapur	1.54	7.04	0.77	0.83	-	67.97	232.68	-	-	-		
Sardar Krushinagar		7.22	0.15	0.33	141	13.5	180.0	8.20	8.40	0.68		
Thiruvananthapuram		-	-	-	-	-	-	-	-	-		
Udaipur		8.1	0.50	0.56	155.76	2.87	250.13	-	-	-		

BUDGET

6

A total budget of Rs. 219.12 lakhs were released to 21 centers during 2020-21. The centre wise allocations of funds are given below.

Name of the Institute	A. Other than STC/SCSP/NE								Total	SCSP Component			Grant-in-Aid, under NE Component				Grand Total
	Grant-in-Aid General			Sub Total	Grant-in-Aid Capital			Sub Total		Grant-in-Aid General			Grant-in-Aid General				
	Domestic T.A.	Research Expenses	Operational charges		Works	Livestock	urniture ixture			Research Expenses	Operational charges	Total SCSP	Domestic T.A.	Research Expenses	Operational charges	Total NEH	
IGKV, Raipur	0.15	1.80	2.50	4.45	0.00	0.00	0.00	0.00	4.45	0.00	0.00	0.00	0.00	0.00	0.00	0.00	**4.45**
SDAU, S.K. Nagar	0.00	1.40	3.75	5.15	0.00	0.00	0.00	0.00	5.15	0.00	0.00	0.00	0.00	0.00	0.00	0.00	**5.15**
HAREC, Bajaura	0.10	1.39	5.35	6.84	0.00	0.00	0.00	0.00	6.84	1.00	1.50	2.50	0.00	0.00	0.00	0.00	**9.34**
BAU, Ranchi	0.10	1.55	2.55	4.20	0.00	0.00	0.00	0.00	4.20	0.73	0.75	1.48	0.00	0.00	0.00	0.00	**5.68**
ICAR-IISR, Calicut	0.22	4.70	4.70	9.62	0.00	0.00	0.00	0.00	9.62	0.00	0.00	0.00	0.00	0.00	0.00	0.00	**9.62**
ICAR-CTCRI, Trivandram	0.00	1.42	14.30	15.72	0.00	0.00	0.00	0.00	15.72	2.40	0.60	3.00	0.00	0.00	0.00	0.00	**18.72**
UAS, Dharwad	0.00	0.55	4.27	4.82	0.00	0.00	0.00	0.00	4.82	0.00	0.00	0.00	0.00	0.00	0.00	0.00	**4.82**
JNKVV, Jabalpur	0.15	1.80	2.50	4.45	0.00	0.00	0.00	0.00	4.45	0.00	0.00	0.00	0.00	0.00	0.00	0.00	**4.45**
ICAR-IISS, Bhopal	0.10	1.95	7.00	9.05	0.00	0.00	0.00	0.00	9.05	0.00	0.00	0.00	0.00	0.00	0.00	0.00	**9.05**
BSKKV, RARS, Karjat	0.10	1.80	2.55	4.45	0.00	0.00	0.00	0.00	4.45	0.00	0.00	0.00	0.00	0.00	0.00	0.00	**4.45**
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	0.40	8.00	7.05	15.45	**15.45**
PAU, Ludhiana	0.20	2.70	7.40	10.30	2.00	1.62	0.00	3.62	13.92	0.00	0.00	0.00	0.00	0.00	0.00	0.00	**13.92**
MPUA&T, Udaipur	0.40	6.20	5.80	12.40	0.00	0.00	0.00	0.00	12.40	1.25	1.50	2.75	0.00	0.00	0.00	0.00	**15.15**
ICAR-NRC Seed Spices, Ajmer	0.10	1.95	7.60	9.65	0.00	0.00	0.00	0.00	9.65	0.00	0.00	0.00	0.00	0.00	0.00	0.00	**9.65**
ICAR-RC-NEH, Gangtok	0.00	0.00	0.00	0.00	1.00	0.00	0.00	1.00	1.00	0.00	0.00	0.00	1.00	3.00	10.45	14.45	**15.45**
TNAU, Coimbatore	0.50	5.87	5.52	11.89	0.00	0.00	0.00	0.00	11.89	5.25	2.50	7.75	0.00	0.00	0.00	0.00	**19.64**
ICAR-IIFSR, Modipuram	0.10	1.15	8.00	9.25	0.00	0.00	0.00	0.00	9.25	0.00	0.00	0.00	0.00	0.00	0.00	0.00	**9.25**
National PI, ICAR-IIFSR, Modipuram	0.00	0.00	8.50	8.50	0.00	0.00	0.00	0.00	8.50	0.00	0.00	0.00	0.00	0.00	0.00	0.00	**8.50**
GBPUA&T, Pantnagar	0.00	5.20	10.23	15.43	0.00	0.00	0.00	0.00	15.43	0.00	0.00	0.00	0.00	0.00	0.00	0.00	**15.43**
ICAR-VPKAS, Almora	0.15	3.60	6.10	9.85	0.00	0.00	0.00	0.00	9.85	0.00	0.00	0.00	0.00	0.00	0.00	0.00	**9.85**
RKMVERI, Narendrapur	0.10	6.50	4.50	11.10	0.00	0.00	0.00	0.00	11.10	0.00	0.00	0.00	0.00	0.00	0.00	0.00	**11.10**
Total	2.47	51.53	113.12	167.12	3.00	1.62	0.00	4.62	171.74	10.63	6.85	17.48	1.40	11.00	17.50	29.90	**219.12**

RESEARCH RESULTS

7

Programme 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-referenced characterization survey was carried out for organic and natural farming farmers involving uncertified 30 households in 10 different villages located in two blocks namely Ani in Kullu and Bhoranj in Hamirpur district of Himachal Pradesh.

The survey villages had a total of 12.68 ha area, out of which area under Natural Farming (NF) was 7.44 ha. In case of organic farming, a total land holding was 4.48ha, out of which 1.32 ha area was under organic farming and rest of the remaining area (8.4 ha) was under conventional farming. Among the surveyed famers of the village, livestock inventory revealed that 100% of the organic and natural farming farmers maintain cows whereas 5% farmers also rear sheep/goats. farmers under organic farming use FYM and vermicompost as organic resources while Jeevamrit, Ghanjeevamrit and Beejamirt was the majour sources of nutrients. Farmers grow major crops as maize, paddy, soybean, sesame, fruits (apple, mango, plum, pear), vegetables (cauliflower, pea, frenchbean, potato, tomato, capsicum and cucumber). Cow urine @24L/ha and neem baan @ 6 l/ha using as plant protection input for organic farming. Dashparni ark/ Brahmastra/ Agniastra/ Butter milk+ Jeevamrit against fungus in apple @ 60L/ ha, Clay soil+ Cow dung+ cow urine+ lime/ Mixture against apple Canker (Chopatiya paint+ asafoetida 10g+flax seed oil 100ml+clay soil 1kg+cow dung 2kg+ cow urine 500ml+reetha as sticker / Jeevamruth+ butter milk @ 30L/ ha used for insect pest & disease management practice under natural farming. Highest area was found to be in case of pea crop during *rabi* season (1.12 ha) followed by apple (1.08 ha). However, the production was maximum for maize crop (7.7 t/ ha) followed by cauliflower (6.5 t/ha). As far as average production is concerned, it was maximum with cauliflower (81.25 t/ha). Potato was only crop grown during summer with 0.40 ha area, 4.8 t/ha production and 12.2 t/ha average production. In case of NF farmers, apple has maximum area (2.22 ha) during *kharif* followed by wheat in *rabi* (2.28 ha) and tomato in summer (0.16 ha). Except maize and wheat, other commodities are sold in the market. The computation of gap in yield in on-station AINP-OF experiments and farmers field showed that all the crops had higher yield under on-station experiment than farmers yield. Under organic farming, wheat yield showed maximum difference which was higher with on-station (23.8%), other crop maize, pea and cauliflower recorded by 4.0, 1.5, and 4.6% higher respectively. Under natural farming, pea and soybean recorded 18.8 and 30.7% higher also with on-station whereas, intercrop maize found to be 12.8% higher on farmers field. Marketing and non-availability of organic inputs observed as constraint.

Bhopal

Geo-referenced organic cluster survey was carried out at villages of Beenapur and Hinoti Sadak, Tehsil- Berasia, district Bhopal. Among the respondents in the villages, the highest total land holding was 13 acre while minimum was 1.5 acre. Out of which the maximum area under organic farming was 1 acre and minimum was 0.5 acre.

Each and every farmers under organic farming using FYM and vermi-compost as organic resources Most of farmers raised the soybean and maize crop during *kharif* season while chickpea crop was grown during rabi season and some of farmers raised wheat crop as per water availability. Neem oil, buttermilk and *kaddha* (decoction) were used as organic pesticide for the control of insect pest and diseases in crops. *Kaddha* was prepared by using leaves of different plants such as neem, oak, custard and karanj unlike natural farming specific input. Yield gap of organic farming farmers found to be 12.2 and 13.4 for soybean and wheat between on-station and farmers field. Only 10-20 % of organic produces retained produced for household consumption and the rest sold out in either *krishimandi* or local market. The reasons behind adoption of organic farming were minimum purchase of external market inputs, healthy produce and improvement in soil health. However, slow responses to organic inputs, non-availability of premium price, and market unavailability for organic produce were opined as the major constraints of adoption of organic farming in the region. Poor access to the certification agencies for adoption of organic farming.

Calicut

Geo-referenced characterization of organic farming farmers of twenty one farmers were conducted in six villages under three blocks namely Koduvally, Adimaly & Devikulam of Idukki, Kozhikode district of Kerala. Out of 21, 6 farmers were large, 8 small and 7 marginal. Average livestock population maintained by the farmers was dairy cattle -2, goat-2 and poultry-3. Vermicompost, neem cake jeevamrit, ground nut cake, bone meal, and cowdung are the organic input used. Pepper, ginger, turmeric, cardamom, nutmeg and coconut were grown as major crops. Plant protection inputs used by the surveyed farmers were *Pseudomonas*, *Trichoderma*, *Bordeaux paste*, neem oil, neem cake, tobacco tincture. Yield gap between on-station and farmers filed found to highest in nutmeg of 36% followed by blackpepper 24%. Difference in yield of ginger and turmeric found to be 6.2 and 6.1% respectively. Unavailability of workers and organic manures, yield loss are the major constraints for organic farming.

Coimbatore

Geo-referenced characterization survey was carried out for organic and natural farming farmers involving 35 households in 4 different villages (Pathakaliapalayam, Ayyampalayam, Kavanthapadi, Bhavani) located in 3 blocks namely Bhavani, Gobichettipalayam and Sathyamangalam in Erode district of Tamilnadu. Out of 35 surveyed farmers, 30 farmers characterized under organic while 5 farmers characterized for natural farming. Average holding size under natural farming/farms is 2.0 ha. In surveyed villages, farmers maintaining cattle's, goats and poultry as livestock with average livestock population cow/buffalo-1, goat-2 and poultary-10 under organic and natural farming. Turmeric, sugarcane, paddy, vegetables and coconut were the major crops under organic farming whereas turmeric and coconut under natural farming. Farmers using farm yard manure and vermi-compost as source of nutrients while adopted practices by the farmers under NF were mulching, whapasa, beejamrit, jeevamrit, ghanjeevamrit, and intercropping etc. Majority of the organic farmers (80 %) were growing turmeric followed by banana, paddy and onion. All of the organic farmers were using FYM as basal application for nutrient management followed by three fourth (75%) of the organic farmers spray Panchagavya @ 3 % as both nutrients source and for pest management. Farmers practicing as plant protection inputs such as neem seed kernel extract; neem oil, herbal leaves extract (5 leaves), fermented butter milk, NSKE 5% and 5 leaves herbal extract 10%. Average yield of major crops such as turmeric, sugarcane, paddy, onion (small) and coconut (20000, 84000, 4500, 4500 and 145000 kg/ha and 60 nuts/tree) on farmer field and found to be 20, 30, 10, 10 and 8% lower than on-station under organic farming. Under natural farming yield gap for turmeric and coconut recorded 28 and 8% respectively. Three fourth of the farmers (75 %) were selling their products through local merchants followed by local market (15 %) and 10 %through online. Reasons for adoption of organic farming as evinced through interaction with farmers were use of locally available farm wastes, satisfaction in producing safe food and as service to save the environment (80 %).

Dharwad

Geo-tagged characterization of organic and natural farming farmers for twenty was characterized in Dharwad and Gadag district of Karnataka. Two geo-tagged villages namely Aminbhavi in Dharwad District and Hulkoti in Gadag Districts were surveyed. Farmers practicing organic farming did so only in 20 - 30% area of their cultivated holding.

Out of 25 surveyed farmers, 20 farmers characterized under organic while 5 farmers characterized for natural farming. Average holding size under natural farming/farms is 0.8 ha. In surveyed villages, farmers maintaining cattle's, goats and poultry as livestock with average livestock population cow-2, buffalo-2, goat-4 and poultary-4 under organic and natural farming. Greengram, soybean, groundnut, chilli, blackgram, rabi sorghum, safflower, maize, cotton were the major crops under organic and natural farming. Farmers using Crop residues, FYM, Vermicompost, and Gokrupamrutha as source of nutrients while mulching, Beejamrit, Jeevamrit, Ghanjeevamrit, Intercropping, Neemaster, Agniaster, Brahmaster and Sour, Buttermilk. practices by the farmers under NF. Growing marigold, ladies finger, cowpea, coriander, mustard, castor as trap crops and some are using bio-pesticides, neem oil and biofungicides. Neemaster, Agniaster, Brahmaster depending on the nature of pests and their intensity farmers practicing for natural farming. Average yield of major crops such as green gram,, soybean, sorghum, groundnut and sunflower found to be higher under on-station experiment and gap in yield compared to farmer field recorded by 2.74, 11.1, 4.76, 13.33 and 18.92% under organic farming. Under natural farming yield gap for green gram, soybean, groundnut, rabi sorghum and maize found to be 22.6, 16.9, 11.7, 20.0 and 9.1% 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. Natural farming farmers got good results in the organically amended soil only, whereas 40% yield reduction was observed in fields newly brought under Natural farming. Difficult to maintain crop diversity in natural farming and Prevailing mindset of chemical farming were the major constraints for natural farming

Jabalpur

Geo-referenced characterization survey was carried out for organic farming involving 50 farmers in 8 different villages located in 3 blocks namely Patan, Panagar and Shahpura in Jabalpur district of Madhya Pradesh. In the surveyed villages, farmers had average land holding size large 8 ha, medium 4 ha, small 1.2 ha and marginal 0.8 ha. All are maintaining cow and buffalo with mean population of 6 nos. Wheat, gram, vegetable pea, lentil were the major crops grown under organic farming. FYM/ Compost/Vermicompost are the main source of organic manure and used @ 10t/ha. Cow urine, neem leaf extract, dashparni ark (plant extracts), butter milk etc. are using as plant protection input. Stale seed bed, hand hoeing and manual uprooting practices adopted for weed management. Crops grown at on-station recorded higher yield compare to farmers field and yield gap between on-station and farmer field found to the tune of 26% for wheat, 6.4 % for vegetable pea. 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 are major problems and observed as constraints.

Karjat

Geo-referenced characterization of organic farming was carried out in 12 different villages under Alibaugh block district Raigad of Maharashtra.

Total 30 farmers were characterized out of which, 12 marginal farmers was found under organic farming. About 43% area covered under organic farming. Surveyed farmers possessing farm animals - 94, buffalo- 4 nos., cow-36 nos., bullock-54 nos. and poultry birds-87 nos. FYM, vermicompost and compost are main sources of organic manure using @ 5 t/ha. Cow urine is main source of plant protection management input. Crop residue availability within the farm used and recycled, FYM - 100%, straw-20% and poultry waste -100%. Majority of farmers controlled weeds through hand weeding in seasonal crops. Cropping systems rice-vegetable, fruit crops (perennial)–mango was followed consisting of rice, vegetable, pulses as major crops. Mean yield of major crops at farmers field recorded for rice, okra and pulse were (2800, 1025 and 850 kg/ha) and gaps

between on station and farmers field found to be 28.6, 21.9 and 76.5% respectively. 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

The geo-tagged characterization was conducted in Faridkot district of Punjab. A total of 30 organic growers were characterized. The surveyed area lies in 30°25.045' - 30°49.114' N latitude, 74°49.166' - 75°00.500' E longitude and at altitude of 201-211 m above mean sea level. Collected the information about total land holding of the farmers, area under organic management and natural farming, crops being grown under organic farming and natural farming, organic manures, concoctions of natural farming and bio pesticides being used, productivity level of the crops as compared to conventional crops, price premium on organic produce, perception of organic growers about organic farming and constraints in its adoption.

Salient Findings

Classification of farmers: Among characterized farmers, 100 per cent were doing organic farming and no farmer was practicing complete natural farming. 25 per cent farmers were using concoctions of natural farming along with organic farming.

Area under organic farming: The proportion of area under organic farming out of total land holding of surveyed growers was 29.25%. Out of total organic growers, 40% were medium farmers followed by semi-medium (15%), large (15%), small (20%) and marginal (10%) farmers.

Crops grown under organic farming: Wheat, basmati rice, vegetables were the prominent crops being grown by farmers under organic farming. Twenty per cent farmers had grown sugarcane. Gobhi sarson and turmeric was being grown by 20 and 15 per cent of farmers, respectively. Although, the pulses are an integral component of organic farming and significantly improve soil health but still these were being grown by very few farmers.

Use of organic manures: Farmyard manure (FYM) was the major source of nutrition, being used by 85 and 90% of the organic growers respectively. Green manuring was the second major source of nutrition used by 75% of farmers in *kharif* season. Vermicompost was used by 20% of farmers during both seasons. The Jeevamrit was used by 25% of farmers during both seasons. The vermiwash was used by 5% of farmers.

Weed management: The hand weeding was the predominant method of weed control practiced by the farmers in *kharif* and *rabi* crops, respectively. Mulching to suppress weeds was also used by farmers. Some of farmers used mechanical methods to control weeds.

Disease and insect-pest management: The sour butter milk was used by 60 and 70% of farmers in *kharif* and *rabi* crops, respectively. Neem based pesticides were used by 70 and 50% of farmers during *kharif* and *rabi* seasons, respectively. Farmers also use natural farming concoctions agniastra and brahmastra to control diseases and insect-pests. Sixty per cent farmers used these products during *both* seasons. *Trichocards* were used by 30% farmers during *kharif* season, mostly in Basmati rice crop.

Productivity of crops: The economic yields of almost all the crops were lower under organic cultivation as compared to conventional cultivation of these crops. The reason behind this might be use of lower dose of FYM or other composts and less N content in these composts. The FYM used by farmers generally is not fully decomposed due to many factors, so it does not produce desired yields. Poor control of insect-pests and diseases also contributes to lower grain yields under organic production.

Marketing and price premium: The organic farmers got price premium on 65% of crops which include wheat, sarson oil, and turmeric powder, products from sugarcane, pulses, maize flour and millets. However, farmers get no premium on 35 per

cent of crops which include basmati rice, rice, maize grains and some vegetables. The organic growers sell their produce in local market and big cities. Some of organic growers had sale point of their produce at their farms itself.

Constraints in adoption: The major constraint faced by farmers in adoption of organic farming was labour intensive operations and lack of marketing facilities (30% each). Other constraints were difficulty in weed control (15%) and reduced yield (14%). 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 was carried out involving 21 farmers in 19 different villages located in 10 blocks in Meerut, Muzaffarnagar, Saharanpur and Bijnor district of Uttar Pradesh.

Total 21 farmers were characterized in which 11.13 ha mean holding size having loam to sandy loam soil in nature without it one farmer having 40 ha of land alone. One farmer is having dairy farm with 113 no. of cattle's, and the avg. no. of cattle/buffalo is 27.5. Sugarcane, wheat, basmati rice, mustard, forage crops (sorghum, berseem, oat, hybrid napier etc.), black gram, potato etc. are the major crops grown by the organic farmers. Farmers are using FYM 7.36 t/ha Vermicompost 4.82 t/ha as source of organic manure. For plant protection management, they were using *Trichoderma* spp., *Pseudomonas fluorescens*, *Fermented buttermilk*, *Dashparni extract, Organoshield (Herbal)* and *Organopower (Herbal)* etc. Weed Management measures for controlling the weeds are hand weeding, mechanical weeding and mulching. Yield gap of major crops between on-station and farmers field found to be 29.12, 25.83, 9.37 and 20.73% for wheat, sugarcane, basmati rice and mustard respectively.

Pantnagar

Geo-referenced characterization of organic farmers was carried out in 7 villages under Kotabag taluk in Nainital district of Uttarakhand. Total 40 nos. of organic farmers surveyed. No natural farming farmers were there in surveyed areas. Among the 40 farmers surveyed, the land holding size of the organic farmers found to be 0.4 ha for marginal and small. All most all the organic farmers are having 2-3 animals (cows, buffalos) whereas some farmers also maintain goat 2-4 nos. Farmers are preparing compost at their own farm and composts are not being purchasing by the farmers, however the quality of composts is not much good as compared to scientific composts. FYM and vermin-compost are the major source of organic manure. All the farmers are using cow urine fortified with neem leaves/neem oil/garlic paste for plant protection purposes. In general, farmers practicing weeding manually. In surveyed area, most of the farmers are growing traditional organic basmati rice during *kharif* season and in *rabi* mostly wheat. The basmati rice is being sale commercially and mostly wheat kept for their own consumptions. The yield of basmati rice ranges from 2666 to 4464 kg/ha, most of the farmers yields are in-between 3000-4000 kg/ha which were less than research farm at Pantnagar. The productivity level of wheat crop ranges from 3200 to 4666 kg/ha, most of the farmers yields were >3500 kg/ha which were approximately equal to research farm at Pantnagar. The productivity of wheat at research farm Pantnagar was lower because the organic research block has been shifted from to other block. Yield gap between on-station and farmers filed found to be 10.8% for basmati rice and about 2.8% for wheat.

Raipur

Geo-referenced characterization of 30 organic farmers was carried out in 2 villages namely Taraighotiya and Ghotulmunda under the block of Durgukondal in Kanker district of Chhattisgarh. The salient features of the survey are as follows. In the surveyed villages, 7 farmers were under large land hoder 13 were under small while 10 farmers were under marginal category. The livestock maintained by the farmers are cow, buffalo, bullock, goat, poultry and pig with average population of dairy (cattle/buffalo)-5.0 goat-3.0, poultry-14.0 and pig-2. 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. The main crops grown under organic farming were rice (mainly short grain aromatic rice), Kodo millet (finger millet) and kutki (little millet), horse gram, black gram and ragi. Among the 30 farmers only 2-3 farmers grow jawer, maize and vegetables like tomato and chilli having assured irrigation facility. For plant protection management, neem oil, seed treatment with *Trichoderma* cow urine spray was used by the farmers for disease and pest

control. For weed management, hand weeding has been adopted by majority of farmers only few farmers have used mechanical weeder for weed management in rice. The average cost involved in weed management was Rs 4567/ha. The yield gap of 42.4% 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 were conducted in three (3) villages namely Mynsain, Pynthor & Umden and Umbathiang in RiBhoi District of Meghalaya. Their GPS coordinates are *25°44'21,61"N - 92°1'1,73"E*, *25°45'18,31"N - 92°1'48,14"E*and *25°44'58,99"N - 92°2'10,67"E,* respectively. The altitudinal ranges of villages Mynsain, Pynthor and Umden Umbathiang are 853 – 901 MSL, 853-894 MSL and 853 – 892 MSL, respectively

The major soil type found in the three villages is the red loamy soil along with few locations composing of the alluvial and laterite soils. The soil prevailing in the lowland and upland regions of the villages were sampled at depths of 0-15 cm and 15-30 cm and the average nitrogen (N), phosphorus (P), soil organic content (SOC) and pH content were analyzed by standard procedures. The available N, P, SOC and pH of the soil at lowland condition were recorded to be 212.1±25.6 kg/ha, 9.3±6.0 kg/ha, 15.8±3.4 mg/kg and 4.96± 0.65, respectively for 0-15 cm depth and 185.1±21.6 kg/ha, 11.2±1.5 kg/ha, 12.8±.6.3 mg/kg and 4.87±0.65, respectively for 15-30 cm soil depth. Similarly the available N, P, SOC and pH of the soil at upland condition were recorded at 205.7 ± 34.5 kg/ha, 21.6± 11.8 kg/ha, 13.3±3.6 mg/kg and 4.83±0.68 pH, respectively, for 0-15 cm soil depth and 168.1± 62.4 kg/ha, 8.9 ± 2.5 kg/ha, 10.3± 0.45 mg/kg and 5.04±0.65, respectively for 15-30 cm soil depth.

The farmers of the villages are mostly dependent upon rainfall for raising their crops except for those who have constructed micro rain harvesting structures ***(Jalkund)*** which have greatly promoted the productivity of crops (especially vegetables) grown in the winter season.

Participation: The number of farmers who are actively participating in the activities that are under the purview of the NPOF in Mynsain, Pynthor and Umden sums to about 303 individuals collectively.

Livelihood: 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 sweet potatoes, potatoes, pumpkin, yam, corn, tomato, beans, chillies, cabbage, cauliflower, radish, broccoli, carrot etc.

Farming system: Almost all farmers from the village maintain an average of 3-4 numbers of farm animals (goats, cows, pigs or poultry) for acquiring additional benefits and income for themselves and inputs for their farming practices. The climatic and edaphic condition of the 3 villages is more likely the same (receiving around 2400 mm annual rainfall in the months of April to November with a mild climate) with diminutive variations and therefore the food crops grown in the 3 villages at various cropping seasons are of the same type. Major Crops grown during the Kharif season at the aforementioned villages are rice, maize, French bean, ginger, colocasia, sweet potato, turmeric, some vegetables etc. During the *Rabi* season, the farmers usually cultivate French bean, mustard, radish, cole crops, tomato, potato, peas, etc., whilst the post Rabi season is highlighted by the cultivation of various cucurbits. But overall, the cropping intensity is very low (less than 130%). 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 and pest management: 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.

Economy: 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

Geo-referenced characterization survey was carried out for organic and natural farming farmers involving 35 households in 4 different villages (Aloda, Sawalpura, Gilo ki dhani, Akhepura) located in 2 blocks in Sikar district of Rajasthan. Out of 35, 30 organic and 5 of natural farming farmers were characterized.

Soil type in surveyed village found to be sandy. Farmers (100%) are using average quantity @ 16 t/ha FYM +700 kg vermicompost as nutrient source for crop production. Average cost of manuring involve of Rs. 20,000. Major crops in *kharif are* bajra and in *rabi* wheat which is occupies the major area under organic farming. All the farmers are following hand weeding for controlling weeds and most of them are using *Trichoderma*, neem oil and homemade bio-pesticide for pests and disease management. Average yield of bajra (1300 kg/ha) and wheat (2040 kg/ha) recorded at farmers field under organic farming. Organic growers are selling their produce in local market and not getting any premium price for their produce this the major constrain but adopting organic farming is due harmful effect of chemicals on human health and soil fertility.

Almora

Total 35 household, out of which 30 organic and 5 natural farming farmers were characterized in Baburkhola village located in Dwarahat block of Almora district in Uttarakhand under geo-referenced characterization survey. Average holding size of organic farmer/farm is 0.212 ha. Farmers maintaining cow, goat, poultry as livestock having average population of 2.5, 2.1, 23.3 nos. respectively. FYM is the major source of manure and applied average quantity @ 17.9 t/ha. Cost of mauring Rs. 26950 is involved. Name of plant protection inputs used by the organic growers was *Nimbicidine, Rakh* (wood ash) and *Tricoderma,* whereas hand weeding is the main practice for weed management practice. Fingermillet, barnyardmillet, black soybean and horsegram were the major crops grown by the farmers. Average yield at farmers field were recorded 1288, 824, 545 and 378 kg/ha respectively and yield gap found at farmers field found to be 39, 33, 90 and 134% over on-station. Wild animal (Wild boar, monkey, stray animal) menace is the major problem/constraints. In case of natural farming, the average holding size of the organic farmers was 1.34 ha with finger millet, barnyard millet, bhat (black soybean), yellow soybean, horse gram, wheat, lentil, pea being the major crops grown by farmers. The FYM was main organic manure with the mean application rate of 4732 kg/ha. All the farmers were practicing hand weeding for controlling of the weeds.

Gangtok

Geo-referenced characterization survey of the organic cluster, Timpyem Village of East Sikkim was selected for the study. The GPS coordinates of the village are 27033'94"N-88060'29"E, Altitude 1150-1500m at mean sea level. Total 50 farmers were characterized where 30 out of 30 practicing organic while 8 out of 20 doing natural farming. Average land holding size for organic and natural farming was 0.6 ha. 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 most profitable cash crop and has become a major source of income for the farmers followed by Paddy. The paddy is usually cultivated for self-consumption. There are other crops and vegetables that the villagers grow like tomato, beans, chillies, cole crops such as cabbage, cauliflower, radish, broccoli, etc. Almost all farmers from the village maintain an average of 3-4 numbers of farm animals for acquiring additional benefits and income for themselves and inputs for their farming practices. Major crops are grown during the pre-*Kharif* season at the aforementioned crops are rice, maize, French bean, ginger, turmeric, some vegetables etc. In the Rabi season, the farmers usually cultivate French bean, mustard, radish, cole crops, tomato, peas, etc., Crop enhancement inputs such as manure comes in the form of farmyard manure which is either cow dung or pig manure, poultry manure, vermicompost

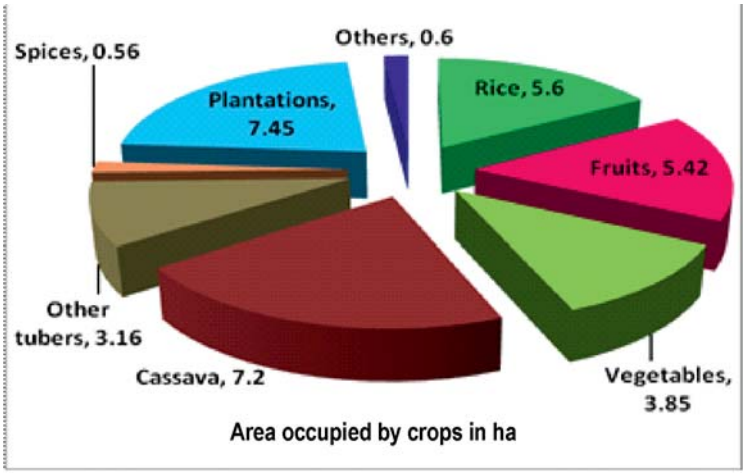
and other composted materials. Most of the farmers collect manure from their livestock shed. Weed management adopted by the farmers is basically a mechanical/manual hand weeding. Pest management is purely practiced by the villagers manually or by ITKs. As most of the farmers grow their local pest resistant varieties, incidence of large scale infestation is very less. However, with the introduction of high yielding cultivars, report of some pest attack is noticed. Crops produce are utilized for household consumption or marketed if there is a surplus. Production profit is highest in the pre-kharif and 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. Mean yield of major cropsof rice, maize, soybean and buckwheat under organic farming recorded at farmers field of 2150,1990,960,and 780kg/ha respectively and gap of yield compared to on-station experimentation found to be 34, 43, 78.8 and 30.3%. Under natural farming, yield gap between on-station and farmers file for soybean and vegetable pea recorded of 71.8 and 48.4%

Sardarkrushinagar

Geo-referenced characterization of organic farmer/farms cluster was done in Patan district of Gujarat. Total 30 households for organic and natural farming were selected from 18 villages located in two blocks (Harij and Shankheshwar). Average land holding size of farms is 0.75 ha and 1.0 ha out of which 15 and 25% land being cultivated under organic and natural farming respectively. Average number of animals per household was 1.66 and 2.5. Farmers using farm yard manure as main sources of nutrient for raising the field crop under organic @ 5-6 t/ha. Input for natural farming used by the farmers is beejamrit, jeevamrit, ghanjeevamrit and intercropping. And quantity applied @ Jeevamrit: 250 (litres/ha), Ghanjeevamrit: 200 (kg/ha), Beejamirt (kg /kg of seeds): 10 ml/kg of seeds. Under organic farming, majority of farmers grow green gram in *kharif* and wheat in *rabi*.. Average yield of green gram is 500 kg/ha and wheat is 2900 kg/ha. In case of natural farming, Majority of farmers grow green gram and black gram in *kharif* and wheat and chick pea in *rabi.* Average yield of green gram is 450 kg/ha and wheat is 2500 kg/ha. Fruit and vegetables were grown organically for home consumption. Use of neem leaves, dasparni and Go mutra based indigenous botanical concoctions were used for plant protection in crops, fruit and vegetables. On average, 30.0-40 kg neem leaves were used as insecticide during *kharif* & *rabi,* for weed management only hand weeding is done. On average 40-45 man-days during *kharif* and 30-35 man-days during *rabi* were used in weeding. Yield gap in wheat, green gram, blackgram and chickpea crop from on-station to farmers field was observed 17.4, 5.8, 6.4 and 6.8% respectively under organic condition whereas wheat recorded 25.6% under NF. Major constraint for OF and NF was lack of availability of large quantity of organic inputs from small land holding farmer, no assured market and lack of premium price for organic product, low productivity of crops, lack of organic pesticides and selling of products.

Thiruvananthapuram

Geo-referenced survey of uncertified 30 farmers practicing organic farming in Thiruvananthapuram and Kollam district of Kerala was conducted. The survey was carried out under Kazhakkoottam blocks in Kollam district, and Kazhakkoottam and Kilimanoor blocks in Thiruvananthapuram.



Ninety per cent of the farmers belonged to the small and marginal group with a land holding size <2 ha. 60% of farmers had a land holding size < 1 ha, 30% 1-2 ha and 10% >2 ha. Average land holding size was 0.62 ha. The soil type was laterite (100%). Most of the farming situation surveyed was rainfed (80%), some are irrigated.

Major Crops: Fruit crops (banana, mango, jack fruit, guava, rambuttan); 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, arrowroot, sweet potato); Spices (ginger, turmeric, pepper) and Plantation crops (coconut, rubber).

About 50% of the surveyed farmers owned cow, 20% had goat, 60% had poultry (hen and duck), 10% had fish and 13.3% had apiary as an integral part of organic farming. Nutrient sources for organic farming constituted cow dung slurry/FYM (100%), poultry manure (60%), vermicompost (40%), biogas slurry (6.7%), neem cake (66.7%), groundnut cake (36.7%), bio-formulations like Panchagavya (33.3%), Jeevamrutham (13.3%), and green manuring (13.3%). Ash (66.7%) and bone meal (50%) were also used. Majority of farmers conducted soil testing before raising the crop. Indigenous preparations like Haritha kashayam were also been used by the farmers (26.67%). For insect pest management, neem oil-garlic emulsion (36.67%), neem soap (40%), neem oil (13.33%), fish amino acid (46.67%), egg amino acid (23.33%), kanthari emulsion (50%), neem soap (33.33%), *Beauveria* (50%), *Trichoderma* (66.67%), *Pseudomonas* (73.33%), kanjivellam (40%). Also practicing cultural methods, intercropping, trap crops on field bunds and some indigenous practices. Major constraints faced by the farmers were high input cost, non-availability of quality organic manures, labour shortage, small and fragmented land holdings, low price of the produce, damage due to pig and other animal attack. Mean yield of cassava and taro at farmers field recorded of 29628 and 14540kg/ha and yield gap over on-station found to be by 7.13 (+) and 1.66 (-) respectively.

Udaipur

Total 56 farmers out of which 51 of organic and 5 of natural farming farmers practicing from different 12 villages, located in Salavatiya Kotdi and Bhadsora blocks of Bhilwara district of Rajasthan were surveyed. The highlights of the Geo-referenced on–farm characterisation of organic growers are as follows:

Average land holding size of surveyed farmers is 1.37 ha whereas average land holding size under organic farming and natural farming is 0.85 and 0.96 ha respectively. Average number of animals per household is 5.6 for organic and 10.2 for natural farming. Average vermicompost production of 1.87 tonnes/year and available crop residues is 2.53 tonne per household. Majority of farmers grow maize in *kharif* and wheat in *Rabi* under organic farming whereas, majority of farmers grow maize, soybean, blackgram and groundnut in *kharif* and wheat, fenugreek, chickpea and barseem in *rabi* under natural farming. Neem leaves, Dashparni, NSKE and Go mutra used for plant protection in crops, fruit and vegetables. Mulching, Beejamrit, Jeevamrit, intercropping etc. the practices adopted by the farmers under NF. Hand weeding and hoeing, hand weeding and mulching are the practice adopted by the farmers for weed management. Average yield at farmers field under organic farming found to be lower than on-station experimentation for maize, blackgram, wheat, chickpea and fenugreek of 1850, 375, 3520, 980 and 1540kg/h) with gap of 8.43, 9.33, 5.40, 15.31 and 11.36% respectively. Average yield at farmers field under natural farming for maize, blackgram, soybean, groundnut, wheat, fenugreek, chickpea, tomato, brinjal, onion and barseem recorded 2000, 390, 1300, 1700, 3200, 1500, 950, 5200, 14800, 8400 and 10200 kg/ha with productivity gap 13.0, 9.3, -8.3, 15.0, 20.0, 21.0, 26.9, 13.3, 10.8, 6.7 and -27.5% respectively. 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	Kullu & Hamirpur	2	Ani & Bhoranj	10	30	10	20		0.37	8	2	0	10	7	3
Bhopal	Bhopal	2	Beenapur & Hinoti Sadak	2	30	30	0	0.38	-	-	-	-	-	-	-
Calicut	Idukki, & Kozhikode	3	Koduvally, Adimaly & Devikulam	6	21	21	0	-	-	7	8	6	-	-	-
Coimbatore	Erode	3	Bhavani, Gobichettipalayam & Sathyamangalam	6	35	30	5	-	2.0	-	-	-	-	-	-
Dharwad	Dharwad &Gadag	2	-	2	25	20	5	-	0.8	-	-	-	-	-	-
Jabalpur	Jabalpur	3	Patan, Panagar & Shahpura	8	50	50	0	-	-	-	-	-	-	-	-
Karjat	Raigad	1	Alibaugh	12	30	12	0	2.5		9	12	18			
Ludhiana	Faridkot	2	-	16	30	30	0	-	-	-	-	-	-	-	-
Modipuram	Meerut, Muzaffarnagar, Saharanpur, Bijnor	10	-	19	21	21	0	11.13	-	-	-	-	-	-	-
Pantnagar	Nainital	1	Kotabagh	7	80	80	0	-	-	-	-	-	-	-	-
Raipur	Kanker	1	Durgukondal	2	30	30	0	-	-	10	13	7	-	-	-
Ranchi	Ranchi		Not reported	-	-	-	0		-	-	-	-	-	-	-
Umiam	Ri-Bhoi	1	Bhoirymbong	3	303	303	0	0.14	-	-	-	-	-	-	-
Ajmer	Sikar	1	-	5	35	30	5	3.25	-	-	-	-	-	-	-
Almora	Almora	1	Dwarahat	2	35	30	5	0.212	1.34	-	-	-	-	-	-
Gangtok	East Sikkim	30	-	289	50	30	20	0.60	0.60	-	-	-	-	-	-
Narendrapur	South 24 Parganas	1	Basanti	10	10	10	0	0.25	-	-	-	-	-	-	-
S K Nagar	Patan	2	Harij and Shankheshwar	18	60	30	30			18	9	3			
Thiruvananthapuram	Thiruvananthapuram, Kollam	3	Kazhakoottam, Kilimanoor,	9	30	30	0			-	-	-	-	-	-
Udaipaur	Bhilwara & Chittorgarh	8	-	15	56	51	5	0.96	0.81	-	-	-	-	-	-

Table 7.1.2: Mean livestock population and livestock maintained by organic/natural farmers 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	Kullu & Hamirpur	Ani (Kullu), Bhoranj (Hamirpur)	Cow Calves Sheep/goat Bullock	16 (10) - - -	37 (20) 9 (9) 1 (1) 2 (1)	FYM & Vermincompost	2.5-3.0 t/ha	Jeevamrit Ghanjeevamrit Beejamirt	500 l/ha 250 kg/ha 1 kg/kg of seed treatment
Bhopal	Bhopal	Beenapur, Hinoti Sadak	Dairy cattle	4.5	-	Vermicompost & CDM	2.5 t/ha	-	-
Calicut	Idukki, Kozhikode	Koduvally, Adimaly, Devikulam	Dairy (cattle/buffalo): Goat: Poultry:	5 2 3	-	Vermicompost, Neem cake, Cow dung & Got manure,	5.0 t/ha	-	-
Coimbatore	Erode	Bhavani, Gobichettipalayam & Sathyamangalam	Dairy (cattle/buffalo) Goat Poultry Ducks	4 7 10 2	1 2 10 -	FYM Vermicompost	2.5 t/ha 5.0 t/ha	Beejamrit, Jeevamrit, Ghanjeevamrit	500 l/ha 250 kg/ha 2 litre
Dharwad	Dharwad and Gadag		Dairy (cattle/buffalo): Cow Buffalo Goat Poultry	 2 2 4 4	-	-	2.0 t/ha	Beejamrut, Jeevamrut, Ghanjeevamrut Mulching	0.5 kg/kg seed treat. 1500 l/ha 1000 kg/ha
Jabalpur	Jabalpur	Patan, Panagar & Shahpura	Dairy (cattle/buffalo)	6	-	FYM/ Compost/Vermicompost	10 t/ha	-	-
Karjat	Raigad	Alibaugh	Dairy (cattle/buffalo) Goat	1 1	-	FYM, Vermicompost, Compost	5.0 t/ha	-	-
Ludhiana	Faridkot	-	Dairy (cattle/buffalo)	3	-	FYM, Vermicompost,	15 t/ha	-	-
Modipuram	Meerut, Muzaffarnagar, Saharanpur, Bijnor	-	Dairy (cattle/buffalo)	27.50	-	FYM/compost Vermicompost	7.36 t/ha 4.82 t/ha	-	-
Pantnagar	Nainital	Kotabagh	Dairy (cattle/buffalo) Goat	2-3 2-4	-	FYM, Vermi compost	-	-	-
Raipur	Kanker	Durgukondal	Dairy (cattle/buffalo) Goat	5.0 3.0	-	FYM	5.0 t/ha	-	-

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	
Ranchi	Ranchi	Not reported							
Umiam	Ri-Bhoi	Bhoirymbong	Dairy (cattle/buffalo) Goat Poultry Piggery	0.15 0.11 8 1.4		FYM, Pig manure,Poultry manure, vermicompost	4.0 t/ha		
Ajmer	Sikar	-	Dairy (cattle/buffalo) Goat	09 5.0		FYM + Vermicompost	16 t/ha+700 kg		
Almora	Almora	Dwarahat	Dairy (cattle/buffalo) Goat Poultry	2.5 2.1 23.3		FYM	17.9 t/ha	Jeevamrit Dasparni-	500 litre/ha 400 ml in 20 l water
Gangtok	East Sikkim	-	Dairy (cattle/buffalo) Goat Poultry Pig	3 4 25 2	2 3 25 -	FYM Pig manure Poultry manure Vermicompost	5-6 t/ha	Jeevamrit (litres/ha) Ghanjeevamrit (kg/ha) Beejamirt (kg /kg of seeds)	250-500 litres/ha 250 kg/ha
Narendrapur	South 24 Parganas	Basanti	Dairy (cattle/buffalo) Goat	2 1		Dried cow dung compost	2-3 t/ha		
S K Nagar	Patan	Harij and Shankheshwar	Dairy (cattle/buffalo)	3.4		FYM, Vermi compost and compost	5-6 t/ha	Jeevamrit: Ghanjeevamrit: Beejamirt (kg /kg of seeds):	250 (litres/ha) 200 (kg/ha) 10 ml/kg of seeds
Thiruvananthapuram	Thiruvananthapuram, Kollam	Kazhakoottam, Kilimanoor, Chadayamangalam	Dairy (cattle/buffalo) Goat: Poultry Duck Fish Apiculture	0.8 0.5 3 0.134 0.1 0.134		FYM, Vermicompost, Neem cake, Groundnut cake, Poultry manure, Goat manure, Haritha kashayam, Gomuthram Panchagavyam, Jeevamritham, Ghanajeevamrutham, Biogas slurry, Green manuring, Ash, Bone meal	13.58 t/ha	Mulching, beejamrit, jeevamrit, intercropping etc	
Udaipur	Bhilwara & Chittorgarh	-	Dairy (cattle/buffalo) Goat: Poultry	4 3 1	Cow 2.6 Buffalo	FYM and Vermicompost	3.96 t/ha	FYM Vermicompost	20 t/ha 6.6 t/ha

Figures in parentheses are the number of farmer

Table 7.1.3: Major crop, yield and yield gap of 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	Kullu & Hamirpur	Ani (Kullu), Bhoranj (Hamirpur)	Maize (sole)	5000	4806	4.0	-	-	-
			Maize (intercrop)	-	-	-	3150	3611	-12.8
			Soybean	-	-	-	1960	1500	30.7
			Wheat	2600	2100	23.8			
			Pea	6200	6107	1.5	7500	6315	18.8
			Cauliflower	8500	8125	4.6	-	-	-
Bhopal	Bhopal	Beenapur, Hinoti Sadak	Soybean	460	404	12.2	-	-	-
			Wheat	4217	3651	13.4	-	-	-
Calicut	Idukki, Kozhikode	Koduvally, Adimaly, Devikulam	Black pepper	570	710	24.0	-	-	-
			Ginger	10720	11385	6.2			
			Turmeric	3741	3970	6.12			
			Nutmeg	470	640	36.0			
Coimbatore	Erode	Bhavani, Gobichettipalayam & Sathyamangalam	Turmeric	25000	20000	20	25000	18000	28.0
			Sugarcane	120000	84000	30	-	-	-
			Paddy	5000	4500	10	-	-	-
			Onion (small)	16000	14500	10	-	-	-
			Coconut	65 nuts/ tree	60 nuts/ tree	8	65 nuts/ tree	60 nuts/ tree	8.0
Dharwad	Dharwad and Gadag		Green gram	750	730	2.7	650	530	22.6
			Soybean	800	720	11.1	725	620	16.9
			Groundnut	2500	2200	13.3	1200	1074	11.7
			Rabi Sorghum	1250	1000	25.0	900	750	20.0
			Maize	-	-	-	1800	1650	9.1
			Chilli	600	550	9.1	-	-	-
Jabalpur	Jabalpur	Patan, Panagar & Shahpura	Wheat	4056	3000	26.04	-	-	-
			Gram	1004	1000	0.40			
			Lentil	-	800	-			
			Vegetable pea	5341	5000	6.38			
Karjat	Raigad	Alibaugh	Rice	3600	2800	800			
			Okara	1250	1025	225			
			Pulse	1500	850	650			

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 (%)
Ludhiana	Faridkot	-	Basmati rice	3850	3600	(-) 6.4			
			Sugarcane	41000					
			Wheat	4420	3100	(-) 29.8			
			Turmeric	14500					
			Maize	3200					
			Millets	8000					
Modipuram	Meerut, Muzaffarnagar, Saharanpur, Bijnor	-	Wheat	4910	3480	29.12			
			Sugarcane	83840	62184	25.83			
			Basmati rice	4398	3986	9.37			
			Mustard	2523	2000	20.73			
Pantnagar	Nainital	Kotabagh	Basmati Rice	4897	3818	10.79%			
			Wheat	4106	3826	2.8%			
Raipur	Kanker	Durgukondal	Rice	2923	1681.67	42.2			
Ranchi	Ranchi	Not reported							
Umiam	Ri-Bhoi	Bhoirymbong	Rice	4230	3200	33.4			
			Maize	3500	2450	45.74			
			Potato	19500	14500	36.9			
			French bean	6500	5300	26.6			
Ajmer	Sikar	-	Wheat	-	2040	-			
			Bajra	-	1300	-			
Almora	Almora	Dwarahat	Finger millet	1795	1288	39	1795	1382	30
			Barnyard millet	1096	824	33	1096	996	10
			Black soybean	1037	545	90	1037	658	58
			Horsegram	885	378	134	885	426	108
Gangtok	East Sikkim	-	Rice	3260	2150	34.0			
			Maize	3490	1990	43.0			
			Soybean	1726	960	79.8	1426	830	71.8
			Buckwheat	1120	780	30.3			
			Vegetable Pea				6036	3126	48.4
Narendrapur	South 24 Parganas	Basanti	Rice (White) var. Shatabdi	4500	3900 - 4200	10			

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 (%)
S K Nagar	Patan	Harij and Shankheshwar	Wheat	3583	2950	17.38	3600	2680	25.55
			Green gram	583	549	5.83			
			Black gram	652	610	6.44			
			Chick pea	1535	1430	6.84			
Thiruvananthapuram	Thiruvananthapuram, Kollam	Kazhakoottam, Kilimanoor, Chadayamangalam	Cassava	27655	29628	+7.13			
			Taro	14785	14540	-1.66			
Udaipur	Bhilwara & Chittorgarh		Maize	2006	1850	8.43	2300	2000	13.04
			Blackgram	410	375	9.33	430	390	9.30
			Soybean				1200	1300	-8.33
			Groundnut				2000	1700	15.0
			Wheat	3710	3520	5.40	4000	3200	20.0
			Fenugreek	1715	1540	11.36	1900	1500	21.05
			Chickpea	1130	980	15.31	1300	950	26.92
			Tomato				6000	5200	13.33
			Brinjal				16600	14800	10.84
			Onion				9000	8400	6.66
			Barseem (fodder)				80000	102000	-27.5

Table 7.1.4. Name of the plant protection input used, weed management practices and constraints for organic/natural 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	Kullu	Cow urine @24L/ha, Neem baan @ 6L/ ha	Dashparni ark/ Brahmastra/ Agniastra/ Butter milk+ Jeevamrit against fungus in apple @ 60L/ ha, Clay soil+ Cow dung+ cow urine+ lime/ Mixture against apple Canker (Chopatiya paint+ asafoetida 10g+flax seed oil 100ml+clay soil 1kg+cow dung 2kg+ cow urine 500ml+reetha as sticker / Jeevamruth+ butter milk @ 30L/ha	Manual	Mulching, hand weeding	Marketing and non-availability of organic inputs	
Bhopal	Bhopal	Neem oil, Kadhah, cow urine, butter milk @ 8 l/ha	-	Manual	-	No Premium price and market for organic produce and Poor access to the certification agencies for adoption to organic farming	-
Cailcut	Idukki, Kozhikode	Pseudomonas, Trichoderma, Bordeaux paste, Neem oil, Tobacco tincture @ 5 kg/ha and 12 l/ha		Manual cutting and grass cutters		Unavailability of workers and organic manures, Yield loss	-
Coimbatore	Erode	Neem Seed Kernel @ 25 kg/ha Neem oil @ 15 litres/ha 5 leaves herbal extract @ 50 litres/ha Fermented butter milk@ 50 litres/ha	Neem Seed Kernel @ 25 kg/ha, Five leaves herbal extract @ 50 litres/ha	Mulching; manual weeding	Mulching, hand weeding	Non availability of organic inputs, Inadequate market facilities for sale, No premium / guaranteed price for organic products, & Interference of middle man for purchasing the organic vegetables	Infestation of pests and diseases, No premium / guaranteed price for organic 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 and Gadag	Growing marigold, ladies finger, cowpea, coriander, mustard, castor as trap crops and Some are using bio-pesticides, neem oil and bio- fungicides using, 250 g/ha (seed rate of trap crop), 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 depending on the nature of pests and their intensity, 500 litre/ha	Inter cultivation, hand weeding, growing intercrops to smother weeds	Mulching, intercropping	Non availability of required quantity of organic manures, Inadequate number of owned livestock, Lack of organized market facility for organic produce, 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.	More time required for preparation of liquid organic manures and local plant protection extracts. Natural farming farmers got good results in the organically amended soil only, whereas 40% yield reduction was observed in fields newly brought under Natural farming. Difficult to maintain crop diversity in natural farming and Prevailing mindset of chemical farming
Jabalpur	Jabalpur	Cow urine, Neem leaf extract, Dashparni ark (plant extracts), butter milk etc. @ 20-25 litre		Stale seed bed, hand hoeing and manual uprooting		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 are major problems	
Karjat	Raigad	Cow urine @5 lit./ha	-	hand weeding	-	Low yield, non-availability of labour, lack of co-operative market, marketing of produce & availability of inputs	-

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
Ludhiana	Faridkot	Achook @ 2.5 lt/ha Neemastra @ 7.5 lt/ha Agniastra @ 9 lt/ha Brahmastra @ 7.5 lt/ha	-	Hand hoeing, mechanical hoeing, mulching	-	Marketing, no subsidy on organic inputs, high labour cost, Price premium low yields, weeds problem	-
Modipuram	Meerut, Muzaffar-nagar,	Trichoderma spp.`Fermented @2.5 kg/ha, buttermilk, Neemashtra, Organoshield (Herbal), Organopower (Herbal)		Manual Mechanical Mulching Intercropping		Lack of marketing facilities, low premium price or no premium price, lower productivity and gap in package of practices , high cost on plant protection (weeding), lack of technical knowledge and advisory services and lack of subsidy/no incentives for organic inputs	
Pantnagar	Nainital	Cow urine+ Neem leaves/ Neem oil/ Garlic/ Chilli paste.(10 l/ha)		Hand weeding			
Raipur	Kanker	Neem oil - 1.0 litre ha^{-1} Trichoderma - 10 g kg^{-1} seed		Hand weeding		Lack of technical knowledge of improved organic farming practices, Lack of irrigation facility. Non availability of organic plant protection inputs. Lack of organized market for organic produce	
Ranchi	Ranchi	Not reported					

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
Umiam	RiBhoi	Neem oil, Trichoderma Viride, Beaveria bassiana, Vermiwash		Hand Weeding and manual Weeding by spade, wheel, hoe		Water in Availability in Winter season, Quality seed materials, organic pesticides	
Ajmer	Sikar	Trichoderma @2-3 kg Calotropisleaf oil, neem oil @2.0 l, pheromone traps, aak-dhatura leaf extract	z	Hand weeding		Disease and Pest Management	
Almora	Almora	Nimbicidine, Rakh (wood ash), Tricoderma, 4.4 litre / ha	Dashparni, Trichoderma, Ash	Hand weeding	Hand weeding	Wild animal (Wild boar, monkey, stray animal) menace	Wild animal (Wild boar, monkey, stray animal) menace
Gangtok	East Sikkim	COC, Sulphur powder, Phytoneem, Botanicals and Spinosad (4ml/lit)	Jeevamrit (250-500 litres/ ha) Ghanjeevamrit (250 kg/ha) Beejamirt (kg /kg of seeds)	Mulching, hand weeding	Mulching and intercropping	Difficulty in using bio control agents, non-availability of bio pesticides and non-availability of bio-fertilizers.	Difficulty in preparation of jeevamrit, beejamrit, ghanjeevamrit and Waspa, v Self-life of organic inputs is very less
Narendrapur	South 24 Parganas	Neem oil (brought from shop) or homemade plant extracts (200 litre working solution /ha, 6 litre oil/plant extract /100 litre)		Manual or weeder based		Marketing and Availability of organic pesticides	
S K Nagar	Patan	Jivamrut, neem oil and nimastra (450 lit/ha)	Neemastra (200 lit/ ha), Dasparni extract (200 lit/ha), Neemastra, Dashparni ark and Bramhastra	Hand weeding	Hand weeding	Lack of availability of large quantity of organic inputs from small land holding farmer. No assured market and lack of premium price for organic product, low productivity of crops Lack of organic pesticides.	Selling of 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
Thiruvananth-apuram	Thiruvanan-thapuram and Kollam	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 Labour shortage Small and fragmented land holdings Low price of the produce Damage due to peacock, wild boar, porcupine, and other wild animals	
Udaipur	Bhilwara & Chittorgarh	Dashparni, Neem leaf extract, Cow urine	Jeevamrit (litres/ha): 880 lit/ha Beejamirt (kg/kg of seeds):160g	Hand weeding and Hoeing	Hand weeding, mulching	Low yield of crops Low technical knowledge Timely availability of inputs Poor mechanisation	Low yield of crops Low technical knowledge Timely availability of inputs Poor mechanisation

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 the 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 ITKs evaluated, 3G extract (Ginger, Garlic and Green chilli) @ 5% was recorded most effective against sucking pests infesting *viz.,* aphids, leafhoppers, thrips and whiteflies in cotton crop. Yield of cotton recoded of 2051 kg/ha with this treatment. In maize crop. 3G extract (Ginger, Garlic and Green chilli) @ 5% was also perform better and recorded highest yield of 4865 kg/ha with minimum incidence of fall worm.

Table 7.1.2.1: Performance of 3G extract, *lantana-calotropis* extract and cow dung -cow urine extract on sucking pests in cotton and maize crop

Name of the crop	Insect pest	Best performing treatment	Reduction in incidence compared to control (%)	Yield (kg/ha)	Yield increase over control (%)
Cotton	Leafhoppers	Ginger, garlic and green chilli extract (3G) @ 5%	73.90	2051	**25.6**
	Thrips		64.54		
	Whiteflies		68.59		
	Aphids		72.09		
Maize	Fall armyworm		58.75	4925	18.5

Gangtok

Name of the ITKs identified for validation

i. Cow dung extract

ii. Cow urine

iii. Solution of a mixture of 10% agave extract + 5% cow urine + 2.5% ground chilly

Validation of cow dung extract and cow urine (Table 7.1.2.2)**:** Farmers used well decomposed cow dung and keeping it for 3-4 days then filtering with a cotton cloth before applying it on crops to improve the production and productivity of vegetable crops. Three concentrations 5%, 10% (farmers practice), 15% of cow dung extract was validated along with control (only water spray). It was applied on cabbage and radish which grown under low cost plastic tunnel and red cherry pepper grown

under low cost plastic rain shelters. It was observed that all the treatments have significantly improved the yield of cabbage, red cherry pepper and radish as compared to control. There was no significant difference observed between farmer's practice and higher doses applied (15%), however, lower dose (5%) yield was significantly less than the farmer's practice (10%) to the tune of 22.5, 28.5. Likewise, farmers are using cow urine. @ 10% for improving the yield of tomato and cucurbitaceous vegetables (bottle and bitter gourd). Results indicated that application of 10% cow urine perform the better and recorded highest yield of tomato, bottle gourd and bitter gourd but not much variation observed within the concentration of cow urine. Yield of tomato, bottle gourd and bitter gourd increased with 10% over to 5% cow urine application by 8.3, 9.1 and 11.3%.

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

Crops	Yield (kg/m²)				Crops	Yield (kg/plant)			
	Cow dung extract (5%)	Cow dung extract (10% Farmer's Practice)	Cow dung extract (15%)	Control (only water spray).		Cow urine (5%)	Cow urine (10% Farmer's Practice)	Cow urine (15%)	Control (only water spray)
Cabbage	6.20	8.00	7.80	3.80	Tomato	4.80	5.20	4.64	1.80
Radish	4.58	6.41	6.98	2.68	Bottle gourd	8.58	9.36	8.50	3.54
Red cherry pepper	1.30	1.60	1.63	0.69	Bitter gourd	2.56	2.85	2.68	1.28

Validation of solution of a mixture of 10% agave extract + 5% cow urine + 2.5% ground chilly (Table 7.1.2.3)**:** Farmers are managing aphids and fruit borer by spraying 0.2% solution of a mixture of 10% agave extract + 5% cow urine + 2.5% ground chilly. Before spraying all the ingredients were mixed properly in plastic container and kept in shade for 3 days and then from this mixture 0.2% solution is prepared for spray in vegetable crops. Three concentrations 0.1%, 0.2% (farmers practice), 0.5% solution spray was validated along with control (only water spray). These were evaluated on tomato and french bean growing under low cost plastic rain shelters and broccoli growing under low cost plastic tunnels. Result indicated that increase in yield of tomato and broccoli was observed with higher doses of solution application (0.5%) over the farmer's practice (0.2%) however, french bean yield was highest in farmer's practice (0.2%). The per cent reduction for incidence of aphid and fruit borer population revealed that application of 0.5% recorded maximum suppression of aphid population over control in tomato (80.4 and 72%), French bean (79.8%) and broccoli (83.5%) followed by solution spray 2 0.1 and 0.2% respectively.

Table 7.1.2.3: Yield of vegetable crops as influenced by cow dung and cow urine application at Gangtok

Treatment details	Yield of tomato (kg/plant)	Yield of french bean (kg/m²)	Yield of broccoli kg/m²)	(Per cent reduction over control			
				Aphid		Fruit borers	
				Tomato	French bean	Tomato	Broccoli
0.1% solution spray	3.9	3.7	5.8	65.9	70.8	62.8	67.8
0.2% solution spray (*Farmer's Practice)*	4.2	5.2	4.3	58.8	63.0	54.5	6 9 . 8
0.5% solution spray	4.9	4.0	6.0	80.4	79.8	72.0	83.5
Control (only water spray)	1.0	1.5	1.9	-	-	-	-

Udaipur

A. Evaluation of indigenous pesticides for control of sucking pest in cauliflower

Name of ITKs:

i. Standard chili mixture (0.3%)
ii. Spray of *Teekha* sat (5%)
iii. Neem oil (0.5%)
iv. Dung ash (250 kg/ha)
v. Silica powder (2%)

Five indigenous ITK pesticides were evaluated for their efficacy to control sucking pest in cauliflower (Table 7.1.2.4). Among the indigenous ITKs, *Teekha sat* outperformed better resulted in significantly higher curd yield (17500 kg/ha), net return (Rs. 2,21,300/ha) and benefit cost ratio (5.21) with highest reduction of sucking pest (58.1%) followed by application of neem oil (0.55) where yield of curd, net return, B: ratio and incidence of sucking pest recorded 17100 kg/ha, Rs. 2,15,200/ha, 5.21 and 56.6% respectively.

Table 7.1.2.4: Effect of indigenous pesticides on Growth and Yield attributes and yield of cauliflower

Treatments	Curd yield (kg/ha)	Gross return (Rs/ha)	Net return (Rs/ha)	B:C ratio	% reduction over control in aphid population
Standard chilli mixture (0.3%)	14400	216000	174700	4.23	45.55 (36.70)
Teekha sat (5%)	17500	262500	221300	5.37	58.10 (43.46)
Neem oil (0.5%)	17100	256500	215200	5.21	56.60 (40.38)
Dung ash (250 kg/ha)	13350	200250	159100	3.87	44.46 (35.28)
Silica powder (2%)	16200	243000	201930	4.92	50.24 (38.08)
Control	11130	166950	125950	3.07	-
CD at 5 %	1208	18125	18125	0.44	6.8


Spray standard red chilli mixture (0.3%)


Spray of Teekha sat (5%)(0.3%)


Neem oil (0.5%)


Dung ash (250 kg/ha)


Silica powder (2%)


Control

Evaluation of indigenous pesticides for control of sucking pest in Cabbage

B. Evaluation of indigenous pesticides for control of sucking pest in Cabbage

Name of ITKs:

i. Standard chili mixture (0.3%)
ii. Spray of *Teekha* sat (5%)
iii. Neem oil (0.5%)
iv. Dung ash (250 kg/ha)
v. Silica powder (2%)

Five indigenous ITK pesticides were evaluated for their efficacy to control sucking pest in cabbage (Table7.1.2.5). Among the indigenous ITKs, *Teekha sat* resulted in significantly higher curd yield (15480 kg/ha), net return (Rs. 1,91,000/ha) and benefit cost ratio (4.64) with highest reduction of sucking pest (58.1%) which was at par by application of neem oil (0.5%) where yield of curd, net return, B: ratio and incidence of sucking pest recorded 14520 kg/ha, Rs. 1,75,500/ha, 4.27 and 56.6% respectively.

Table 7.1.2.5: Effect of indigenous pesticides on Growth and Yield attributes and yield of cauliflower

Treatments	Curd yield (kg/ha)	Gross return (Rs/ha)	Net return (Rs/ha)	B:C ratio	% reduction over control in aphid population
Standard chilli mixture (0.3%)	13000	195000	153700	3.72	45.55 (38.23)
Teekha sat (5%)	15480	232200	191000	4.64	58.10 (43.30)
Neem oil (0.5%)	14520	217800	176500	4.27	56.60 (42.93)
Dung ash (250 kg/ha)	11980	179700	138550	3.37	44.46 (37.31)
Silica powder (2%)	13530	202950	161880	3.94	50.24 (39.67)
Control	10760	161400	120400	2.94	-
CD (P=0.05)	1064	15961	15961	0.39	8.3

Spray standard chilli mixture (0.3%)

Spray of Teekha sat (5%)

Neem oil (0.5%)

Dung ash (250 kg/ha)

Silica powder (2%)

Control

Evaluation of indigenous pesticides for control of sucking pest in Cauliflower

C. Organic management for diseases in tomato and onion

Name of ITKs:

(i) Dasparni
(ii) Teen Ghol Jaiv Keetnashi
(iii) Bharmastra
(iv) Panchparni
(v) Buttermilk

Descriptions

(i) Dasparni preparation: Neem (5 kg), Karanj (2 kg), Babool (2 kg), Papaya (2 kg), Custard apple (2 kg), Tulsi (2 kg), Nerium (2 kg), Aak (2 kg), Dhatura (2 kg), Castor (2 kg), Turmeric (500 g), Ginger (500 g), Garlic (500 g), Green chilli (500 g), Tobacco (1 kg). Crush leaves of all plant and mix them with 5 kg cow dung and 5 lit, cow urine in 200 lit water and ferment for 40 days. Shake regularly three times a day. Extract after crushing and filtering.

Chemical and biological characteristics of Dashparni

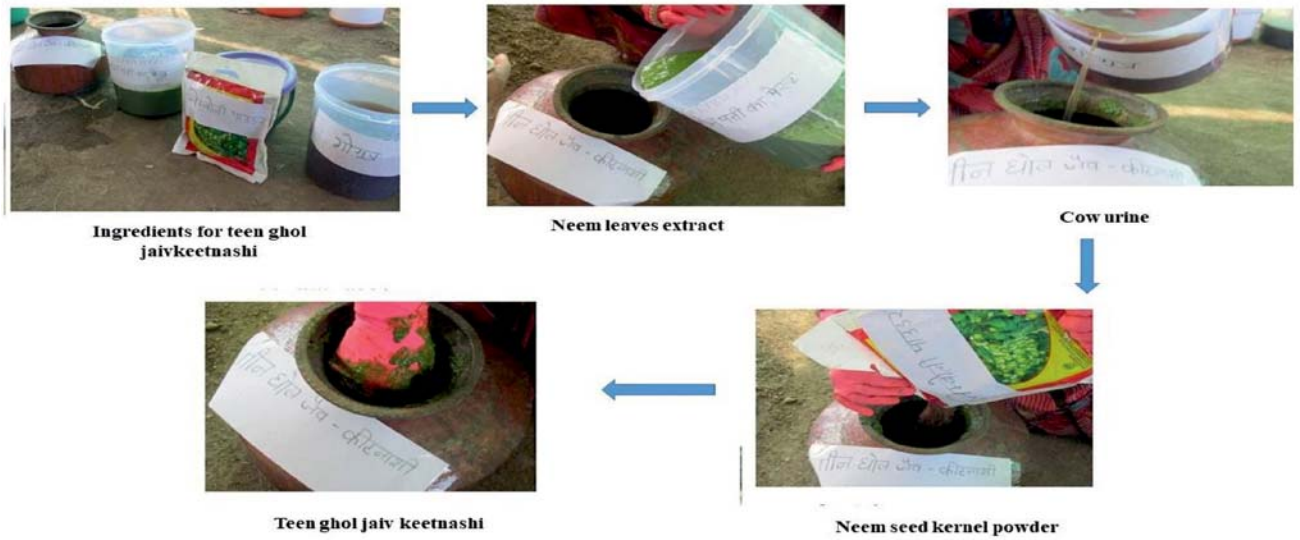
pH	EC (dS/m)	N (%)	P (%)	K (%)	Bacterial count (cfu/ml)	Fungal count (cfu/ml)	Actinomy-cetes count (cfu/ml)	Acid phosphatase (µg/ml)	Alkaline phosphatase (µg/ml)	Dehydroge-nase (µg/ml)
7.05-7.10	0.07-0.09	1.138-1.11	0.225-40.229	0.515-0.520	8.65-10.60 $x10^8$	4.8-6.4 $x10^5$	7.2-9.1 $x10^5$	28.97-30.40	51.10-53.55	65.64-67.20

Preparation of Dashparni

(ii) Teen Ghol Jaiv Keetnashi preparation : Mixture I: Mix 3 kg neem leaves paste and 1 kg neem seed kernel extract powder in 10 lit cow urine in a copper pot of 15 lit capacity and boiled this mixture till it become half of its original quantity. Keep it for 10 days. Mixture II: Keep overnight 500 g green chilli paste in 1 lit water. Mixture III: Keep overnight 250 g garlic paste in 1 lit water. Mix all three mixtures in 200 lit of water. Now teen ghol jaivkeetnashi is ready for application.

Chemical and biological characteristics of Teen Ghol Jaiv Keetnashi

pH	EC (dS/m)	N (%)	P (%)	K (%)	Bacterial count (cfu/ml)	Fungal count (cfu/ml)	Actinomy-cetes count (cfu/ml)	Acid phosphatase (µg/ml)	Alkaline phosphatase (µg/ml)	Dehydroge-nase (µg/ml)
7.20-7.35	2.65-2.75	0.560-0.565	0.226-0.238	0.985-0.995	1.14-3.10 x10^8	0.75-1.70 x10^5	0.35-0.85 x10^5	4.83-6.15	0.52-2.10	4.39-6.30



Preparation of Teen Ghol Jaiv keetnashi

(iii) Bharmastra: Add the 5 litre of cow urine in the 100 litres of water. Add the 5 kg of cow dung to the water as well. Crush the 5 kg of neem leaves to the water. Allow this solution to ferment for 24 hours. Stir the solution twice a day by using a stick. Filter the solution using a cloth and use it. Bharmastra @ 5% is use for foliar application. Neemastra solution can be stored for 6 months.

Chemical and biological characteristics of Bhramastra

pH	EC (dS/m)	N (%)	P (%)	K (%)	Bacterial count (cfu/ml)	Fungal count (cfu/ml)	Actinomy-cetes count (cfu/ml)	Acid phosphatase (µg/ml)	Alkaline phosphatase (µg/ml)	Dehydroge-nase (µg/ml)
4.85-4.89	0.92-0.98	0.200-0.205	0.004-0.005	0.660-0.669	1.61 x10^4	11.69 x10^6	3.29 x10^3	61.76	31.83	81.44

Preparation of Bhramastra

Results

Validation of ITKs for pest and disease management in tomato (Table 7.1.2.6):

Among the different treatments (ITKs), application of Dasparni (10%) on tomato crop showed significant effect for all the traits resulted in higher yield (18973 kg/ha), net return (Rs. 2,43,295/ha), and B:C ratio (5.89) due to lowest incidence of insect pest and disease i.e. early blight (16.1%) and late blight (11.2%). Next best performing treatment being Bramastra (10%) which recorded yield, net return, B:C ratio, % incidence of early and late blight of 18153 kg/ha, Rs. 2,31,247/ha, 5.63, 18.3% and 14% respectively.

Table 7.1.2.6: Effect of organic inputs on growth, yield attributes and yield of tomato

Treatments	Early blight (PDI)	Late blight (PDI)	Plant height at harvest (cm)	No. of branches plant	Yield (kg/ha)	Gross return (Rs/ha)	Net return (Rs/ha)	B:C ratio
Control	56.9	34.7	47.9	5.5	12728	190922	150422	3.71
Butter milk (5 %)	36.6	26.6	50.5	5.8	13779	206683	165543	4.02
Teen Ghol Jaiv Keetnashi (5%)	27.7	20.3	49.8	5.7	15098	226470	185170	4.48
Panchparni (10 %)	22.2	18.4	54.5	6.3	17314	259710	218510	5.30
Bharmastra (10 %)	18.3	14.0	54.3	6.8	18153	272297	231247	5.63
Dashparni (10 %)	16.1	11.2	57.2	6.8	18973	284595	243295	5.89
CD (P	2.9	1.98	6.3	0.7	2647			

Field view of experiment

Fruiting in tomato

Effect of organic input on tomato

D. Management of *purple blotch* in organic onion

Among the different indigenous inputs, application of Daspanrni @ 10% recorded significantly lowest percent disease incidence for *purple blotch* (11%) resulted higher yield of onion (8692 kg/ha), Net return Rs. 83,080/ha, benefit cost ration (1.76), followed by Bharmastra (10%) which recorded 15.5% purple blotch incidence, 8126 kg/ha of yield, Rs. 74,839/ha of net return and 1.59 B:C ratio.

Table 7.1.2.7: Effect of organic inputs on growth and yield attributes and yield of onion

Treatments	Purple blotch (PDI)	Plant height at harvest (cm)	No. of branches plant	Yield (kg/ha)	Gross return (Rs/ha)	Net return (Rs/ha)	B:C
Control	31.4	31.1	5.8	6745	101170	54670	1.18
Butter milk (5%)	28.9	29.8	6.1	7115	106720	59580	1.26
Teen Ghol Jaiv Keetnashi (5%)	22.5	30.8	6.4	7537	113063	65763	1.39
Panchparni (10%)	15.5	32.8	6.8	7800	117000	69800	1.48
Bharmastra (10%)	11.0	32.6	7.1	8126	121889	74839	1.59
Dashparni (10%)	7.5	32.6	7.7	8692	130380	83080	1.76
CD (P=0.05)	2.1	3.6	0.5	1065	15980	15980	0.34

Management of purple blotch in organic onion

E. Evaluation of ITK on effect of herbal concoctions on insect-pest of okra

Treatment details and descriptions

T_1	Desi herbal concotions (1 kg neem leaves + 1 kg aak + 1 kg datura paste)
T_2	Desi keetnasak (6 kg neem leaves extract + 1 kg aak leaves + ½ kg tobacco leaves in one earthen pot for 15 days in dung heap & spray in 1:10 ratio)
T_3	Incubates butter milk (100 L butter milk in copper pot for 10-15 days incubation)
T_4	Seed treatment/seedling treatment with babhut amrit pani + desi ark (10 kg neem leaves + 5 kg neem seed kernel + 2 kg aak leaves + 2 kg datura leaves + 10 L water, boil all & sieve & mixed in 100 L water & spray)
T_5	Butter milk herbal concentration (5 kg neem leaves + 5 kg aak leaves + 10 L butter milk + 100 g copper. Keep it for 7 days in pot. Mix in 100 L water & spray
T_6	Water spray
T_7	Control

Results (Table 7.1.2.8 and 7.1.2.9): Among the different herbal concoctions, treatment T4 i.e. seed treatment/seedling treatment with babhut amrit pani + desi ark (10 kg neem leaves + 5 kg neem seed kernel + 2 kg aak leaves + 2 kg datura leaves + 10 L water, boil all & sieve & mixed in 100 L water & spray) significantly performed better and recorded lowest population of jassids, white fly, mealy bug and red cotton bug followed by application of Desi keetnasak (6 kg neem leaves extract + 1 kg aak leaves + ½ kg tobacco leaves in one earthen pot for 15 days in dung heap & spray in 1:10). Yield attributing characters such as, plant height at harvest, number of branches/plants, fruit length, number of fruits/plant and fruit yield/ha (123 cm, 6.00, 16.00 cm, 22.00 and 3704 kg/ha, respectively) were also recorded maximum with treatment T4 i.e. seed treatment/seedling treatment with babhut amrit pani + desi ark followed by application of desi keetnasak treatment (118 cm, 6.00, 15.50 cm, 20.00 and 3241 kg/ha, respectively) along with gross return, net return and BC ratio (Rs.111111/ha, Rs.69511/ha and 1.67, respectively). Next best performing treatment been T2 i.e. T2:Desi keetnasak (6 kg neem leaves extract + 1 kg aak leaves + ½ kg tobacco leaves in one earthen pot for 15 days in dung heap & spray in 1:10) in term of pest population, yield and monetary return.

Table 7.1.2.8: Effect of different herbal concoctions on insect-pest management of okra

Treatment	Pest population (No./plant)				
	Dose (%)	Jassids	White fly	Mealy bug	Red cotton bug
T1:Desi herbal concotions (1 kg neem leaves + 1 kg aak + 1 kg datura paste)	10	2.1	3.1	2.9	3.1
T2:Desi keetnasak (6 kg neem leaves extract + 1 kg aak leaves + ½ kg tobacco leaves in one earthen pot for 15 days in dung heap & spray in 1:10)	10	1.1	1.5	1.3	1.2
T3: Incubates butter milk (100L buttermilk in copper pot for) 10-15 days incubation	10	3.0	4.1	3.6	3.7
T4: Seed treatment/seedling treatment with babhut amrit pani + desi ark (10 kg neem leaves + 5 kg neem seed kernel + 2 kg aak leaves + 2 kg datura leaves + 10 L water, boil all & siev & mix in 100 L water & spray)	20	0.37	0.54	0.28	0.41
T5: Butter milk herbal concotions (5 kg neem leaves + 5 kg aak leaves + 10 L buttermilk + 100 g copper. Keep it for 7 days in pot. Mix in 100 L water & spray	20	1.5	2.1	1.9	2.1
T6: Water spray	-	4.4	5.7	4.6	4.8
T7:Control	-	4.4	5.8	4.6	4.9


Desi herbal concotions


Desi keetnasak


Incubates butter milk

Seed treatment/seedling treatment with babhut amrit pani + desi ark

Butter milk herbal concentration

Control

Effect of different herbal concoctions on insect-pest management of okra

Table 7.1.2.9: Effect of different herbal concentration growth, yield attributes and yield of okra

Treatment	Plant height at harvest (Cm)	No. of branches/ plant	Fruit length (Cm)	No of fruits per plant	Fruit yield (kg/ha)	Gross return (Rs./ha)	Net return (Rs./ha)	BC ratio
T1: Desi herbal concotions (1 kg neem leaves + 1 kg aak + 1 kg datura paste)	114	5.00	15.00	17.00	2685	80556	38956	0.94
T2: Desi keetnasak (6 kg neem leaves extract + 1 kg aak leaves + ½ kg tobacco leaves in one earthen pot for 15 days in dung heap & spray in 1:10)	118	6.00	15.50	20.00	3241	97222	55622	1.34
T3: Incubates butter milk (100L buttermilk in copper pot for 10-15 days incubation)	112	4.50	14.00	16.00	2407	72222	30622	0.74
T4: Seed treatment/seedling treatment with babhut amrit pani + desi ark (10 kg neem leaves + 5 kg neem seed kernel + 2 kg aak leaves + 2 kg datura leaves + 10 L water, boil all & siev & mix in 100 L water & spray)	123	6.00	16.00	22.00	3704	111111	69511	1.67
T5: Butter milk herbal concotions (5 kg neem leaves + 5 kg aak leaves + 10 L buttermilk + 100 g copper. Keep it for 7 days in pot. Mix in 100 L water & spray	116	5.50	15.00	15.00	2870	86111	44511	1.07
T6: Water spray	109	4.00	12.50	15.00	2130	63889	22289	0.54
T7: Control	102	3.00	11.00	13.00	1852	55556	13956	0.34
CD (P=0.05)	4.583	0.236	0.664	0.832	133.602	4008.062	4008.06	0.096

F. Evaluation of ITK for management of sucking pests on okra

Description of treatment

T_1	Butter milk (10 L butter milk fermented for 10 days and mixed in 100 L water for spray in 1 acre) at 45 DAS and 10 days interval
T_2	Red chilli concoction (Red chilli powder 100 g+ 3 kg Aloe Vera extract+10 L cow urine in 100L water) at 45 DAS and 10 days interval
T_3	Application of cow urine (Spray of cow urine and water (1:10) at 45 DAS and 10 days interval)
T_4	Application of cow dung slurry (Spraying of cow dung slurry and water (1:10) at 45 DAS and 10 days interval)
T_5	Application of cow dung slurry + cow urine (Spraying of cow dung slurry and cow urine (1:1) then the mixed with water (1:5) at 45 DAS and 10 days interval)
T_6	Application of dung and wood ash (Dusting on leaves @ 50g/plant at 45 DAS and 10 days interval)
T_7	Control (No pest management) but spraying of water

Result (Table 7.1.2.10 and 7.1.2.11):

Six herbal concoctions along with control treatment (no any pest management only water spray) was evaluated to test their efficacy and for management of sucking peat in okra. Among the different herbal mixtures, application of cow dung slurry (spray of cow dung slurry and water (1:10) at 45 DAS with10 days interval) resulted in maximum reduction of pest population per plant as compared to other treatments followed by application of butter milk (10 L butter milk fermented for 10 days and mixed in 100 L water for spray in 1 acre) at 45 DAS and 10 days interval.

Yield contributing characters such as plant height at harvest, number of branches/plants, fruit length, number of fruits/plant and fruit yield/ha (122 cm, 6.50, 15.50 cm, 20.00 and 2407 kg/ha, respectively) were also recorded highest with application of Cow dung slurry + cow urine (Spraying of cow dung slurry and cow urine (1:1) then the mixed with water (1:5) at 45 DAS and 10 days interval) followed by application of Butter milk (10 L butter milk fermented for 10 days and mixed in 100 L water for spray in 1 acre) at 45 DAS and 10 days interval (118 cm, 6.00, 14.40 cm, 18.50 and 1852 kg/ha, respectively) at 45 DAS and 10 days interval. Gross return, net return and BC ratio (Rs. 72222/ha, Rs28500/ha and 0.65, respectively) were also followed the same trend with the application of cow dung slurry + cow urine in 1:1 ratio mixed with water in 1:5 ratio twice at 45 DAS and 10 days interval followed by application of butter milk (Rs55556/ha, Rs13956/ha and 0.34, respectively).

Table 7.1.2.10: Effect of different ITKs on insect pest management of okra

Treatment details	Dose	Pest population (No./plant)			
		Jassids	White fly	Mealy bug	Red cotton bug
Butter milk (10 L butter milk fermented for 10 days and mixed in 100 L water for spray in 1 acre) at 45 DAS and 10 days interval	10%	1.3	1.4	1.3	1.5
Red chilli concoction (Red chilli powder 100 g+ 3 kg Aloe Vera extract+10 L cow urine in 100L water) at 45 DAS and 10 days interval	10%	2.9	2.4	3.2	2.6
Cow urine (Spraying of cow urine and water (1:10) at 45 DAS and 10 days interval)	10%	3.5	2.7	4.1	3.8
Cow dung slurry (Spraying of cow dung slurry and water (1:10) at 45 DAS and 10 days interval)	10%	0.42	0.68	0.36	0.49
Cow dung slurry + cow urine (Spraying of cow dung slurry and cow urine (1:1) then the mixed with water (1:5) at 45 DAS and 10 days interval)	20%	1.9	1.7	1.8	1.9
Dung and wood ash (Dusting on leaves @ 50g/plant at 45 DAS and 10 days interval)	50g/plant	2.2	1.9	2.5	2.1
Control (No pest management) but spray of water	-	4.8	3.7	5.3	4.6

Table 7.1.2.11: Effect of different ITKs on growth, yield attributes and yield of okra

Treatment	Plant height at harvest (Cm)	No. of branches/ plant	Fruit length (Cm)	No of fruits per plant	Fruit yield (kg/ha)	Gross return (Rs./ha)	Net return (Rs./ha)	BC ratio
Butter milk (10 L butter milk fermented for 10 days and mixed in 100 L water for spray in 1 acre) at 45 DAS and 10 days interval	118	6.00	14.40	18.50	1852	55556	13956	0.34
Red chilli concoction (Red chilli powder 100 g+ 3 kg Aloe Vera extract+10 L cow urine in 100L water) at 45 DAS and 10 days interval	114	4.50	13.20	16.00	1204	36111	-5539	-0.13
Cow urine (Spraying of cow urine and water (1:10) at 45 DAS and 10 days interval)	112	4.00	12.40	15.40	1019	30556	-12844	-0.30
Cow dung slurry (Spraying of cow dung slurry and water (1:10) at 45 DAS and 10 days interval)	117	6.00	14.10	17.60	1574	47222	5522	0.13
Cow dung slurry + cow urine (Spraying of cow dung slurry and cow urine (1:1) then the mixed with water (1:5) at 45 DAS and 10 days interval)	122	6.50	15.50	20.00	2407	72222	28522	0.65
Dung and wood ash (Dusting on leaves @ 50g/plant at 45 DAS and 10 days interval)	108	5.00	13.60	17.10	1389	41667	67	0.00
Control (No pest management) but spray of water	105	3.50	11.60	13.00	926	27778	-13422	-0.33
CD (P=0.05)	4.30	0.23	0.62	0.77	71.0	2132	2132	0.05

Application of Cow dung slurry + Cow urine

Application of dung and wood ash

Application of Cow dung slurry


Application of Butter milk


Application of Red chilli concoction


Application of Cow urine

Effect of different ITKs on pest management in okra

G. Evaluation of plant powders for management of storage grain pests in maize and black gram

Treatments:

- Neem leaf powder* (1%, 2%, 3%, Control)
- Neem seed kernel powder* (1%, 2%, 3%, Control)
- Karanj leaf powder* (1%, 2%, 3%, Control)
- Eucalyptus leaf powder* (1%, 2%, 3%, Control)
- Percent powder in reference to total weight of grain
- Duration of storage: 90 Days

Methodology

The experiments on the effect of different organic powder treatments *i.e.* Neem seed kernel powder, Neem leaf powder, Karanj powder and Eucalyptus powder against infestation of stored pests (rice weevil and pulse beetle) were conducted in Completely Randomized Design with three replications in laboratory at Department of Entomology, RCA, Udaipur during reported year. The four sets of experiments were carried out using 450gm of maize and black gram in one kg capacity plastic container. Freshly emerged twenty adults of *Sitophilus oryzae* and *Callosobruchus chinensis* were released in each container separately and maintained up to four months. The culture was maintained in plastic containers of 500gm capacity containing each seeds in order to maintain a stock culture for a continuous fresh supply of large number of insects required for the experimentation. Observations on number and percentage of damaged seed were recorded.

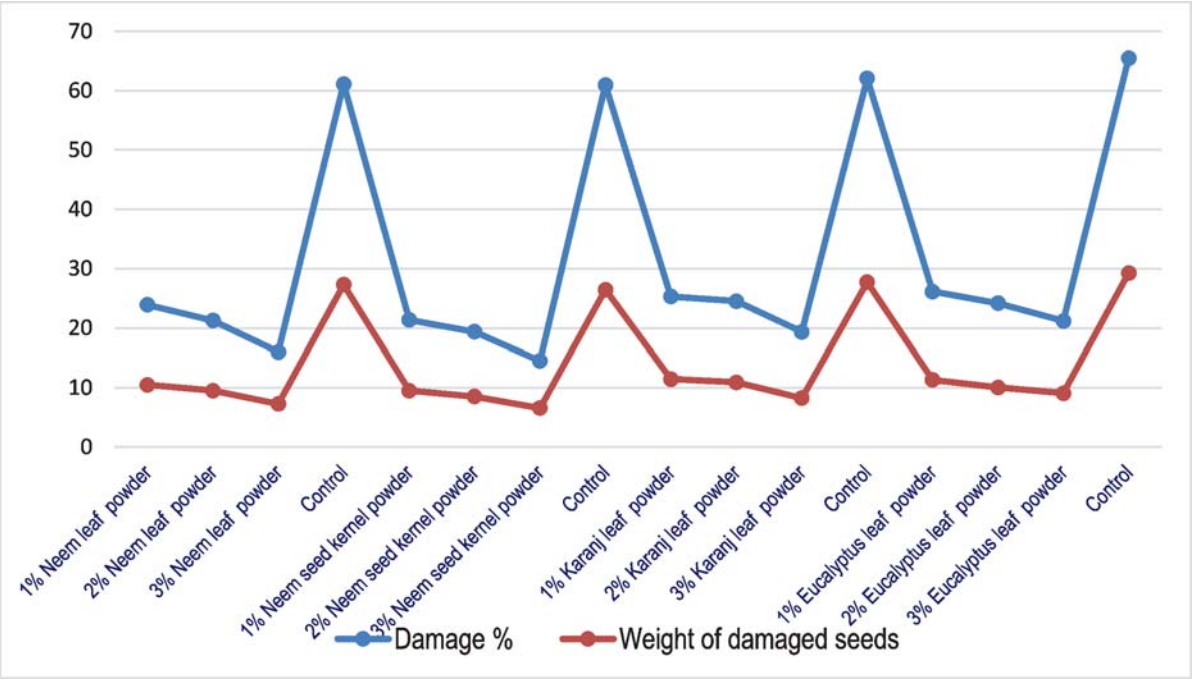
Results (Table 7.1.2.12 -7.1.2.14)

Different plant powders viz., Neem leaf powder, Neem seed kernel powder, Karanj leaf powder and Eucalyptus leaf powder was used against rice weevil, Sitotroga cerealella and pulse beetle, Callosobruchus chinensis of stored seeds of Maize and blackgram. The use of different organic treatments proved significantly effective in reducing the stored insect pest infestation. Among all the treatments, use of neem seed kernels powder @ 3% of total weigh of grains was found to be most effective in reducing the stored pest infestation in maize and blackgram.

In maize grain, the damage percentage ranged from 14.51 to 65.52 due to rice weevil, *Sitophilus oryzae*; whereas, 9.99 to 67.85 in blackgram due to pulse beetle, *Callosobruchus chinensis*. The neem seed kernel powder 3% was observed to be most effective with the minimum damage seed per cent 14.51%, followed by neem leaf powder 3% (16.00%), karanj leaf powder 3% (19.34%) and eucalyptus leaf powder (21.17%) against rice weevil in stored maize. The neem seed kernel powder 3% was observed to be most effective with the minimum damage seed per cent 9.99%, followed by neem leaf powder 3% (10.08%), karanj leaf powder 3% (10.60%) and eucalyptus leaf powder (11.27%) against pulse beetle in stored black gram. .

Table 7.1.2.12: Efficacy of various plant powders against rice weevil, *Sitotroga cerealella* of stored seeds of maize

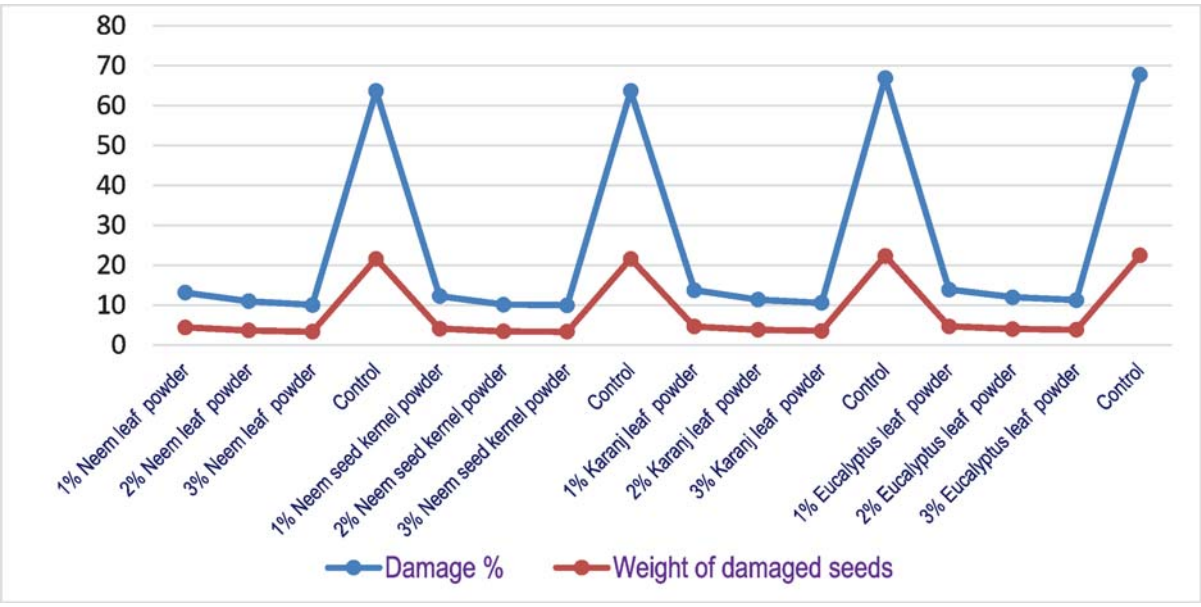
Treatments	Weight of 100 healthy seeds = 20-22 grams Weight of 100 damaged seeds = 13-14 grams			
	Total No. of Seeds in 50 grams	Damages Seeds	Damage %	Weight of damaged seeds
Neem leaf powder 1%	314	75	23.89	10.50
Neem leaf powder 2%	320	68	21.25	9.52
Neem leaf powder 3%	325	52	16.00	7.28
Control	319	195	61.13	27.30
CD (P=0.05)			2.06	1.86
Neem seed kernel powder 1%	318	68	21.38	9.52
Neem seed kernel powder 2%	315	61	19.37	8.54
Neem seed kernel powder 3%	324	47	14.51	6.58
Control	310	189	60.97	26.46
CD (P=0.05)			3.52	1.22
Karanj leaf powder 1%	324	82	25.31	11.48
Karanj leaf powder 2%	318	78	24.53	10.92
Karanj leaf powder 3%	305	59	19.34	8.26
Control	319	198	62.07	27.72
CD (P=0.05)			4.21	1.54
Eucalyptus leaf powder 1%	310	81	26.13	11.34
Eucalyptus leaf powder 2%	298	72	24.16	10.08
Eucalyptus leaf powder 3%	307	65	21.17	9.10
Control	319	209	65.52	29.26
CD (P=0.05)			5.67	0.91



Efficacy of various plant powders against rice weevil, *Sitotroga cerealella* of stored seeds of maize

Table 7.1.2.13: Efficacy of various plant leaf powders against pulse beetle, *Callosobruchus chinensis* of stored seeds of black gram

Treatments	Weight of 100 healthy seeds = 6.5 grams Weight of 100 damaged seeds = 2.5 grams			
	Total No. of Seeds in 50 grams	Damages Seeds	Damage %	Weight of damaged seeds
Neem leaf powder 1%	1354	178	13.15	4.45
Neem leaf powder 2%	1348	148	10.98	3.70
Neem leaf powder 3%	1339	135	10.08	3.38
Control	1358	865	63.70	21.63
CD			2.31	1.03
Neem seed kernel powder 1%	1345	165	12.27	4.13
Neem seed kernel powder 2%	1349	137	10.16	3.43
Neem seed kernel powder 3%	1352	135	9.99	3.38
Control	1358	865	63.70	21.63
CD			3.49	0.71
Karanj leaf powder 1%	1344	185	13.76	4.63
Karanj leaf powder 2%	1352	154	11.39	3.85
Karanj leaf powder 3%	1349	143	10.60	3.58
Control	1335	894	66.97	22.35
CD			0.20	1.12
Eucalyptus leaf powder 1%	1351	188	13.92	4.70
Eucalyptus leaf powder 2%	1349	162	12.01	4.05
Eucalyptus leaf powder 3%	1358	153	11.27	3.83
Control	1325	899	67.85	22.48
CD			7.58	1.06



Efficacy of various plant leaf powders against pulse beetle, *Callosobruchus chinensis* of stored seeds of blackgram

Table 7.1.214: Evaluation of organic management practices using plant powders for storage pests infesting Maize and Black gram

Name of the crop	Insect pest	Best performing treatment	Percent damage of seeds (%)
Maize	*Sitophilus oryzae*	Neem seed kernel powder @ 3% of total weight of grains	14.51
		Neem leaf powder @ 3% of total weight of grains	16.00
		Karanj leaf powder @ 3% of total weight of grains	19.34
		Eucalyptus leaf powder @ 3% of total weight of grains	21.17
Black gram	*Callosobruchus chinensis*	Neem seed kernel powder @ 3% of total weight of grains	9.99
		Neem leaf powder @ 3% of total weight of grains	10.08
		Karanj leaf powder @ 3% of total weight of grains	10.60
		Eucalyptus leaf powder @ 3% of total weight of grains	11.27

H. Evaluation of plant-based oils for management stored grain pests of maize and black gram

Treatments:

- Neem oil (1%, 2%, 3%, Control) as a percent of total weight of grains
- Citronella oil (1%, 2%, 3%, Control) as a percent of total weight of grains
- Karanj oil (1%, 2%, 3%, Control) as a percent of total weight of grains
- Clove oil (1%, 2%, 3%, Control) as a percent of total weight of grains

Period of storage: 90 Days

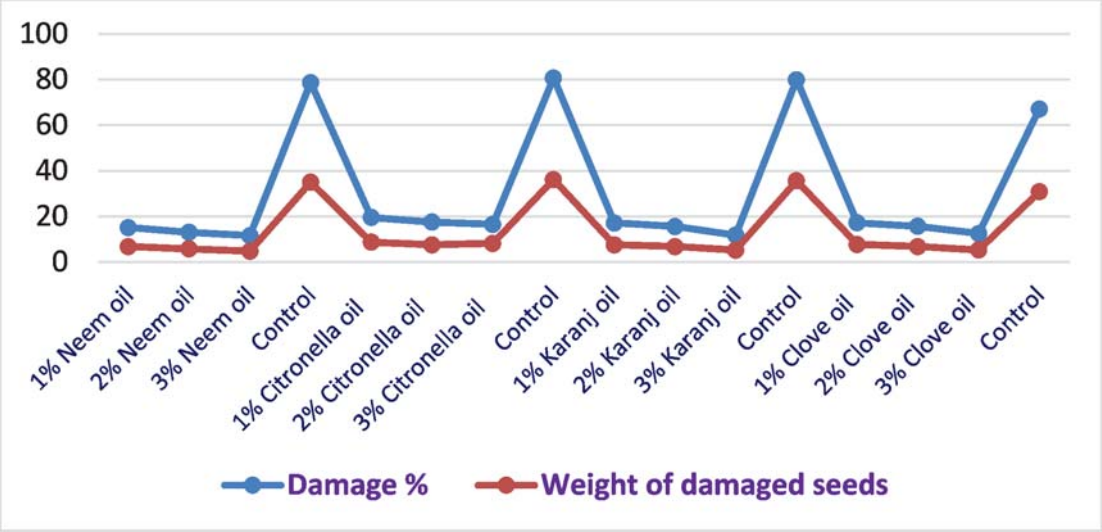
Methodology

The experiments on the effect of different organic oil treatments *i.e.*Neem oil, Karanj oil, Clove oil and Citronella oil against infestation of stored pests (*viz.*, rice weevil and pulse beetle) were undertaken in completely randomized design with three replications in laboratory at Department of Entomology, RCA, Udaipur. The four sets of experiments were carried out using 450gm of maize and black gram in one kg capacity plastic container. Freshly emerged twenty adults of *Sitophilus oryzae* and *Callosobruchus chinensis* were released in each container separately and maintained up to four months. The stock culture was maintained in plastic containers of 500gm capacity containing each seeds in order to maintain a continuous fresh supply of large number of insects required for the experimentation. Observations on number and percentage of damaged seed were recorded.

Results (Table 7.1.2.15 - 7.1.2.17)**:** Different plant oils *viz*., Neem oil, Citronella oil, Karanj oil and Clove oil were used against rice weevil, *Sitophilus oryzae* and pulse beetle, *Callosobruchus chinensis* of stored seeds of maize and blackgram. The use of different organic treatments proved significantly effective in reducing the stored insect pest infestation. Among all the treatments, use of neem oil @ 3% was found to be most effective in reducing the stored pest infestation in maize and blackgram. In maize, the damage percentage ranged from 11.53 to 80.63 due to rice weevil, *Sitophilus oryzae*; whereas, 9.52 to 70.49 in blackgram due to pulse beetle, *Callosobruchus chinensis*. The neem oil 3% was observed to be most effective with the minimum damage seed per cent 11.53%, followed by karanj oil 3% (11.78%), clove oil 3% (12.46%) and citronella oil 3% (16.48%) in against rice weevil in maize. Similarly, neem oil 3% was observed to be most effective with the minimum damaged seed per cent 9.52% followed by karanj oil 3% (10.09), clove oil 3% (10.24%) and citronella oil 3% (10.56%) against pulse beetle in blackgram.

Table 7.1.2.15: Efficacy of various plant oils against rice weevil, *Sitophilus Oryzae* of stored seeds of maize

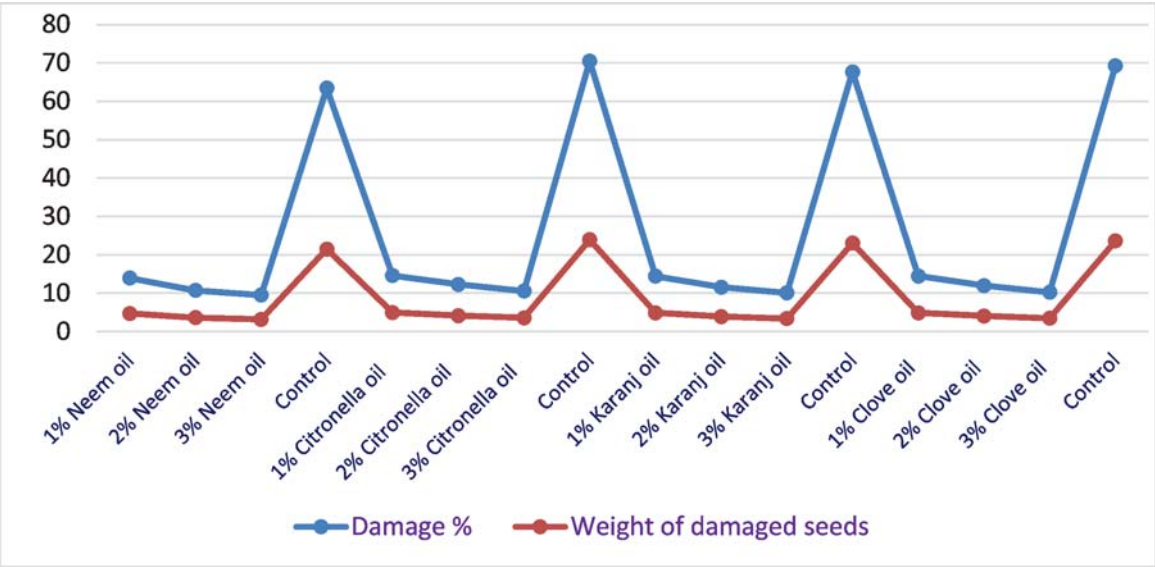
Treatments	Weight of 100 healthy seeds = 20-22 grams Weight of 100 damaged seeds = 13-14 grams			
	Total No. of Seeds in 50 grams	Damages Seeds	Damage %	Weight of damaged seeds
Neem oil 1%	318	48	15.09	6.72
Neem oil 2%	315	41	13.02	5.74
Neem oil 3%	295	34	11.53	4.76
Control	318	250	78.62	35.00
CD			5.34	0.88
Citronella oil 1%	318	62	19.50	8.68
Citronella oil 2%	309	54	17.48	7.56
Citronella oil 3%	352	58	16.48	8.12
Control	320	258	80.63	36.12
CD			4.15	1.26
Karanj oil 1%	315	54	17.14	7.56
Karanj oil 2%	308	48	15.58	6.72
Karanj oil 3%	314	37	11.78	5.18
Control	318	254	79.87	35.56
CD			3.77	1.16
Clove oil 1%	320	55	17.19	7.70
Clove oil 2%	307	48	15.64	6.72
Clove oil 3%	305	38	12.46	5.32
Control	328	220	67.07	30.80
CD			3.69	2.05



Efficacy of various plant oils against rice weevil, *Sitophilus oryzae* of stored seeds of maize

Table 7.1.2.9.16: Efficacy of various plant oils against pulse beetle, *Callosobruchus chinensis* of stored seeds of black gram

Treatments	Weight of 100 healthy seeds = 6.5 grams Weight of 100 damaged seeds = 2.5 grams			
	Total No. of Seeds in 50 grams	Damages Seeds	Damage %	Weight of damaged seeds
Neem oil 1%	1348	188	13.95	4.70
Neem oil 2%	1352	145	10.72	3.63
Neem oil 3%	1345	128	9.52	3.20
Control	1354	859	63.44	21.48
CD			2.56	1.01
Citronella oil 1%	1358	198	14.58	4.95
Citronella oil 2%	1342	165	12.30	4.13
Citronella oil 3%	1354	143	10.56	3.58
Control	1359	958	70.49	23.95
CD			5.71	1.02
Karanj oil 1%	1352	195	14.42	4.88
Karanj oil 2%	1348	156	11.57	3.90
Karanj oil 3%	1348	136	10.09	3.40
Control	1361	921	67.67	23.03
CD			5.22	1.10
Clove oil 1%	1349	195	14.46	4.88
Clove oil 2%	1354	162	11.96	4.05
Clove oil 3%	1358	139	10.24	3.48
Control	1365	945	69.23	23.63
CD			4.86	0.98



Efficacy of various plant oils against pulse beetle, *Callosobruchus chinensis* of stored seeds of blackgram

Table 7.1.2.17: Evaluation of organic management practices using plant oils for storage pests infesting maize and black gram during 2020-21

Name of the crop	Insect pest	Best performing treatment	Percent damage of seeds (%)
Maize	*Sitophilus oryzae*	Neem oil 3%	11.53
		Karanj oil 3%	11.78
		Clove oil 3%	12.46
		Citronella oil 3%	16.48
Black gram	*Callosobruchus chinensis*	Neem oil 3%	9.52
		Karanj oil 3%	10.09
		Clove oil 3%	10.24
		Citronella oil 3%	10.56

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

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 resuts

Narendrapur

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

A. Physico-chemical, biochemical, and molecular characterization of *Beejamrit* (Table 7.1.3.1)

Beejamrit is a microbial inoculant of plant beneficial bacteria that can be effectively used as a seed priming agent to improve germination and early seedling protection against pests and diseases (Mukherjee et al., 2022).

[*This part of the research has been published in the World Journal of Microbiology and Biotechnology and is available at https://doi.org/10.1007/s11274-022-03296-3*].

1.1. The gradual depletion of organic C in the *Beejamrit* solution after its incubation

In this study, we observed that the organic carbon (in percent value) in the *Beejamrit* solution undergoes gradual depletion over incubation (Table 1). It is also evident from this study that organic C depletion occurred more rapidly after 1-day of decomposition. In conclusion, we report an amazingly uniform decomposition pattern of organic carbon and protein residues in the *Beejamrit* solution.

1.2. Decomposition leads to pH changes in the *Beejamrit* solution

We next sought 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 (Table 1). The initial alkaline pH of the *Beejamrit* solution (8.51±0.03), 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.

1.3. Microbial population dynamics in *Beejamrit*

In this study, we observed that the overall bacterial population of the *Beejamrit* input did not increase considerably up to 2-days of initial decomposition (Table 2). 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 (Table 2). 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.

1.4. *Beejamrit* is a potential source of plant beneficial bacteria

This study reveals that the population of free-living nitrogen fixers (FNFs) gradually grows over days of decomposition (Table 2). We also sought to study phosphate-solubilizing bacteria (PSB) to elucidate their potential role in phosphorus availability to crop plants. Together, our results showed a dynamic structure of plant beneficial bacterial niches in the *Beejamrit* formulation.

Table 7.1.3.1: Physico-chemical parameters of *Beejamrit* after different incubation period

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
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

Note: Data are means ± standard errors of mean

Table 7.1.3.2: Microbiological parameters of *Beejamrit* after different incubation period

Parameters (CFU/ml)	*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
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 actinomy-cetes (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

B. Physico-chemical, biochemical, and molecular characterization of *Jeevamrit*

Jeevamrit is a fermented microbial inoculum derived from cattle excreta and forest soils. There are two types of *Jeevamrit* commonly popular in India: '*Dhrava Jeevamrit*' is the liquid-based formulation applied as a foliar spray or soil drenching; the dried form, on the other hand, prepared for storage and soil application is termed as '*Ghana Jeevamrit*' (Smith et al., 2020).

[*This part of the research has been communicated to the Indian Journal of Agricultural Sciences (IJAS) and is under review for publication*].

1.1. Decomposition of organic materials leads to gradual depletion of organic C in *Jeevamrit* (Tables 7.1.3.3 and 7.1.3.4).

In this study, we 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 Taken together, we report the decomposition of *Dhrava Jeevamrit* and the *Ghana Jeevamrit* upon days of incubation, and the rate of decomposition is observed to be more rapid during the first 2-days of incubation.

1.2. Detailed nutrient analyses revealed that *Dhrava Jeevamrit* and *Ghana Jeevamrit* have low plant-available N, P, and K content (Tables 7.1.3.3 and 7.1.3.4).

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. Together, we report that the plant-available N content (e.g., NH_4^+-N) of *Dhrava Jeevamrit* and *Ghana Jeevamrit* is in the range of 0.002-to-0.009 percent and 0.7-to-0.9 percent, respectively.

It was reported 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. Taken together, this study concludes that the *Dhrava Jeevamrit* and the *Ghana Jeevamrit* have an exceedingly low P_2O_5 in the range of 0.002-to-0.004 percent and 0.04-to-0.05 percent, respectively.

In this study, 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 *Dhrava Jeevamrit*, K_2O content has decreased slightly in concentration. On the other hand, K_2O concentration was found to be the highest in the *Ghana Jeevamrit* samples after 2-days of decomposition. We observed that the available K content of *Dhrava Jeevamrit* and *Ghana Jeevamrit* ranges from 0.0004-to-0.0009 percent and 0.7-to-0.9 percent, respectively.

1.3. Microbial population dynamics in the *Jeevamrit* and the *Ghana Jeevamrit* inputs (Table 7.1.3.5 and 7.1.3.6)

We observed that the bacterial population changed significantly over the course of the incubation period in the *Dhrava Jeevamrit* and the *Ghana Jeevamrit* samples 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). 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 (Tables 2A and 2B). On the other hand, the fungal population of *Dhrava Jeevamrit* does not change considerably over the course of incubation surprisingly, the fungal population in the *Ghana Jeevamrit* samples has shown a significant decline over the course of incubation.

1.4. *Dhrava Jeevamrit* and *Ghana Jeevamrit* are rich sources of plant-beneficial bacteria (Table 7.1.3.5 and 7.1.3.6)

Plant beneficial bacteria consist of free-living nitrogen-fixers (FNFs), phosphate-solubilizing bacteria (PSB), potassium-solubilizing bacteria (KSB), and IAA producers. It revealed that the population of FNFs increases significantly over time as the decomposition process progresses (Tables 2A and 2B). On the other hand, we found that there was no significant change in the PSB count in the *Dhrava Jeevamrit* samples. However, a gradual rise in the PSB population was reported in the case of *Ghana Jeevamrit* samples. We also found that the KSB population in the *Dhrava Jeevamrit* and the *Ghana Jeevamrit* samples showed significant changes over the incubation period, and the counts reached their highest after 2-days of incubation Taken together, we conclude that *Dhrava Jeevamrit* and *Ghana Jeevamrit* are excellent sources of plant-beneficial bacteria, particularly after 2-days of incubation.

Table 7.1.3.3: Physico-chemical parameters of *Dhrava Jeevamrit* after different incubation period

Parameters	*Dhrava Jeevamrit* Desi (D)				*Dhrava Jeevamrit* HF				*Dhrava Jeevamrit* 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
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)	1097.8± 3.9	1083.3± 4.8	1194.6± 5.0	1055.4± 8.6	709.5± 4.7	712.5± 22.8	786.3± 34.4	717.6± 9.2	829.9± 9.6	904.0± 7.4	926.5± 5.3	861.1± 8.2

Table 7.1.3.4: Physico-chemical parameters of *Ghana Jeevamrit* after different incubation period

Parameters	*Ghana Jeevamrit* Desi (D)				*Ghana Jeevamrit* HF				*Ghana Jeevamrit* 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
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± 0.05	3.36± 0.05	3.19± 0.06	3.13± 0.14	3.13± 0.15	2.92± 0.12	2.88± 0.15	2.68± 0.08	3.27± 0.05	3.23± 0.17	2.95± 0.08	2.82± 0.08
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 ±0.3	170.00 ±1.0	164.33 ±1.3	163.17 ± 0.4	103.42 ± 2.7	110.67 ±1.3	109.33 ±1.4	106.08 ±0.8	124.83 ±5.3	129.83 ±4.8	132.17 ±3.3	122.83 ±2.0
Available K (PPM)	2161± 30	2431± 45	2073± 13	1911± 31	1399± 125	1543± 41	1630± 30	1263± 19	1853± 3	1928± 26	1998± 3	1764± 12

Table 7.1.3.5: Microbiological parameters of *Dhrava Jeevamrit* after different incubation period

Parameters (CFU per ml)	*Dhrava Jeevamrit* Desi (D)				*Dhrava Jeevamrit* HF				*Dhrava Jeevamrit* 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
Total bacteria (10^{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 fungus(10^5)	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 actinomy-cetes (10^{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 (10^{10})	1.10± 0.11	122± 33.13	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 (10^5)	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

Table 7.1.3.6: Microbiological parameters of *Ghana Jeevamrit* after different incubation period

Parameters (CFU per g)	*Ghana Jeevamrit* Desi (D)				*Ghana Jeevamrit* HF				*Ghana Jeevamrit* 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
Total bacteria (10^{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 fungus (10^5)	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 actino-mycetes (10^{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 (10^{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± .58	013.90± 0.17	43.93± 1.68	15.47± 0.50
Total PSB (10^{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

Ludhiana

Characterization of inputs (Jeevamrit, Ghanjeevamrit)

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		

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

Microbial properties

In genral, population of bacteria was more in NF inputs prepared from HF cow (Table 5.1). In jeevamrit, bacterial and fungi population was highest under HF treatment after one and two days of preparation. There was 25 – 31.6 per cent increase in bacterial population and 80 – 87 per cent increase in fungi population two days after preparation than first day.

Chemical properties

In genral, value of pH, EC and OC was more in NF inputs prepared from HF cow (Table 5.2). In jeevamrit, pH was highest under HF treatment after 24, 48 and 96 hours of preparation. EC was higher in NF inputs prepared from Desi + HF. Available Nitrogen (0.34 %) was higher in higher in NF inputs prepared from Desi + HF 96 hours after preparation whereas available Phosphorous (0.018 %) was higher in NF inputs prepared from Desi cow 24 hours after preparation.

Biochemical properties

In biochemical analysis, carbohydrates, total soluble protein and free fatty acids were analyzed. Value of carbohydrates were higher (3.6 %) in NF inputs prepared from Desi + HF 96 hours after preparation. Total soluble protein were highest NF inputs prepared from Desi cow at the time of preparation. free fatty acid were higher (2.36 %) in NF inputs prepared from Desi + HF 96 hours after preparation

Table 5.1 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	130	8	1
	2	190	1	1
HF cow	1	150	10	1
	2	200	2	1
Desi + HF cow	1	130	9	1
	2	180	2	1

CFU stands for colony forming units

Table 5.2. 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	7.88	0.15	0.38	0.005	0.018	0.009
	48	7.21	0.34	0.24	0.0088	0.004	0.0037
	96	7.22	0.44	0.21	0.0006	0.0007	0.0006
HF cow	24	8.14	0.14	0.37	0.006	0.017	0.010
	48	8.14	0.38	0.24	0.0090	0.004	0.0026
	96	8.18	0.43	0.20	0.0005	0.0004	0.0006
Desi + HF	24	7.71	0.16	0.38	0.004	0.015	0.009
	48	7.96	0.36	0.25	0.0087	0.006	0.0075
	96	7.98	0.46	0.20	0.34	0.0006	0.0007

Table 5.3. 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	2.1	1.75	1.1	1.5	1.01	0.61	0.30	1.1	2.5
HF cow	3.05	2.43	1.54	1.1	0.86	0.50	0.20	1.6	2.08
Desi + HF cow	3.6	1.9	1.18	1.2	1.09	0.67	0.20	1.8	2.36

GHANJEEVAMRIT

Microbial properties

In general, population of bacteria was more in NF inputs 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 14.4 – 16.6 per cent increase in bacterial population and 50 – 66.6 per cent increase in fungi population two days after preparation than first day.

Chemical properties

In general, value of pH, EC and OC was more in NF inputs prepared from desi cow (Table 5.5). In jeevamrit, pH was highest under desi cow treatment after 24, 48 and 96 hours of preparation. EC was higher in NF inputs prepared from Desi + HF.

Available Nitrogen (0.10 %) was higher in higher in NF inputs prepared from Desi + HF 24 hours after preparation whereas available Phosphorous (0.156 %) was higher in NF inputs prepared from HF cow 24 hours after preparation.

Biochemical properties

In biochemical analysis, carbohydrates, total soluble protein and free fatty acids were analyzed. Value of carbohydrates were higher (18.8 %) in NF inputs prepared from Desi + HF at the time of preparation. total soluble protein were highest NF inputs prepared from HF cow at the time of preparation. free fatty acid were higher (6.04 %) in NF inputs prepared from Desi + HF 96 hours after preparation

Table 5.4. 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	45	2	1
	2	60	1	1
HF cow	1	60	3	1
	2	70	1	1
Desi + HF	1	50	2	1
	2	60	1	1

CFU stands for colony forming units

Table 5.5. 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	6.87	2.15	7.4	0.10	0.15	0.008
	48	6.89	2.27	7.4	0.018	0.02	0.04
	96	6.90	2.23	7.3	0.0014	0.0015	0.0005
HF cow	24	6.23	2.47	7.8	0.009	0.156	0.008
	48	6.34	2.44	7.7	0.017	0.02	0.05
	96	6.36	2.47	7.6	0.0015	0.0014	0.006
Desi + HF cow	24	6.50	2.80	7.3	0.0089	0.157	0.007
	48	6.52	2.56	7.08	0.018	0.01	0.06
	96	6.38	2.58	7.11	0.0014	0.0014	0.007

Table 5.6. 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	14.4	11.23	9.85	13.2	9.48	7.21	1.54	3.62	4.18
HF cow	13.05	10.56	8.6	17.62	11.07	9.5	1.99	4.13	5.83
Desi + HF cow	18.8	12.5	7.25	16.42	10.95	8.8	2.69	4.62	6.04

Coimbatore

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

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

Parameters	Beejamirth	Jeevamirth	Ghanajeevamrith
pH	7.08	5.01	7.20
EC (d S m^{-1})	8.26	2.32	2.68
Organic Carbon (%)	0.93	1.53	17.29
Total Nitrogen (%)	2.38	0.90	2.00
Total Phosphorous (%)	0.13	0.15	0.46
Total Potassium (%)	0.49	0.35	0.10
Sodium (%)	0.02	0.05	0.15
Calcium (mg/l / mg/kg)	549	100	132
Magnesium (mg/l)	12.00	54.2	61.75
Sulphate (mg/l)	0.12	245	112
Copper (mg/l)	0.03	BDL	0.13
Manganese (mg/l)	0.08	1.11	2.03
Zinc (mg/l)	0.66	0.81	0.99
Iron (mg/l)	1.23	2.00	34.30

Compound name and activity of Beejamrit

Compound name (Fatty Acid)	Activity of compound
Pinocembrin	Antimicrobial, antifungal
4-tert-butylcalix[4]axene	Herbicidal
Mevastatin, gitoxigenin	Bioconversion, repellents
Columbianetin, lomatin	Increases seed longevity
Dibutoxyanthracine	Pesticidal
Enterolactone	Antimicrobial
Prednacinolone	Insecticidal
Ubiquinol, dupical	Antioxidant property
4-methoxychalcone, cicloprofen	Antibacterial coating
Macrocyclon	Antimicrobial
Erioflorin, nagilactone a	Plant growth regulators and herbicidal
Trimegestone	Antibiotic
Rofe coxib	Antibiotic
Clupanodonic acid	Plant defense
Eldecalcifol	Insecticidal
Petrosaspongiolide m, hyatolide a	Lipid signaling path way
Catalpol	Plant defense
Benzoic acid, 2-ethyl hexanediol diester	Defense response

Compound name and activity of Jeevamrit

Compound name (Fatty Acid)	Activity of compound
Diffractaic acid	Antifungal, secondary metabolites
Retinoic acid	Herbicidal
D-Glucoheptose	Antimicrobial
Benzoic acid, methyl ester	Herbicidal
Carboxybenzene	Fungistatic compound
Daphnin (daphnetin-7-O-glucoside)	Antibacterial activity
Columbianetin, lomatin	Increases seed longevity
Retinoic acid, methyl ester	Herbicidal
1,4-Cyclohexanediol	Insect repellent
Benzoic acid	Inhibits bacteria
Linoleic acid	Activates peroxisome
2-hydroxygarvin B	Anti-fungal
Trimethylbenzene	Component of herbicides
á-Selinene	Insecticidal and Antifungal
Pseudolimonene	Insecticidal
9 - propyl - anthracene	Insecticidal
ar-turmerone	Insecticide and antimicrobial
Stigmasterol	Growth promoter , Salt stress tolerance
Benzoic acid, 2-ethyl hexanediol diester	Defense response

Compound name and activity of Ghanajeevamrit

Compound name	Role / activity
Octadecane, 1-(ethenyloxy)-	Bioactive compound / free radical producers
2,5-cyclohexadien-1-one, 2,6-bis(1,1-dimethylethyl)-4-hydroxy-4- methyl-	Antimicrobial activity
Pergolide	Antimicrobial activity
5-tert-Butylpyrogallol	Anti-inflammation, detoxification in plants
Hexobarbital	Secondary metabolite
Benzothiazole, 2-methylmercapto metabolite	Aryl hydrocarbon receptor agonist and a xenobiotic
Butylated Hydroxytoluene	Inhibits autoxidation of unsaturated organic compounds
Phenol,4,6-di(1,1-dimethylethyl)-2-methyl	Antimicrobial activity
Phlorobutyrophenone	Biphasic effect / plant metabolites / enzyme inhibitors
Thiophene, 2-butyl-5-(2-methylpropyl)-	Nutrient transporters to the plants
Ethanol, 2-(9-octadecenyloxy)-, (Z)-	Antimicrobial activity
2-Pentadecanone, 6,10,14-trimethyl-	Mediating plant-insect interactions
n-Hexadecanoic acid	Fatty acid / plant metabolite
Ascorbic acid 2,6-dihexadecanoate	Major redox buffer and as a cofactor for enzymes

Compound name	Role / activity
Cyclopropanebutanoic acid, 2-[[2-[[2-[(2-pentylcyclopropyl) methyl]cyclopropyl]methyl]cyclopropyl] methyl]-, methyl ester	Involves in the biosynthesis of fatty acids / phylogenic character
2-Cyclopenten-1-one, 3,4-dihydroxy-5-(3-methyl-2-butenyl)-2-(3-methyl-1-oxobutyl)-4-(4-methyl-1-oxo-3-pentenyl)	Non-polar solvent / potential migration in soil or water
Phenanthrene, 9-dodecyltetradecahydro-	Phyto-degrader and inhibit plant contaminants like PAH
4,8,12,16-Tetramethylheptadecan-4-olide	Anti-fungal / antimicrobial activity
Androst-4-ene-3,6,17-trione	Interconnection of Plants with Soil Microbes
Stigmasterol membrane and increases flower numbers	Involve in cell proliferation and activation of plasma
Ergost-25-ene-3,5,6-triol, (3á,5à,6á)-	Antifungal property
17-Pentatriacontene nutrients in plants	Supply nutrients to plants / increase bioavailability of
Tetradecylphosphonate promoting rhizobacteria in the soil rhizosphere	Improve resistance to abiotic stress and growth
Diisooctyl phthalate	Plant decontaminants activity
Cyclohexane, 1,1'-dodecylidenebis [4-methyl-	Non polar solvent / antifungal property

Compound name and activity of Agniasthra

Compound name	Role / activity
Octadecane, 1-(ethenyloxy)-	Bioactive compound / free radical producers
2,5-cyclohexadien-1-one, 2,6-bis(1,1-dimethylethyl)-4-hydroxy-4- methyl-	Antimicrobial activity
Pergolide	Antimicrobial activity
5-tert-Butylpyrogallol	Anti-inflammation, detoxification in plants
Hexobarbital	Secondary metabolite
Benzothiazole, 2-methylmercapto metabolite	Aryl hydrocarbon receptor agonist and a xenobiotic
Butylated Hydroxytoluene	Inhibits autoxidation of unsaturated organic compounds
Phenol,4,6-di(1,1-dimethylethyl)-2-methyl	Antimicrobial activity
Phlorobutyrophenone	Biphasic effect / plant metabolites / enzyme inhibitors
Thiophene, 2-butyl-5-(2-methylpropyl)-	Nutrient transporters to the plants
Ethanol, 2-(9-octadecenyloxy)-, (Z)-	Antimicrobial activity
2-Pentadecanone, 6,10,14-trimethyl-	Mediating plant-insect interactions
n-Hexadecanoic acid	Fatty acid / plant metabolite
Ascorbic acid 2,6-dihexadecanoate	Major redox buffer and as a cofactor for enzymes
Cyclopropanebutanoic acid, 2-[[2-[[2-[(2-pentylcyclopropyl) methyl]cyclopropyl]methyl]cyclopropyl] methyl]-, methyl ester	Involves in the biosynthesis of fatty acids / phylogenic character
2-Cyclopenten-1-one, 3,4-dihydroxy-5-(3-methyl-2-butenyl) -2-(3-methyl-1-oxobutyl)-4-(4-methyl-1-oxo-3-pentenyl)	Non-polar solvent / potential migration in soil or water

Compound name	Role / activity
Phenanthrene, 9-dodecyltetradecahydro-	Phyto-degrader and inhibit plant contaminants like PAH
4,8,12,16-Tetramethylheptadecan-4-olide	Anti-fungal / antimicrobial activity
Androst-4-ene-3,6,17-trione	Interconnection of Plants with Soil Microbes
Stigmasterol	Involve in cell proliferation and activation of plasma
membrane and increases flower numbers	
Ergost-25-ene-3,5,6-triol, (3á,5à,6á)-	Antifungal property
17-Pentatriacontene	Supply nutrients to plants / increase bioavailability of
nutrients in plants	
Tetradecylphosphonate	Improve resistance to abiotic stress and growth
promoting rhizobacteria in the soil rhizosphere	
Diisooctyl phthalate	Plant decontaminants activity
Cyclohexane, 1,1'-dodecylidenebis [4-methyl-	Non polar solvent / antifungal property

Compound name and activity of Agniasthra

Compound name	Role / activity
Undecane	Sex attractant for various types of moths and cockroaches, and an alert signal for a variety of ants.
Pyridine, 3-(1-methyl-2-pyrrolidinyl)-, (S)-	Active alkaloid / nitrogen-containing chemical compounds
1-Cyclohexanol, 2-(3-methyl-1,3-butadienyl)-1,3,3-trimethyl-	ferric-molybdate catalyst yields / governing the peroxide reaction process
2-Nonenal, 2-pentyl	Addition of traces to ionones and methyl ionones lends power and diffusion.
2-Diethylamino-4-phenylthiooct-2-ene nitrile	Plant protection agent
Quinoxalin-2-one, decahydro-3-(3,3-dimethyl - 2-oxobutenylideno	Growth hormones may play important role such as increase in height of plant, number, etc
2-Pentadecanone, 6,10,14-trimethyl-	Non-fatty acid compound, biological pest control
Pentadecanoic acid, 13-methyl-, methyl ester 538 607	Plant metabolite
n-Hexadecanoic acid	Plant lipid / saturated fatty acid
Ascorbic acid 2,6-dihexadecanoate	Major redox buffer and as a cofactor for enzymes
Phorbol	Activator of protein kinase C, which regulates different signal transduction pathways and other cellular metabolic activities.
Stigmastanol	biosynthesis of plant cell membranes and anti-angiogenic and anti-cancer effects
Bufa-20,22-dienolide, 14,15-epoxy-3,16-dihydroxy-	Arthropod source were identified
Propanoic acid, 2-(3-acetoxy-4,4,14-trimethylandrost-8-en-17-yl)-	Propionic acid is a common intermediate product, which is formed by fermentation with propionic acid bacteria.
2,6,9,12,16-Pentamethylheptadeca-2,6,11,15-tetraene-9-carboxylic acid	Plant regulator
Minocycline	Antibiotic activity / antibacterial property
Squalene	Secondary metabolites such as sterols, hormones, or vitamins. It is a carbon source in the aerobic and anaerobic fermentation of microorganisms
Oleanolic acid	Anti-oxidant and anti-inflammatory properties
Gamabufotalin	Antiviral property

Compound name and activity of Brahmasthra

Compound name	Role / activity
1,5-Dibenzoyl-2-deoxy-ribofuranose	Antiviral property
9-Octadecenoic acid (Z)-, hexyl ester	Plant defense response against pathogens
Cyclo propanecarboxaldehyde, 2-methyl-2-(4-methyl-3-pentenyl)-, trans- (+-)	Plant growth and development
n-Decanoic acid	Antibacterial agent
Methyl 6-methyloctanoate	Plant metabolite
Pyridine, 3-(1-methyl-2-pyrrolidinyl)-, (S)-	Plant alkaloid and Antibacterial activity
Benzeneethanol, 4-hydroxy-	Plant metabolite and derivatives of yeast
Diethyl selenide	Plant metabolite and use in phytoremediation
Dasycarpidan-8(16H)-ethanol, 3, 18-didehydro-1-(hydroxymethyl)-, (2.xi., 4.xi.)	Plant growth development, reproduction and disease management
Tertbutyloxyformamide, N-methyl-N-[4-(1-pyrrolidinyl)-2-butynyl]-	Antibiotic compound and Insecticidal activity
2,6-Dimethylphenyl isocyanate	Increase the plant yield
Hexathiane	Anti-inflammatory agent and Medicinal property
Methyl 10,12-octadecadiynoate	Plant metabolite and bioactive compound
Formamide, (2-acetylphenyl)-	Against disease management
Widdrol hydroxyether	Phenolic acids in plants and in disease management
2-Cyclohexen-1-one, 4-(3-hydroxybutyl)-3,5,5-trimethyl-	Antimicrobial and antioxidant property
2-Heptanone, 6-(3-acetyl-1-cyclopropen-1-yl)-3-hydroxy-6-methyl-	Anaesthetic on the pests and pheromone and a mouse metabolite
4-Nitrocinnamic acid	Antimicrobial activity
Serotonin	Growth regulator, and a stress defense molecule
5,6,6-Trimethyl-5-(3-oxobut-1-enyl)-1-oxaspiro[2.5] octan-4-one	Antifungal activity
2-Pentanone, 4-(1,3,3-trimethyl-7-oxabicyclo[4.1.0] hept-2-yl)-	Secondary metabolites of plants are an alternative for the treatment of diseases
4-(2,6,6-Trimethyl-cyclohex-1-enyl)-butyric acid	Involves plant development
9,9'-Biphenanthrene, octacosahydro	Involve in phyto-remediation
cis-Vaccenic acid	Unsaturated fatty acids
Cyclohexane, 1,4-dimethyl-2-octadecyl-	involve in phyto-remediation
(R)-9-(2,3-Dihydroxy-3-methylbutoxy)-4-methoxy-7H-furo (3,2- g)(1)benzopyran-7-one	Natural coumarin compound
Dimethoxycurcumin	Natural plant derived product, antiviral property
Tetradecylphosphonate	Plant biostimulant, resistance to plant diseases and plant stimulant
Piperine	Plant secondary metabolite termed as alkaloids
3,4'-Dimethoxy-5,7,3'-trihydroxyflavone	Plant metabolite and resistant against diseases and anti-viral property
Lupulon	Plant metabolite, Antimicrobial agent and antibiotic property and inhibit bacterial growth

Udaipur

Bio-chemical characterization of Jeevamrit, Beejamrit and Ghanjeevamrit at Udaipur

Parameters	Jeevamrit Units	Beejamrit Units	Ghanjeevamrit Units
pH	3.90-4.10	8.20-8.25	5.35-5.50
EC (dS/m)	1.60-1.76	5.50-5.60	0.75-0.90
N (%)	1.04-1.22	1.10-1.48	2.30-2.70
P (%)	0.190-0.201	0.127-0.132	0.300-0.330
K (%)	0.200-0.291	0.485-0.492	0.360-0.395
Bacterial count (cfu/ml)	5.30×10^8 - 7.25×10^8	4.32×10^8 – 5.44 x 108	27.8×10^8 – 30.5×10^8
Fungal count (cfu/ml)	4.15×10^4 – 5.85×10^4	0.61×10^5 -0.84 X 10^5	4.50×10^4 – 6.50×10^4
Actinomycetes count (cfu/ml)	2.35×10^5 – 3.70×10^5	0.53×10^5 -0.71 X 10^5	3.25×10^5 – 5.0×10^5
Acid phosphatase (µg/ml)	0.74-1.25	0.84-3.79	80.23-84.66
Alkaline phosphatase (µg/ml)	0.87-3.79	1.97-4.33	11.47-15.42
Dehydrogenase (TPF µg/ml)	0.94-4.47	0.09-3.97	117.11-121.63

Programme 2: Development and Validation of Scientific Package of Practices for Organic and Natural Farming

7.2..1 Evaluation of organic, inorganic and 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	1. 100% Organic (Organic manures equivalent to 100 % N requirement of the system)
		2. 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)	3. 100% inorganic management (No organic manures)
		4. State recommendation or farmers package (Choice to centres)
	Integrated crop management	5. 50% Organic + 50% Inorganic nutrients and management
		6. 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 Plots	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	0.25	0.78
	FYM	0.97	0.26	0.92
	Jeevamrit	0.70	0.28	0.32
	Ghanajeevamrit	0.84	0.18	0.32
	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
Calicut	Farm Yard Manure	0.75	1.0	0.55

Centre	Nutrient Sources	NPK contents on dry weight basis (%)		
		N	P	K
	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	-	-	-
	Sesbania rostrata	-	-	-
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	
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		

Centre	Nutrient Sources	NPK contents on dry weight basis (%)		
		N	P	K
	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 integrated management practices on crop productivity system equivalent yield of different cropping systems (Table 1-3)

Bajaura: Among the crops evaluated in vegetable-based cropping systems for comparative efficiency of organic, inorganic and integrated management, the performance of al crops i.e. French bean, cauliflower, tomato, black gram and summer squash were found to be better under inorganic production system with state recommended package. In case of pea, it was increase 34.43 % under organic with 100% nutrient supplied through organic sources over inorganic. In terms of system equivalent yield (cauliflower equivalent), fallow-cauliflower-tomato resulted in higher cauliflower equivalent yield (22667 kg/ha) among the cropping systems. Among different management practices, integrated management with 50% organic+50% inorganic dose of nutrients resulted in higher equivalent yield (22750 kg/ha) followed by application of 75% nutrients only through organic manures+ 25% nutrient supply through inorganic sources (21900 kg/ha). Cauliflower equivalent yield was increased to the tune of 32.88% under 100% organic compared as compared to 100% inorganic nutrient management.

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

Bhopal: Higher mean yield of soybean (460 kg/ha) was recorded under 100 % organic followed by integrated management practice with application of 50% organic nutrients +50% inorganic nutrients (422 kg/ha) followed by 100% inorganic management practice (362 kg/ha).The yield of soybean was found to be higher with 100% organic practice followed by integrated (50% organic +50 % inorganic) by 27.07 and 16.58% compared to inorganic package respectively. *Rabi* crops such as, wheat, mustard, chickpea and linseed also followed the same trends and recorded maximum yield under 100% organic of 4217, 1917, 1207 and 1988 kg/ha respectively and increased by 8.60, 11.64, 16.39, and 12.13% for *durum* wheat, mustard, chickpea and linseed respectively over inorganic. In terms of system equivalent yield (soybean equivalent), under 100% organic was found maximum (2634 kg/ha) followed by integrated management with 50 % organic and 50% inorganic (2511 kg/ha). The lowest soybean equivalent yield was found under Intergraded management with 25% organic +25% inorganic (1883 kg/ha). Among the cropping systems, soybean-linseed recorded higher soybean equivalent yield (2698 kg/ha) followed by soybean-mustard (2349 kg/ha).

Performance of soybean crop towards organic package

Performance of wheat crop under organic package

Performance of mustard crop under integrated package

Performance of chickpea crop under inorganic package

Calicut: Among the different management packages, organic package consisting of 100% nutrient supply through organic manure recorded higher yield of Ginger (13900 kg/ha) followed Organic with 50% organic sources + seed/seedling treatment with Beejamrit + application of Ghanjeevamrit @ 250kg/ha, Jeevamrit @ 500 litres /ha /time (11300 kg/ha). Whereas the highest yield of turmeric was recorded with integrated management with 25% organic +25% inorganic source + seed/ seedling treatment with Beejamrit + Ghanjeevamrit @ 250 kg/ha, Jeevamrit @ 500 litres /ha /time (31300 kg/ha) followed by 100% organic (29600 kg/ha). There is 5.7% difference was found in yield of turmeric among production system.

Ginger crop under organic package

Turmeric crop under organic package

Coimbatore: Among the management practices, crops brinjal, barnyard millet, tomato and finger millet recorded maximum yield under inorganic management practice with state recommendation of 21703, 1950, 25794 and 2856 kg/ha respectively. There is marginal reduction in yield of brinjal, barnyard millet, tomato and finger millet (7.79, 5.01, 38.60 and 5.19% respectively) with organic compared to inorganic. Chilli and pearl millet (12991 and 2226 kg/ha respectively) registered higher yield towards organic under integrated management practice either with 50:50% each organic +inorganic nutrient. The yield was increased significantly by 16.73 and 32.17% over inorganic while 7.48 and 15.60 was increased over organic respectively.

Brijal

Pearl millet

Chilli

Barnyard millet

Tomato

Finger millet

Dharwad: Crops such as 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, significantly higher pigeon pea seed equivalent yield was recorded under inorganic management package with state recommendation package (1637 kg/ha) in pigeon pea+ groundnut inter cropping system and closely followed by 100% organic treatment (1673 kg/ha).

Jabalpur: Basmati rice based cropping systems with wheat (*durum*), chickpea, maize (fodder), berseem (seed and fodder), vegetable pea and sorghum (fodder) was evaluated. Mean grain yield of basmati rice in *kharif* and yield of other crops during *rabi* and summer as influenced by different nutrient management was recorded higher with inorganic production system. The reduction in mean grain yield of basmati rice with organic was recorded to the tune of 18.56% compared to inorganic. The reduction in the yield of wheat, chickpea, and vegetable pea was also found by 64.32, 40.76 and 8.96 % as compared to inorganic production package. Total mean productivity of cropping system in terms of basmati rice equivalent was recorded higher with 100% organic nutrient management (10173 kg/ha) followed by inorganic (9577 kg/ha) among the production packages. Among crop-sequences, basmati rice- berseem (seed and fodder) led to record maximum basmati rice equivalent yields (10037 kg/ha) followed by Basmati rice – vegetable pea–sorghum (fodder) of 9500 kg/ha.

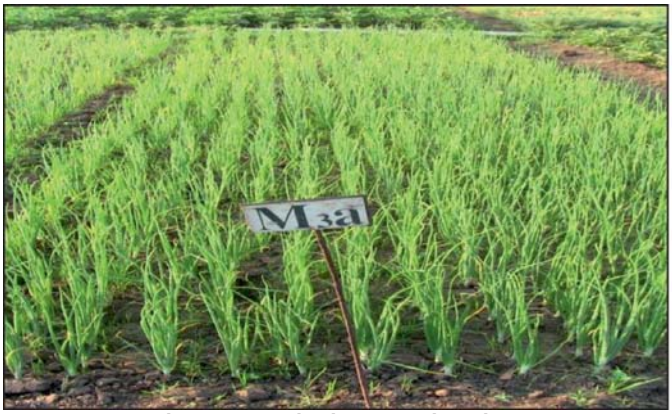
Best performing cropping Sequence (Basmati rice - Berseem)

Karjat: The rice-based cropping systems including vegetable crops were evaluated. Higher mean yield of rice (3195 kg/ha) was recorded with application of 50% each organic and inorganic nutrient under integrated package followed by inorganic package (3127 kg/ha). Chickpea, field bean and onion also resulted good yield with integrated package (50% each organic and inorganic nutrient) and found to be higher by 30.54, 4.23 and 20.30% over 100% inorganic respectively.

Brinjal resulted in higher yield with inorganic package (47341 kg/ha) followed by integrated and organic. Reduction in yield of brinjal with inorganic found to be 8.91% compared to integrated. System productivity in term of rice equivalent yield, rice-

Rice crop under integrated package

Brinjal crop under inorganic package



Onion crop under integrated package

Chickpea crop under integrated package

brinjal system produced maximum rice equivalent yield (43924 kg/ha) compared to other cropping systems. Among the management package, organic management with 100% nutrient supply through organic sources recorded 23.76 and 20.04% higher system productivity over inorganic and integrated package.

Ludhiana: Mean equivalent yield of wheat (9400 kg/ha) was recorded under integrated nutrient management with application of 50% each organic and inorganic nutrient followed by 100% organic (8950 kg/ha) whereas, soybean was recorded higher yield of 1140 kg/ha under organic package with application of 75% N equivalent by organic manure + innovative practice. Chickpea recorded maximum yield (1350 kg/ha) with 100% organic practices followed by integrated package (50% both organic and inorganic) (1300kg/ha). Among the cropping systems, the highest wheat equivalent yield was recorded with *Kharif* moong-wheat-summer moong of 11267 kg/ha.

Performance of Basmati rice, Soybean and chickpea under organic package at Ludhiana

Modipuram: Among the different crop management practices, highest yield of black rice (992 kg/ha), black gram (1150 kg/ha) was recorded under organic production package which was 151.1% higher over inorganic. The yield of finger millet, okra and tomato was recorded highest under inorganic package with state recommendation or farmer package i.e. 2531, 8650 and 14834 kg/ha, respectively while yield of barley (4120 kg/ha) was highest in integrated package with 50% of both organic and inorganic package. The per cent increase in yield of finger millet, okra and tomato under inorganic package with state recommendation or farmer package as compare to organic farming was found to be by 22.75, 11.61 and 36.92 %, respectively

Systems productivity among the various systems, black gram – tomato – sunhemp green manure recorded higher rice equivalent yield of 17258 kg/ha followed by okra – vegetable pea – *sesbania aculeata* green manure of 11293 kg/ha. Among the various production package, systems productivity was highest with 100% organic (11479 kg/ha).

Performance of Black rice, okra, cowpea, finger millet, barley and green manure under organic package

Pantnagar: Among the crops evaluated under basmati rice-based cropping systems, the performance of basmati rice, wheat, and mustard were found to be better under integrated production systems with 50% application of both organic and inorganic. Yield of basmati rice (mean yield 5343 kg /ha) during *kharif* was recorded 14.83% higher with integrated over inorganic while 1.31% over organic. During *rabi*, wheat and mustard recorded higher yield under integrated package (4774 kg/ha and 1636 kg/ha, respectively) and the yield difference between integrated and inorganic found to be significantly by 3.58 and 41.40%, respectively.

Coriander was raised as intercrop with vegetable pea in the manner of 4:2 ratio. Yield of main and intercrop converted into chickpea and vegetable pea equivalent. The highest yield of vegetable pea (6536+938 kg/ha) and potato (18974 kg/ha) was recorded with 100% organic management system. Tuber yield of potato under 100% organic is increase by 23.33 % over inorganic. System productivity in terms of basmati rice equivalent yield recorded higher in integrated package (9901 kg/ha) having 50% nutrients through organic manures and 50% nutrients through inorganic sources. SEY was increased by 18.33% over inorganic. Among all the cropping systems, higher system productivity was recorded with basmati rice-vegetable pea +coriander (10067 kg/ha) followed by basmati rice-potato (9416 kg/ha).

Performance of basmati rice and vegetable pea at Pantnagar

Raipur: Soybean based cropping systems were evaluated with maize (sweet corn), french bean, cabbage, and tomato under different package of practice. 100% organic production system resulted in higher soybean mean yield (2011 kg/ha). Other

crops such as maize (sweet corn), french bean, cabbage, and tomato (14641, 6682, 39281 and 54291 kg/ha, respectively) resulted higher yield under inorganic practices (state recommendation). Yield reduction in maize (sweet corn), french bean, cabbage, and tomato with organic was found to be 5.13, 4.80, 9.62 and 4.22 % respectively in compared to inorganic. The productivity of cropping system in term of soybean equivalent yield recorded higher under organic management practice (13131 kg/ha) and it was increased by 30.99% over inorganic. Soybean-tomato cropping system registered higher soybean equivalent yield (14958 kg/ha) followed by soybean-cabbage (10609 kg/ha).

Ranchi: Rice based cropping systems were evaluated wherein different crops such as wheat, onion, potato and okra were grown with basmati rice variety Birsamati. Organic management practice with 75% organic manure +innovative practice "*Azolla*") resulted in higher mean yield of rice (3703 kg/ha respectively).

Under organic production system with 75% organic manure +innovative practice "*Azolla*" the yield was increased by 36.03% respectively than inorganic. Other crops like onion and potato during *rabi* recorded higher yield with organic package. The yield of onion and potato was increased with organic to the tune of 9.87 and 105.76 % respectively over inorganic package. Wheat and okra recorded highest yield (2863 and 8868 kg/ha, respectively) under integrated package with application of 25% organic +25% inorganic source of nutrients + seed/seedling treatment with Beejamrit + application of Ghanjeevamrit @ 250 kg/ha, Jeevamrit @ 500 litres /ha /time. In case of systems equivalent yield, integrated package with application of 25% organic +25% inorganic source of nutrients + seed/seedling treatment with Beejamrit + application of Ghanjeevamrit @ 250 kg/ha, Jeevamrit @ 500 litres /ha /time found to be higher (12668 kg/ha) among the management practice. Among the cropping systems, rice-onion recorded highest rice equivalent yield (14855 kg/ha) followed by rice-onion (12224 kg/ha).

Rice-75% organic + innovative practices

Wheat under integrated package

Onion under organic

Potato under organic

Okra under 75% organic + 25% inorganic

Onion under 75% Organic + 25% inorganic

Performance of different crops at Ranchi

Umiam: Four vegetable-based cropping systems namely bhindi-carrot, bhindi -potato, bhindi –tomato and bhindi -french bean were grown. Among the management packages, 100% inorganic package recorded maximum mean bhindi yield 12110 kg/ha followed by 100% organic package (11290 kg/ha). Difference between inorganic and inorganic was only 7.26%.

The highest yield of carrot (16730 kg/ha) and french bean (14850 kg/ha) was recorded with 100% organic package followed by integrated management package with application of 50% both organic and inorganic package. However the yield of potato (19100 kg/ha) and tomato (6710 kg/ha) was recorded highest in integrated management package with application of 50% both organic and inorganic package.

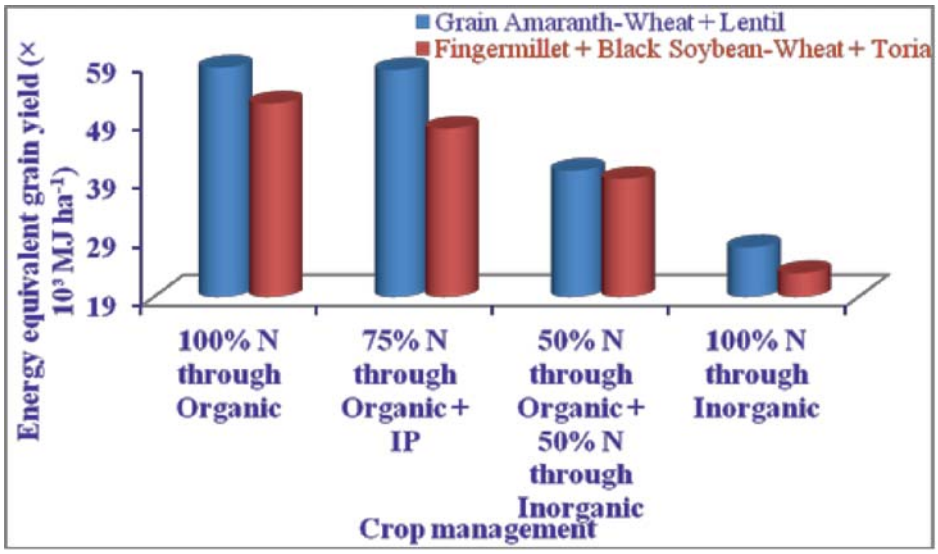
Different crops on raised and sunken beds at Umiam, Meghalaya

Ajmer: Cowpea based cropping system was evaluated (*Kharif)* was evaluated with cabbage intercropped with coriander and funnel (*rabi*). The performance of cowpea under all cropping system, coriander + cabbage, fennel + cabbage, fennel and coriander was found highest in inorganic package under state recommendation package followed by integrated management practice with application of 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. Among nutrient management practice, seed yield coriander + cabbage, fennel + cabbage, fennel and coriander under state recommendation were higher by 18.44, 16.10, 8.08 and 36.84 % respectively over 100% organic package.

Cowpea +maize **Coriander +cabbage** **Fennel +cabbage**

Performance of cowpea, intercrop maize, coriander and fennel crops at Ajmer

Almora: Different nutrient sources were evaluated for finger millet + black soybean (2:1 ratio – substitution of row)-wheat + toria (2:1 ratio) and grain amaranth-wheat + lentil (2:1 ratio) under rainfed system. Among crop management systems, organic management package with application of nutrient with 50% organic source + seed/seedling treatment with Beejamrit + application of Ghanjeevamrit @ 250kg/ha, Jeevamrit @ 500 litres /ha /time produced highest yield of grain amaranth (2071 kg/ha) finger millet grain (2898 kg/ha) and wheat +lentil (1596 kg/ha) and the increase over 100% inorganic was to the tune of 24.98, 65.03 and 113.1%, respectively. The highest grain yield of intercrop of Wheat + toria (1506 kg/ha) was recorded under 100% organic management package.



Energy equivalent grain yield in different crop management system at Almora

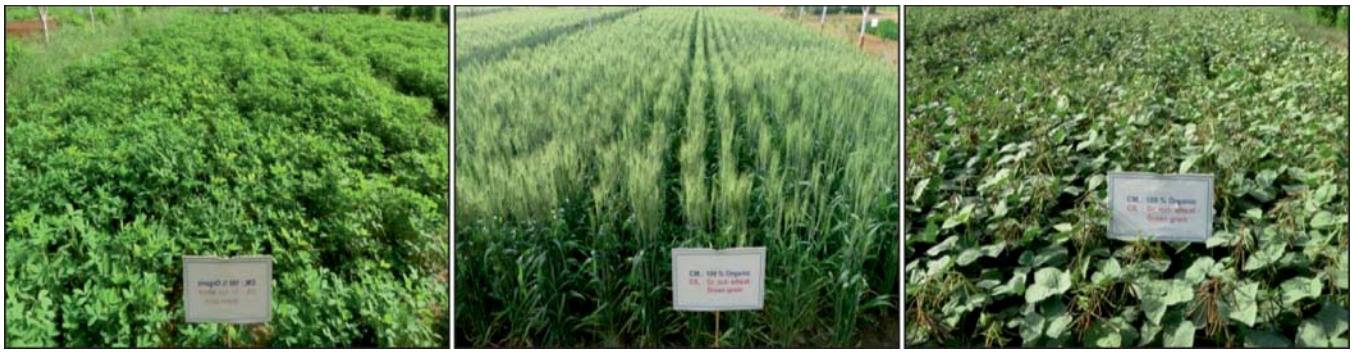
Gangtok: Among all the cropping systems, ginger, soybean, turmeric and black gram were taken as intercrop with maize in *pre kharif*. French bean, buckwheat raj mash and toria were grown in *rabi* season. Yield of maize with intercrops ginger, turmeric, soybean and black gram remarkably higher with organic package. Similarly, frenchbean, buckwheat and rajmash and toria were also recorded highest yield with organic (100% N equivalent though organics (25% FYM+25% VC+25% NK+25% MC).

Significant higher maize yield was recorded under 100 % organics package in maize- soybean- buckwheat cropping system and the maize equivalent yield was also highest under 100% organic management package 10220 kg/ha. Organic package resulted in 18.83% higher mean yield of maize as compared to inorganic. Likewise, ginger, soybean, turmeric and black gram gave 92.98, 114.6, 89.31 and 97.92% higher yield with organic over inorganic respectively. During *rabi* French bean, buckwheat, rajmash and toria recorded higher yield to the tune of 80.05, 65.33, 232.56 and 75.86% with organic over inorganic. The maize equivalent yield was recorded highest under Maize + ginger (1.1)- french Bean cropping sytem (10640 kg/ha).

Toria, rajmash and maize crop at gangtok

Narendrapur: Basmati rice (1873 kg/ha), broccoli (1362 kg/ha), mustard (1258 kg/ha) and sesame (1600 kg/ha) recorded highest yield under 100% organic management package. However yield of vegetable pea was highest under organic nutrient package consisting of 75% organic+25% innovative practices. Under integrated (50% organic+50% inorganic) management package french bean, and green gram recorded the highest yield. The per cent increase in yield of basmati rice under 100% organic and integrated (50% both organic and inorganic) is 5.76 and 8.45%, respectively over inorganic.

Sardarkrushinagar: The general performance of groundnut and green gram during *kharif*, wheat, coriander, and fennel during *rabi* and vegetable cowpea during summer was found to be better under inorganic with state recommendation. Organic practices in groundnut, wheat, green gram, coriander, fennel and vegetable cowpea recorded yield drop to the tune of 7.67, 12.40, 22.86, 9.2,10.84 and 10.14 % respectively over inorganic practice with state recommendation. System equivalent yield (ground nut equivalent) of 3911 kg/ha was recorded highest under organic with application of 100% organic input among the production package which is 34.82 % higher than inorganic. Among the cropping systems, ground nut-wheat-green gram resulted in higher ground nut equivalent yield of 4070 kg/ha which gave 3.99 and 115.12 % higher than green gram- coriander-vegetable cowpea and green gram-fennel- fennel continue system, respectively.



Best performing cropping system ground nut-wheat- green gram under 100% organic practice at SK Nagar

Thiruvananthapuram: Organic production package consisting of 75% organic + innovative practice found to be better for taro while integrated management package with application of 25% organic +25 % inorganic + innovative practice resulted in better yield of cassava. Tuber yield of cassava and taro was higher by 72.44 % & 138.56 % than inorganic. Likewise, vegetable cowpea and groundnut recorded maximum under organic with 75% organic + innovative practices whereas black gram recorded maximum yield (43 kg/ha) under organic practice. Tuber equivalent yield was found highest under organic production package with 75% organic + innovative practice (25433 kg/ha) followed by integrated management package with application of 25% organic +25 % inorganic + innovative practice (22073 kg/ha).

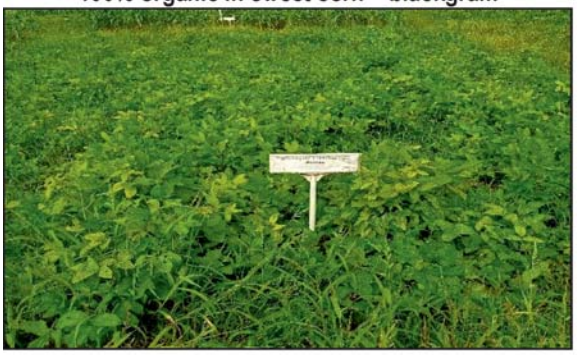
Cassava **Taro** **Vegetable cowpea**

Cassava-tuber **Taro** **Groundnut**

Udaipur: Yield of all crops in cropping systems as affected by organic, inorganic and integrated practices recorded higher with either by inorganic practices or state recommendation. Maize and sweet corn (2400 & 2610 kg/ha) with inter crop of black gram (225 and 230 kg/ha, respectively), sole black gram (500 kg/ha) and soybean (650 kg/ha) during *kharif* and wheat *durum* and *aestivum* (4150 & 4000 kg/ha) recorded maximum yield either in inorganic or in state recommendation practice. Total productivity among the management practices in term of maize equivalent yield, inorganic production system consisting state recommendation/farmers practice being the highest followed by organic package with 75% organic + innovative practice. Out of four cropping systems, maize + black gram (2:2)–wheat (*durum*)–*sesbania* (GM) cropping system gave maximum maize equivalent yield of 9066 kg/ha.

100% organic in sweet corn + blackgram

100% organic in maize + blackgram



Integrated (50% organic+ 50% inorganic) in soybean

Integrated (50% organic+50% inorganic) in blackgram

100% organic in *aestivum* wheat

100% organic in fenugreek

Effect of organic, inorganic and integrated systems on different *kharif* and *rabi* crops in maize-based cropping systems at Udaipur

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

Locations-/Systems	Organic Management (as per NPOP standards)						Inorganic Management						Integrated nutrient Management					
	[1]Organic (100%)			[2]Organic + NF			100% inorganic package (No organic manures)			State recommendations or farmers package			50% Organic + 50% Inorganic			[3]Towards Organic		
	Kharif	*Rabi*	*Summer*	*Kharif*	*Rabi*	*Summer*	*Kharif*	*Rabi*	*Summer*	*Kharif*	*Rabi*	*Summer*	*Kharif*	*Rabi*	*Summer*	*Kharif*	*Rabi*	*Summer*
Bajaura																		
Frenchbean-cauliflower-frenchbean	4570	8100	4680	4560	8440	4620	3880	4830	3710	4840	9940	4860	4420	9800	4550	4250	9650	4420
Fallow-cauliflower-tomato	-	8670	13130	-	8880	13590	-	5920	10250	-	11150	14310	-	10930	14190	-	10890	13960
Black gram-cauliflower-summer squash	520	6800	19630	540	7060	19200	400	4900	15070	610	8550	22450	590	8390	22080	570	7840	21460
Lady finger-pea	6680	6090	-	6840	6240	-	5620	4530	-	7510	8220	-	7380	7930	-	7070	7070	-
Bhopal																		
Soybean-durum wheat	477	4217		333	3527		388	3883		380	3977		421	4100		300	3320	
Soybean- mustard	462	1917		302	1440		350	1717		345	1627		437	1887		257	1373	
Soybean- chickpea	446	1207		309	898		363	1037		332	993		412	1123		286	809	
Soybean- linseed	456	1988		333	1577		347	1773		349	1723		419	1890		293	1490	
Mean	460			319			362			352			422			284		
Calicut																		
Ginger-Fallow	127100			11300			8830						9210			10590		
Turmeric-Fallow	29600			28700			26100						27900			31300		
Coimbatore																		
Brinjal - pearl millet-green manure (dhaincha) -	20134	2071		18074	1948		17221	1907		21703	2155		18565	2226		18497	2022	
Chillies - barnyard miller-green manure (dhaincha)	11238	1875		10747	1764		9829	1546		11471	1950		12991	1802		11994	1629	
Tomato -finger millet-Green manure (dhaincha)	18611	2715		23943	2685		17708	2354		25794	2856		18534	2792		19896	2430	
Dharwad																		
Pigeonpea +greengram (2:4) intercropping system	1054 +78			1087 +55			876 +40			1095 +75			885 +31			926 +52		
Pigeonpea +soybean (2:4) intercropping system	467 +545			386 +467			375 +455			445 +678			375 +505			389 +527		
Pigeonpea +groundnut (2:4) intercropping system	898 +775			875 +716			865 +679			942 +695			874 +487			835 +449		

Locations-/Systems	Organic Management (as per NPOP standards)						Inorganic Management						Integrated nutrient Management					
	[1]Organic (100%)			[2]Organic + NF			100% inorganic package (No organic manures)			State recommendations or farmers package			50% Organic + 50% Inorganic			[3]Towards Organic		
	Kharif	*Rabi*	*Summer*	*Kharif*	*Rabi*	*Summer*	*Kharif*	*Rabi*	*Summer*	*Kharif*	*Rabi*	*Summer*	*Kharif*	*Rabi*	*Summer*	*Kharif*	*Rabi*	*Summer*
Cotton +greengram (1:1) intercropping system	765+ 168			672+ 143			667 +143			899 +123			832 +117			747+ 164		
Cotton +soybean (1:1) intercropping system	697+ 387			645+ 324			626 +325			745 +443			721 +318			695+ 337		
Jabalpur																		
Basmati rice – durum wheat-green manure	4409	2329		4118	2150		5033	3827		2870	1872		4742	2741		4014	2558	
Basmati rice – chickpea - maize fodder	4201	1060	24835	3640	977	24294	4971	1492	26145	2995	956	23379	4315	1393	25646	3972	1352	24502
Basmati rice – berseem (fodder and seed)	4409	59072	178	3993	59904	236	5283	69056	186	2932	57200	211	4388	65104	140	4243	64064	220
Basmati rice – vegetable pea-sorghum (fodder)	4347	4800	28246	3910	4380	27601	5304	5230	29411	3161	4120	27268	4451	4985	28891	4388	4676	28537
Mean	4342			3915			5148			2990			4474			4154		
Karjat																		
Rice-brinjal	3428	42874		3172	38809		3405	47925		2758	33800		3444	44005		2875	42469	
Rice-chickpea	2688	1077		2495	887		2774	907		2360	750		2758	1184		2586	1161	
Rice-field bean	3070	960		2722	810		3095	923		2678	767		3170	962		2841	866	
Rice- onion (white)	3222	14907		3077	9853		3234	13207		2822	9702		3409	15888		2941	11597	
Mean	3102			2867			3127			2655			3195			2811		
Ludhiana																		
Basmati rice-chickpea-green manure	3890	1350		4000	1220		4150	810		4190	890		4230	1300		4020	1250	
Basmati rice-wheat-green manure	3730	3900		3950	3710		4060	4890		4100	4920		4060	4610		4050	3870	
Kharif moong-wheat-summer moong	850	5480	940	780	5100	840	740	5740	620	650	5800	600	840	5660	940	800	5260	880
Soybean-wheat	1100	4670		1140	4520		850	5310		810	5220		1060	4970		1080	4700	

Locations-/Systems	Organic Management (as per NPOP standards)						Inorganic Management						Integrated nutrient Management					
	[1]Organic (100%)			[2]Organic + NF			--100% inorganic package (No organic manures)			State recommendations or farmers package			50% Organic + 50% Inorganic			[3]Towards Organic		
	Kharif	*Rabi*	*Summer*	*Kharif*	*Rabi*	*Summer*	*Kharif*	*Rabi*	*Summer*	*Kharif*	*Rabi*	*Summer*	*Kharif*	*Rabi*	*Summer*	*Kharif*	*Rabi*	*Summer*
Modipuram																		
Black rice –lentil – vegetable cowpea	992			318			395			473			425			217		
Finger millet – barley – sesbania rostrata green manure	2062	2660.0		1886	1450.0		2289	3900		2531	4010		2262	4120		1918	3060	
Okra – vegetable pea – sesbania aculeata green manure	7750	3976.0		6354	3764.0		8106	4324		8650	4297		8310	4256		6484	3846	
Black gram – tomato – sunhemp green manure	1150	10834.0		1035	9666.0		925	10334		1013	14834		1038	12166		800	10234	
Pantnagar																		
Basmati rice - Wheat	5157	4005		4211	3183		4609	4196		4735	4340		5194	4774		4933	4138	
Basmati rice – Mustard	5283	1521		4431	1379		4542	1157		4631	1050		5293	1636		4867	1468	
Basmati rice – Vegetable pea (4 rows vegetable pea + 2 rows coriander)	5343	6536+ 938		4402	2125+ 567		4668	5643+ 717		4831	5714+ 850		5550	6429+ 897		5148	6071+ 750	
Basmati rice – Potato	5314	18974		4557	12821		4794	15385		4661	15897		5335	18667		5031	16667	
Mean	5274			4400			4653			4715			5343			4995		
Raipur																		
Soybean-maize (sweet corn)	1954	13926		1641	12666		1575	13769		1856	14641		1757	12934		1679	11051	
Soybean- french bean	2107	6376		1782	4726		1697	6146		1960	6682		1845	5058		1770	4347	
Soybean-cabbage	2014	35833		1696	28669		1624	31147		1915	39281		1812	30193		1732	23850	
Soybean-tomato	1970	52094		1661	42490		1591	50104		1862	54291		1756	47395		1683	37370	
Mean	2011			1695			1622			1898			1793			1716		
Ranchi																		
Rice -wheat	3445	2436		3731	2777		2856	2788		2538	2178		3295	2556		3349	2863	
Rice -onion	3431	16579		3709	12087		2785	15090		2499	12059		3256	16108		3313	16458	
Rice -potato	3413	22177		3681	11138		2606	10778		2428	9079		3213	17486		3259	22046	
Rice -okra	3463	8211		3691	6983		2642	8047		2285	4634		3284	8332		3270	8868	

Locations-/Systems	Organic Management (as per NPOP standards)						Inorganic Management						Integrated nutrient Management					
	[1]Organic (100%)			[2]Organic + NF			--100% inorganic package (No organic manures)			State recommendations or farmers package			50% Organic + 50% Inorganic			[3]Towards Organic		
	Kharif	*Rabi*	*Summer*	*Kharif*	*Rabi*	*Summer*	*Kharif*	*Rabi*	*Summer*	*Kharif*	*Rabi*	*Summer*	*Kharif*	*Rabi*	*Summer*	*Kharif*	*Rabi*	*Summer*
Mean	3438			3703			2722			2438			3262			3298		
Umiam																		
Bhindi- carrot	10200	16730		10075	13280		11460	15230					10070	16680				
Bhindi- potato	10870	17150		9870	14810		11260	17800					10450	19100				
Bhindi- tomato	11440	6410		10255	5625		12280	5760					10050	6710				
Bhindi- frenchbean	12650	14850		11450	13640		13440	12964					12000	14820				
Mean	11290			10413			12110						10643					
Ajmer																		
Cow pea + maize (4:2) - coriander + cabbage (2:1)	600+ 1182	225+ 3800		536+ 1345	267+ 3950		545+ 1473	300+ 3950		636+1 545	467+ 4300		527+ 1382	217+ 2933		582+ 1436	433+ 4100	
Cow pea + maize (4:2) - fennel + cabbage (2:1)	545+ 1273	1525+ 5775		564+ 1291	1600+ 6075		518+ 1418	1688+ 5825		582+ 1509	1825+ 6650		509+ 1236	1513+ 4675		582+ 1455	1850+ 6400	
Cow pea - fennel	758	2167		767	2150		675	2183		792	2342		517	2092		783	2317	
Cow pea - coriander	808	475		750	508		800	608		842	650		500	467		833	633	
Almora																		
Grain Amaranth-Wheat + Lentil	1999	1543		2071	1596		1657	749					1994	919.5				
Fingermillet + Black Soybean-wheat + Toria	2641	1506		2898	1320		1756	792					2554	1128.8				
Gangtok																		
Maize + ginger (1.1)- french Bean	3150+ 7430	6140		2870+ 6820	5580		2067+ 3850	3410					2810+ 6440	5260				
Maize - soybean - buckwheat	3270	1760	1240	3080	1600	1200	2710	820	750				2950	1440	1130			
Maize + turmeric (1:1)- rajmash	3020+ 13100	1430		2920+ 11500	1150		2580+ 6920	430					2780+ 10300	820				
Maize -black gram (pahenlo dal)- toria	3040	950	1020	2930	920	810	2600	480	580				2910	730	650			
Narendrapur																		
Basmati rice-broccoli-sesbania green maunre	1873	1362		1871	1272		1771	1343		1715	1267		1727	1348		1685	1268	

Locations-/Systems	Organic Management (as per NPOP standards)						Inorganic Management						Integrated nutrient Management					
	[1]Organic (100%)			[2]Organic + NF			--100% inorganic package (No organic manures)			State recommendations or farmers package			50% Organic + 50% Inorganic			[3]Towards Organic		
	Kharif	*Rabi*	*Summer*	*Kharif*	*Rabi*	*Summer*	*Kharif*	*Rabi*	*Summer*	*Kharif*	*Rabi*	*Summer*	*Kharif*	*Rabi*	*Summer*	*Kharif*	*Rabi*	*Summer*
Rice -mustard-green gram	4561	1258	1350	4578	1250	1358	4498	921	1350	4462	1083	1371	4612	1169	1429	4521	983	1425
Rice -frenchbean-green gram	4325	6458	1683	4407	6333	1675	4312	5750	1767	4315	6250	1750	4237	6917	1767	4408	6458	1758
Rice -vegetable pea-sesame	4876	2917	1600	4880	3083	1633	4443	2250	1425	4468	2417	1415	4832	2667	1542	4795	2333	1433
Sardarkrushinagar																		
Groundnut - wheat - green gram	1014	3583	486	819	3111	431	1000	3389	442	1092	4028	597	1069	3750	497	806	3056	425
Green gram - coriander - vegetable cowpea	583	1000	4111	478	839	3528	517	994	3694	681	1092	4528	603	1019	4139	481	828	3528
Green gram - fennel - fennel continue	544	747		433	606		472	617		603	828		581	764		450	603	
Thiruvananthapuram																		
Cassava-vegetable cowpea	22400	1435		27650	1625		16220	855		14010	1012		27580	848		27970	825	
Cassava-groundnut	22400	2040		27650	2238		16220	2367		14010	1625		27580	2078		27970	2002	
Taro-blackgram	6840	616		14790	633		4120	595		1810	362		8970	561		9830	572	
Taro-greengram	6840	642		14790	522		4120	337		1810	337		8970	403		9830	547	
Udaipur																		
Maize + blackgram (2:2) – durum wheat – sesbania (GM)	2210+ 160	3655		2300+ 210	4100		2380+ 215	3516		2400+ 225	4075		2180+ 155	4150		2120+ 140	3610	
Blackgram – wheat (triticum aestivum)	410	3710		430	3950		480	3480		500	3940		380	4000		395	3660	
Sweet corn + blackgram (2:2) – chickpea	2300+ 180	1130		2500+ 200	1290		2520+ 210	988		2610+ 230	1240		2100+ 155	1320		2150+ 162	1070	
Soybean – fenugreek	535	1775		570	1850		605	1480		650	1745		507	1685		520	1590	

[1]Organic manures equivalent to 100 % N requirement of the system);
[2]Nutrients supply of only 50% 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.
[3]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

Table 7.2.2: Influence of organic, inorganic and integrated packages on straw yield (kg/ha) of crops in cropping systems at various locations

Locations/Systems	Organic Management (as per NPOP standards)						Inorganic Management						Integrated nutrient Management					
	[1]Organic (100%)			[2]Organic + NF			100% inorganic package (No organic manures)			[1]Organic (100%)			Organic + NF			100% inorganic package (No organic manures)		
	Kharif	*Rabi*	*Summer*	*Kharif*	*Rabi*	*Summer*	*Kharif*	*Rabi*	*Summer*	*Kharif*	*Rabi*	*Summer*	*Kharif*	*Rabi*	*Summer*	*Kharif*	*Rabi*	*Summer*
Bajaura																		
Frenchbean-cauliflower-frenchbean	1450	5560	1580	1440	5870	1300	1210	3380	1290	1470	6870	1620	1420	6860	1550	1400	6690	1500
Fallow-cauliflower-tomato		5980			6130			3860			7750			7560			7520	
Black gram-cauliflower-summer squash	1600	4980	2860	1630	5030	3020	1450	3500	1850	1690	6240	3320	1660	6050	3260	1650	5560	3240
Lady finger-pea	2440	1580		2400	1620		1700	1120		2570	2030		2540	1980		2480	1860	
Bhopal																		
Soybean-durum wheat	1966	5110		1634	4120		1719	4564		1717	4790		1889	4907		1540	3743	
Soybean- mustard	1885	4343		1731	3333		1723	3776		1625	3740		1870	4026		1576	3094	
Soybean- chickpea	1901	2530		1571	2192		1677	2223		1665	2167		1871	2397		1501	2158	
Soybean- linseed	1834	4279		1590	3603		1673	3840		1591	3757		1821	4017		1440	3378	
Mean	1897			1632			1698			1650			1863			1514		
Coimbatore																		
Brinjal - pearl millet-green manure (dhaincha) -		5712			5424			5328			5952			6288			5520	
Chillies - barnyard miller-green manure (dhaincha)		3514			3690			3430			3652			3180			2985	
Tomato -finger millet-Green manure (dhaincha)		7980			8590			7525			7785			7910			8425	
Jabalpur																		
Basmati rice – durum wheat-green manure	6032	4701		5907	4568		5636	5782		5283	3993		6552	4726		6760	4944	
Basmati rice – chickpea - maize fodder	6448	2954		6198	2746		5948	2933		5137	2808		6593	2933		6593	3162	
Basmati rice – berseem (fodder and seed)	6468	175		6427	174		5803	180		5116	177		6427	179		6260	174	
Basmati rice – vegetable pea-sorghum (fodder)	6219			6136			5720			4243			6136			6556		
Mean	6292			6167			5777			4945			6427			6542		
Ludhiana																		
Basmati rice-chickpea-green manure	6730	2420		6700	2200		7100	1490		7280	1560		7250	2270		6720	2250	

Locations/Systems	Organic Management (as per NPOP standards)						Inorganic Management						Integrated nutrient Management					
	[1]Organic (100%)			[2]Organic + NF			100% inorganic package (No organic manures)			[1]Organic (100%)			Organic + NF			100% inorganic package (No organic manures)		
	Kharif	*Rabi*	*Summer*	*Kharif*	*Rabi*	*Summer*	*Kharif*	*Rabi*	*Summer*	*Kharif*	*Rabi*	*Summer*	*Kharif*	*Rabi*	*Summer*	*Kharif*	*Rabi*	*Summer*
Basmati rice-wheat-green manure	6770	6610		6840	6220		6790	6900		7010	7040		6930	6300		6360	6710	
Kharif moong-wheat-summer moong	1400	7330	1400	1320	7120	1370	910	7510	970	930	7580	980	1430	7490	1430	1290	7570	1360
Soybean-wheat	4130	6830		3770	6740		2930	7290		3150	7160		4090	7020		3810	7030	
Pantnagar																		
Basmati rice - Wheat	5816	4168		4943	3448		5197	4731		5339	4894		5858	5172		5563	4483	
Basmati rice – Mustard	5499	3856		5202	3690		4921	3271		4820	2788		5734	4803		5272	4738	
Basmati rice – Vegetable pea (4 rows vegetable pea + 2 rows coriander)	5561			4963			5057			5234			5777			5578		
Basmati rice – Potato	5757			5139			5406			5049			5553			5451		
Mean	5658			5062			5145			5111			5731			5466		
Sardarkrushinagar																		
Groundnut - wheat - green gram	1681	3917	1181	1514	3306	1014	1542	3694	1006	1819	4375	1375	1653	4181	1183	1236	3389	950
Green gram - coriander - vegetable cowpea	1094	1369	1944	922	1222	1861	992	1350	1917	1258	1592	2222	1186	1389	1972	872	1217	1528
Green gram - fennel - fennel continue	989	1083		683	975		903	1008		1089	1247		967	1119		647	953	
Udaipur																		
Maize + blackgram (2:2) – durum wheat – sesbania (GM)	4400+ 455	7300		4600+ 490	7500		4500+ 570	6400		4700+ 600	7520		4100+ 530	7600		4200+ 510	6800	
Blackgram – wheat (triticum aestivum)	1120	7020		1200	7780		1300	6420		1400	7600		1000	7900		1050	6740	
Sweet corn + blackgram (2:2) – chickpea	4650+ 400	3240		4900+ 480	3650		5090+ 510	2980		5260+ 600	3600		4000+ 300	3820		4200+- 320	3150	
Soybean – fenugreek	1420	3640		1500	3920		1680	3180		1800	3895		1300	3800		1360	3480	

[1]Organic manures equivalent to 100 % N requirement of the system);
[2]Nutrients supply of only 50% 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.
[3]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

Table 7.2.3: Influence of organic, inorganic and integrated package on systems productivity (kg/ ha) at various locations

Locations/Cropping systems	Organic		Inorganic		Integrated		Mean
	[1]Organic (100%)	[2]Organic + NF	100% inorganic package (No organic manures)	State recommen-dations or farmers package	50% Organic + 50% Inorganic	[3]Towards Organic	
Bajaura (Cauliflower equivalent yield)							
Frenchbean-cauliflower-frenchbean	22000	22200	16200	24500	23300	22700	21817
Fallow-cauliflower-tomato	21800	22500	16200	25500	25100	24900	22667
Black gram-cauliflower- summer squash	20000	20300	15100	23800	23300	22300	20800
Lady finger-pea	15800	16200	12400	19800	19300	17700	16867
Mean	19900	20300	14975	23400	22750	21900	
Bhopal (Soybean equivalent yield)							
Soybean-durum wheat	-	-	-	-	-	-	2336
Soybean- mustard	-	-	-	-	-	-	2349
Soybean- chickpea	-	-	-	-	-	-	1687
Soybean- linseed	-	-	-	-	-	-	2698
Mean	2634	2023	2305	2249	2511	1883	
Coimbatore (Brinjal equivalent yield)							
Brinjal - pearl millet-green manure (dhaincha)	27411	27112	27306	28548	27439	27412	27538
Chillies - barnyard miller-green manure (dhaincha)	17299	17997	16618	19599	21995	20666	19029
Tomato -finger millet-Green manure (dhaincha)	22955	28239	21474	30364	23001	23784	24970
Mean	22555	24449	21799	26170	24145	23954	
Dharwad (Cotton equivalent yield)							
Pigeonpea + greengram	1113	1128	906	1151	908	965	1029
Pigeonpea + soybean	808	678	659	869	691	718	737
Pigeonpea + groundnut	1134	1278	1247	1333	1148	1088	1205
Cotton + greengram	967	844	839	1047	972	944	936
Cotton + soybean	1084	969	951	1188	1039	1032	1044
Mean	1021	979	920	1118	952	949	
Jabalpur (Rice equivalent yield)							
Basmati rice – wheat (durum) – green manure	8841	8267	8447	4780	7349	6540	7371
Basmati rice – chickpea – maize fodder	9158	8190	8864	5873	8034	7627	7958
Basmati rice-berseem (fodder and seed)	10946	10735	11034	7994	9666	9846	10037
Basmati rice – vegetable pea–sorghum (fodder)	11745	10718	9962	6958	8942	8675	9500
Mean	10173	9478	9577	6401	8498	8172	
Karjat (Rice equivalent yield)							
Rice-brinjal	52449	47571	46392	33169	42985	40975	43924
Rice-chickpea	10336	9034	7661	6419	8916	8560	8488
Rice-field bean	11702	10109	9225	7749	9498	8579	9477
Rice-onion (white)	35691	24985	25750	19436	30384	22743	26498
Mean	27545	22925	22257	16693	22946	20214	
Ludhiana (Wheat equivalent yield)							
Basmati rice-chickpea-green manure	8400	8200	7300	7600	8700	8300	8083
Basmati rice-wheat-green manure	8600	8700	10000	10100	9700	9000	9350
Kharif moong-wheat-summer moong	12000	11000	10700	10400	12100	11400	11267
Soybean-wheat	6800	6800	7000	6800	7100	6800	6883
Mean	8950	8675	8750	8725	9400	8875	
Modipuram (Rice equivalent yield)							
Black rice –lentil – vegetable cowpea	6436	4246	3750	4100	3921	3360	4302
Finger millet – barley – sesbania rostrata green manure	7261	5638	7221	7738	7353	5881	6849
Okra – vegetable pea – sesbania aculeata green manure	13100	11415	11139	11547	11230	9324	11293
Black gram – tomato – sunhemp green manure	19117	17092	18318	19136	16360	13527	17258

Locations/Cropping systems	Organic		Inorganic		Integrated		Mean
	[1]Organic (100%)	[2]Organic + NF	100% inorganic package (No organic manures)	State recommen-dations or farmers package	50% Organic + 50% Inorganic	[3]Towards Organic	
Mean	11479	9598	10107	10630	9716	8023	
Pantnagar (Basmati rice grain equivalent)							
Basmati rice - wheat	8119	6565	7643	7874	8647	7925	7796
Basmati rice – mustard	9408	8169	7528	7341	9514	8645	8434
Basmati rice – vegetable pea (4 rows vegetable pea + 2 rows coriander)	11172	8676	9381	9896	11108	10169	10067
Basmati rice – potato	10659	8169	8915	8919	10335	9496	9416
Mean	9840	7895	8367	8508	9901	9059	
Raipur (Soybean equivalent yield)							
Soybean-maize (sweet corn)	11415	10213	9066	9867	8864	7795	9537
Soybean-garden pea	8796	6795	6874	7617	6218	5574	6979
Soybean-chilli	13558	10932	9651	12039	9594	7879	10609
Soybean-onion	18753	15350	14504	15854	13971	11314	14958
Mean	13131	10823	10024	11344	9662	8141	
Ranchi (Rice equivalent yield)							
Rice -wheat	6176	6508	5688	4716	6083	6212	5897
Rice -onion	16694	15796	14103	11544	15337	15656	14855
Rice -potato	16719	14819	7992	6939	12358	14519	12224
Rice -okra	10032	10674	8777	6060	11956	14283	10297
Mean	12405	11949	9140	7315	11434	12668	
Gangtok (Maize equivalent yield)							
Maize + ginger (1.1)- french Bean	12800	11900	7160	-	10700		10640
Maize - soybean - buckwheat	6200	5720	3240	-	5350		5128
Maize + turmeric (1:1)- rajmash	12600	10700	5260	-	8690		9313
Maize -black gram (pahenlo dal)- toria	9280	8220	5710	-	6780		7498
Mean	10220	9135	5343	-	7880		
Sardarkrushinagar (Groundnut equivalent yield)							
Groundnut - wheat - green gram	4684	4592	3622	4335	3987	3202	4070
Green gram - coriander - vegetable cowpea	4717	3983	3489	4240	3862	3191	3914
Green gram - fennel - fennel continue	2332	1869	1592	2079	1957	1526	1892
Mean	3911	3481	2901	3551	3268	2640	
Thiruvananthapuram (Tuber equivalent yield)							
Cassava-vegetable cowpea	33090	34490	20100	18330	40980	42780	31628
Cassava-groundnut	25100	35710	24650	19830	25370	23970	25772
Taro-blackgram	8170	16220	4740	1780	10140	7860	8152
Taro-greengram	7640	15310	5070	3020	9430	13680	9025
Mean	18500	25433	13640	10740	21480	22073	
Udaipur (Maize equivalent yield)							
Maize + blackgram (2:2)–wheat (durum)–sesbania (GM)	8592	9609	8817	9743	9164	8469	9066
Blackgram – wheat (Triticum aestivum)	7684	8149	7671	8473	7982	7534	7916
Sweet corn + blackgram (2:2)–chickpea	7173	7959	7353	8169	7159	6707	7420
Soybean – fenugreek	4607	4955	4270	4904	4488	4320	4591
Mean	7014	7668	7028	7822	7198	6758	

[1]Organic manures equivalent to 100 % N requirement of the system);
[2]Nutrients supply of only 50% 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.
[3]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

Influence of organic management with reduced dose of organic manures, integrated and inorganic nutrient management packages on soil physical and available nutrient status (Table 7.2.4 -7.2.10)

Bajaura: pH, organic carbon, available N, P, K, Mn, Zn, Cu and Fe were estimated. The soil pH in different cropping systems as influenced by nutrient management was higher with integrated (7.20) and being on par with organic package whereas lower value of soil pH was recorded in inorganic management. Cropping systems and nutrient management package recorded soil organic carbon ranging from 0.82 as minimum under inorganic to 1.58% as maximum in organic management with 100% nutrients application through organic manures in frenchbean-cauliflower-frenchbean system. An increase in 69.77% in organic carbon was observed with organic over inorganic practice. Availability of residual N (264.0 kg/ha), phosphorus (78.5 kg/ha) and potassium (254.4 kg/ha) were higher with integrated followed by organic farming system. Among the cropping systems, french bean-cauliflower- french bean recorded maximum N availability in the soil whereas P was highest under black gram-cauliflower- summer squash and K in fallow-cauliflower-tomato. Available iron and zinc (16.7 and 3.70 ppm) were recorded higher under organic package with 100% organic management and being on par with integrated while manganese and copper recorded higher under integrated package (50% each organic and inorganic) of 12.5 and 2.99 ppm. Available iron was found to be higher (15.8 ppm) at the end of black gram-cauliflower- summer squash whereas, manganese (10.6 ppm) was higher fallow-cauliflower-tomato, ladyfinger-pea recorded higher copper (2.49 ppm) among the cropping systems.

Bhopal: Physical and chemical properties of soil in term of pH, OC, available N, P, & K were estimated. Not much changes were observed among various input practice and cropping systems. Soil organic carbon was higher under organic (1.02%) followed by 75% input through organic +innovative practice (0.96%) and integrated (75% organic input+25% inorganic) of 0.92%. An increase in organic carbon was found to be 59.38% with organic over inorganic. Available N and K were higher under organic management while the P was higher under integrated crop management with application of 50% both organic and inorganic. N and K were found to be increase by N (10.75%) and K (14.56%) compared to inorganic package.

Calicut: pH, OC, available N, P, & K were estimated. In ginger and black pepper, soil pH, organic carbon, nitrogen, phosphorus and potassium were higher under organic management practice. An increase in SOC, found to higher to the tune of 15.39% and 7.14% with organic over inorganic in ginger and black pepper, respectively. The available N and K was higher under integrated management system in turmeric whereas phosphorous were higher under organic management. Micronutrients such as iron, manganese and copper recorded higher under organic with either 100% input supply through organic (100% organic) or 75% organic +innovative practice in ginger and turmeric.

Dharwad: Numerically similar value recorded for bulk density among various input practices and cropping system. The highest bulk density was recorded under cotton + green gram (1:1) intercropping system (1.28 g/cm^3). Lower EC was recorded with organic management practice (1.25 g/cm^3) while, in case of pH it was higher (7.74) under inorganic practice. pH was lower under organic (7.19). The organic carbon increased significantly from 6.16% with 100% inorganic to 6.45 % with 100% organic and it was increased by 4.71%. Among the cropping systems, Cotton +green gram (1:1) intercropping system recorded maximum SOC (6.59 %) and Nitrogen (232.5 kg/ha) while available phosphorous was recorded minimum (38.8 kg/ha). The maximum K was recorded under Pigeon pea +green gram (2:4) intercropping system (467.5 kg/ha). Higher residual availability of Mn, Zn and Cu were observed under inorganic practice compared to inorganic and integrated whereas, Fe availability was higher under organic practice. The cropping systems showed mixed influence on micronutrient status and did not influence Zn status.

Jabalpur: The electrical conductivity, pH, Organic carbon was estimated. Among different input practices and cropping systems the maximum EC was recorded under Basmati rice – durum wheat-green manure cropping system (0.32 ds/m). There were no significant different in case of pH value among different cropping systems while highest pH (7.31) was observed under inorganic management package with state recommendation. However the maximum organic carbon was recorded under 100% organic management package (0.76%). Among different management system the maximum available N (240 kg/ha), available P (12.8 kg/ha) and available K (340kg/ha) was recorded under 100 % organic system. The per cent increase over inorganic of available N, P and K is to the tune of 6.20, 17.43 and 8.63%, respectively.

Karjat: There was not any significant effect on pH in soil due to input management practice as well as different cropping systems. Soil pH recorded in range between 6.67 to 6.80. Adoption of 100% organic package remained at par with 75% organic+ innovative organic practices and recorded higher SOC content (1.27%) in soil compared to inorganic (1.18%) which was improved to the tune of 7.63% over inorganic. Variation in soil available N, P and K was among different input packages were studied and record the highest available N (264.9 kg/ha), available P (27 kg/ha) and available K (359.6 kg/ha) under organic management system.

Ludhiana: Electrical conductivity, pH, soil organic carbon, soil available nitrogen, phosphorus and potassium were higher under 100% organic management practice. Soil organic carbon found to be higher by 9.5% over integrated. Available N, P and K were also higher under organic management package and found to be higher by N (8.37%), P (8.63%) and K (6.83%) than inorganic package. Among the cropping systems, all the systems available N and K was found maximum under basmati rice-wheat-green manure cropping system.

Modipuram: Among different management practices the maximum EC (0.25 ds/m), OC (0.91%) and available K (35.5 kg/ha) was recorded under 100% organic management package. However the maximum pH (8.23 and 8.27), available N (230.3 and 230.9 kg/ha) and available K (367.7 and 378.8 kg/ha) was recorded with inorganic management practice either with 100% inorganic or state recommendation, respectively. The percent increase of available N and K 100% in inorganic practice over 100% organic is to the tune of 14.24 and 18.27%, respectively.

Pant Nagar: Lower EC (0.31 dsm^{-1}) was recorded under organic package with application of 75% organic + innovative inputs as compared with other packages while the highest (0.52 dsm^{-1}) is under 100% inorganic management packages. Basmati rice – Mustard and Basmati rice – Vegetable pea (4 rows vegetable pea + 2 rows coriander) recorded higher and numerically similar EC (0.44 dsm^{-1}). Soil pH varied from 7.0 to 7.80 across the various management options and cropping systems. At the end of cropping cycle, maximum soil organic carbon (1.43 %) was recorded under 100% organic package followed by 75% organic +innovative input (1.31 %). The significant improvement in soil organic carbon found to be 68.24 % with organic package over inorganic. Likewise, maximum available N, and P (166 and 26.6 kg/ha) in soil was recorded under organic management whereas, availability of K was higher with integrated management package. In case of available Fe, Mn, Cu and Zn there were no significant different among different cropping system and input management packages.

Raipur: EC, Soil organic carbon, available N, P and K were estimated. Among different management package the minimum EC (0.23 and 0.22 ds/m) was recorded under integrated management package. Soil organic carbon content varied from 0.75 to 0.78% after end of cropping cycle. Organic carbon content was similar among the nutrients input package and no remarkable difference was noticed; it was recorded slightly higher with organic and state recommendation (0.78%). As regards to cropping system no significant variation in soil carbon was noticed among different soybean-based cropping system. The available N, P and K content of soil was affected due to nutrient management practices. The available N was recorded maximum with 100% organic management practice while the available P with state recommendation and available K with Integrated management practice with 50% application of both organic and inorganic.

Ranchi: Higher pH, organic carbon, available N and K were recorded with 100% organic followed by 75% organic + innovative practices however available P was maximum with 100% inorganic nutrient management. About 90% remarkable improvement in soil organic carbon with organic package was observed however under integrated an increase of about 77.8% was noticed compared to inorganic.

Narendrapur: Bulk density, Electrical conductivity, pH, Soil organic carbon, Available P and K were estimated for different cropping system and nutrient management practices. It has been observed that there were no significant difference in case of Bulk density and pH while the EC was found maximum under inorganic management with state recommendation followed by 100% inorganic management package. Soil organic carbon (0.85%) was found maximum under organic management with 50% N organic + innovative inputs and rice-vegetable pea-sesame cropping system (0.87%). Available P (76 kg/ha) and K (250.9 kg/ha) was found maximum under inorganic management package with state recommendation.

Sardarkrushinagar: In general, bulk density varies from 1.44 to 1.47 g/cc. Electrical conductivity was found higher (0.18 ds/m) under green gram - coriander - vegetable cowpea cropping system. The pH status was improved due to the adoption of

75% organic+ 75% inorganic input. The pH content was higher in integrated practices (75% organic and 75% inorganic) all the three cropping systems whereas, organic carbon content was found higher under 100% organic practices. The electrical conductivity was within the safe limits due to the management practice and cropping systems. Available N content was highest under organic management system with 50% organic sources+ innovative input (155 kg/ha) followed by 100% organic management system (154.7 kg/ha). While available P was maximum under 100% organic management package and available K under integrated crop management with application of 50% both organic and inorganic. Available Mn, Zn and Cu contents were higher under 100% organic practice while the soil available Fe was higher under integrated crop management with 25% organic + 25% inorganic + innovative inputs (5.63 kg/ha) followed by 100% organic system. Fe and Mn content were higher under Groundnut- Wheat- Green gram system.

Thiruvananthapuram: Among different nutrient management system the bulk density of the soil was found maximum (1.22 g/cc) under 100% inorganic management packages. The pH and organic carbon status were improved due to the adoption of 100% organic inputs. The pH and organic carbon content were higher in organic practice. Cassava-groundnut cropping system recorded the maximum pH value i.e. 4.74 while the Organic carbon was maximum under taro-black gram cropping system.

Table 7.2.4: Influence of organic, inorganic and integrated package on soil physico-chemical properties (bulk density and electrical conductivity) at the end of cropping cycle at various locations

Locations/Systems	Bulk Density (g cm^{-3})							Electricity Conductivity (ds/m)						
	Organic		Inorganic		Integrated		Mean	Organic		Inorganic		Integrated		Mean
	[1]Organic (100%)	[2]Organic + NF	100% inorganic package (No organic manures)	State recommen-dations or farmers package	50% Organic + 50% Inorganic	[3]Towards Organic		[1]Organic (100%)	[2]Organic + NF	100% inorganic package (No organic manures)	State recommen-dations or farmers package	50% Organic + 50% Inorganic	[3]Towards Organic	
Bhopal														
Soybean-durum wheat	-	-	-	-	-	-	-	0.30	0.29	0.29	0.29	0.28	0.29	0.29
Soybean- mustard	-	-	-	-	-	-	-	0.29	0.29	0.29	0.28	0.28	0.28	0.29
Soybean- chickpea	-	-	-	-	-	-	-	0.30	0.29	0.29	0.29	0.28	0.28	0.29
Soybean- linseed	-	-	-	-	-	-	-	0.29	0.29	0.29	0.29	0.29	0.29	0.29
Mean	-	-	-	-	-	-	-	0.29	0.29	0.29	0.29	0.28	0.29	
Dharwad														
Pigeonpea +greengram (2:4) intercropping system	1.22	1.22	1.27	1.31	1.28	1.25	1.26	0.09	0.09	0.10	0.12	0.08	0.09	0.10
Pigeonpea +soybean (2:4) intercropping system	1.25	1.31	1.28	1.22	1.26	1.25	1.26	0.07	0.07	0.08	0.11	0.09	0.07	0.08
Pigeonpea +groundnut (2:4) intercropping system	1.27	1.20	1.29	1.25	1.26	1.27	1.26	0.06	0.07	0.08	0.11	0.08	0.08	0.08
Cotton +greengram (1:1) intercropping system	1.27	1.28	1.28	1.28	1.26	1.28	1.28	0.07	0.07	0.11	0.08	0.09	0.06	0.08
Cotton +soybean (1:1) intercropping system	1.24	1.24	1.27	1.24	1.27	1.27	1.26	0.08	0.08	0.11	0.08	0.08	0.07	0.08
Mean	1.25	1.25	1.28	1.26	1.27	1.26		0.07	0.08	0.10	0.10	0.08	0.07	
Jabalpur														
Basmati rice – durum wheat-green manure	-	-	-	-	-	-	-	0.30	0.31	0.31	0.32	0.34	0.33	0.32
Basmati rice – chickpea - maize fodder	-	-	-	-	-	-	-	0.29	0.28	0.31	0.29	0.30	0.28	0.29
Basmati rice – berseem (fodder and seed)	-	-	-	-	-	-	-	0.32	0.26	0.31	0.31	0.28	0.27	0.29
Basmati rice – vegetable pea-sorghum (fodder)	-	-	-	-	-	-	-	0.32	0.29	0.31	0.29	0.28	0.25	0.29
Mean	-	-	-	-	-	-	-	0.31	0.29	0.31	0.30	0.30	0.28	
Ludhiana														
Basmati rice-chickpea-green manure	-	-	-	-	-	-	-	0.28	0.25	0.21	0.23	0.21	0.20	0.23

Locations/Systems	Bulk Density (g cm^{-3})							Electricity Conductivity (ds/m)						
	Organic		Inorganic		Integrated		Mean	Organic		Inorganic		Integrated		Mean
	[1]Organic (100%)	[2]Organic + NF	100% inorganic package (No organic manures)	State recommen-dations or farmers package	50% Organic + 50% Inorganic	[3]Towards Organic		[1]Organic (100%)	[2]Organic + NF	100% inorganic package (No organic manures)	State recommen-dations or farmers package	50% Organic + 50% Inorganic	[3]Towards Organic	
Basmati rice-wheat-green manure	-	-	-	-	-	-	-	0.29	0.26	0.22	0.24	0.25	0.26	0.25
Kharif moong-wheat-summer moong	-	-	-	-	-	-	-	0.34	0.34	0.23	0.22	0.27	0.28	0.28
Soybean-wheat	-	-	-	-	-	-	-	0.27	0.26	0.21	0.20	0.24	0.26	0.24
Mean	-	-	-	-	-	-	-	0.30	0.28	0.22	0.22	0.24	0.25	
Modipuram														
Black rice –lentil – vegetable cowpea	-	-	-	-	-	-	-	0.26	0.28	0.36	0.38	0.29	0.31	0.31
Finger millet – barley – sesbania rostrata green manure	-	-	-	-	-	-	-	0.27	0.21	0.19	0.19	0.18	0.16	0.20
Okra – vegetable pea – sesbania aculeata green manure	-	-	-	-	-	-	-	0.22	0.20	0.19	0.19	0.21	0.18	0.20
Black gram – tomato – sunhemp green manure	-	-	-	-	-	-	-	0.23	0.21	0.20	0.19	0.19	0.19	0.20
Mean	-	-	-	-	-	-	-	0.25	0.23	0.24	0.24	0.22	0.21	
Pantnagar														
Basmati rice - Wheat	-	-	-	-	-	-	-	0.37	0.28	0.50	0.38	0.38	0.31	
Basmati rice – Mustard	-	-	-	-	-	-	-	0.31	0.29	0.61	0.50	0.40	0.50	
Basmati rice – Vegetable pea (4 rows vegetable pea + 2 rows coriander)	-	-	-	-	-	-	-	0.54	0.35	0.47	0.41	0.41	0.43	
Basmati rice – Potato	-	-	-	-	-	-	-	0.26	0.33	0.49	0.46	0.37	0.33	
Mean	-	-	-	-	-	-	-							
Raipur														
Soybean-maize (sweet corn)	-	-	-	-	-	-	-	0.22	0.22	0.22	0.23	0.22	0.21	0.22
Soybean- french bean	-	-	-	-	-	-	-	0.25	0.22	0.25	0.25	0.22	0.19	0.23
Soybean-cabbage	-	-	-	-	-	-	-	0.25	0.25	0.25	0.26	0.25	0.24	0.25
Soybean-tomato	-	-	-	-	-	-	-	0.24	0.25	0.25	0.24	0.23	0.26	0.25
Mean	-	-	-	-	-	-	-	0.24	0.24	0.25	0.24	0.23	0.22	

Table 7.2.5: 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/Systems	pH							Organic Carbon						
	Organic		Inorganic		Integrated		Mean	Organic		Inorganic		Integrated		Mean
	[1]Organic (100%)	[2]Organic + NF	100% inorganic package (No organic manures)	State recommen-dations or farmers package	50% Organic + 50% Inorganic	[3]Towards Organic		[1]Organic (100%)	[2]Organic + NF	100% inorganic package (No organic manures)	State recommenda-tions or farmers package	50% Organ-ic + 50% Inorganic	[3]Towards Organic	
Bajaura														
Frenchbean-cauliflower-frenchbean	7.10	6.90	6.70	7.00	7.10	7.00	6.97	1.58	1.33	0.82	1.09	1.18	1.20	1.20
Fallow-cauliflower-tomato	7.10	7.00	6.80	7.10	7.00	6.90	6.98	1.42	1.32	0.85	1.06	1.22	1.18	1.18
Black gram-cauliflower-summer squash	7.20	6.90	6.80	6.90	7.10	7.10	7.00	1.45	1.36	0.87	1.14	1.23	1.24	1.22
Lady finger-pea	7.10	7.00	6.70	7.10	7.00	7.00	6.98	1.40	1.34	0.88	1.05	1.22	1.26	1.19
Mean	7.13	6.95	6.75	7.03	7.05	7.00		1.46	1.34	0.86	1.09	1.21	1.22	
Bhopal														
Soybean-durum wheat	7.64	7.67	7.69	7.67	7.64	7.64	7.66	1.09	1.00	0.68	0.65	0.91	0.90	0.87
Soybean- mustard	7.62	7.64	7.66	7.68	7.63	7.65	7.65	1.02	0.98	0.67	0.65	0.91	0.91	0.86
Soybean- chickpea	7.61	7.63	7.68	7.70	7.63	7.64	7.65	1.04	0.95	0.59	0.60	0.93	0.95	0.84
Soybean- linseed	7.63	7.63	7.66	7.67	7.65	7.65	7.65	0.94	0.90	0.60	0.59	0.90	0.92	0.81
Mean	7.63	7.64	7.67	7.68	7.64	7.65		1.02	0.96	0.64	0.62	0.91	0.92	
Calicut														
Ginger-Fallow	5.90	5.60	5.30		5.50	5.80	5.62	3.00	2.80	2.60		2.80	2.70	2.78
Turmeric-Fallow	5.50	5.30	4.80		5.10	5.20	5.18	3.00	2.80	2.80		3.00	3.00	2.92
Dharwad (g/kg)														
Pigeonpea +greengram (2:4) intercropping system	7.31	7.38	7.74	7.89	7.03	7.55	7.48	6.51	6.26	6.06	6.26	6.81	6.48	6.40
Pigeonpea +soybean (2:4) intercropping system	7.05	7.08	7.54	7.80	7.29	7.40	7.36	6.30	6.27	6.12	6.34	6.58	6.29	6.32
Pigeonpea +groundnut (2:4) intercropping system	6.99	6.71	7.50	7.81	7.45	7.44	7.32	6.51	6.23	6.02	6.48	6.39	6.46	6.35
Cotton +greengram (1:1) intercropping system	7.06	7.29	8.11	7.40	7.47	7.35	7.45	6.58	6.68	6.35	6.67	6.46	6.80	6.59
Cotton +soybean (1:1) intercropping system	7.56	7.62	7.79	7.35	7.55	7.62	7.58	6.36	6.65	6.26	6.78	6.19	6.37	6.44
Mean	7.19	7.22	7.74	7.65	7.36	7.47		6.45	6.42	6.16	6.51	6.49	6.48	

Locations/Systems	pH							Organic Carbon						
	Organic		Inorganic		Integrated		Mean	Organic		Inorganic		Integrated		Mean
	[1]Organic (100%)	[2]Organic + NF	100% inorganic package (No organic manures)	State recommen-dations or farmers package	50% Organic + 50% Inorganic	[3]Towards Organic		[1]Organic (100%)	[2]Organic + NF	100% inorganic package (No organic manures)	State recommenda-tions or farmers package	50% Organ-ic + 50% Inorganic	[3]Towards Organic	
Jabalpur														
Basmati rice – durum wheat-green manure	7.19	7.19	7.28	7.30	7.21	7.20	7.23	0.77	0.75	0.72	0.71	0.74	0.75	0.74
Basmati rice – chickpea - maize fodder	7.20	7.18	7.28	7.31	7.21	7.19	7.23	0.75	0.74	0.72	0.71	0.72	0.74	0.73
Basmati rice – berseem (fodder and seed)	7.20	7.18	7.28	7.31	7.22	7.20	7.23	0.75	0.74	0.72	0.70	0.72	0.75	0.73
Basmati rice – vegetable pea-sorghum (fodder)	7.20	7.18	7.26	7.31	7.20	7.18	7.22	0.77	0.75	0.71	0.70	0.74	0.75	0.74
Mean	7.20	7.18	7.28	7.31	7.21	7.19		0.76	0.75	0.72	0.71	0.73	0.75	
Karjat														
Rice –brinjal							6.77							1.14
Rice – chickpea							6.69							1.22
Rice – field bean							6.75							1.24
Rice – white onion							6.75							1.18
Mean	6.72	6.75	6.77	6.74	6.67	6.80		1.27	1.25	1.18	1.12	1.19	1.16	
Ludhiana														
Basmati rice-chickpea-green manure	7.40	7.20	7.20	7.30	7.30	7.30	7.28	0.57	0.52	0.48	0.44	0.53	0.52	0.51
Basmati rice-wheat-green manure	7.70	7.40	7.40	7.10	7.30	7.40	7.38	0.67	0.66	0.49	0.47	0.56	0.58	0.57
Kharif moong-wheat-summer moong	7.20	7.20	7.50	7.40	7.40	7.21	7.32	0.61	0.61	0.43	0.42	0.58	0.59	0.54
Soybean-wheat	7.80	7.40	7.20	7.20	7.60	7.40	7.43	0.61	0.58	0.45	0.43	0.54	0.53	0.52
Mean	7.53	7.30	7.33	7.25	7.40	7.33		0.62	0.59	0.46	0.44	0.55	0.56	
Modipuram														
Black rice –lentil – vegetable cowpea	7.50	7.90	8.40	8.50	7.40	8.20	7.98	0.88	0.81	0.67	0.67	0.78	0.76	0.76
Finger millet – barley – sesbania rostrata green manure	7.60	7.70	8.30	8.10	8.30	8.10	8.02	0.91	0.87	0.67	0.68	0.75	0.79	0.78

Locations/Systems	pH							Organic Carbon						
	Organic		Inorganic		Integrated		Mean	Organic		Inorganic		Integrated		Mean
	[1]Organic (100%)	[2]Organic + NF	100% inorganic package (No organic manures)	State recommen-dations or farmers package	50% Organic + 50% Inorganic	[3]Towards Organic		[1]Organic (100%)	[2]Organic + NF	100% inorganic package (No organic manures)	State recommenda-tions or farmers package	50% Organ-ic + 50% Inorganic	[3]Towards Organic	
Okra – vegetable pea – sesbania aculeata green manure	7.87	7.84	8.11	8.20	7.98	7.98	8.00	0.90	0.89	0.67	0.60	0.80	0.78	0.77
Black gram – tomato – sunhemp green manure	7.88	7.66	8.11	8.29	7.89	8.01	7.97	0.95	0.88	0.65	0.68	0.80	0.73	0.78
Mean	7.71	7.78	8.23	8.27	7.89	8.07		0.91	0.86	0.67	0.66	0.78	0.77	
Pantnagar														
Basmati rice - Wheat	7.80	7.40	7.70	7.90	6.90	7.50		1.39	1.29	0.91	0.9	1.14	1.27	
Basmati rice – Mustard	7.10	7.10	7.70	7.90	6.90	7.40		1.41	1.26	0.86	0.97	1.2	1.23	
Basmati rice – Vegetable pea (4 rows vegetable pea + 2 rows coriander)	7.60	7.10	7.90	7.50	6.70	7.40		1.56	1.36	0.87	0.91	1.18	1.3	
Basmati rice – Potato	7.70	7.10	7.90	7.60	7.50	6.90		1.37	1.31	0.77	0.94	1.15	1.22	
Mean														
Raipur														
Soybean-maize (sweet corn)	7.63	7.63	7.57	7.59	7.62	7.62	7.61	0.74	0.78	0.77	0.80	0.78	0.76	0.77
Soybean- french bean	7.59	7.63	7.59	7.62	7.59	7.61	7.61	0.81	0.74	0.77	0.76	0.77	0.74	0.77
Soybean-cabbage	7.59	7.59	7.59	7.57	7.56	7.60	7.58	0.81	0.77	0.77	0.78	0.78	0.75	0.78
Soybean-tomato	7.58	7.59	7.62	7.59	7.58	7.59	7.59	0.76	0.75	0.76	0.76	0.76	0.74	0.76
Mean	7.60	7.61	7.59	7.59	7.59	7.61		0.78	0.76	0.77	0.78	0.77	0.75	
Ranchi														
Rice -wheat							6.06							0.77
Rice -onion							6.01							0.75
Rice -potato							6.07							0.70
Rice -okra							6.05							0.79
Mean	6.47	6.46	5.50	5.43	6.10	6.32		1.12	1.10	0.40	0.34	0.63	0.92	
Narendrapur														
Basmati rice-broccoli-sesbania green maunre	6.70	6.70	6.70	6.75	6.74	6.73	6.72	0.78	0.76	0.73	0.70	0.71	0.78	0.74

Locations/Systems	pH							Organic Carbon						
	Organic		Inorganic		Integrated		Mean	Organic		Inorganic		Integrated		Mean
	[1]Organic (100%)	[2]Organic + NF	100% inorganic package (No organic manures)	State recommen-dations or farmers package	50% Organic + 50% Inorganic	[3]Towards Organic		[1]Organic (100%)	[2]Organic + NF	100% inorganic package (No organic manures)	State recommenda-tions or farmers package	50% Organ-ic + 50% Inorganic	[3]Towards Organic	
Rice-mustard-green gram	6.78	6.82	6.73	6.75	6.76	6.68	6.75	0.77	0.78	0.68	0.70	0.72	0.75	0.74
Rice-frenchbean-green gram	6.91	7.03	6.97	6.92	7.02	7.10	6.99	0.88	0.91	0.80	0.73	0.87	0.84	0.84
Rice-vegetable pea-sesame	6.98	7.15	6.84	6.86	7.15	7.09	7.01	0.88	0.96	0.80	0.79	0.89	0.88	0.87
Mean	6.84	6.92	6.81	6.82	6.92	6.90		0.83	0.85	0.76	0.73	0.80	0.81	
Sardarkushinagar														
Groundnut - wheat - green gram	7.81	7.75	7.80	7.77	7.79	7.86	7.80	0.36	0.35	0.27	0.28	0.32	0.34	0.32
Green gram - coriander - vegetable cowpea	7.73	7.94	7.96	7.88	7.74	7.92	7.86	0.33	0.32	0.30	0.28	0.30	0.31	0.30
Green gram - fennel - fennel continue	7.87	7.95	7.85	7.97	8.02	7.97	7.94	0.32	0.32	0.25	0.23	0.28	0.27	0.28
Mean	7.80	7.88	7.87	7.87	7.85	7.92		0.34	0.33	0.27	0.26	0.30	0.31	
Thiruvananthapuram														
Cassava-vegetable cowpea	4.65	4.72	4.16	4.20	4.10	4.45	4.38	0.98	1.06	0.80	0.90	1.12	0.86	0.95
Cassava-groundnut	4.95	5.12	4.98	4.28	4.37	4.72	4.74	1.12	1.06	0.65	0.88	0.92	0.95	0.93
Taro-blackgram	4.70	5.12	4.12	4.30	4.45	3.96	4.44	1.17	1.08	0.72	0.86	0.95	0.98	0.96
Taro-greengram	4.46	4.85	4.23	4.18	3.86	4.25	4.31	1.16	1.06	0.62	0.86	0.93	0.96	0.93
Mean	4.69	4.95	4.37	4.24	4.20	4.35		1.11	1.07	0.70	0.88	0.98	0.94	

[1]Organic manures equivalent to 100 % N requirement of the system);
[2]Nutrients supply of only 50% 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.
[3]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

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

Locations/Systems	Organic		Inorganic		Integrated		
	[1]Organic (100%)	[2]Organic + NF	100% inorganic package (No organic manures)	State recommendations or farmers package	50% Organic + 50% Inorganic	[3]Towards Organic	Mean
Bajaura							
Frenchbean-cauliflower-french-bean	262.1	261.5	249.3	258.0	260.6	261.0	258.8
Fallow-cauliflower-tomato	258.5	257.7	250.3	260.9	243.1	258.5	254.8
Black gram-cauliflower- summer squash	255.9	250.2	239.1	245.4	270.5	269.9	255.2
Lady finger-pea	273.7	269.6	246.4	246.2	281.7	263.6	263.5
Mean	262.6	259.8	246.3	252.6	264.0	263.3	
Bhopal							
Soybean-durum wheat	266.0	248.0	234.0	239.0	245.0	238.0	245.0
Soybean- mustard	257.0	236.0	232.0	238.0	229.0	230.0	237.0
Soybean- chickpea	250.0	244.0	228.0	225.0	242.0	248.0	239.5
Soybean- linseed	237.0	225.0	218.0	216.0	229.0	221.0	224.3
Mean	252.5	238.3	228.0	229.5	236.3	234.3	
Calicut							
Ginger-fallow	355.8	333.9	309.8		326.0	317.4	328.6
Turmeric-fallow	363.6	332.8	331.5		363.8	363.9	351.1
Dharwad							
Pigeon pea +green gram (2:4) intercropping system	192.0	234.0	227.0	226.0	235.0	224.0	223.0
Pigeon pea +soybean (2:4) intercropping system	245.0	240.0	220.0	207.0	226.0	247.0	230.8
Pigeon pea +groundnut (2:4) intercropping system	227.0	236.0	225.0	219.0	213.0	225.0	224.2
Cotton +green gram (1:1) inter-cropping system	273.0	236.0	214.0	223.0	211.0	238.0	232.5
Cotton +soybean (1:1) intercrop-ping system	203.0	227.0	246.0	224.0	247.0	227.0	229.0
Mean	228.0	234.6	226.4	219.8	226.4	232.2	
Jabalpur							
Basmati rice – durum wheat-green manure	250.0	230.0	226.0	226.0	229.0	230.0	231.8
Basmati rice – chickpea - maize fodder	230.0	228.0	226.0	225.0	226.0	229.0	227.3
Basmati rice – berseem (fodder and seed)	229.0	228.0	226.0	225.0	227.0	230.0	227.5
Basmati rice – vegetable pea-sorghum (fodder)	251.0	229.0	226.0	225.0	228.0	230.0	231.5
Mean	240.0	228.8	226.0	225.3	227.5	229.8	
Karjat							
Rice –brinjal	-	-	-	-	-	-	252.7
Rice – chickpea	-	-	-	-	-	-	265.2
Rice – field bean	-	-	-	-	-	-	266.1
Rice – white onion	-	-	-	-	-	-	243.1
Mean	264.9	262.0	260.9	243.3	259.9	249.8	
Ludhiana							
Basmati rice-chickpea-GM	365.8	364.4	312.9	320.4	347.9	360.8	345.4
Basmati rice-wheat-green manure	357.8	352.9	345.8	338.9	351.8	351.9	349.9
Kharif moong-wheat-summer moong	318.5	310.8	319.0	312.5	319.0	310.5	315.1

Locations/Systems	Organic		Inorganic		Integrated		Mean
	[1]Organic (100%)	[2]Organic + NF	100% inorganic package (No organic manures)	State recommendations or farmers package	50% Organic + 50% Inorganic	[3]Towards Organic	
Soybean-wheat	361.4	360.5	317.3	318.9	358.7	352.2	344.8
Mean	350.9	347.2	323.8	322.7	344.4	343.9	
Modipuram							
Black rice –lentil – vegetable cowpea	186.8	192.3	207.5	206.3	197.5	201.5	198.7
Finger millet – barley – sesbania rostrata green manure	169.8	174.8	188.6	187.6	179.6	183.2	180.6
Okra – vegetable pea – sesbania aculeata green manure	276.0	300.7	321.5	326.1	311.1	316.1	308.6
Black gram – tomato – sunhemp GM	173.6	178.5	203.6	203.4	188.7	186.1	189.0
Mean	201.6	211.6	230.3	230.9	219.2	221.7	
Pantnagar							
Basmati rice - wheat	169.0	165.0	164.0	158.0	164.0	163.0	163.8
Basmati rice – mustard	165.0	165.0	159.0	158.0	165.0	161.0	162.2
Basmati rice – vegetable pea (4 rows vegetable pea + 2 rows coriander)	167.0	162.0	158.0	158.0	166.0	159.0	161.7
Basmati rice – potato	163.0	165.0	154.0	155.0	163.0	164.0	160.7
Mean	166.0	164.3	158.8	157.3	164.5	161.8	
Raipur							
Soybean-maize (sweet corn)	271.0	234.0	261.0	267.0	258.0	242.0	255.5
Soybean- french bean	266.0	234.0	266.0	268.0	257.0	244.0	255.8
Soybean-cabbage	268.0	239.0	260.0	267.0	258.0	242.0	255.7
Soybean-tomato	271.0	236.0	265.0	268.0	257.0	244.0	256.8
Mean	269.0	235.8	263.0	267.5	257.5	243.0	
Ranchi							
Rice -wheat	-	-	-	-	-	-	299.3
Rice -onion	-	-	-	-	-	-	289.7
Rice -potato	-	-	-	-	-	-	288.8
Rice -okra	-	-	-	-	-	-	290.0
Mean	330.3	323.5	270.3	226.5	293.3	307.7	
Narendrapur							
Basmati rice-broccoli-sesbania GM	-	-	-	-	-	-	-
Rice-mustard-green gram	-	-	-	-	-	-	-
Rice-frenchbean-green gram	-	-	-	-	-	-	-
Rice-vegetable pea-sesame	-	-	-	-	-	-	-
Mean	-	-	-	-	-	-	-
Sardarkushinagar							
Groundnut - wheat - green gram	156.8	155.2	150.5	158.4	158.4	156.8	156.0
Green gram - coriander - vegetable cowpea	153.7	156.0	147.3	149.0	153.7	152.1	152.0
Green gram - fennel - fennel continue	153.7	153.7	144.3	145.8	152.1	150.5	150.0
Mean	154.7	155.0	147.4	151.1	154.7	153.1	

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

Locations/Treatments	Organic		Inorganic		Integrated		Mean
	[1]Organic (100%)	[2]Organic + NF	100% inorganic package (No organic manures)	State recommendations or farmers package	50% Organic + 50% Inorganic	[3]Towards Organic	
Bajaura							
Frenchbean-cauliflower-frenchbean	75.2	74.3	66.1	67.7	77.5	72.2	72.2
Fallow-cauliflower-tomato	76.9	74.8	59.5	68.6	79.6	75.5	72.5
Black gram-cauliflower-summer squash	75.9	71.5	68.4	68.7	80.2	71.8	72.8
Lady finger-pea	72.5	73.4	64.8	64.7	76.6	77.1	71.5
Mean	75.1	73.5	64.7	67.4	78.5	74.2	
Bhopal							
Soybean-durum wheat	57.0	56.0	84.0	86.0	106.0	99.0	81.3
Soybean- mustard	54.0	56.0	82.0	83.0	97.0	92.0	77.3
Soybean- chickpea	55.0	52.0	83.0	85.0	102.0	95.0	78.7
Soybean- linseed	55.0	53.0	84.0	93.0	95.0	93.0	78.8
Mean	55.3	54.3	83.3	86.8	100.0	94.8	
Calicut							
Ginger-fallow	158.3	132.7	19.8		67.8	134.8	102.7
Turmeric-fallow	32.7	30.5	1.6		11.3	25.1	20.2
Dharwad							
Pigeon pea +green gram (2:4) intercropping system	44.9	42.7	37.0	47.7	44.1	39.8	42.7
Pigeon pea +soybean (2:4) intercropping system	41.9	37.0	43.2	42.3	42.0	41.0	41.2
Pigeon pea +groundnut (2:4) intercropping system	39.7	38.3	41.9	37.5	43.6	39.9	40.2
Cotton +green gram (1:1) intercropping system	36.1	40.6	34.9	38.6	42.2	40.1	38.8
Cotton +soybean (1:1) intercropping system	38.1	41.7	37.8	47.9	38.1	42.8	41.1
Mean	40.1	40.1	39.0	42.8	42.0	40.7	
Jabalpur							
Basmati rice – durum wheat-green manure	12.9	11.9	11.2	9.4	11.2	12.6	11.5
Basmati rice – chickpea - maize fodder	12.6	11.9	10.8	9.1	11.2	12.2	11.3
Basmati rice – berseem (fodder and seed)	13.3	12.6	11.2	9.8	11.9	12.9	11.9
Basmati rice – vegetable pea-sorghum (fodder)	12.6	11.5	10.5	9.4	11.2	12.2	11.2
Mean	12.8	12.0	10.9	9.4	11.3	12.5	
Karjat							
Rice –brinjal	-	-	-	-	-	-	25.6
Rice – chickpea	-	-	-	-	-	-	27.2
Rice – field bean	-	-	-	-	-	-	27.5
Rice – white onion	-	-	-	-	-	-	24.4
Mean	27.0	26.9	26.7	24.6	26.6	25.2	
Ludhiana							
Basmati rice-chickpea-GM	46.9	48.1	41.8	40.1	48.5	43.2	44.8
Basmati rice-wheat-green manure	50.4	50.3	47.2	46.5	46.0	45.1	47.6

Locations/Treatments	Organic		Inorganic		Integrated		Mean
	[1]Organic (100%)	[2]Organic + NF	100% inorganic package (No organic manures)	State recommendations or farmers package	50% Organic + 50% Inorganic	[3]Towards Organic	
Kharif moong-wheat-summer moong	50.9	48.9	46.8	44.6	47.0	49.8	48.0
Soybean-wheat	48.3	45.7	45.0	42.8	47.1	46.5	45.9
Mean	49.1	48.3	45.2	43.5	47.2	46.2	
Modipuram							
Black rice –lentil – vegetable cowpea	28.5	25.6	20.1	21.0	23.4	21.3	23.3
Finger millet – barley – sesbania rostrata green manure	29.7	26.6	21.0	21.9	24.4	22.2	24.3
Okra – vegetable pea – sesbania aculeata green manure	29.1	24.5	34.8	33.3	26.3	26.5	29.1
Black gram – tomato – sunhemp GM	54.6	43.8	35.6	27.5	39.2	31.6	38.7
Mean	35.5	30.1	27.9	25.9	28.3	25.4	
Pantnagar							
Basmati rice - wheat	26.4	24.5	21.6	21.5	24.6	24.6	23.9
Basmati rice – mustard	27.5	25.3	18.9	19.8	25.7	25.5	23.8
Basmati rice – vegetable pea (4 rows vegetable pea + 2 rows coriander)	24.5	24.7	19.8	19.7	26.7	24.3	23.3
Basmati rice – potato	28.1	27.8	19.6	21.7	23.7	25.6	24.4
Mean	26.6	25.6	20.0	20.7	25.2	25.0	
Raipur							
Soybean-maize (sweet corn)	23.1	21.4	22.6	23.9	22.7	21.0	22.4
Soybean- french bean	23.8	21.3	22.2	23.2	22.0	21.4	22.3
Soybean-cabbage	23.4	21.9	22.5	23.5	22.1	21.2	22.4
Soybean-tomato	23.0	21.1	22.3	23.4	22.7	21.0	22.3
Mean	23.4	21.4	22.4	23.5	22.4	21.1	
Ranchi							
Rice -wheat	-	-	-	-	-	-	57.2
Rice -onion	-	-	-	-	-	-	55.1
Rice -potato	-	-	-	-	-	-	55.2
Rice -okra	-	-	-	-	-	-	57.6
Mean	56.1	53.0	59.7	58.7	53.9	56.4	
Narendrapur							
Basmati rice-broccoli-sesbania GM	74.7	75.6	75.4	76.9	72.8	73.1	74.7
Rice-mustard-green gram	71.0	73.0	76.1	79.3	75.4	74.8	74.9
Rice-frenchbean-green gram	75.1	78.3	75.3	77.4	72.4	77.4	76.0
Rice-vegetable pea-sesame	64.8	63.4	65.8	70.3	64.7	65.9	65.8
Mean	71.4	72.6	73.1	76.0	71.3	72.8	
Sardarkushinagar							
Groundnut - wheat - green gram	19.0	17.4	17.4	16.5	18.2	18.5	17.8
Green gram - coriander - vegetable cowpea	17.1	15.1	14.8	15.7	16.5	16.0	15.9
Green gram - fennel - fennel continue	16.5	17.1	15.7	14.8	17.4	16.2	16.3
Mean	17.5	16.5	16.0	15.7	17.4	16.9	

Table 7.2. 8: Influence of organic, inorganic and integrated package on soil available potassium at the end of cropping cycle at various locations

Locations/Treatments	Organic		Inorganic		Integrated		Mean
	[1]Organic (100%)	[2]Organic + NF	100% inorganic package (No organic manures)	State recommendations or farmers package	50% Organic + 50% Inorganic	[3]Towards Organic	
Bajaura							
Frenchbean-cauliflower-frenchbean	247.0	255.5	135.6	170.3	247.9	252.3	218.1
Fallow-cauliflower-tomato	250.2	254.5	138.6	186.3	259.4	259.3	224.7
Black gram-cauliflower- summer squash	252.9	236.6	134.9	175.3	262.1	255.6	219.6
Lady finger-pea	239.2	233.3	132.6	176.5	248.3	242.8	212.1
Mean	247.3	245.0	135.4	177.1	254.4	252.5	
Bhopal							
Soybean-durum wheat	696.0	694.0	599.0	591.0	665.0	672.0	652.8
Soybean- mustard	684.0	660.0	606.0	630.0	666.0	658.0	650.7
Soybean- chickpea	686.0	664.0	602.0	606.0	629.0	637.0	637.3
Soybean- linseed	678.0	661.0	588.0	580.0	654.0	660.0	636.8
Mean	686.0	669.8	598.8	601.8	653.5	656.8	
Calicut							
Ginger-fallow	231.8	237.7	167.6		186.3	183.2	201.3
Turmeric-fallow	203.0	172.4	218.4		258.4	240.6	218.6
Dharwad							
Pigeon pea +green gram (2:4) intercropping system	490.0	527.0	396.0	444.0	456.0	492.0	467.5
Pigeon pea +soybean (2:4) intercropping system	433.0	410.0	413.0	409.0	421.0	456.0	423.7
Pigeon pea +groundnut (2:4) intercropping system	368.0	358.0	381.0	444.0	430.0	418.0	399.8
Cotton +green gram (1:1) intercropping system	393.0	365.0	434.0	452.0	463.0	433.0	423.3
Cotton +soybean (1:1) intercropping system	363.0	363.0	387.0	456.0	427.0	475.0	411.8
Mean	409.4	404.6	402.2	441.0	439.4	454.8	
Jabalpur							
Basmati rice – durum wheat-GM	355.0	324.0	311.0	299.0	320.0	335.0	324.0
Basmati rice – chickpea - maize fodder	332.0	323.0	308.0	298.0	310.0	326.0	316.2
Basmati rice – berseem (fodder and seed)	336.0	324.0	315.0	295.0	317.0	322.0	318.2
Basmati rice – vegetable pea-sorghum (fodder)	336.0	324.0	318.0	293.0	316.0	330.0	319.5
Mean	339.8	323.8	313.0	296.3	315.8	328.3	
Karjat							
Rice –brinjal							339.7
Rice – chickpea							349.1
Rice – field bean							353.2
Rice – white onion							346.2
Mean	359.6	358.1	356.1	320.8	351.0	336.8	
Ludhiana							
Basmati rice-chickpea-GM	156.1	151.8	146.1	142.2	146.1	140.6	147.2
Basmati rice-wheat-green manure	158.5	155.9	145.8	146.4	150.7	148.3	150.9
Kharif moong-wheat-summer moong	150.8	145.0	142.3	146.2	145.9	141.7	145.3
Soybean-wheat	148.0	150.9	140.3	139.8	143.5	145.5	144.7
Mean	153.4	150.9	143.6	143.7	146.6	144.0	

Locations/Treatments	Organic		Inorganic		Integrated		Mean
	[1]Organic (100%)	[2]Organic + NF	100% inorganic package (No organic manures)	State recommendations or farmers package	50% Organic + 50% Inorganic	[3]Towards Organic	
Modipuram							
Black rice –lentil – vegetable cowpea	292.3	305.6	349.1	349.9	309.1	338.8	324.1
Finger millet – barley – sesbania rostrata green manure	317.7	332.2	379.5	380.3	335.9	368.2	352.3
Okra – vegetable pea – sesbania aculeata green manure	323.3	356.1	384.9	400.5	365.3	370.3	366.7
Black gram – tomato – sunhemp GM	310.2	316.0	357.4	384.5	330.4	331.6	338.4
Mean	310.9	327.5	367.7	378.8	335.2	352.2	
Pantnagar							
Basmati rice - wheat	233.0	237.0	234.0	234.0	235.0	238.0	235.2
Basmati rice – mustard	234.0	234.0	236.0	235.0	236.0	236.0	235.2
Basmati rice – vegetable pea (4 rows vegetable pea + 2 rows coriander)	235.0	233.0	236.0	233.0	236.0	234.0	234.5
Basmati rice – potato	235.0	234.0	234.0	234.0	238.0	237.0	235.3
Mean	234.3	234.5	235.0	234.0	236.3	236.3	
Raipur							
Soybean-maize (sweet corn)	375.0	355.0	372.0	374.0	374.0	351.0	366.8
Soybean- french bean	373.0	354.0	370.0	374.0	378.0	355.0	367.3
Soybean-cabbage	373.0	354.0	370.0	375.0	373.0	352.0	366.2
Soybean-tomato	373.0	357.0	372.0	374.0	374.0	356.0	367.7
Mean	373.5	355.0	371.0	374.3	374.8	353.5	
Ranchi							
Rice -wheat	-	-	-	-	-	-	184.5
Rice -onion	-	-	-	-	-	-	184.5
Rice -potato	-	-	-	-	-	-	185.3
Rice -okra	-	-	-	-	-	-	186.5
Mean	221.0	216.9	155.5	146.3	186.8	184.6	
Narendrapur							
Basmati rice-broccoli-sesbania GM	252.8	254.5	259.9	260.6	255.6	249.4	255.4
Rice-mustard-green gram	246.4	241.4	257.1	261.7	248.0	247.8	250.4
Rice-frenchbean-green gram	231.3	228.4	244.5	244.3	231.2	237.7	236.2
Rice-vegetable pea-sesame	229.8	227.8	234.5	237.0	220.2	223.8	228.8
Mean	240.1	238.0	249.0	250.9	238.7	239.7	
Sardarkushinagar							
Groundnut - wheat - green gram	175.8	181.4	173.6	180.3	178.1	179.2	178.1
Green gram - coriander - vegetable cowpea	169.1	168.0	162.4	168.0	172.5	170.2	168.4
Green gram - fennel - fennel continue	173.6	169.1	166.9	168.0	175.8	169.1	170.4
Mean	172.9	172.9	167.6	172.1	175.5	172.9	

[1]Organic manures equivalent to 100 % N requirement of the system);
[2]Nutrients supply of only 50% 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.
[3]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

Table 7.2.9: 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

Locations/Systems	Soil Available Iron (ppm)							Soil Available Manganese (ppm)						
	Organic		Inorganic		Integrated		Mean	Organic		Inorganic		Integrated		Mean
	[1]Organic (100-%)	[2]Organic + NF	100% inorganic package (No organic manures)	State recommen-dations or farmers package	50% Or-ganic + 50% Inor-ganic	[3]Towards Organic		[1]Organic (100%)	[2]Organic + NF	100% inorganic package (No organic manures)	State recom-mendations or farmers package	50% Organ-ic + 50% Inor-ganic	[3]Towards Organic	
Bajaura														
Frenchbean-cauliflower-frenchbean	16.1	13.8	9.0	11.3	15.7	13.6	13.3	11.7	10.4	7.2	8.5	13.3	10.7	10.3
Fallow-cauliflower-tomato	16.6	13.5	10.4	12.1	15.2	14.1	13.7	12.5	10.6	7.3	9.4	13.2	10.8	10.6
Black gram-cauliflower-summer squash	18.8	15.2	9.6	12.4	18.1	15.9	15.0	11.7	8.9	6.8	8.5	11.8	10.6	9.7
Lady finger-pea	15.3	14.8	9.8	11.6	17.8	15.4	14.1	11.8	10.7	7.0	9.3	11.6	10.7	10.2
Mean	16.7	14.3	9.7	11.9	16.7	14.8		11.9	10.2	7.1	8.9	12.5	10.7	
Bhopal														
Soybean-durum wheat	8.20	7.74	7.00	6.70	7.66	7.71	7.50	5.60	5.04	4.30	4.00	4.96	5.01	4.82
Soybean- mustard	7.79	7.57	7.07	6.71	7.53	7.55	7.37	5.34	5.16	4.37	4.01	4.83	4.85	4.76
Soybean- chickpea	7.76	7.69	7.01	6.95	7.51	7.61	7.42	5.06	4.99	4.31	4.25	4.81	4.91	4.72
Soybean- linseed	7.68	7.65	6.80	7.10	7.60	7.61	7.41	4.98	4.95	4.10	4.40	4.90	4.91	4.71
Mean	7.86	7.66	6.97	6.87	7.58	7.62		5.25	5.04	4.27	4.17	4.88	4.92	
Calicut														
Ginger-Fallow	42.70	42.20	34.00		41.50	44.70	41.02	16.10	15.50	12.30		20.70	16.80	16.28
Turmeric-Fallow	50.40	44.40	31.30		38.00	44.70	41.76	8.00	5.90	4.00		5.40	8.70	6.40
Dharwad (mg.kg)														
Pigeonpea +greengram (2:4) intercropping system	10.50	7.96	8.00	9.44	9.58	11.19	9.45	10.80	13.30	13.50	13.60	12.50	12.70	12.73
Pigeonpea +soybean (2:4) intercropping system	11.10	8.04	7.64	10.78	10.56	8.22	9.39	14.40	11.00	14.40	14.40	13.90	13.50	13.60
Pigeonpea +groundnut (2:4) intercropping system	10.80	10.95	7.88	7.51	7.76	8.07	8.83	12.00	10.90	11.60	14.50	12.70	11.60	12.22
Cotton +greengram (1:1) intercropping system	9.94	7.56	8.00	8.78	9.64	8.20	8.69	11.80	12.30	12.70	14.70	14.30	12.90	13.12
Cotton +soybean (1:1) inter-cropping system	9.08	8.64	7.98	9.34	11.12	8.66	9.14	11.90	11.10	14.00	14.80	11.20	13.90	12.82
Mean	10.28	8.63	7.90	9.17	9.73	8.87		12.18	11.72	13.24	14.40	12.92	12.92	
Pantnagar														
Basmati rice - Wheat	32.67	32.68	32.61	32.58	32.64	32.64	32.64	8.23	8.24	8.20	8.21	8.22	8.23	8.22

Locations/Systems	Soil Available Iron (ppm)							Soil Available Manganese (ppm)						
	Organic		Inorganic		Integrated		Mean	Organic		Inorganic		Integrated		Mean
	[1]Organic (100-%)	[2]Organic + NF	100% inorganic package (No organic manures)	State recommen-dations or farmers package	50% Or-ganic + 50% Inor-ganic	[3]Towards Organic		[1]Organic (100%)	[2]Organic + NF	100% inorganic package (No organic manures)	State recom-mendations or farmers package	50% Organ-ic + 50% Inor-ganic	[3]Towards Organic	
Basmati rice – Mustard	32.70	32.80	32.60	32.60	32.65	32.70	32.68	8.20	8.23	8.19	8.19	8.21	8.20	8.20
Basmati rice – Vegetable pea (4 rows vegetable pea + 2 rows coriander)	32.70	32.60	32.60	32.60	32.64	32.70	32.64	8.20	8.20	8.18	8.20	8.20	8.19	8.20
Basmati rice – Potato	32.80	32.60	32.60	32.80	32.60	32.60	32.67	8.20	8.23	8.17	8.19	8.19	8.21	8.20
Mean	32.72	32.67	32.60	32.65	32.63	32.66		8.21	8.23	8.19	8.20	8.21	8.21	
Sardarkushinagar														
Groundnut - wheat - green gram	5.90	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	4.60	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	

Table7.2.10: Influence of methods of organic, inorganic and integrated package on soil available micronutrients (Zinc and Copper) at the end of cropping cycle

Locations/Systems	Zinc (ppm)							Copper (ppm)						
	Organic		Inorganic		Integrated		Mean	Organic		Inorganic		Integrated		Mean
	[1]Organic (100%)	[2]Organic + NF	100% inorganic package (No organic manures)	State recommen-dations or farmers package	50% Or-ganic + 50% Inorganic	[3]Towards Organic		[1]Organic (100%)	[2]Organic + NF	100% inorganic package (No organic manures)	State recom-mendations or farmers package	50% Organic + 50% Inorganic	[3]Towards Organic	
Bajaura														
Frenchbean-cauliflower-frenchbean	4.00	2.92	1.96	2.04	3.17	3.01	2.85	2.23	1.79	1.06	1.58	2.42	2.25	1.89
Fallow-cauliflower-tomato	3.43	2.94	1.80	2.21	3.34	2.99	2.79	3.23	1.93	1.12	1.77	3.83	2.52	2.40
Black gram-cauliflower-summer squash	3.79	3.20	1.90	2.93	3.01	2.87	2.95	1.42	1.25	1.05	1.14	1.76	1.55	1.36
Lady finger-pea	3.59	2.68	2.00	2.47	3.17	2.85	2.79	3.57	2.20	1.08	1.56	3.96	2.55	2.49
Mean	3.70	2.94	1.92	2.41	3.17	2.93		2.61	1.79	1.08	1.51	2.99	2.22	
Bhopal														
Soybean-durum wheat	1.20	1.00	0.65	0.73	0.91	0.93	0.90	0.72	0.67	0.55	0.59	0.65	0.66	0.64
Soybean- mustard	0.99	0.92	0.69	0.71	0.84	0.87	0.84	0.68	0.67	0.52	0.57	0.57	0.64	0.61
Soybean- chickpea	0.94	0.92	0.72	0.67	0.79	0.83	0.81	0.71	0.70	0.50	0.53	0.66	0.67	0.63
Soybean- linseed	0.92	0.85	0.67	0.68	0.82	0.84	0.80	0.73	0.70	0.50	0.51	0.61	0.62	0.61
Mean	1.01	0.92	0.68	0.70	0.84	0.87		0.71	0.69	0.52	0.55	0.62	0.65	
Calicut														
Ginger-Fallow	5.90	4.80	0.80		3.50	4.70	3.94	18.00	17.80	17.20		17.40	19.30	17.94
Turmeric-Fallow	3.50	4.70	0.40		1.60	2.50	2.54	0.90	0.90	5.10		2.00	1.40	2.06
Dharwad (mg.kg)														
Pigeonpea +greengram (2:4) intercropping system	0.77	0.73	0.91	0.71	0.74	0.92	0.80	2.04	1.53	2.34	1.68	1.54	2.35	1.91
Pigeonpea +soybean (2:4) intercropping system	0.89	0.76	0.75	0.75	0.68	0.84	0.78	1.85	1.59	2.28	2.07	1.41	1.40	1.77
Pigeonpea +groundnut (2:4) intercropping system	0.70	0.71	0.83	0.86	0.70	0.86	0.78	1.99	1.42	1.78	2.48	1.41	2.15	1.87
Cotton +greengram (1:1) intercropping system	0.76	0.73	0.79	0.85	0.73	0.73	0.77	1.94	1.51	2.21	2.01	1.50	2.03	1.87
Cotton +soybean (1:1) intercropping system	0.91	0.67	0.66	0.90	0.72	0.68	0.76	1.60	1.40	2.01	1.95	2.18	1.90	1.84
Mean	0.81	0.72	0.79	0.81	0.71	0.81		1.88	1.49	2.12	2.04	1.61	1.97	
Pantnagar														
Basmati rice - Wheat	1.06	1.04	1.07	1.06	1.08	1.07	1.06	3.99	3.96	3.95	3.96	3.97	3.98	3.97

Locations/Systems	Zinc (ppm)							Copper (ppm)						
	Organic		Inorganic		Integrated		Mean	Organic		Inorganic		Integrated		Mean
	[1]Organic (100%)	[2]Organic + NF	100% inorganic package (No organic manures)	State recommen-dations or farmers package	50% Or-ganic + 50% Inorganic	[3]Towards Organic		[1]Organic (100%)	[2]Organic + NF	100% inorganic package (No organic manures)	State recom-mendations or farmers package	50% Organic + 50% Inorganic	[3]Towards Organic	
Basmati rice – Mustard	1.05	1.08	1.05	1.06	1.05	1.05	1.06	3.97	3.95	3.93	3.94	3.96	3.96	3.95
Basmati rice – Vegetable pea (4 rows vegetable pea + 2 rows coriander)	1.04	1.06	1.08	1.08	1.07	1.07	1.07	3.98	3.97	3.92	3.93	3.98	3.97	3.96
Basmati rice – Potato	1.05	1.09	1.05	1.06	1.07	1.06	1.06	3.98	3.98	3.92	3.92	3.99	3.97	3.96
Mean	1.050	1.068	1.063	1.065	1.068	1.063		3.980	3.965	3.930	3.938	3.975	3.970	
Sardarkushinagar														
Groundnut - wheat - green gram	0.62	0.54	0.70	0.54	0.42	0.48	0.55	0.76	0.84	0.58	0.50	0.80	0.84	0.72
Green gram - coriander - vegetable cowpea	0.52	0.30	0.52	0.38	0.16	0.22	0.35	1.04	0.80	0.58	0.54	0.88	0.66	0.75
Green gram - fennel - fennel continue	0.70	0.76	0.50	0.66	0.56	0.70	0.65	0.72	0.66	0.50	0.50	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	

[1]Organic manures equivalent to 100 % N requirement of the system);
[2]Nutrients supply of only 50% 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.
[3]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

Influence of organic management package with reduced dose of organic manures, integrated and inorganic management packages on N, P and K and micronutrients uptake (Table 7.2.11 & 7.2.14)

Bajaura: Effect of organic, inorganic and integrated nutrient management on total uptake of major nutrients revealed that cauliflower under different cropping system resulted in uptake the maximum N, P and K under integrated management package and being on par to each state recommendation. However the N, P and K uptake by black gram and french bean was maximum under 100% organic management.

Micronutrients, copper uptake among different cropping systems were recorded higher with 100% inorganic except the uptake by cauliflower which was maximum under integrated nutrient management system.

Among different cropping systems and management practices, the uptake of Fe found to be higher in french bean-cauliflower-french bean cropping system while the uptake of Mn and Zn was maximum under cauliflower-tomato and black gram-cauliflower-summer squash system.

Calicut: In case of turmeric, nutrient uptake of N, P and K in turmeric rhizome was found to be higher under integrated with 75 % organic manure +25% inorganic inputs followed by organic. The maximum uptake of Fe (3202.8 mg/kg) and Cu (249.8 g/ha) by ginger was recorded under 50% organic nutrient +innovative inputs while for turmeric it was maximum under Fe, Mn and Cu uptake was maximum under 100% inorganic management.

Pant Nagar: During kharif in basmati rice, highest uptake of nutrient N was observed under 100% organic management package in under different cropping system except basmati rice- mustard cropping system which is maximum under integrated with 50% organic+50% inorganic practice followed by 100% organic management system. Uptake of P in basmati rice was maximum under integrated management package either with 50% application of both organic and inorganic or with 25% organic application+ 25 % inorganic + innovative inputs. For basmati rice-wheat, basmati rice-mustard the uptake of K was found maximum under integrated with 50% organic+50% inorganic practice followed by 100% inorganic practice.

Udaipur: Uptake of N, P and K for *Kharif* crops, black gram, sweet corn+ black gram and soybean was recorded maximum under 100% inorganic management system followed by integrated management package and for Rabi crop, wheat and chickpea was recorded under integrated crop management package with 50% application of both organic and inorganic. The NPK uptake by Fenugreek was maximum under 50% organic + innovative inputs (108.54, 17.77 and 57.87 unit per cent).

Table 7.2.11: Influence of organic, inorganic and integrated package on N uptake of crops and cropping systems

Locations/Treatments	Organic Management						Inorganic Management						Towards organic (Integrated)					
	[1]Organic (100%)			[2]Organic + NF			100% inorganic package (No organic manures)			State recommendations or farmers package			50% Organic + 50% Inorganic			[3]Towards Organic		
	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	2.37	2.86	2.47	2.33	2.82	2.43	2.33	2.94	2.35	2.39	2.97	2.41	2.4	2.98	2.42	2.42	2.97	2.43
Fallow-cauliflower-tomato		2.92	2.14		2.87	2.06		2.90	2.05		3.02	2.31		3.06	2.29		3.05	2.30
Black gram-cauliflower-summer squash	2.50	2.89	1.88	2.44	2.85	1.83	2.30	2.95	1.85	2.37	3.00	1.88	2.39	3.01	1.89	2.38	3.04	1.87
Lady finger-pea	1.98	3.45		1.92	3.42		1.96	3.37		2.07	3.43		2.06	3.46		2.04	3.45	
Calicut																		
Ginger-Fallow	168.6			275.30			143.60						177.80			266.00		
Turmeric-Fallow	118.5			104.6			120.8						96.2			119.2		
Pantnagar																		
Basmati rice - Wheat	108.3	80.3		44	75.4		71.9	101.8		74.6	96.8		104.8	109.5		67.3	109.6	
Basmati rice – Mustard	97.4	89.7		71.9	79.5		66.8	112.9		67.5	103.8		106.2	119.6		96.6	119.8	
Basmati rice – Vegetable pea (4 rows vegetable pea + 2 rows coriander)	110.4			56.3			65.5			76.1			83			95.3		
Basmati rice – Potato	109.8			86.2			75.8			69.9			106			98.3		
Udaipur																		
Maize + blackgram (2:2)–wheat (durum)–sesbania (GM)	62.23	94.87		63.64	104.31		76.03	89.65		60.29	101.75		68.74	105.68		71.74	94.61	
Blackgram – wheat (Triticum aestivum)	30.68	101.73		31.81	111.28		37.91	96.63		30.39	99.32		31.89	113.60		35.01	101.99	
Sweet corn + blackgram (2:2)–chickpea	81.81	71.48		86.15	81.39		99.34	64.3		82.37	75.39		80.68	84.18		86.79	69.56	
Soybean – fenugreek	55.81	100.38		58.52	108.54		66.18	87.71		64.96	102.45		55.57	101.91		58.35	95.43	

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

Locations/Treatments	Organic Management						Inorganic Management						Towards organic (Integrated)					
	[1]Organic (100%)			[2]Organic + NF			100% inorganic package (No organic manures)			State recommendations or farmers package			50% Organic + 50% Inorganic			[3]Towards Organic		
	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	0.30	0.46	0.30	0.29	0.45	0.29	0.28	0.37	0.26	0.32	0.45	0.29	0.33	0.48	0.29	0.31	0.46	0.27
Fallow-cauliflower-tomato		0.47	0.32		0.46	0.29		0.40	0.32		0.45	0.36		0.46	0.38		0.45	0.35
Black gram-cauliflower-summer squash	0.32	0.41	0.33	0.31	0.40	0.34	0.35	0.38	0.30	0.35	0.42	0.32	0.34	0.45	0.34	0.35	0.44	0.32
Lady finger-pea	0.28	0.38		0.26	0.39		0.29	0.38		0.34	0.41		0.33	0.42		0.30	0.40	
Calicut																		
Ginger-Fallow	42.90			48.00			28.00						29.60			35.30		
Turmeric-Fallow	38.74			33.73			28.55						24.81			32.34		
Pantnagar																		
Basmati rice - Wheat	27.5	26.3		13.5	26.8		21.5	37.2		27.4	32.7		32.5	43.5		19.6	45.3	
Basmati rice – Mustard	25.0	33.6		24.0	33.9		23.2	42.6		21.7	38.6		35.2	53.5		32.1	55.6	
Basmati rice – Vegetable pea (4 rows vegetable pea + 2 rows coriander)	30.0			16.5			22.4			20.4			27.8			35.8		
Basmati rice – Potato	30.9			25.4			27.3			18.3			33.1			30.6		
Udaipur																		
Maize + blackgram (2:2)–wheat (durum)–sesbania (GM)	12.220	29.99		12.470	34.22		13.440	29.5		11.570	30.77		12.340	33.96		13.660	31.42	
Blackgram – wheat (Triticum aestivum)	4.450	30.56		4.530	33.51		5.450	29.31		4.690	30.32		4.580	34.12		4.950	31.72	
Sweet corn + blackgram (2:2)–chickpea	13.260	13.89		13.700	16.01		16.160	13.03		12.290	13.07		13.900	16.81		14.840	14.12	
Soybean – fenugreek	6.210	16.15		6.500	17.77		7.410	14.7		6.910	16.6		6.020	16.77		6.520	16.26	

Table 7.2.13: 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)					
	[1]Organic (100%)			[2]Organic + NF			100% inorganic package (No organic manures)			State recommendations or farmers package			50% Organic + 50% Inorganic			[3]Towards Organic		
	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	1.97	2.53	1.97	1.96	2.52	1.95	1.99	2.50	1.99	2.03	2.52	2.03	2.02	2.55	2.05	2.01	2.54	2.04
Fallow-cauliflower-tomato		2.54	2.34		2.52	2.32		2.51	2.30		2.53	2.35		2.55	2.37		2.53	2.35
Black gram-cauliflower-summer squash	2.08	2.55	2.18	2.10	2.54	2.19	2.10	2.52	2.16	2.14	2.55	2.18	2.13	2.56	2.20	2.15	2.53	2.19
Lady finger-pea	2.14	0.89		2.13	0.91		2.15	0.96		2.19	0.97		2.17	0.98		2.16	0.96	
Calicut																		
Ginger-Fallow	157.0			160.3			115.5						98.1			140.3		
Turmeric-Fallow	88.16			74.35			94.16						85.68			99.85		
Pantnagar																		
Basmati rice - Wheat	93.9	63.4		36.0	62.5		66.4	79.7		72.4	74.5		95.3	87.3		58.9	86.4	
Basmati rice – Mustard	82.9	73.4		58.0	72.8		57.3	89.6		59.9	84.5		96.5	97.4		80.4	96.4	
Basmati rice – Vegetable pea (4 rows vegetable pea + 2 rows coriander)	93.7			48.1			62.1			68.2			74.0			84.1		
Basmati rice – Potato	91.8			71.8			68.0			59.0			89.9			89.9		
Udaipur																		
Maize + blackgram (2:2)–wheat (durum)–sesbania (GM)	67.10	136.29		68.63	144.2		76.47	123.25		67.25	140.37		73.82	145.29		88.77	131.16	
Blackgram – wheat (Triticum aestivum)	14.82	131.62		15.55	145.89		18.33	122.55		17.20	139.77		14.67	148.48		16.43	129.75	
Sweet corn + blackgram (2:2)–chickpea	72.50	69.10		73.63	78.45		81.59	63.77		70.03	66.86		65.39	81.87		73.14	68.06	
Soybean – fenugreek	28.65	53.40		30.04	57.87		34.08	47.04		33.10	56.12		26.95	55.59		28.44	51.76	

[1]Organic manures equivalent to 100 % N requirement of the system);
[2]Nutrients supply of only 50% 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.
[3]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

Table 7.2.14.1: Influence of organic, inorganic and integrated nutrient management on micronutrients iron (Fe) uptake by different crops in cropping systems at Bajaura and Calicut

Locations/Treatments	Organic Management (as per NPOP standards)						Inorganic Management						Towards organic (Integrated)					
	[1]Organic (100%)			[2]Organic + NF			100% inorganic package (No organic manures)			State recommendations or farmers package			50% Organic + 50% Inorganic			[3]Towards Organic		
	Kharif	*Rabi*	*Summer*	*Kharif*	*Rabi*	*Summer*	*Kharif*	*Rabi*	*Summer*	*Kharif*	*Rabi*	*Summer*	*Kharif*	*Rabi*	*Summer*	*Kharif*	*Rabi*	*Summer*
Bajaura (mg/kg)																		
Frenchbean-cauliflower-frenchbean	112.0	57.0	113.0	110.0	56.0	110.0	101.0	44.0	99.0	112.0	56.0	110.0	114.0	57.0	113.0	113.0	55.0	111.0
Fallow-cauliflower-tomato		59.0	59.0		58.0	57.0		49.0	49.0		55.0	56.0		59.0	59.0		57.0	58.0
Black gram-cauliflower-summer squash	112.0	60.0	56.0	113.0	58.0	54.0	101.0	46.0	44.0	112.0	57.0	52.0	115.0	58.0	58.0	114.0	55.0	57.0
Lady finger-pea	46.0	47.0		45.0	45.0		40.0	37.0		47.0	42.0		48.0	46.0		49.0	45.0	
Calicut (uptake unit in g/ha)																		
Ginger-Fallow	2641.6			3202.8			2025.8						1919.5			2101.1		
Turmeric-Fallow	5.5			4.5			8.1						4.8			5.6		

Table 7.2.14.2: Influence of organic, inorganic and integrated nutrient management on micronutrients Manganese (Mn) uptake by different crops in cropping systems at Bajaura and Calicut

Locations/Treatments	Organic Management (as per NPOP standards)						Inorganic Management						Towards organic (Integrated)					
	[1]Organic (100%)			[2]Organic + NF			100% inorganic package (No organic manures)			State recommendations or farmers package			50% Organic + 50% Inorganic			[3]Towards Organic		
	Kharif	Rabi	Summer	Kharif	Rabi	Summer	Kharif	Rabi	Summer	Kharif	Rabi	Summer	Kharif	Rabi	Summer	Kharif	Rabi	Summer
Bajaura (mg/kg)																		
Frenchbean-cauliflower-frenchbean	23.0	29.0	25.0	29.0	32.0	28.0	21.0	20.0	21.0	26.0	26.0	25.0	23.0	27.0	26.0	27.0	28.0	24.0
Fallow-cauliflower-tomato		25.0	29.0		26.0	30.0		22.0	25.0		27.0	28.0		28.0	29.0		30.0	30.0
Black gram-cauliflower-summer squash	28.0	28.0	29.0	30.0	29.0	30.0	20.0	20.0	19.0	28.0	26.0	26.0	28.0	28.0	28.0	30.0	29.0	29.0
Lady finger-pea	26.0	25.0		27.0	26.0		21.0	20.0		26.0	24.0		26.0	27.0		27.0	27.0	
Calicut (uptake unit in g/ha)																		
Ginger-Fallow	931.1			1223.2			1386.9						896.7			1206.2		
Turmeric-Fallow	509.37			508.96			826.78						486.23			615.37		

Table 7.2.14.3: Influence of organic, inorganic and integrated nutrient management on micronutrients Zinc (Zn) uptake by different crops in cropping systems at Bajaura and Calicut

Locations/Treatments	Organic Management (as per NPOP standards)						Inorganic Management						Towards organic (Integrated)					
	[1]Organic (100%)			[2]Organic + NF			100% inorganic package (No organic manures)			State recommendations or farmers package			50% Organic + 50% Inorganic			[3]Towards Organic		
	Kharif	*Rabi*	*Summer*	*Kharif*	*Rabi*	*Summer*	*Kharif*	*Rabi*	*Summer*	*Kharif*	*Rabi*	*Summer*	*Kharif*	*Rabi*	*Summer*	*Kharif*	*Rabi*	*Summer*
Bajaura (mg/kg)																		
Frenchbean-cauliflower-frenchbean	29.0	27.0	29.0	28.0	26.0	30.0	18.0	20.0	19.0	26.0	26.0	27.0	27.0	27.0	26.0	26.0	28.0	27.0
Fallow-cauliflower-tomato		26.0	26.0		25.0	24.0		20.0	19.0		25.0	23.0		26.0	26.0		27.0	25.0
Black gram-cauliflower-summer squash	30.0	26.0	23.0	31.0	27.0	26.0	21.0	19.0	19.0	27.0	23.0	24.0	28.0	26.0	25.0	29.0	27.0	26.0
Lady finger-pea	18.0	16.0		17.0	15.0		12.0	11.0		17.0	15.0		18.0	16.0		16.0	15.0	
Calicut (uptake unit in g/ha)																		
Ginger-Fallow	328..8			282.5			331.5						237.7			217.8		
Turmeric-Fallow	294.6			276.8			255.2						214.4			272.3		

Table 7.2.14.4: Influence of organic, inorganic and integrated nutrient management on micronutrients Copper (Cu) uptake by different crops in cropping systems at Bajaura and Calicut

Locations/Treatments	Organic Management (as per NPOP standards)						Inorganic Management						Towards organic (Integrated)					
	[1]Organic (100%)			[2]Organic + NF			100% inorganic package (No organic manures)			State recommendations or farmers package			50% Organic + 50% Inorganic			[3]Towards Organic		
	Kharif	*Rabi*	*Summer*	*Kharif*	*Rabi*	*Summer*	*Kharif*	*Rabi*	*Summer*	*Kharif*	*Rabi*	*Summer*	*Kharif*	*Rabi*	*Summer*	*Kharif*	*Rabi*	*Summer*
Bajaura (mg/kg)																		
Frenchbean-cauliflower-frenchbean	12.1	18.7	13.2	11.4	12.7	11.9	8.4	7.7	7.9	10.0	9.5	9.5	10.7	12.1	11.5	9.7	11.3	10.8
Fallow-cauliflower-tomato		12.6	10.2		12.5	7.9		8.7	7.1		10.6	8.5		12.2	9.1		10.9	9.6
Black gram-cauliflower-summer squash	12.9	12.6	9.3	12.8	12.5	8.8	7.9	9.3	5.2	9.0	10.3	6.8	11.5	12.7	8.7	11.7	12.9	8.9
Lady finger-pea	8.1	21.3		7.6	19.4		4.9	9.3		7.1	15.7		7.5	16.6			7.7	17.8
Calicut (uptake unit in g/ha)																		
Ginger-Fallow	222.4			249.8			190.6						171.2			191.2		
Turmeric-Fallow	34.5			30.3			46.1						22.9			28.1		

Soil Microbial population as influenced by the different management practices (Table 7.2.15 and 7.2.16)

Bajaura: In general, the organic management practice improved soil microbial properties irrespective of cropping systems compare to inorganic and integrated practice. At the end of cropping cycle, microbial bacteria , Fungi, actinomycetes and Phosphate solubilizing bacteria (26.6, 24.3, 23.7 and 25.1 log cfu/g, respectively) recorded maximum in organic management practice with 75% organic + 25% innovative inputs followed by integrated with 75% organic and 25% inorganic. While among different cropping system the maximum population of bacteria, fungi, actinomycetes and phosphate solubilizing bacteria was maximum either under cauliflower- tomato or blackgram- cauliflower- summer squash cropping system.

Dharwad: Among different cropping system the maximum Fungal and actinomycetes population was recorded under Pigeon pea +groundnut (2:4) intercropping system. However the bacterial population was recorded maximum under Pigeon pea +green gram (2:4) intercropping system. Integrated management package resulted in higher actinomycetes and Phosphate solubilizing bacteria while the bacterial count was highest under 75% organic +25% innovative input.

Narendrapur: Application of organic nutrient consisting of 75% organic+25% innovative organic practice resulted in higher microbial population in the soil *viz*. fungi, bacteria and actinomycetes. Population of bacteria (21.08× 10^8 cfu/g), fungi (12.54 ×10^8 cfu/g) and actinomycetes (23× 10^8 cfu/g) with 75% organic +innovative practices under organic management was increased to the tune of 65.85, 29.68 and 31.88% for bacteria, fungi and actinomycetes of compared to 100% inorganic management, respectively. Among the cropping systems, basmati rice–broccoli – s*esbania* green manure recorded higher bacterial and actinomycetes population of 17.88×10^8 cfu/g and 23.33 ×10^8 cfu/g, respectively. Fungai was found to be highest in paddy– mustard– green gram followed by rice- vegetable pea- sesame cropping system at the end of crop cycle in the soil.

Sardarkrushinagar: It is evident from the data outlined in table that bacterial, fungi and actinomycetes population was higher under organic input package either by 100% organic or 75% organic + 25% innovative inputs in all three cropping systems at the end of cropping cycle. Among different cropping cycle the maximum bacterial (15.73×10^8 cfu/g) and fungal (4.37×10^8 cfu/g) population was reported under groundnut- wheat- green gram cropping system and the actinomycetes population (8.93×10^8 cfu/g) was maximum under green gram- coriander and vegetable cowpea cropping system.

Thiruvananthapuram: Bacterial count was higher in either by 100% organic or 75% organic + 25% inorganic in Cassava-veg. cowpea and Taro-black gram. Cassava-groundnut and Taro- green gram cropping system have been found higher bacterial population in either 100% inorganic or state recommendation. The fungal counts were mostly higher under 100% inorganic practice followed by state recommended and integrated with 75% organic and 25% inorganic in Taro- green gram cropping system. However, the actinomycete count was higher in 100% inorganic practice followed by state recommended and integrated with &5% organic and 25% inorganic practice.

Table 7.2.15: Population of bacteria and fungi in rhizospheric soil as influenced by the different nutrient practices and cropping systems

Locations/Systems	Bacteria (log cfu/g)							Fungi (log cfu/g)						
	Organic		Inorganic		Integrated		Mean	Organic		Inorganic		Integrated		Mean
	[1]Organic (100%)	[2]Organic + NF	100% inorganic package (No organic manures)	State recommendations or farmers package	50% Organic + 50% Inorganic	[3]Towards Organic		[1]Organic (100%)	[2]Organic + NF	100% inorganic package (No organic manures)	State recommendations or farmers package	50% Organic + 50% Inorganic	[3]Towards Organic	
Bajaura														
Frenchbean-cauliflower-frenchbean	22.8	25.6	14.2	17.6	18.9	23.4	20.4	20.8	23.5	15.1	19.1	18.7	22.4	19.9
Fallow-cauliflower-tomato	21.9	26.3	14	17.5	20.1	26.6	21.1	19.4	24.9	14.6	19.6	18.3	21.6	19.7
Black gram-cauliflower- summer squash	20.2	26.4	13.9	17.2	18.4	22.5	19.8	19.5	24.5	14.7	19.3	19.2	24.8	20.3
Lady finger-pea	22.6	28.1	14.1	17.8	18.5	23.7	20.8	19.7	24.4	14.8	18.3	18.8	25.4	20.2
Mean	21.9	26.6	14.1	17.5	19.0	24.1		19.9	24.3	14.8	19.1	18.8	23.6	
Dharwad	(10^6 x cfu)							(10^4 x cfu)						
Pigeonpea +greengram (2:4) intercropping system	233.0	251.0	165.0	233.0	171.0	196.0	208.2	7.0	8.3	11.0	7.7	9.7	8.3	8.7
Pigeonpea +soybean (2:4) intercropping system	93.0	216.0	157.0	238.0	219.0	187.0	185.0	7.0	8.7	9.0	6.7	6.0	9.0	7.7
Pigeonpea +groundnut (2:4) intercropping system	231.0	230.0	249.0	177.0	250.0	225.0	227.0	10.3	12.0	18.0	13.0	22.3	18.7	15.7
Cotton +greengram (1:1) intercropping system	254.0	266.0	239.0	226.0	246.0	206.0	239.5	6.7	8.3	10.0	12.3	11.0	7.7	9.3
Cotton +soybean (1:1) intercropping system	273.0	207.0	151.0	228.0	185.0	150.0	199.0	4.3	6.7	8.3	7.0	3.3	4.7	5.7
Mean	216.8	234.0	192.2	220.4	214.2	192.8		7.1	8.8	11.3	9.3	10.5	9.7	
Narendrapur	(10^9 CFU/g)							(10^4 CFU/g)						
Basmati rice-broccoli-sesbania green maunre	24.1	21.2	11.8	12.3	18.4	19.5	17.9	12.1	12.6	7.7	7.4	9.8	13.9	10.6
Rice-mustard-green gram	19.1	24.2	11.1	12.8	16.9	15.9	16.7	13.0	14.1	10.1	10.3	13.0	13.7	12.4
Rice-frenchbean-green gram	18.5	19.3	13.3	12.6	16.2	15.2	15.9	10.6	10.3	9.8	10.1	9.7	11.1	10.3
Rice-vegetable pea-sesame	19.5	19.6	14.7	15.1	16.6	18.4	17.3	12.1	13.2	11.1	11.1	9.8	10.7	11.3

Locations/Systems	Bacteria (log cfu/g)							Fungi (log cfu/g)						
	Organic		Inorganic		Integrated		Mean	Organic		Inorganic		Integrated		Mean
	[1]Organic (100%)	[2]Organic + NF	100% inorganic package (No organic manures)	State recommendations or farmers package	50% Organic + 50% Inorganic	[3]Towards Organic		[1]Organic (100%)	[2]Organic + NF	100% inorganic package (No organic manures)	State recommendations or farmers package	50% Organic + 50% Inorganic	[3]Towards Organic	
Mean	20.3	21.1	12.7	13.2	17.0	17.3		12.0	12.5	9.7	9.7	10.6	12.3	
Sardarkushinagar														
Groundnut - wheat - green gram	15.3	25.7	4.4	7.7	10.4	31.0	15.7	6.4	8.3	0.9	2.7	3.7	4.3	4.4
Green gram - coriander - vegetable cowpea	11.9	21.6	3.4	6.5	12.3	17.6	12.2	5.3	7.3	1.1	1.5	3.1	5.0	3.9
Green gram - fennel - fennel continue	15.6	20.2	1.3	6.3	8.3	10.8	10.4	4.2	8.1	0.6	2.1	3.0	4.0	3.7
Mean	14.3	22.5	3.0	6.8	10.3	19.8		5.3	7.9	0.9	2.1	3.3	4.5	
Thiruvananthapuram														
Cassava-vegetable cowpea	35.7	29.5	12.8	17.3	23.2	16.2	22.5	12.7	12.7	32.3	11.0	10.3	8.7	14.6
Cassava-groundnut	16.8	22.2	13.3	6.3	2.7	5.3	11.1	7.3	12.0	13.5	19.2	9.3	15.3	12.8
Taro-blackgram	19.8	18.2	8.0	25.2	18.5	16.5	17.7	9.0	8.7	10.8	12.2	10.0	11.3	10.3
Taro-greengram	14.8	15.8	17.3	75.3	15.3	113.0	41.9	10.0	9.3	13.0	16.0	11.3	9.8	11.6
Mean	21.8	21.4	12.9	31.0	14.9	37.8		9.8	10.7	17.4	14.6	10.2	11.3	

[1]Organic manures equivalent to 100 % N requirement of the system);
[2]Nutrients supply of only 50% 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.
[3]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

Table 7.2.16: Population of actinomycetes and phosphorus solubilizing bacteria in rhizosphere soil as influenced by the different nutrient practices and cropping systems

Locations/Cropping systems	Soil actinomycetes (log cfu/g)							Phosphate solubilizing bacteria (log cfu/g)						
	Organic		Inorganic		Integrated		Mean	Organic		Inorganic		Integrated		Mean
	[1]Organic (100%)	[2]Organic + NF	100% inorganic package (No organic manures)	State recommendations or farmers package	50% Organic + 50% Inorganic	[3]Towards Organic		[1]Organic (100%)	[2]Organic + NF	100% inorganic package (No organic manures)	State recommendations or farmers package	50% Organic + 50% Inorganic	[3]Towards Organic	
Bajaura														
Frenchbean-cauliflower-frenchbean	20.5	23.5	13.6	17.7	18.4	22.6	19.4	22.8	25.6	17.0	20.3	20.6	23.2	21.6
Fallow-cauliflower-tomato	19.9	25.0	13.5	17.4	18.1	23.0	19.5	23.4	24.8	17.8	20.7	21.4	24.6	22.1
Black gram-cauliflower- summer squash	21.6	22.9	11.8	18.6	18.8	20.9	19.1	25.3	25.4	17.6	19.8	20.5	24.5	22.2
Lady finger-pea	20.5	23.5	13.6	17.7	18.4	22.6	19.4	23.6	24.6	17.9	20.0	20.7	23.6	21.7
Mean	20.6	23.7	13.1	17.9	18.4	22.3		23.8	25.1	17.6	20.2	20.8	24.0	
Dharwad	(10^5 x cfu)							(10^4 x cfu)						
Pigeonpea +greengram (2:4) intercropping system	34.7	39.0	36.0	22.7	40.3	28.3	33.5	6.7	15.3	17.3	16.3	14.7	16.0	14.4
Pigeonpea +soybean (2:4) intercropping system	35.3	27.3	19.3	16.3	26.0	18.3	23.8	14.0	12.0	15.0	16.7	16.3	14.3	14.7
Pigeonpea +groundnut (2:4) intercropping system	24.3	29.0	35.7	33.0	50.7	53.0	37.6	23.7	16.7	16.7	11.7	19.7	23.3	18.6
Cotton +greengram (1:1) intercropping system	26.3	24.7	31.3	25.0	28.0	23.0	26.4	22.0	22.7	24.3	20.3	33.0	29.0	25.2
Cotton +soybean (1:1) intercropping system	23.3	20.7	33.3	32.0	28.0	31.7	28.2	30.7	28.3	25.0	28.3	29.7	32.0	29.0
Mean	28.8	28.1	31.1	25.8	34.6	30.9		19.4	19.0	19.7	18.7	22.7	22.9	
Narendrapur	(10^6 CFU/g)													
Basmati rice-broccoli-sesbania green maunre	25.1	29.8	18.6	21.0	22.8	22.7	23.3	-	-	-	-	-	-	-
Rice-mustard-green gram	25.2	25.0	19.0	17.8	21.0	22.5	21.7	-	-	-	-	-	-	-
Rice-frenchbean-green gram	22.9	19.0	16.5	9.5	17.5	19.8	17.5	-	-	-	-	-	-	-
Rice-vegetable pea-sesame	18.8	17.9	15.7	9.8	17.5	19.8	16.6	-	-	-	-	-	-	-

Locations/Cropping systems	Soil actinomycetes (log cfu/g)							Phosphate solubilizing bacteria (log cfu/g)						
	Organic		Inorganic		Integrated		Mean	Organic		Inorganic		Integrated		Mean
	[1]Organic (100%)	[2]Organic + NF	100% inorganic package (No organic manures)	State recommendations or farmers package	50% Organic + 50% Inorganic	[3]Towards Organic		[1]Organic (100%)	[2]Organic + NF	100% inorganic package (No organic manures)	State recommendations or farmers package	50% Organic + 50% Inorganic	[3]Towards Organic	
Mean	23.0	22.9	17.4	14.5	19.7	21.2		-	-	-	-	-	-	-
Sardarkushinagar														
Groundnut - wheat - green gram	10.2	10.3	3.3	4.4	5.7	8.2	7.0	-	-	-	-	-	-	-
Green gram - coriander - vegetable cowpea	12.6	14.3	4.0	4.2	8.2	10.3	8.9	-	-	-	-	-	-	-
Green gram - fennel - fennel continue	9.4	12.7	4.3	2.2	6.1	9.3	7.3	-	-	-	-	-	-	-
Mean	10.7	12.4	3.8	3.6	6.7	9.3		-	-	-	-	-	-	-
Thiruvananthapuram														
Cassava-vegetable cowpea	1.8	2.2	2.8	1.8	1.8	1.5	2.0	-	-	-	-	-	-	-
Cassava-groundnut	1.5	1.7	5.5	5.2	2.2	3.0	3.2	-	-	-	-	-	-	-
Taro-blackgram	3.7	3.2	2.8	2.7	2.7	2.2	2.9	-	-	-	-	-	-	-
Taro-greengram	2.7	3.2	3.0	3.3	1.8	1.5	2.6	-	-	-	-	-	-	-
Mean	2.4	2.6	3.5	3.3	2.1	2.1		-	-	-	-	-	-	-

Effect of different management systems (Organic, inorganic and integrated) on quality aspects of organic produce (Table 2.7.17)

Bajaura: Quality parameters protein, TSS (^{0}brix) and vitamin C in different vegetable crops namely french bean, black gram, tomato, pea and cauliflower were estimated. In general, protein content among the various input practice observed slightly numerically higher under integrated nutrient management, although in pea, protein was better in inorganic with state recommendation. Tomato recorded maximum TSS content with integrated consisting of 75% organic + 25% inorganic practice. Whereas, In Pea highest TSS recorded under 100% organic practice. The highest vitamin C content of tomato fruits (34.80 mg/100g) and Cauliflower (47.20 mg/100g) was recorded in integrated consisting of 75% Organic + 25% Inorganic nutrients.

Bhopal: Although, nutritional quality constituents in soybean and wheat did not influence significantly due to different nutrient management practices but all the quality parameters *viz*. protein, oil, methionine and tryptophan content percent in soybean, protein and globulin, ash and gluten percent in wheat were maximum in organic either with organic or integrated nutrient management practices.

Calicut: In turmeric, curcumin and oil content was higher in organic management either 100% organic or 75% organic+ 25% innovative inputs while the oleoresin % was maximum under 100% inorganic management package. Oleoresin content in Ginger was recorded higher under 75% organic+ 25% innovative inputs while there was not difference in case of oil per cent.

Coimbatore: All the quality parameter in chilli and tomato did not differ significantly due to various input management package. Ascorbic acid (127.60 mg/100g) and TSS (5.80 Brix) in chilli was higher under organic input practice. Ascorbic acid in brinjal (15.39 mg/100g) and T. acidity (0.36 Brix) was higher under organic practice, but these were on par to other management practices.

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 manure or with 75% organic + 25% innovative practice compared to inorganic. In case of wheat, reverse was recorded wherein protein and moisture was found to be higher in inorganic 100% followed by state recommendation.

Table 7.2.17: Influence of organic, inorganic and integrated package on quality of crops at different locations

Locations	Crops	Quality parameters	Organic		Inorganic		Integrated	
			[1]Organic (100%)	[2]Organic + NF	100% inorganic package (No organic manures)	State recommen-dations or farmers package	50% Organic + 50% Inorganic	[3]Towards Organic
Bajura	French bean (kharif)	Protein %	14.20	14.30	13.70	14.20	14.20	14.50
	French bean (summer)		14.30	14.20	13.60	14.30	14.40	14.40
	Black gram		14.30	14.20	13.50	14.30	14.40	14.40
	Pea		20.50	20.40	20.10	20.60	20.30	20.50
	Tomato	TSS (^{0} Brix)	5.20	5.00	4.00	5.20	5.20	5.40
	Pea		14.00	13.30	10.20	13.20	12.00	13.10
	Tomato	Vitamin C (mg/100g)	34.80	34.20	30.20	30.40	34.20	35.50
	Cauliflower		47.20	45.43	42.00	44.87	46.60	45.40
Bhopal	Soybean	Protein %	35.90	35.81	35.15	35.01	35.66	35.83
		Oil (%)	18.03	17.99	17.95	17.97	18.00	18.02
		Methionine (g/16gN)	1.77	1.75	1.73	1.74	1.74	1.76
		Tryptophan (g/16gN)	1.85	1.83	1.79	1.80	1.82	1.84
	Wheat	Protein %	11.75	11.50	11.43	11.50	11.55	11.72
		Globulin %	24.30	23.92	23.72	23.75	24.08	24.26
		Ash%	1.74	1.67	1.59	1.62	1.68	1.72
		Gluten%	17.11	17.02	16.84	16.92	16.92	17.08
Calicut	Ginger	Oil (%)	2.00	2.00	1.70	-	2.00	2.00
		Oleoresin content (%)	4.20	4.70	4.30	-	4.10	4.60
	Turmeric	Oil (%)	4.45	5.24	4.70	-	4.75	5.07
		Oleoresin (%)	11.33	12.41	14.24	-	11.41	13.15
		Curcumin (%)	5.27	5.19	4.36	-	5.24	5.13
Coimbatore	Tomato	Titrable acidity (%)	1.24	1.32	0.65	0.82	0.90	1.16
		Ascorbic acid (mg/100g)	25.82	25.56	21.85	22.50	22.75	23.46
		Total soluble solids (^{0} Brix)	4.23	4.16	3.44	3.92	3.88	4.08
	Chilli	Total soluble solids (^{0} Brix)	5.50	5.80	4.50	4.90	5.30	5.50
		Ascorbic acid	125.9	127.6	116.8	120.6	120.3	123.5
	Brinjal	Titrable Acidity (%)	0.32	0.36	0.20	0.22	0.28	0.30
		Ascorbic acid (mg/100g)	14.84	15.39	13.56	13.95	14.25	14.52
Ranchi	Rice	Protein (%)	9.29	9.43	9.33	9.12	9.23	9.14
		Moisture (%)	14.34	14.23	14.13	13.99	14.23	14.15
	Wheat	Protein (%)	11.29	11.27	11.42	11.12	11.36	11.39
		Moisture (%)	10.13	10.15	10.37	10.22	10.24	10.25

Influence of organic, inorganic and integrated management packages on economics of different crops and cropping systems Table (7.2.18 and 19)

Bajaura: Gross return and cost of cultivation was recorded maximum (5,04,250 and 1,29,344 Rs/ha, respectively) under inorganic management practice with state recommendation followed by integrated management package with application of both 50% organic and inorganics and the per cent increase over organic is to the tune of 8.95 and 3.57 %, respectively. Among the cropping system, fallow-cauliflower-tomato gave the highest gross return and net return and B:C ratio (5,11,443 Rs/ha, 3,17,777 Rs/ha, and 1.64 respectively). All the input practice registered with higher B:C ratio under integrated practices with 75% organic + 25% inorganic (1.36).

Economic system: Tomato-Cauliflower

Bhopal: 100% organic input followed by integrated (50% organic + 50% inorganic) production systems recorded maximum gross returns (Rs. 1,27,735/ha and 1,21,802/ha, respectively), net returns (Rs. 45,57/ha and Rs. 422,223/ha, respectively) and B:C ratio (0.87 and 0.83, respectively). Among the cropping systems, soybean-linseed recorded maximum net return (Rs. 55121/ha) and B:C ratio (1.11).

Calicut: Highest gross return for turmeric was under integrated (50% organic + 50% inorganic) (Rs 4,34,000/ha) followed by 100% inorganic practice (Rs 4,22,800/ha). Higher net return was recorded in 100% inorganic management practice and the percent decrease over 100% organic was to the tune of 19.32 %. The benefit cost ratio eas observed maximum under 100% inorganic management practice (1.85).

Coimbatore: Among the production systems, maximum net return of Rs. 2,03,173 per hectare was recorded in tomato - finger millet-green manure (dhaincha) system. Under different nutrient management techniques, the maximum net return was recorded under organic management package either with 100% organic or with 75% organic nutrients +25% innovative practices. The benefit cost ratio was recorded higher in organic management wuith 75% organic + 25% innovative inputs (1.36) followed by 100% organic (1.04). Cropping system Brinjal - pearl millet-green manure (*dhaincha*) found more profitable in term of benefit cost ratio 1.16 and te percent increase over chili-barnyard green manure and tomato-finger millet-green manure system is to the tune of 26.09 and 24.73%, respectively.

Dharwad: Among the production packages, though gross return of 100% inorganic packages was higher by 4.72% and 12.64 % in 100% organic and 75% organics + innovative organic practices, respectively, however, cost of cultivation was highest for organics practices. The net return was recorded maximum under inorganic management practice with state recommendation (Rs. 42,409/ha) and the percent increase over 100% organic is to the tune of 23.13%. However, among the cropping system, highest net return (Rs 64,480/ha) and B:C ratio (1.89) was recorded in Pigeonpea + groundnut intercropping system.

Jabalpur: Basmati rice – berseem (fodder and seed) reported maximum gross return (Rs. 3,01,108/ha) and net return (Rs. 1,63,121/ha) and B:C ratio (2.19) among different cropping system**.** Among different nutrient management system, 100%

organic management practice recorded maximum gross return and cost of cultivation. 100% inorganic nutrient management resulted in maximum net return (Rs. 1,55,478/ha) and B:C ratio (2.19).

Karjat: Among different cropping system the maximum net returns and B: C ratio was recorded under rice-brinjal cropping system followed by rice onion cropping system. However among different nutrient management practices the maximum net return was recorded under 100% organic management package (Rs. 3,00,215/ha) followed by 100% inorganics (Rs. 2,52,631/ ha). The B:C ratio was highest under 100% inorganic management system (2.36).

Ludhiana: Though the cost of cultivation was higher (25.20%) under organic input practice due to the higher gross return (21.91%), there was an increase in net return (19.65%), under organic practices as compared to inorganics. Integrated practices showed a increase in net return by 11.68% as compared to inorganic practice. Among the cropping systems, significantly higher increase in net return (Rs. 162066 /ha) for *Kharif* moong-wheat-summer moong. There was no significant variation in B:C ratios of all the input practices however, Basmati rice-wheat-GM showed higher B:C ratio (2.70).

Pantnagar: Organic input practice showed higher increase in gross return over the integrated practice as compared to inorganic input. Highest increase by 48.4% in gross return was noticed under 100% organic over the inorganic input practice. Cost of cultivation was maximum (Rs. 94149/ha) under integrated management with 25% nutrients through organic +25% nutrients through inorganic source of nutrients + innovative inputs. On comparing the net returns, there was higher net return under 100% organic (RS. 324819/ha) which was 60.79% higher than 100% inorganic management system. Integrated input practices did not show any significant variation in net returns. Benefit cost ratio was highest for inorganic input (2.65). On comparing the cropping systems, Basmati rice -vegetable pea (4 rows vegetable pea +2 rows coriander) showed higher gross return, (Rs. 468923/ha) under 100% organic input and a total of Rs. 362112/ha for all the input practice. The b:c ratio was highest with Basmati rice- mustard cropping system.

Raipur: Among different management packages, the gross return (Rs. 636830/ha) and cost of cultivation (Rs. 114467) was observed maximum under 100% organic management package. The net return and B:C ratio was higher under organic management package and highest under 100% organic management practices (Rs.522363/ha) and B:C ratio (5.53), and was 72.28% and 0.24% higher than 100% inorganic management system. When comparing different cropping system, the maximum net return and B:C ratio was observed under soybean-tomato cropping system.

Ranchi: Among different management packages, the gross return (Rs. 307500/ha) and cost of cultivation (Rs. 113984/ha) was observed maximum under 100% organic management package. The net return and B:C ratio was higher under organic management package and highest under organic management practices with application of 75% organic+ 25% innovative inputs (Rs.194058/ha) and B:C ratio (1.83), and was 71.75% and 44.09% higher than 100% inorganic management system. When comparing different cropping system, the maximum net return and B:C ratio was observed under rice onion cropping system.

Umiam: Bhindi-carrot cropping system resulted in highest gross return and cost of cultivation followed by Bindi –tomato cropping system. Among different management packages, the gross return (Rs. 502650/ha) and cost of cultivation (Rs. 219563/ha) was observed maximum under 100% organic management package. The net return was higher under 100% organic management package (Rs.283088/ha) and the B:C ratio was observed maximum under integrated management package with application of 50% both organic and inorganic management practices (1.40), and they were 8.5% and 7.7% higher than 100% inorganic management system.

Ajmer: Among different management packages, the net return (Rs. 94692/ha) and B: C ratio (3.74) was observed maximum under integrated. When comparing different cropping the maximum net return and B: C ratio was observed under Cow pea + maize (4:2) - fennel + cabbage (2:1) cropping system followed by Cow pea – fennel cropping system.

Almora: Among different management packages, the gross return (Rs. 157858/ha) and cost of cultivation (Rs. 91123/ha) was observed maximum under organic management practices with application of 75% organic+ 25% innovative inputs. However, the net returns were maximum with 100% organic management (Rs. 87414/ ha). The B: C ratio was higher under integrated management package management practices with application of 75% organic+ 25% innovative inputs (1.76). When comparing different cropping system, the maximum net return and B: C ratio was observed under rice onion cropping system.

Narendrapur: Among different management packages, the gross return (Rs. 307500/ha) and cost of cultivation (Rs. 113984/ha) was observed maximum under 100% organic management package. The net return and B: C ratio was higher under organic management package and highest under organic management practices with application of 75% organic+ 25% innovative inputs (Rs.194058/ha) and B: C ratio (1.83), and was 71.75% and 44.09% higher than 100% inorganic management system. When comparing different cropping system, the maximum net return and B: C ratio was observed under Grain Amaranth-Wheat + Lentil cropping system.

Sardarkrushinagar: 100% organic management package resulted in maximum gross return (Rs. 176000/ha) and cost of cultivation (Rs. 106632/ha) among all different nutrient management packages and the per cent increase over 100% inorganic management is to the tune of 38.8% and 40.7%, respectively. The net return and B: C ratio was recorded under inorganic management package with state recommendation (Rs. 70503/ha and 0.77, respectively). When comparing different cropping system, green gram - coriander - vegetable cowpea recorded maximum net return (Rs. 80338/ha) and B: C ratio (0.84).

Thiruvananthapuram: Cassava followed by vegetable cowpea cropping system recorded maximum net return (Rs. 310001/ha) and B: C ratio (1.94) among different cropping system. Within different nutrient management system the highest net return and B: C ratio was recorded with organic management system with 75% organic and 25% innovative inputs and the per cent increase in net return and B: C ratio when compared with 100% organic management system was to the tune of 330.9% and 34.6%, respectively.

Udaipur: All the four cropping systems performed better under inorganic with state recommendation for gross return, net return and benefit cost ratio due to the lower cost of cultivation compared to organic input practice. Organic and integrated practice recorded 43.9 and 18.7% lower net return respectively. Among 4 cropping systems evaluated under different management practices, maize + black gram (2:2) – durum wheat – *sesbania* (GM) recorded maximum net return (Rs 136339/ha).

Table 7.2.18. Influence of organic, inorganic and integrated production systems on economics (gross return and cost of cultivation) of different crops and cropping system at different locatio

Location/Cropping systems	Gross Return (Rs/ha)							Cost cultivation (Rs/ha)						
	Organic		Inorganic		Integrated		Mean	Organic		Inorganic		Integrated		Mean
	[1]Organic (100%)	[2]Organic + NF	100% inorganic package (No organic manures)	State recommen-dations or farmers package	50% Organic + 50% Inorganic	[3]Towards Organic		[1]Organic (100%)	[2]Organic + NF	100% inorganic package (No organic manures)	State recommen-dations or farmers package	50% Or-ganic + 50% Inorganic	[3]Towards Organic	
Bajaura														
Frenchbean-cauliflower-frenchbean	4,80,000	4,86,267	3,81,142	5,62,550	5,32,375	5,18,183	4,93,420	2,60,356	2,52,606	2,29,582	2,64,592	2,47,724	2,57,971	2,52,139
Fallow-cauliflower-tomato	4,79,337	4,93,769	3,74,650	5,80,778	5,73,322	5,66,800	5,11,443	2,06,890	1,97,640	1,70,365	2,10,365	1,89,394	1,87,339	1,93,666
Black gram-cauliflower- summer squash	4,96,550	5,12,813	3,01,360	4,76,870	4,66,570	4,46,470	4,50,106	2,57,185	2,49,835	2,16,713	2,68,213	2,51,128	2,59,672	2,50,458
Lady finger-pea	3,95,375	4,05,000	2,48,300	3,96,800	3,85,500	3,53,433	3,64,068	1,61,315	1,57,065	1,46,605	1,74,205	1,62,062	1,67,657	1,61,485
Mean	4,62,816	4,74,462	3,26,363	5,04,250	4,89,442	4,71,222		2,21,437	2,14,287	1,90,816	2,29,344	2,12,577	2,18,160	
Bhopal														
Soybean-durum wheat							1,13,366							55506
Soybean- mustard							1,10,105							49347
Soybean- chickpea							81,825							47343
Soybean- linseed							1,30,870							49575
Mean	1,27,735	98,103	1,11,811	1,09,085	1,21,802	91,322		52,134	50,132	50,085	50,379	50,949	48,977	
Calicut														
Ginger-Fallow	2,97,000	2,80,000	1,71,000		2,05,200	2,46,400	2,39,920	1,83,996	1,91,296	1,45,100		1,56,034	1,75,600	1,70,405
Turmeric-Fallow	4,08,800	3,89,200	4,22,800		4,34,000	3,80,800	4,07,120	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) -	4,48,219	4,13,384	3,12,064	3,86,197	3,41,327	3,27,911	3,71,517	1,88,851	1,67,557	1,53,408	1,90,358	1,69,418	1,58,453	1,71,341
Chillies - barnyard millet-green manure (dhaincha)	3,58,297	3,42,206	2,49,828	2,95,216	3,20,244	2,94,722	3,10,086	1,76,961	1,59,443	1,41,999	1,82,449	1,59,499	1,50,685	1,61,839
Tomato -finger millet-green manure (dhaincha)	4,46,363	5,46,661	3,37,162	4,71,022	3,60,833	3,73,617	4,22,610	2,58,923	2,21,586	1,85,206	2,25,476	2,22,084	2,03,346	2,19,437
Mean	4,17,626	4,34,084	2,99,685	3,84,145	3,40,801	3,32,083		2,08,245	1,82,862	1,60,204	1,99,428	1,83,667	1,70,828	
Dharwad														
Pigeonpea +greengram (2:4) intercropping system	89,000	90,260	72,480	92,100	72,660	77,200	82,283	32,714	29,915	22,587	29,330	26,280	30,460	28,548

Location/Cropping systems	Gross Return (Rs/ha)							Cost cultivation (Rs/ha)						
	Organic		Inorganic		Integrated		Mean	Organic		Inorganic		Integrated		Mean
	[1]Organic (100%)	[2]Organic + NF	100% inorganic package (No organic manures)	State recommen-dations or farmers package	50% Organic + 50% Inorganic	[3]Towards Organic		[1]Organic (100%)	[2]Organic + NF	100% inorganic package (No organic manures)	State recommen-dations or farmers package	50% Or-ganic + 50% Inorganic	[3]Towards Organic	
Pigeonpea +soybean (2:4) intercropping system	64,610	54,230	52,750	69,500	55,250	57,470	58,968	34,714	31,915	24,587	31,330	28,280	32,460	30,548
Pigeonpea +groundnut (2:4) intercropping system	1,06,715	1,02,220	99,755	1,06,635	91,835	87,005	99,028	38,714	35,915	28,587	35,330	32,280	36,460	34,548
Cotton +greengram (1:1) intercropping system	48,330	42,180	41,930	52,330	48,620	47,190	46,763	40,250	35,237	22,400	33,965	25,816	36,852	32,420
Cotton +soybean (1:1) intercropping system	54,200	48,450	47,550	59,400	51,950	51,600	52,192	44,250	39,237	26,400	37,965	29,816	40,852	36,420
Mean	72,571	67,468	62,893	75,993	64,063	64,093		38,128	34,444	24,912	33,584	28,494	35,417	
Jabalpur														
Basmati rice – durum wheat-green manure	2,65,244	2,48,024	2,53,424	1,43,391	2,20,480	1,96,198	2,21,127	1,81,883	1,67,978	1,21,691	1,17,107	1,44,873	1,56,465	1,48,333
Basmati rice – chickpea - maize fodder	2,74,739	2,45,696	2,65,934	1,76,203	2,41,030	2,28,813	2,38,736	1,94,484	1,79,343	1,31,904	1,27,071	1,56,281	1,68,469	1,59,592
Basmati rice – berseem (fodder and seed)	3,28,372	3,22,051	3,31,025	2,39,834	2,89,991	2,95,374	3,01,108	1,56,702	1,49,286	1,23,955	1,21,591	1,35,346	1,41,042	1,37,987
Basmati rice – vegetable pea-sorghum (fodder)	3,52,345	3,21,537	2,98,851	2,08,741	2,68,257	2,60,253	2,84,997	2,08,492	1,93,351	1,49,774	1,44,941	1,74,151	1,86,339	1,76,175
Mean	3,05,175	2,84,327	2,87,309	1,92,042	2,54,940	2,45,160		1,85,390	1,72,490	1,31,831	1,27,678	1,52,663	1,63,079	
Ludhiana														
Basmati rice-chickpea-green manure	1,90,945	2,12,315	1,53,635	1,58,928	1,98,450	1,73,939	1,81,369	98,134	1,06,824	82,282	87,816	89,103	92,341	92,750
Basmati rice-wheat-green manure	2,46,892	2,44,487	2,27,987	2,28,158	2,23,899	2,02,496	2,28,987	94,855	96,975	73,543	83,449	80,282	82,100	85,201
Kharif moong-wheat-summer moong	3,20,134	2,94,778	2,35,638	2,29,135	2,64,476	2,49,120	2,65,547	1,18,960	1,28,187	90,663	90,392	91,547	1,01,137	1,03,481
Soybean-wheat	1,95,186	1,92,752	1,64,622	1,61,101	1,66,428	1,61,545	1,73,606	85,294	89,651	70,795	70,524	73,456	67,420	76,190
Mean	2,38,289	2,36,083	1,95,471	1,94,331	2,13,313	1,96,775		99,311	1,05,409	79,321	83,045	83,597	85,750	
Pantnagar														
Basmati rice - Wheat	3,54,407	2,96,136	2,62,058	2,68,515	2,90,602	2,70,279	2,90,333	97,274	91,274	81,925	81,925	94,454	94,940	90,299

Location/Cropping systems	Gross Return (Rs/ha)							Cost cultivation (Rs/ha)						
	Organic		Inorganic		Integrated		Mean	Organic		Inorganic		Integrated		Mean
	[1]Organic (100%)	[2]Organic + NF	100% inorganic package (No organic manures)	State recommen-dations or farmers package	50% Organic + 50% Inorganic	[3]Towards Organic		[1]Organic (100%)	[2]Organic + NF	100% inorganic package (No organic manures)	State recommen-dations or farmers package	50% Or-ganic + 50% Inorganic	[3]Towards Organic	
Basmati rice – Mustard	4,02,774	3,56,294	2,58,834	2,53,583	3,14,862	2,90,439	3,12,798	85,942	79,942	66,240	66,240	81,616	78,270	76,375
Basmati rice – Vegetable pea (4 rows vegetable pea + 2 rows coriander)	4,68,923	3,75,325	3,10,700	3,25,136	3,59,490	3,33,100	3,62,112	97,682	1,00,682	92,106	92,106	96,717	1,01,189	96,747
Basmati rice – Potato	4,49,687	3,56,283	2,97,669	2,97,781	3,37,865	3,14,250	3,42,256	95,616	94,316	80,918	80,918	89,341	1,02,196	90,551
Mean	4,18,948	3,46,010	2,82,315	2,86,254	3,25,705	3,02,017		94,129	91,554	80,297	80,297	90,532	94,149	
Raipur														
Soybean-maize (sweet corn)	5,53,628	4,95,331	3,51,761	3,82,840	3,43,923	3,02,446	4,04,988	1,14,120	1,01,585	83,415	85,415	98,773	93,405	96,119
Soybean- french bean	4,26,606	3,29,558	2,66,711	2,95,540	2,41,258	2,16,271	2,95,991	75,906	73,504	64,087	66,088	70,008	70,535	70,021
Soybean-cabbage	6,57,563	5,30,202	3,74,459	4,67,113	3,72,247	3,05,705	4,51,215	1,19,451	1,02,617	82,946	84,946	1,01,207	93,482	97,442
Soybean-tomato	9,09,521	7,44,475	5,62,755	6,15,135	5,42,075	4,38,983	6,35,491	1,48,392	1,32,657	1,12,486	1,14,486	1,30,447	1,23,672	1,27,023
Mean	6,36,830	5,24,892	3,88,922	4,40,157	3,74,876	3,15,851		1,14,467	1,02,591	85,734	87,734	1,00,109	95,274	
Ranchi														
Rice -wheat	1,60,672	1,68,161	1,34,064	96,390	1,15,228	1,16,950	1,31,911	78,310	69,822	65,446	58,294	59,778	60,252	65,317
Rice -onion	3,99,091	3,90,359	2,73,258	2,20,972	2,91,852	3,04,112	3,13,274	1,32,955	1,22,936	1,12,565	1,00,424	1,15,980	1,16,462	1,16,887
Rice -potato	4,20,495	3,67,560	2,23,513	1,85,403	2,35,656	2,97,750	2,88,396	1,47,614	1,32,936	1,15,986	97,694	1,16,500	1,30,041	1,23,462
Rice -okra	2,49,740	2,64,250	1,84,044	1,47,584	1,88,928	2,01,844	2,06,065	97,057	88,405	68,922	60,728	79,954	87,481	80,425
Mean	3,07,500	2,97,583	2,03,720	1,62,587	2,07,916	2,30,164		1,13,984	1,03,525	90,730	79,285	93,053	98,559	
Umiam														
Bhindi-Carrot	563800	483070	515025		501735		515908	246680	219790	225500		217760		227432.5
Bhindi-Potato	492580	417305	435965		415615		440366	227780	203140	209700		185260		206470
Bhindi-Tomato	517100	495840	501250		474660		497213	217680	198260	201250		185760		200737.5
Bhindi-Frenchbean	437120	390520	398660		393970		405068	186110	173290	171200		157260		171965
Mean	502650	446683.75	462725		446495			219563	198620	201913		186510		
Almora														
Grain Amaranth-Wheat + Lentil	200722	195238	52147		140207		147079	117658	129853	10631		73634		82944

Location/Cropping systems	Gross Return (Rs/ha)							Cost cultivation (Rs/ha)						
	Organic		Inorganic		Integrated		Mean	Organic		Inorganic		Integrated		Mean
	[1]Organic (100%)	[2]Organic + NF	100% inorganic package (No organic manures)	State recommen-dations or farmers package	50% Organic + 50% Inorganic	[3]Towards Organic		[1]Organic (100%)	[2]Organic + NF	100% inorganic package (No organic manures)	State recommen-dations or farmers package	50% Or-ganic + 50% Inorganic	[3]Towards Organic	
Fingermillet + Black Soybean-wheat + Toria	139612	120477	38317		95663		98517	47848	52392	-5899		26390		30183
Mean	170167	157858	45232		117935			82753	91123	2366		50012		
Narendrapur														
Basmati rice-broccoli-sesbania green maunre	2,10,835	2,00,721	1,82,948	1,73,829	1,82,316	1,73,171	1,87,303	1,16,252	1,11,877	1,08,526	1,14,993	1,00,661	1,00,661	1,08,828
Rice -mustard-green gram	2,38,309	2,38,539	1,81,339	1,90,606	2,00,242	1,88,407	2,06,240	1,33,306	1,27,406	1,24,474	1,31,820	1,21,678	1,21,678	1,26,727
Rice -frenchbean-green gram	5,90,458	5,83,556	4,79,342	5,07,665	5,45,808	5,21,598	5,38,071	1,93,918	1,75,243	1,61,507	1,81,281	1,54,523	1,54,523	1,70,166
Rice -vegetable pea-sesame	2,52,603	2,58,350	1,91,781	1,95,022	2,12,560	1,99,848	2,18,361	1,18,558	1,12,858	1,13,087	1,17,597	1,09,582	1,09,582	1,13,544
Mean	3,23,051	3,20,292	2,58,852	2,66,780	2,85,232	2,70,756		1,40,509	1,31,846	1,26,898	1,36,423	1,21,611	1,21,611	
Sardarkrushinagar														
Groundnut - wheat - green gram	2,10,785	2,06,632	1,63,011	1,95,069	1,79,408	1,44,094	1,83,167	1,37,876	1,25,649	93,981	1,09,500	1,15,818	1,26,867	1,18,282
Green gram - coriander - vegetable cowpea	2,12,283	1,79,247	1,56,992	1,90,799	1,73,803	1,43,589	1,76,119	1,01,721	95,760	85,783	1,00,781	93,412	97,226	95,781
Green gram - fennel - fennel continue	1,04,933	84,111	71,643	93,538	88,049	68,674	85,158	80,298	70,281	47,618	57,617	64,083	72,316	65,369
Mean	1,76,000	1,56,663	1,30,549	1,59,802	1,47,087	1,18,786		1,06,632	97,230	75,794	89,299	91,105	98,803	
Udaipur														
Maize + blackgram (2:2)–wheat (durum)–sesbania (GM)	2,04,397	2,23,106	2,05,476	2,26,945	2,12,842	1,98,884	2,11,942	1,02,896	88,386	55,007	65,007	78,961	63,359	75,603
Blackgram – wheat (Triticum aestivum)	1,66,888	1,78,820	1,65,570	1,84,980	1,75,050	1,62,470	1,72,296	69,926	67,487	44,820	54,865	57,399	48,209	57,118
Sweet corn + blackgram (2:2)–chickpea	1,85,395	2,05,157	1,89,003	2,10,866	1,85,980	1,73,053	1,91,576	1,02,406	97,555	72,366	82,410	87,407	76,996	86,523
Soybean – fenugreek	1,25,193	1,34,570	1,16,152	1,34,368	1,23,011	1,17,794	1,25,181	58,490	61,855	43,824	53,914	51,201	45,181	52,411
Mean	1,70,468	1,85,413	1,69,050	1,89,290	1,74,221	1,63,050		83,430	78,821	54,004	64,049	68,742	58,436	

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

Location/Cropping systems	Net return (Rs/ha)							Return per rupee						
	Organic		Inorganic		Integrated		Mean	Organic		Inorganic		Integrated		
	[1]Organic (100%)	[2]Organic + NF	100% inorganic package (No organic manures)	State recommen-dations or farmers package	50% Organic + 50% Inorganic	[3]Towards Organic		[1]Organic (100%)		[1]Organic (100%)	[2]Organic + NF	100% inorganic package (No organic manures)	State recommen-dations or farmers package	50% Organic + 50% Inorganic
Bajaura														
Frenchbean-cauliflower-frenchbean	2,19,644	2,33,661	1,51,560	2,97,958	2,84,651	2,60,212	2,41,281	0.84	0.93	0.66	1.13	1.15	1.01	0.95
Fallow-cauliflower-tomato	2,72,447	2,96,129	2,04,285	3,70,413	3,83,928	3,79,461	3,17,777	1.32	1.50	1.20	1.76	2.03	2.03	1.64
Black gram-cauliflower-summer squash	2,39,365	2,62,978	84,647	2,08,657	2,15,442	1,86,798	1,99,648	0.93	1.05	0.39	0.78	0.86	0.72	0.79
Lady finger-pea	2,34,060	2,47,935	1,01,695	2,22,595	2,23,438	1,85,776	2,02,583	1.45	1.58	0.69	1.28	1.38	1.11	1.25
Mean	2,41,379	2,60,176	1,35,547	2,74,906	2,76,865	2,53,062		1.14	1.27	0.74	1.24	1.36	1.22	
Bhopal														
Soybean-durum wheat							35,026							0.63
Soybean- mustard							41,774							0.85
Soybean- chickpea							18,117							0.38
Soybean- linseed							55,121							1.11
Mean	45,576	24,912	35,445	33,065	42,223	20,880		0.87	0.50	0.71	0.66	0.83	0.43	
Calicut														
Ginger-Fallow	1,13,004	88,704	25,900		49,166	70,800	69,515	0.61	0.46	0.18		0.32	0.40	0.39
Turmeric-Fallow	2,26,301	2,17,488	2,74,592		2,70,011	2,07,691	2,39,217	1.24	1.27	1.85		1.64	1.20	1.44
Coimbatore														
Brinjal - pearl millet-green manure (dhaincha) -	2,59,367	2,45,826	1,58,656	1,95,839	1,71,909	1,69,458	2,00,176	1.37	1.47	1.03	1.03	1.01	1.07	1.16
Chillies - barnyard millet-green manure (dhaincha)	1,81,335	1,82,763	1,07,829	1,12,767	1,60,745	1,44,038	1,48,246	1.02	1.15	0.76	0.62	1.01	0.96	0.92
Tomato -finger millet-green manure (dhaincha)	1,87,440	3,25,075	1,51,956	2,45,546	1,38,749	1,70,271	2,03,173	0.72	1.47	0.82	1.09	0.62	0.84	0.93
Mean	2,09,381	2,51,221	1,39,480	1,84,717	1,57,134	1,61,256		1.04	1.36	0.87	0.91	0.88	0.95	

Location/Cropping systems	Net return (Rs/ha)							Return per rupee						
	Organic		Inorganic		Integrated		Mean	Organic		Inorganic		Integrated		
	[1]Organic (100%)	[2]Organic + NF	100% inorganic package (No organic manures)	State recommen-dations or farmers package	50% Organic + 50% Inorganic	[3]Towards Organic		[1]Organic (100%)		[1]Organic (100%)	[2]Organic + NF	100% inorganic package (No organic manures)	State recommen-dations or farmers package	50% Organic + 50% Inorganic
Dharwad														
Pigeonpea +greengram (2:4) intercropping system	56,286	60,345	49,893	62,770	46,380	46,740	53,736	1.72	2.02	2.21	2.14	1.76	1.53	1.90
Pigeonpea +soybean (2:4) intercropping system	29,896	22,315	28,163	38,170	26,970	25,010	28,421	0.86	0.70	1.15	1.22	0.95	0.77	0.94
Pigeonpea +groundnut (2:4) intercropping system	68,001	66,305	71,168	71,305	59,555	50,545	64,480	1.76	1.85	2.49	2.02	1.84	1.39	1.89
Cotton +greengram (1:1) intercropping system	8,080	6,943	19,530	18,365	22,804	10,338	14,343	0.20	0.20	0.87	0.54	0.88	0.28	0.50
Cotton +soybean (1:1) intercropping system	9,950	9,213	21,150	21,435	22,134	10,748	15,772	0.22	0.23	0.80	0.56	0.74	0.26	0.47
Mean	34,443	33,024	37,981	42,409	35,569	28,676		0.95	1.00	1.50	1.30	1.24	0.85	
Jabalpur														
Basmati rice – durum wheat-green manure	83,361	80,046	1,31,733	26,284	75,607	39,733	72,794	1.45	1.48	2.08	1.22	1.52	1.25	1.50
Basmati rice – chickpea - maize fodder	80,255	66,353	1,34,030	49,132	84,749	60,344	79,144	1.41	1.37	2.02	1.39	1.54	1.36	1.52
Basmati rice – berseem (fodder and seed)	1,71,670	1,72,765	2,07,070	1,18,243	1,54,645	1,54,332	1,63,121	2.10	2.16	2.67	1.97	2.14	2.09	2.19
Basmati rice – vegetable pea-sorghum (fodder)	1,43,853	1,28,186	1,49,077	63,800	94,106	73,914	1,08,823	1.69	1.66	2.00	1.44	1.54	1.40	1.62
Mean	1,19,785	1,11,838	1,55,478	64,365	1,02,277	82,081		1.66	1.67	2.19	1.51	1.69	1.53	
Karjat														
Rice-brinjal	6,19,172	5,55,397	5,94,743	3,60,113	4,91,374	4,43,481	5,10,713	2.86	2.80	3.41	2.49	2.70	2.48	2.79
Rice-chickpea	72,669	55,514	49,805	30,394	59,867	56,531	54,130	1.63	1.51	1.56	1.35	1.59	1.57	1.54
Rice-field bean	89,757	67,170	60,404	46,387	62,532	49,078	62,555	1.73	1.58	1.56	1.49	1.57	1.46	1.57

Location/Cropping systems	Net return (Rs/ha)							Return per rupee						
	Organic		Inorganic		Integrated		Mean	Organic		Inorganic		Integrated		
	[1]Organic (100%)	[2]Organic + NF	100% inorganic package (No organic manures)	State recommen-dations or farmers package	50% Organic + 50% Inorganic	[3]Towards Organic		[1]Organic (100%)		[1]Organic (100%)	[2]Organic + NF	100% inorganic package (No organic manures)	State recommen-dations or farmers package	50% Organic + 50% Inorganic
Rice- onion (white)	4,19,263	2,44,090	3,05,573	1,95,772	3,58,295	2,11,906	2,89,150	2.83	2.17	2.89	2.25	2.85	2.05	2.51
Mean	3,00,215	2,30,543	2,52,631	1,58,167	2,43,017	1,90,249		2.26	2.02	2.36	1.90	2.18	1.89	
Ludhiana														
Basmati rice-chickpea-green manure	92,810	1,05,491	71,353	71,112	1,09,347	81,598	88,619	1.95	1.99	1.87	1.81	2.23	1.88	
Basmati rice-wheat-green manure	1,52,037	1,47,512	1,54,444	1,44,709	1,43,617	1,20,395	1,43,786	2.60	2.52	3.10	2.73	2.79	2.47	2.70
Kharif moong-wheat-summer moong	2,01,174	1,66,591	1,44,976	1,38,743	1,72,929	1,47,984	1,62,066	2.69	2.30	2.60	2.53	2.89	2.46	2.58
Soybean-wheat	1,09,892	1,03,101	93,826	90,576	92,971	94,125	97,415	2.29	2.15	2.33	2.28	2.27	2.40	2.29
Mean	1,38,978	1,30,674	1,16,150	1,11,285	1,29,716	1,11,026		2.38	2.24	2.48	2.34	2.55	2.30	2.38
Pantnagar														
Basmati rice - Wheat	2,57,133	2,04,862	1,80,133	1,86,590	1,96,148	1,75,339	2,00,034	2.06	2.21	2.42	2.42	2.05	2.04	2.20
Basmati rice – Mustard	3,16,832	2,76,352	1,92,594	1,87,343	2,33,246	2,12,169	2,36,423	2.39	2.67	3.64	3.64	2.46	2.62	2.90
Basmati rice – Vegetable pea (4 rows vegetable pea + 2 rows coriander)	3,71,241	2,74,643	2,18,594	2,33,030	2,62,773	2,31,911	2,65,365	2.05	1.99	2.09	2.09	2.00	1.92	2.02
Basmati rice – Potato	3,54,071	2,61,967	2,16,751	2,16,863	2,48,524	2,12,054	2,51,705	2.09	2.13	2.46	2.46	2.19	1.90	2.21
Mean	3,24,819	2,54,456	2,02,018	2,05,957	2,35,173	2,07,868		2.15	2.25	2.65	2.65	2.18	2.12	
Raipur														
Soybean-maize (sweet corn)	4,39,508	3,93,746	2,68,346	2,97,425	2,45,150	2,09,041	3,08,869	4.85	4.88	4.22	4.48	3.48	3.24	4.19
Soybean- french bean	3,50,700	2,56,054	2,02,624	2,29,452	1,71,250	1,45,736	2,25,969	5.62	4.48	4.16	4.47	3.45	3.07	4.21
Soybean-cabbage	5,38,112	4,27,585	2,91,513	3,82,167	2,71,040	2,12,223	3,53,773	5.50	5.17	4.51	5.50	3.68	3.27	4.61

Location/Cropping systems	Net return (Rs/ha)							Return per rupee						
	Organic		Inorganic		Integrated		Mean	Organic		Inorganic		Integrated		
	[1]Organic (100%)	[2]Organic + NF	100% inorganic package (No organic manures)	State recommen-dations or farmers package	50% Organic + 50% Inorganic	[3]Towards Organic		[1]Organic (100%)		[1]Organic (100%)	[2]Organic + NF	100% inorganic package (No organic manures)	State recommen-dations or farmers package	50% Organic + 50% Inorganic
Soybean-tomato	7,61,129	6,11,818	4,50,269	5,00,649	4,11,628	3,15,311	5,08,467	6.13	5.61	5.00	5.37	4.16	3.55	4.97
Mean	5,22,362	4,22,301	3,03,188	3,52,423	2,74,767	2,20,578		5.53	5.04	4.47	4.96	3.69	3.28	
Ranchi														
Rice -wheat	82,362	98,339	68,618	38,096	55,450	56,698	66,594	1.05	1.41	1.05	0.65	0.93	0.94	1.01
Rice -onion	2,66,136	2,67,423	1,60,693	1,20,548	1,75,872	1,87,650	1,96,387	2.00	2.18	1.43	1.20	1.52	1.61	1.66
Rice -potato	2,72,881	2,34,624	1,07,527	87,709	1,19,156	1,67,709	1,64,934	1.85	1.76	0.93	0.90	1.02	1.29	1.29
Rice -okra	1,52,683	1,75,845	1,15,122	86,856	1,08,974	1,14,363	1,25,641	1.57	1.99	1.67	1.43	1.36	1.31	1.56
Mean	1,93,516	1,94,058	1,12,990	83,302	1,14,863	1,31,605		1.62	1.83	1.27	1.05	1.21	1.29	
Umiam														
Bhindi-Carrot	3,17,120	2,63,280	2,89,525		2,83,975		2,88,475	1.29	1.20	1.28		1.30		1.27
Bhindi-Potato	2,64,800	2,14,165	2,26,265		2,30,355		2,33,896	1.16	1.05	1.08		1.24		1.13
Bhindi-Tomato	2,99,420	2,97,580	3,00,000		2,88,900		2,96,475	1.38	1.50	1.49		1.56		1.48
Bhindi-Frenchbean	2,51,010	2,17,230	2,27,460		2,36,710		2,33,103	1.35	1.25	1.33		1.51		1.36
Mean	2,83,088	2,48,064	2,60,813		2,59,985			1.29	1.25	1.30		1.40		
Ajmer														
Cow pea + maize (4:2) - coriander + cabbage (2:1)	33,285	49,610	38,264	64,264	51,385	76,087	52,149	1.73	2.42	2.47	2.79	2.43	3.53	2.56
Cow pea + maize (4:2) - fennel + cabbage (2:1)	97,975	1,24,090	1,19,346	1,49,036	1,26,029	1,53,327	1,28,301	2.56	3.78	4.96	4.71	3.71	5.2	4.15
Cow pea - fennel	89,015	1,05,890	1,16,266	1,22,016	1,06,359	1,27,427	1,11,162	2.42	3.37	4.85	4.04	3.29	4.49	3.74
Cow pea - coriander	-7,515	5,690	11,384	14,664	12,825	21,927	9,829	0.83	1.16	1.44	1.41	1.36	1.73	1.32
Mean	53,190	71,320	71,315	87,495	74,150	94,692		1.89	2.68	3.43	3.24	2.70	3.74	

Location/Cropping systems	Net return (Rs/ha)							Return per rupee						
	Organic		Inorganic		Integrated		Mean	Organic		Inorganic		Integrated		
	[1]Organic (100%)	[2]Organic + NF	100% inorganic package (No organic manures)	State recommen-dations or farmers package	50% Organic + 50% Inorganic	[3]Towards Organic		[1]Organic (100%)		[1]Organic (100%)	[2]Organic + NF	100% inorganic package (No organic manures)	State recommen-dations or farmers package	50% Organic + 50% Inorganic
Almora														
Grain Amaranth-Wheat + Lentil	83,064	65,385	41,516		66,573		64,135	0.71	0.50	3.91		0.90		1.50
Fingermillet + Black Soybean-wheat + Toria	91,764	68,085	44,216		69,273		68,335	1.92	1.30	-7.50		2.62		-0.41
Mean	87,414	66,735	42,866		67,923			1.31	0.90	-1.80		1.76		
Narendrapur														
Basmati rice-broccoli-sesbania green maunre	94,583	88,844	73,791	58,178	82,286	73,167	78,475	0.81	0.79	0.68	0.51	0.82	0.73	0.72
Rice -mustard-green gram	1,05,003	1,11,133	75,768	56,587	59,661	68,928	79,513	0.79	0.87	0.61	0.43	0.49	0.57	0.63
Rice -frenchbean-green gram	3,96,539	4,08,313	3,84,301	3,40,318	3,24,819	3,53,142	3,67,905	2.04	2.33	2.38	1.88	2.10	2.29	2.17
Rice -vegetable pea-sesame	1,34,045	1,45,492	99,473	82,251	82,199	85,440	1,04,817	1.13	1.29	0.88	0.70	0.75	0.78	0.92
Mean	1,82,543	1,88,445	1,58,333	1,34,333	1,37,241	1,45,170		1.19	1.32	1.14	0.88	1.04	1.09	
Sardarkrushinagar														
Groundnut - wheat - green gram	72,909	80,983	69,030	85,570	63,590	17,227	64,885	0.53	0.64	0.73	0.78	0.55	0.14	0.56
Green gram - coriander - vegetable cowpea	1,10,562	83,487	71,209	90,018	80,391	46,363	80,338	1.09	0.87	0.83	0.89	0.86	0.48	0.84
Green gram - fennel - fennel continue	24,634	13,830	24,025	35,920	23,965	-3,642	19,789	0.31	0.20	0.50	0.62	0.37	-0.05	0.33
Mean	69,368	59,433	54,755	70,503	55,982	19,983		0.64	0.57	0.69	0.77	0.59	0.19	
Thiruvananthapuram														
Cassava-vegetable cowpea	2,84,433	3,11,909	1,67,645	1,17,011	5,07,635	4,71,371	3,10,001	1.75	1.83	1.72	1.47	2.63	2.23	1.94
Cassava-groundnut	2,26,703	4,14,909	2,64,871	1,64,622	2,16,766	1,69,623	2,42,916	1.82	2.39	2.16	1.71	1.75	1.55	1.90

Location/Cropping systems	Net return (Rs/ha)							Return per rupee						
	Organic		Inorganic		Integrated		Mean	Organic		Inorganic		Integrated		
	[1]Organic (100%)	[2]Organic + NF	100% inorganic package (No organic manures)	State recommen-dations or farmers package	50% Organic + 50% Inorganic	[3]Towards Organic		[1]Organic (100%)		[1]Organic (100%)	[2]Organic + NF	100% inorganic package (No organic manures)	State recommen-dations or farmers package	50% Organic + 50% Inorganic
Taro-blackgram	-99,064	2,94,158	-91,350	-2,35,026	78,728	-1,09,415	-26,995	0.81	1.58	0.7	0.27	1.19	0.78	0.89
Taro-greengram	-1,32,568	2,64,648	-42,851	-1,79,487	67,156	1,82,906	26,634	0.74	1.52	0.87	0.46	1.16	1.36	1.02
Mean	69,876	3,21,406	74,579	-33,220	2,17,571	1,78,621		1.28	1.83	1.36	0.98	1.68	1.48	
Udaipur														
Maize + blackgram (2:2)–wheat (durum)–sesbania (GM)	1,01,501	1,34,720	1,50,469	1,61,938	1,33,881	1,35,525	1,36,339	0.99	1.52	2.74	2.49	1.70	2.14	1.93
Blackgram – wheat (Triticum aestivum)	96,962	1,11,333	1,20,750	1,30,115	1,17,651	1,14,261	1,15,179	1.39	1.65	2.69	2.37	2.05	2.37	2.09
Sweet corn + blackgram (2:2)–chickpea	82,989	1,07,602	1,16,637	1,28,456	98,573	96,057	1,05,052	0.81	1.10	1.61	1.56	1.13	1.25	1.24
Soybean – fenugreek	66,703	72,715	72,328	80,454	71,810	72,613	72,771	1.14	1.18	1.65	1.49	1.40	1.61	1.41
Mean	87,039	1,06,593	1,15,046	1,25,241	1,05,479	1,04,614		1.08	1.36	2.17	1.98	1.57	1.84	

[1]Organic manures equivalent to 100 % N requirement of the system);
[2]Nutrients supply of only 50% 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.
[3]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

7.3 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 is presented and discussed

Bajaura (Table 7.3.1.1 – 7.3.1.2)

Evaluation of maize varieties under organic condition (Table 7.3.1.1): 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. Best performing variety i.e., Bajaura Makka recorded significantly higher Fresh weight of cobs (6850 kg/ha), 1000- grains weight (329 g), grain yield (5470 kg/ha kg/ha), net returns (Rs. 85,121/ha) and B:C ratio (2.42) followed by Girija which recorded 1000- grains weight (327 g) and yield (5090 kg/ha), net returns (Rs. 76,652/ha) and B:C ratio (2.18).

Table 7.3.1.1: Yield attributes and yield of different maize varieties under organic condition at Bajaura

Variety/ Hybrid	Plant height (cm)	Fresh weight of cobs (kg/ha)	Cob length (cm)	Cob diameter (cm)	No. of rows/ cob	1000 Grain weight (g)	Grain yield (kg/ha)	Moisture (%)	Net Returns (RS. /ha)	B:C
Early Composite	256.0	6000	18.6	4.3	14.7	230	4700	15.5	68188	1.94
Girija	247.3	6440	18.8	4.6	14.7	327	5090	19.0	76652	2.18
Bajaura Makka	234.4	6850	18.9	4.3	12.7	329	5470	16.1	85121	2.42
Palampur Sankar Makka II	200.3	6500	19.0	4.7	16.1	296	4950	18.6	73713	2.09
L-317	211.3	6060	16.3	4.4	14.4	270	4780	16.2	69987	1.99
L-315	209.3	6550	19.9	4.5	14.7	301	5010	16.8	75094	2.13
CD at 5%	3.08	2980	0.06	0.04	0.30	5.54	2480	0.25	5079.8	0.14

Evaluation of wheat varieties under organic condition (Table 7.3.1.2): Three varieties of wheat were evaluated for their performance under organic conditions during *rabi*. Significant differences among the varieties for all the traits were observed. HPW-368 recorded significantly higher grain yield (3030 kg/ha), 1000- grain weight (47.1 g), net return (Rs.94319/ha) and B:C ratio (2.61) followed by HP-349 which recorded yield (2690 kg/ha),1000- grains weight (46.2 g) and net returns (Rs. 79367/ha) and B:C ratio (2.19).

Table 7.3.1.2: Yield attributes and yield of wheat varieties under organic condition at Bajaura

Variety/ Hybrid	Grain yield(kg/ha)	1000 Grain weight (g)	Net Returns (RS./ha)	B:C
HPW-368	3030	47.1	94319	2.61
HS-507	2660	45.0	78077	2.16
HS-562	2610	45.5	76213	2.11
HP-349	2690	46.2	79367	2.19
HPW-373	2580	44.3	74923	2.07
HPW-360	2280	43.1	62023	1.72
CD at 5%	1720	NS	7471.63	0.20

Best performing varieties/hybrids of maize and wheat at Bajaura

Bhopal (Table 7.3.2.1-7.3.2.2)

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 during *kharif* and *rabi respectively* grown by the farmers in the region.

Performance of different varieties of groundnut (Table 7.3.2.1):

Among different varieties of groundnut, the maximum plant height (43 cm), Pods/plant (32), Seed/pod (2.3), pod yield (1983 kg/ha) and total biomass yield (4296 kg/ha) was recorded with the variety GPBD-5. The plant height of groundnut in GPBD-5 variety was statistically at par with GJG-17, GJGHPS-1, ICGV-16690 and JL-24. The pods/plant of groundnut in GPBD-5 variety was statistically at par with GJG-17, DH-256, GG-20 and JL-24 while there was no significant difference in case of seeds/pod. The Pod yield was also found statistically at par with GJG-17 and the significantly lowest pod yield was obtained with DH-101 (1253 kg/ha).

Table 7.3.2.1: Yield attributes, yields and quality of groundnut under organic management at Bhopal

Variety	Plant height (cm)	Pods/plant	Seeds/pod	Pod yield (kg ha^{-1})	Total biomass yield (kg ha^{-1})
ICGV-16697	39	25	2.3	1716	3900
GJG-17	42	31	2.0	1887	4171
DH-256	40	29	2.0	1757	3805
GJGHPS-1	41	26	2.0	1752	3923
GG-20	40	27	2.0	1743	3661
ICGV-16690	41	25	2.3	1501	3152
DH-86	37	24	1.7	1443	3164
DH-101	35	21	1.7	1253	3013
GPBD-5	43	32	2.3	1983	4296
JL-24	41	30	2.0	1773	3839
DH-245	40	23	2.0	1488	3297
DH-232	38	25	2.0	1647	3574
LSD (P=0.05)	2.8	5.1	NS	176	481

Performance of Mustard (Table 7.3.2.2): Among different varieties of mustard maximum siliqua/plant (449), seeds/siliqua (13.7), test weight (6.3g), seed yield (1988 kg/ha) and biomass yield (6598 kg/ha) was recorded by the variety Aravali. The seeds/siliqua of mustard in Aravali variety was statistically at par with RH-749, Pusa Mahak, CS-52 and Maya. The test weight of Aravali variety was statistically at par with RH-749 and PGN-229. Seed yield of Aravali variety was statistically at par with DRMR-150-35, Pusa Mahak, CS-52 and Maya. Biomass yield of Aravali variety was statistically at par with RH-749 and CS-52.

General view of different varieties of groundnut and mustard at Bhopal under organic condition

The plant height of DRMR-150-35 variety was significantly higher (165 cm) than other varieties followed by CS-52 (164 cm). Aravali recorded significantly higher siliqua/plant (449) followed by CS-52 (433).

Table 7.3.2.2: Yield attributes, yield and quality of different mustard varieties under organic management at Bhopal

Variety	Plant height (cm)	Siliqua/plant	Seeds/siliqua	Test weight (g)	Seed yield (kg ha^{-1})	Biomass yield (kg ha^{-1})
DRMR-IJ - 31	159	235	9.7	5.1	1332	4148
NRCDR-2	159	273	11.0	5.2	1574	5162
NRCHB-101	160	243	10.3	5.4	1340	4170
DRMR-150-35	165	347	11.7	5.4	1730	5131
NRCDR-601	154	253	11.3	5.2	1496	4262
RH-749	158	411	12.3	5.9	1905	5960
ARAVALI	155	449	13.7	6.3	1988	6598
PUSA MAHAK	158	325	12.0	5.8	1745	5108
CS-52	164	433	13.3	6.0	1970	6255
MAYA	152	394	12.0	5.4	1830	5612
PM-22	155	313	11.0	5.2	1555	4825
PGN-229	153	252	10.7	5.9	1390	4200
LSD (P=0.05)	NS	54	2.0	0.4	280	905

Calicut (Table 7.3.3.1-7.3.3.2)

Performance of different varieties of ginger and turmeric: Different varieties of ginger and turmeric was evaluated for their yield response to screen out as promising varieties for organic management practices for central India. Two varieties of ginger and thirteen varieties of turmeric grown by the farmers in the region.

Performance on of Ginger (Table 7.3.3.1): Two varieties of ginger were evaluated for their performance under organic conditions. Varada recorded higher yield (14770 t/ha), oleoresin content (4.2%) followed by Rajatha which recorded yield (10660 t/ha), oleoresin content (4.0%). Cost of cultivation for both the varieties was (Rs 183996/ha) and NRPRI was (0.61).

Table 7.3.3.1: Yield and quality of ginger varieties under organic management at Calicut

Ginger varieties	Yield (t/ha)	Cost of cultivation (Rs./ha)	Net return	NRPRI	Oleoresin content (%)
Varada	14770	183996	113204	0.61	4.2
Rajatha	10660				4.0

Performance on of turmeric (Table 7.3.3.2): The Yield of turmeric in Pragati variety (38.8 t/ha) was statistically at par with Suguna (37.7 t/ha) and Sudarsana (37.3 t/ha). Oil content of Suguna variety (5.27 %) was statistically at par with Kedaram (5.10%). Pragati recorded higher oleoresin content (14.11%) followed by Alappey supreme (11.93%). Curcumin content of Sudarsana variety (6.03%) was significantly at par with Suguna and Alappey supreme. Cost of cultivation, net return and NRPRI was 1,82,499 Rs/ha, 2,26,301 Rs/ha, 1.24 respectively.

Table 7.3.3.2: Yield and quality of turmeric varieties under organic management at Calicut

Varieties	Yield (t/ha)	Oil content (%)	Oleoresin content (%)	Curcumin content (%)
Prathibha	16.6	4.37	11.14	5.65
Alappey supreme	22.4	4.53	11.93	5.91
Varna	27.6	4.43	11.1	3.53
Shoba	29.6	4.23	9.99	3.94
Sona	26.2	4.30	9.46	4.91
Kanthi	28.8	5.03	9.92	3.79
Suvarna	34.8	4.90	11.24	3.76
Suguna	37.7	5.27	11.72	5.91
Sudarsana	37.3	4.50	11.86	6.03
Kedaram	24.1	5.10	11.86	5.77
Prabha	30.9	4.43	11.57	5.74
Pragati	38.8	4.73	14.11	5.33
Mean	29.6	4.65	11.33	5.27
CD(0.05)	Var-1.6	0.17	0.34	0.14
Cost of cultivation (Rs./ha)	1,82,499			
Net return (Rs./ha)	2,26,301			
NRPRI	1.24			

General view of different varieties of turmeric and best performing variety of turmeric Suguna at Calicut

Coimbatore (Table 7.3.4.1-7.3.4.4)

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

Performance of Rice under organic farming (Table 7.3.4.1): All the traits showed significant difference among rice varieties evaluated under organic condition. Among different variety of rice maximum plant height (135.6 cm), productive tillers/m^2 (269), panicle weight (3.85 g), fertility percentage (89.46%) and test weight (27.80 g) was recorded by the variety Kuzhiadichan. Plant height of Kuzhiadichan variety was statistically at par with Garudan samba (130.7 cm), Kullakar (124.4 cm), Anaikomban (132.3 cm). Number of productive tillers/m^2 of Kuzhiadichan variety was statistically at par with Athur Kichili samba (206), Illuppaipoo samba (218), Thuaiya malli samba (210), kullakar (223) and Anaikomban (240). Panicle weight of Kuzhiadichan variety was statistically at par with Poonkar (3.76 g). fertility percentage of Kuzhiadichan variety was statistically at par with Kullakar (81.59 %) and Anaikomban (86.16 %). Test weight of Kuzhiadichan variety was statistically at par with

Poonkar (26.65 g). Anaikomban recorded higher panicle length (26.7 cm) followed by Poonkar (24.9 cm) and Kuzhiadichan (24.9 cm). Milagu samba recorded maximum filled grains/ panicle (157.2) followed by Anaikomban (146.4).

Table 7.3.4.1: Yield attributes of different rice varieties under organic farming at Coimbatore

Treatments	Plant height at harvest (cm)	Productive tillers / m^2(No)	Panicle length (cm)	Panicle weight (g)	Filled grains/ panicle (No.)	Fertility percentage	Test weight (g)
Athur Kichili samba	114.8	206	22.7	2.81	119.7	73.89	19.02
Garudan samba	130.7	190	21.2	2.65	100.3	68.66	20.20
Illuppaipoo samba	115.1	218	24.6	2.58	86.6	70.93	24.42
Milagu samba	123.8	184	22.0	2.94	157.2	74.72	15.24
Poonkar	108.6	113	24.9	3.76	112.8	72.68	26.65
Sorna masuri	116.3	179	21.9	3.05	135.3	77.57	18.90
Thuaiya malli samba	117.9	210	24.4	2.60	105.9	70.52	19.21
Thanga samba	112.8	158	22.3	3.25	110.2	66.19	22.0
Kuzhiadichan	135.6	269	24.9	3.85	128.4	89.46	27.80
Kullakar	124.4	223	22.3	3.00	115.9	81.59	22.50
Anaikomban	132.3	240	26.7	3.18	146.4	86.16	19.60
Thulasi vasa samba	110.1	187	23.9	2.60	130.2	63.87	14.50
CD (P=0.05)	**11.54**	**69.8**	**1.15**	**0.29**	**15.43**	9.49	**1.62**

Economics of Rice under organic farming:

Twelve varieties of rice were evaluated for their performance under organic conditions. Among different variety of rice maximum grain yield (5611 kg/ha), straw yield (8522 kg/ha), harvest index (0.40%), cost of cultivation (86655 Rs/ha), net return (89456 Rs/ha) and B:C ratio (2.03) recorded by Kuzhiadichan. Straw yield of Kuzhiadichan variety was statistically at par with Athur Kichili samba (7256 kg/ha), Garudan samba (7572 kg/ha), Kullakar (7189 kg/ha) and Anaikomban (7600 kg/ha).

Table 7.3.4.2: Yield and economics of different rice varieties under organic farming at Coimbatore

Treatments	Grain yield (kg/ha)	Straw yield (kg/ha)	Harvest Index (%)	Cost of cultivation (Rs./ha)	Net return (Rs./ha)	B:C ratio
Athur Kichili samba	3383	7256	0.32	82367	30505	1.37
Garudan samba	2850	7572	0.27	81341	17390	1.21
Illuppaipoo samba	3172	6367	0.33	81961	22778	1.28
Milagu samba	2994	5711	0.34	84827	59962	1.71
Poonkar	2556	4794	0.35	81929	18413	1.22
Sorna masuri	3478	6117	0.36	84474	56196	1.67
Thuaiya malli samba	3089	6500	0.32	81800	20938	1.26
Thanga samba	2750	6078	0.31	81148	11046	1.14
Kuzhiadichan	5611	8522	0.40	86655	89456	2.03
Kullakar	3867	7189	0.35	83298	42941	1.52
Anaikomban	4800	7600	0.39	85864	81042	1.94
Thulasi vasa samba	2606	5161	0.34	80870	4988	1.06
CD (P=0.05)	704.56	2005	-			

Quality parameter of rice: Poonkar recorded higher hulling percentage (90%) followed by Illuppaipoo samba (89%), Kullakar (89%). Higher milling percentage was recorded by Sorna masuri (80 %), Thuaiya malli samba (80 %), Thanga samba (80 %) followed by Athur Kichili samba (79%), Milagu samba (79%), Thulasi vasa samba (79%). Thanga samba recorded maximum head rice recovery (75%) followed by Thulasi vasa samba (72%). Kullakar recorded maximum kernel length (6.3mm) followed by Poonkar (6.0 mm). Thanga samba recorded maximum L/B ratio (3.24) followed by Illuppaipoo samba, Milagu samba and Thuaiya malli samba (3.00). Poonkar recorded maximum kernel length after cooking (9.8 mm) followed by Sorna masuri, Thuaiya malli samba, Thanga samba (9.5cm). Kullakar recorded maximum kernel breath after cooking (3.5 mm) followed by Kuzhiadichan (3.3 mm). Milagu samba recorded maximum linear elongation ratio (1.76) followed by Thanga samba (1.73). Milagu samba recorded maximum breadth wise elongation ratio (2.21) followed by Thanga samba (1.59). Sorna masuri recorded maximum volume expansion ratio (4.6) followed by Thuaiya malli samba (4.4). Illuppaipoo samba recorded maximum gel consistency (135 mm) followed by Sorna masuri (125 mm). Milagu samba, Kuzhiadichan, Thulasi vasa samba, recorded maximum alkali spreading value (4) followed by Athur Kichili samba , Garudan samba, Poonkar, Sorna masuri, Thuaiya malli samba, Thanga samba, Kullakar and Anaikomban (3). Thanga samba recorded maximum amylose percentage (27.1%) followed by Kullakar (25.2%). Poonkar recorded maximum protein percentage (10.4 %) followed by Milagu samba (9.70%). Among all the varieties of brown rice Thuaiya malli samba recorded maximum iron (15.8 mg/kg) followed by Thulasi vasa samba (13.7 mg/kg). Kullakar recorded maximum zinc (20.5 mg/kg) followed by Anaikomban (20.3 mg/kg).

Table 7.3.4.3: Quality parameters of traditional rice varieties grown organically at Coimbatore

Entry No.	Hulling (%)	Milling (%)	Head rice recovery (%)	Kernel length (mm)	Kernel breadth (mm)	L/B ratio	Kernel length after cooking (mm)	Kernel breadth after cooking (mm)	Linear elongation ratio	Breadth wise elongation ratio	Volume expansion ratio	Gel consistency (mm)	Alkali spreading value	Amylose %	Protein %	Brown Rice	
																Fe (mg/kg)	Zn (mg/kg)
V1	85	79	55	5.6	2.0	2.80	8.5	2.6	1.52	1.30	4.1	46	3	18.5	8.04	7.5	11.9
V2	87	73	50	5.7	2.3	2.59	8.7	3.1	1.53	1.35	4.0	63	3	20.4	8.40	8.1	18.1
V3	89	76	53	5.7	1.9	3.00	9.3	2.6	1.63	1.37	4.3	135	2	14.4	9.40	11.9	16.5
V4	87	79	70	4.2	1.4	3.00	7.4	3.1	1.76	2.21	4.1	100	4	17.4	9.70	10.7	17.4
V5	90	78	54	6.0	2.5	2.40	9.8	3.2	1.63	1.28	3.7	85	3	20.7	10.4	9.0	19.7
V6	86	80	52	5.6	1.9	2.95	9.5	2.7	1.70	1.42	4.6	125	3	23.2	7.26	8.0	14.5
V7	85	80	50	5.7	1.9	3.00	9.5	2.7	1.67	1.42	4.4	58	3	17.3	6.16	15.8	19.3
V8	88	80	75	5.5	1.7	3.24	9.5	2.7	1.73	1.59	4.2	86	3	27.1	6.19	10.3	15.3
V9	88	74	53	5.5	2.3	2.39	9.1	3.3	1.65	1.43	4.0	123	4	16.3	9.13	8.1	16.3
V10	89	75	50	6.3	2.4	2.63	9.4	3.5	1.49	1.46	3.7	76	3	25.2	9.54	10.7	20.5
V11	84	74	63	5.6	2.3	2.43	8.0	3.0	1.43	1.30	4.2	92	3	20.1	8.25	10.9	20.3
V12	86	79	72	4.2	1.7	2.47	6.5	2.5	1.55	1.47	4.1	102	4	13.3	7.99	13.7	17.6

Performance of green gram (Table 7.3.4.4): Twelve varieties of green gram were evaluated for their performance under organic conditions. Plant height (71.0 cm) and number of branches/plant (22.5) of COGG-17-16 variety was significantly higher than others but plant height of COGG-17-16 was statistically at par with COGG-16-10 and CO 8. Number of branches/plant of COGG-17-16 variety was statistically at par with CO7 (19.8), CO 8(18.3), COGG-13-19 (16.8) and COGG-16-10 (20.3). COGG-17-13 recorded higher number of pods / plant (26.9) followed by COGG-16-10 (25.6). COGG-16-10 was recorded higher pod length (10.3 cm) followed by CO 7 (9.0 cm). COGG-17-16 recorded maximum yield (981 kg/ha), cost of cultivation (36596 Rs/ha), net return (22262 Rs/ha), and B:C ratio (1.61) followed by COGG-16-10 which recorded yield (898 kg/ha), cost of cultivation (35989 Rs/ha), net return (17911 Rs/ha) and B:C ratio (1.50).

Table 7.3.4.4: Growth and yield of green gram grown organically at Coimbatore

Treatments	Plant height at harvest (cm)	Number of branches / plant	Number of pods/ plant	Pod length (cm)	Yield (Kg/ha)	Cost of cultivation (Rs./ha)	Net return (Rs./ha)	B:C ratio
CO 6	50.3	15.0	22.9	8.1	680	34387	6413	1.19
CO 7	63.9	19.8	21.2	9.0	816	35382	13552	1.38
CO 8	64.0	18.3	24.6	8.8	830	35486	14298	1.40
COGG-979	56.8	13.7	22.0	7.8	704	34561	7664	1.22
COGG-980	54.5	15.3	24.9	6.9	736	34799	9368	1.27
COGG-13-19	60.5	16.8	21.8	8.0	784	35147	11869	1.34
COGG-13-32	46.1	12.7	23.3	7.0	711	34616	8059	1.23
COGG-13-39	59.2	11.8	21.5	7.7	649	34163	4804	1.14
COGG-16-10	70.2	20.3	25.6	10.3	898	35989	17911	1.50
COGG-17-02	50.7	11.7	21.8	8.1	646	34136	4614	1.14
COGG-17-13	44.1	16.6	26.9	6.5	691	34465	6976	1.20
COGG-17-16	71.0	22.5	23.8	8.4	981	36596	22262	1.61
CD (P=0.05)	4.69	6.11	1.15	0.72	15.29			

Best performing variety of rice Kuzhiadichan

Green gram crop under organic cultivation at Coimbatore

Jabalpur (Table 7.3.5.1-7.3.5.5)

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

Performance of rice varieties (Table 7.3.5.1): Significant difference among the varieties for yield and yield attributing characters were observed. Among the rice varieties, PS 3 was the leading variety in maximum plant height (79.8cm) and effective tillers/hill (12.1 nos.) followed by IR 64 which recorded plant height (78.7 cm) and effective tillers/hill (11.7 nos.). Maximum panicle length (28.2 cm) and 1000- grains weight (23.9 g) was recorded with the variety IR 64. panicle length of IR 64 variety was statistically at par with PS 3 (28.0 cm), Sahyadri (25.9 cm) and PS 4 (27.3 cm). 1000- grains weight of IR 64 varieties was statistically at par with Sahyadri (23.6 g) , PS 4 (23.6 g), MTU 1010 (23.5 g) and Pusa basmati 1 (23.5 g). Maximum sterility percentage was recorded with variety Danteswari (20.5%). Sterility percentage of Danteswari variety was statistically at par with Madhumati (19.2%). IR 64 recorded maximum grains/panicle (108) followed by PS 3 (105). PS 3 variety

recorded maximum grain yield (5447 kg/ha), net return (122328 Rs/ha) and B:C ratio (2.28) followed by PS 4 which recorded grain yield (4865 kg/ha), net return (99074 Rs/ha) and B:C ratio (2.04). Cost of cultivation for all the twelve varieties of rice was 95539 Rs/ha.

Table 7.3.51: Yield attributes and yield of rice varieties under organic farming at Jabalpur

Rice varieties	Plant height (cm)	Effective tillers/ hill	Panicle length (cm)	Grains/ panicle	1000-grains weight (g)	Sterility (%)	Grain yield (kg/ha)	Cost of cultivation (Rs./ha)	Net Returns (Rs./ha)	B:C ratio
PS 5	69.58	9.20	19.13	90	22.67	17.34	3520	95539	45261	1.47
Sahyadri	77.00	11.23	25.90	101	23.58	10.86	3692	95539	52141	1.55
PS 4	77.88	11.62	27.33	103	23.58	10.03	4865	95539	99074	2.04
BVD 109	71.17	10.18	21.03	94	23.42	14.54	4252	95539	74521	1.78
JR-201	70.69	9.82	19.30	92	23.25	15.16	3421	95539	41305	1.43
Danteshwari	66.88	8.80	16.47	86	21.25	20.45	2583	95539	7778	1.08
Madhumati	68.55	8.98	17.60	89	22.42	19.17	2655	95539	10661	1.11
IR 36	71.97	10.85	21.60	96	23.42	13.24	3158	95539	30766	1.32
MTU 1010	75.62	11.10	23.63	99	23.50	11.10	3588	95539	47961	1.50
IR 64	79.83	12.13	28.17	108	23.92	8.95	3265	95539	35042	1.37
Pusa basmati 1	73.83	10.92	22.57	97	23.45	11.99	4360	95539	78861	1.83
PS 3	78.73	11.68	28.03	105	23.83	8.86	5447	95539	122328	2.28
CD (P=0.5)	0.77	0.21	2.74	1.39	0.43	1.65	57.4			

Quality parameters of Rice (Table 7.3.5.2): Among all the varieties of rice PS 5 recorded higher protein percentage (6.85 %) which is statistically at par with all the other varieties. PS 5 recorded significantly higher elongation ratio (1.96%) which is statically at par with PS 4 (1.95). PS 5 recorded significantly higher ASV (7) which is statically at par with PS 4 (6) and Pusa basmati (6). Maximum hulling percentage (74.73%) was recorded with the variety PS 5 but statistically at par with PS 4 (73.33%), Madhumati (71.73 %), MTU 1010 (72.96 %), IR 64 (72.20 %), Pusa basmati 1 (73.03 %), PS 3 (73.66 %). Danteswari recorded maximum milling percentage (65.84%) which is statistically at par with Sahyadri (63.07%), JR-201(65.32) and IR 36 (64.62%).

Table:7.3.5.2: Quality parameters of different rice varieties under organic farming

Rice Varieties	Protein %	Elongation ratio	ASV	Hulling %	Milling %
PS 5	6.85	1.96	7.00	74.73	57.24
Sahyadri	6.25	1.79	5.00	69.06	63.07
PS 4	6.83	1.95	6.00	73.33	60.84
BVD 109	6.15	1.78	4.33	70.50	62.32
JR-201	6.10	1.75	4.00	65.06	65.32
Danteshwari	6.15	1.75	1.00	64.56	65.84
Madhumati	6.35	1.81	2.00	71.73	61.95
IR 36	6.06	1.52	2.33	69.10	64.62
MTU 1010	6.09	1.69	2.00	72.96	61.64
IR 64	6.05	1.45	2.67	72.20	61.91
Pusa basmati 1	6.10	1.75	6.00	73.03	60.85
PS 3	6.45	1.82	5.33	73.66	58.00
CD (P=0.5 %)	1.15	0.09	1.24	3.28	3.50

Performance of wheat varieties (Table 7.3.5.3): Among the wheat varieties, all the parameters showed significant differences. JW 17 recorded significantly higher ear head length (13.67 cm) which is significantly at par with C 306. Maximum grains / ear head (49) was recorded with JW 17 variety. The grains/ear head of variety JW 17 was significantly at par with JW 3269 (46) and C 306 (47). The maximum plant height (93.60 cm), effective tillers/ m^2 (470), test weight (39.87 g), grain yield (4072 kg/ha), net return (37746 Rs/ha) and B:C ratio (1.51) was recorded with the variety JW 17 followed by C 306.

Table 7.3.5.3: Yield attributes, yield and economics of wheat varieties under organic farming at Jabalpur

Wheat varieties	Plant height (cm)	Effective tillers /m^2	Ear head length (cm)	Grains/ ear head	Test weight (g)	Grain yield (kg/ha)	Cost of cultivation (Rs./ha)	Net Returns (Rs./ha)	B:C ratio
JW 17	93.60	470	13.67	49	39.87	4072	74244	37746	1.51
JW 3020	83.50	363	10.43	36	36.97	3238	74244	14806	1.20
JW 3173	85.43	381	10.67	40	37.20	3415	74244	19673	1.26
JW 3269	91.23	435	12.77	46	39.03	3844	74244	31477	1.42
JW 3288	90.07	424	11.87	45	38.90	3753	74244	28954	1.39
HI 1531	84.40	371	10.57	38	37.10	3307	74244	16694	1.22
HI 1500	88.70	414	11.57	44	38.73	3653	74244	26205	1.35
C 306	92.43	453	13.47	47	39.43	3945	74244	34242	1.46
HD 2004	86.33	391	10.67	41	37.87	3492	74244	21797	1.29
HI 2987	87.40	406	11.53	43	38.13	3572	74244	23991	1.32
HD 4672	82.67	320	10.13	35	36.20	3154	74244	12480	1.17
HI 1418	80.37	294	10.07	34	35.87	3064	74244	10025	1.14
CD (P=0.5)	0.70	7.65	0.40	2.47	0.40	70.38			

Quality parameters of wheat (Table 7.3.5.4): Among the wheat varieties, all the parameters showed significant differences. HD 4672 recorded significantly higher protein (11.07%) which was significantly at par with C 306 (10.61 %), HI 2987 (10.73 %). Among the wheat varieties HD 4672 recorded maximum wet gluten percentage (9.30 %), dry gluten percentage (8.46 %), sedimentation value (54.9) followed by HI 2987 which recorded wet gluten percentage (8.80 %), dry gluten percentage (7.99 %), sedimentation value (49.5).

Table 7.3.5.4: Quality parameters of wheat varieties under organic farming at Jabalpur

Wheat Varieties	Protein %	Wet gluten %	Dry gluten %	Sedimentation value
JW 17	10.43	8.34	7.37	43.2
JW 3020	9.21	7.20	6.19	33.3
JW 3173	9.85	7.75	6.69	33.3
JW 3269	10.50	8.61	7.64	45
JW 3288	10.08	7.97	6.90	35.1
HI 1531	9.50	7.46	6.42	32.4
HI 1500	10.20	8.18	7.13	40.5
C 306	10.61	8.70	7.80	48.6
HW 2004	10.14	8.07	7.01	37.8
HI 2987	10.73	8.80	7.99	49.5
HD 4672	11.07	9.30	8.46	54.9
HI 1418	8.51	6.64	5.68	22.5
CD (P=0.5 %)	**0.47**	**0.38**	**0.33**	**5.43**

Soil properties under different varieties of rice and wheat at the end of cropping cycle (Table 7.3.5.5)

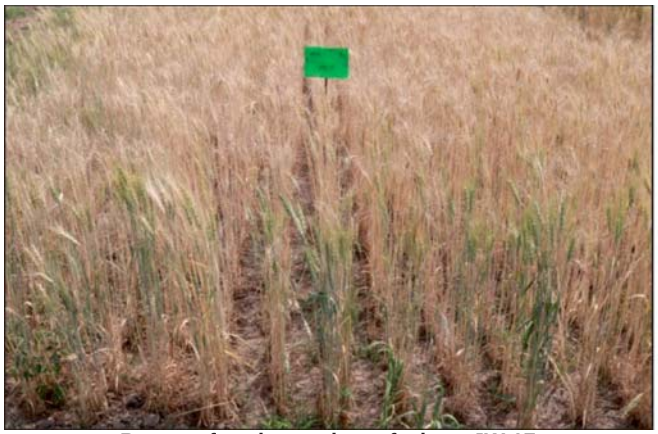
The highest Ph (7.62) after the end of cropping cycle was recorded with the varieties PS 3 (rice) – HI 1418 (wheat) cropping cycle followed by PS 4 (7.41)– JW 3173 (7.41). The highest EC (0.36 ds/m) after the end of cropping cycle was recorded with the varieties Shehdri (rice) – JW 3020 (wheat) and IR 64 (rice) – HI 2987 (wheat) cropping cycle followed by Pusa basmati 1 (0.35 ds/m)– HD 4672 (0.35 ds/m). The highest OC (0.74 g/kg) after the end of cropping cycle was recorded with the varieties BVD 109 (rice) – JW 3269 (wheat), Danteswari (rice) – HI 1531 (wheat), IR 36 (rice) – C 306 (wheat) , MTU 1010 (rice) – HD 2004 (wheat) and PS 5 (rice) – JW 17 (wheat). The highest N content (229 kg/ha) after the end of cropping cycle was recorded with the varieties PS 5 (rice) – JW 17 (wheat), BVD 109 (rice) – JW 3269 (wheat), Danteswari (rice) – HI 1531 (wheat) and MTU 1010 (rice) – HD 2004 (wheat) followed by PS 4 (7.41)– JW 3173 (7.41) and IR 36 (rice) – C 306 (wheat). The highest P content (12.56 kg/ha) after the end of cropping cycle was recorded with the varieties IR 64 (rice) – HI 2987 (wheat) and PS 3 (rice) – HI 1418 (wheat) followed by MTU 1010 (rice) – HD 2004 (wheat). The highest K content (324 kg/ha) after the end of cropping cycle was recorded with the PS 3 (rice) – HI 1418 (wheat) followed by JR-201 (rice) – JW 3288 (wheat).

Table 7.3.5.5: soil properties under different varieties of rice and wheat at Jabalpur after end of cropping cycle at Jabalpur

T. No.	*Kharif* (Rice)	*Rabi* (Wheat)	pH	EC(dS/m)	OC(g/kg)	Available nutrients (kg/ha)		
						N	P	K
T_1	PS 5	JW 17	7.13	0.32	0.74	**229**	10.47	297
T_2	Shehdri	JW 3020	7.12	0.36	0.72	227	10.82	308
T_3	PS 4	JW 3173	7.41	0.29	0.72	228	9.77	294
T_4	BVD 109	JW 3269	7.18	0.32	0.74	**229**	11.52	300
T_5	JR-201	JW 3288	7.32	0.31	0.72	227	11.17	331
T_6	Danteshwari	HI 1531	7.10	0.32	0.74	**229**	12.22	319
T_7	Madhuri	HI 1500	7.41	0.34	0.71	226	10.47	305
T_8	IR 36	C 306	7.32	0.32	0.74	228	11.17	306
T_9	MTU 1010	HD 2004	7.27	0.31	0.74	**229**	11.87	315
T_{10}	IR 64	HI 2987	7.51	0.36	0.72	227	12.56	299
T_{11}	Pusa basmati 1	HD 4672	7.45	0.35	0.70	225	10.47	294
T_{12}	PS 3	HI 1418	7.62	0.32	0.72	227	12.56	324

Best performing variety of rice IR-64

Best performing variety of rice Pusa Sugandha-3



Best performing variety of wheat JW 17

Best performing variety of wheat C-306

Karjat (Table 7.3.6.1 and 7.3.6.4)

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

Performance of rice varieties (Table 7.3.6.1)**:** 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. Maximum grain yield (4589 kg/ha) was recorded by the variety Sahyadri-5 (late maturing variety). The variety Sahyadri-5 was statistically at par with Sahyadri-3 (mid- late) (4546 kg/ha) and Sahyadri-4 (early) (4348 kg/ha). Sahyadri-5 recorded significantly higher straw yield (6746 kg/ha) which was statistically at par with variety Sahyadri-3 (6704 kg/ha).

Performance of cowpea varieties (Table 7.3.6.1): Among the different varieties of cowpea, maximum seed yield (1285 kg/ha) was recorded by variety Kokan sadabhar which was statistically at par with GC 5 (1245 kg/ha), GC 6 (1110 kg/ha), Phule pandhari (1226 kg/ha), Phule vithai (1183 kg/ha), Phule Sonali (1233 kg/ha) and Kokan safed (1111 kg/ha). Panvel red was recorded significantly higher stover yield (2105 kg/ha) which was statistically at par with GC-5 (2053 kg/ha), Phule pandhari (1955 kg/ha), Phule vithai (2020 kg/ha), Phule Sonali (2035 kg/ha) and Kokan safed (2066 kg/ha).

Table 7.3.6.1: Evaluation of response for different varieties of rice and cowpea on yields under organic condition at Karjat

Rice (*Kharif*)			
Varieties		**Grain yield (kg/ ha)**	**Straw yield (kg/ ha)**
Early	Karjat - 4	3157	4663
	Karjat-7	3285	5102
	Ratnagiri-1	3051	4637
	Sahyadri-4	4348	6590
Mi date	Karjat-5	3569	4578
	Karjat-6	3129	4819
	Palghar-1	3172	4578
	Sahyadri-3	4546	6704
Late	Ratnagiri-2	3272	5197
	Ratnagiri-3	3197	4936
	Karjat-8	3214	4478
	Sahyadri-5	4589	6746
Grown by Farmers	Karjat-3	4107	5045
	Jaya	3199	4507
	Karjat-2	3144	4379
CD (P=0.05)		294	1371

Cowpea (*Rabi*)		
Varieties	**Seed yield (kg/ ha)**	**Stover yield (kg/ ha)**
GC-2	814	1232
GC-3	750	1621
GC-4	1035	1199
GC-5	1245	2053
GC-6	1110	1238
Phule Pandhari	1226	1955
Phule Vithai	1183	2020
Phule Sonali	1233	2035
Pusa Falguni	621	1025
PCP-1131	920	1518
Dalkhan Local	889	1092
Kokan Sadabhar	1285	1365
Kokan Safed	1111	2066
Panvel Local	879	1451
Panvel Red	661	2105
CD (P=0.05)	176	305

System equivalent yield and economics (Table 7.3.6.2)**:** In rice - cowpea system higher system's equivalent yield (13744 kg/ha), gross return (249446 Rs/ha), net return (106986 Rs/ha) and B:C ratio (1.75) was recorded by variety Sahyadri-3 (rice) – Phule sonali (cowpea). The variety Sahyadri-3 (rice) – Phule sonali (cowpea) was statistically at par with Sahyadri-4 (rice) – GC-5 (cowpea).

Table 7.3.6.2. Response of different varieties of rice and cowpea in rice-cowpea system on system equivalent yield and economics under organic management at Karjat

Rice	Cowpea	System's equivalent yield (kg/ha)	Gross returns (Rs./ha)	Net returns (Rs./ha)	B:C ratio
Karjat - 4	GC-2	9288	168575	26115	1.18
Karjat-7	GC-3	9207	167105	24645	1.17
Ratnagiri-1	GC-4	103.19	187286	44826	1.31
Sahyadri-4	GC-5	13543	245814	103354	1.73
Karjat-5	GC-6	11375	206465	64005	1.45
Karjat-6	Phule Pandhari	11640	211275	68815	1.48
Palghar-1	Phule Vithai	11435	207548	65088	1.46
Sahyadri-3	Phule Sonali	13744	249446	106986	1.75
Ratnagiri-2	Pusa Falguni	8372	151943	9483	1.07
Ratnagiri-3	PCP-1131	9998	181470	39010	1.27
Karjat-8	Dalkhan Local	9726	176535	34075	1.24
Sahyadri-5	Kokan Sadabhar	13994	253984	111524	1.78
Karjat-3	Kokan Safed	12235	222058	79598	1.56
Jaya	Panvel Local	9705	176145	33685	1.24
Karjat-2	Panvel Red	8510	154458	11998	1.08
CD (P=0.05)		1232	22356	22356	0.16

Soil chemical properties table (7.3.6.3): The highest Ph (7.06) after the end of cropping cycle was recorded with the varieties Ratnagiri 3 (rice) – PCP-1131 (cowpea) followed by Ratnagiri 2 (rice) – Pusa Falguni (cowpea) and there was no significance difference among varieties. Highest soil EC (0.38 dSm^{-1}) recorded with the variety Karjat-2 (rice) – Panvel red (cowpea) and there was no significance difference among varieties. Highest soil OC (1.24%) recorded with the variety Sahyadri-5 (rice) – Kokan sadabhar (cowpea) and Ratnagiri 2 (rice) – Pusa Falguni (cowpea) and there was no significance difference among varieties. Sahyadri-5 (rice) – Kokan sadabhar (cowpea) recorded significantly higher available nitrogen (261.67 kg/ha) which was statistically at par with Ratnagiri 2 (rice) – Pusa Falguni (cowpea), Karjat-3 (rice) – Kokan Safed (cowpea) and Jaya (rice) – Panvel local (cowpea). Sahyadri-5 (rice) – Kokan sadabhar (cowpea) recorded significantly higher available P_2O_5 (23.23 kg/ha) which was statistically at par with Karjat-3 (rice) – Kokan Safed (cowpea) and Jaya (rice) – Panvel local (cowpea). Sahyadri-5 (rice) – Kokan sadabhar (cowpea) recorded significantly higher available K_2O (261.67 kg/ha) which was statistically at par with Ratnagiri 2 (rice) – Pusa Falguni (cowpea), Karjat-3 (rice) – Kokan Safed (cowpea) and Jaya (rice) – Panvel local (cowpea).

Table 7.3.6.3: Chemical properties of soil after complete of cropping cycle of different varieties of rice and cowpea at Karjat.

Rice Varieties	Cowpea varieties	Soil pH	Soil EC (dSm^{-1})	Organic carbon (%)	Available Nitrogen(Kg/ha)	Available P_2O_5 (Kg/ha)	Available) K_2O (Kg/ha
Karjat – 4	GC-2	6.89	0.35	1.20	236.59	18.84	374.98
Karjat-7	GC-3	6.94	0.36	1.20	231.57	20.13	371.39
Ratnagiri-1	GC-4	6.85	0.35	1.12	219.87	20.39	365.57
Sahyadri-4	GC-5	6.88	0.36	1.16	225.72	20.13	367.81
Karjat-5	GC-6	6.73	0.35	1.14	225.72	19.62	357.06
Karjat-6	Phule Pandhari	6.90	0.37	1.08	207.33	20.91	336.45
Palghar-1	Phule Vithai	6.73	0.36	1.20	244.11	20.39	394.24
Sahyadri-3	Phule Sonali	6.67	0.36	1.21	238.26	19.62	387.07
Ratnagiri-2	Pusa Falguni	7.03	0.36	1.24	252.47	21.94	404.10
Ratnagiri-3	PCP-1131	7.06	0.37	1.12	219.03	19.36	354.82
Karjat-8	Dalkhan Local	6.86	0.37	1.17	247.46	20.39	389.31
Sahyadri-5	KokanSadabhar	6.80	0.34	1.24	261.67	23.23	412.16
Karjat-3	Kokan Safed	6.93	0.37	1.20	253.31	22.97	405.44
Jaya	Panvel Local	6.85	0.37	1.20	257.49	22.97	408.58
Karjat-2	Panvel Red	6.84	0.38	1.09	219.87	19.36	351.23
CD(P=0.05)	NS	NS	NS	12.44	2.27	9.46	

Total N, P and K uptake of by the rice and cowpea varieties (Table 7.3.6.4): The highest total nitrogen uptake (161.1 kg/ha) of rice - cowpea cropping system during Kharif and Rabi was recorded by Sahyadri-4 (rice) – GC-5 (cowpea). The highest total nitrogen uptake by variety Sahyadri-4 (rice) – GC-5 (cowpea) was statistically at par with Sahyadri-3 (rice) – Phule Sonali (cowpea), Sahyadri-5 (rice) – Kokan Sadabhar (cowpea) and Karjat 3 (rice) – Kokan Safed (cowpea). The highest total Phosphorus uptake (25.0 kg/ha) of rice - cowpea cropping system during Kharif and Rabi was recorded by Sahyadri-5 (rice) – Kokan Sadabhar (cowpea). The highest total Phosphorus uptake by variety Sahyadri-5 (rice) – Kokan Sadabhar (cowpea) was statistically at par with Sahyadri-3 (rice) – Phule Sonali (cowpea). The highest total Potassium uptake (139.6 kg/ha) of rice - cowpea cropping system during Kharif and Rabi was recorded by Sahyadri-3 (rice) – Phule Sonali (cowpea).The highest total Potassium uptake by variety Sahyadri-3 (rice) – Phule Sonali (cowpea) was statistically at par with Sahyadri-4 (rice) – GC-5 (cowpea) and Sahyadri-5 (rice) – Kokan Sadabhar (cowpea).

Rice and *rabi* cowpea crop at Karjat

Table 7.3.6.4: Total N, P and K uptake of by the rice and cowpea under rice-cowpea cropping system at Karjat.

		N Uptake (Kg/ha)			P Uptake (Kg/ha)			K Uptake (Kg/ha)		
		Kharif	*Rabi*	Total	*Kharif*	*Rabi*	Total	*Kharif*	*Rabi*	Total
Karjat – 4	GC-2	53.83	47.20	101.03	12.27	3.64	15.92	66.94	26.56	93.49
Karjat-7	GC-3	60.58	59.24	119.82	12.66	4.10	16.76	72.87	32.08	104.95
Ratnagiri-1	GC-4	52.16	51.95	104.11	11.33	3.97	15.30	66.01	28.73	94.74
Sahyadri-4	GC-5	80.58	80.56	161.14	15.96	5.75	21.71	93.60	43.70	137.30
Karjat-5	GC-6	62.17	58.56	120.73	13.29	4.27	17.56	66.89	30.17	97.06
Karjat-6	Phule Pandhari	56.94	75.84	132.78	11.58	5.64	17.22	67.91	42.48	110.39
Palghar-1	Phule Vithai	56.35	77.46	133.81	11.75	5.70	17.45	65.88	42.58	108.47
Sahyadri-3	Phule Sonali	81.47	78.61	160.07	16.82	5.79	22.61	96.13	43.44	139.57
Ratnagiri-2	Pusa Falguni	57.88	37.27	95.15	12.41	2.89	15.29	72.52	21.69	94.21
Ratnagiri-3	PCP-1131	56.29	56.85	113.13	12.12	4.27	16.39	69.37	32.35	101.73
Karjat-8	Dalkhan Local	55.76	47.02	102.78	11.71	3.61	15.32	64.27	25.53	89.80
Sahyadri-5	KokanSadabhar	86.59	67.56	154.14	19.22	5.75	24.97	98.51	34.94	133.44
Karjat-3	Kokan Safed	66.04	79.27	145.31	14.05	5.99	20.04	73.44	43.24	116.67
Jaya	Panvel Local	57.63	55.21	112.84	12.13	4.22	16.34	65.40	31.04	96.44
Karjat-2	Panvel Red	56.90	61.28	118.18	11.38	4.49	15.86	62.68	38.61	101.29
CD(P=0.05	10.99	12.31	19.99	2.37	0.94	2.86	17.57	6.05	20.41	

Ludhiana (Table 7.3.7.1-7.3.7.2)

Performance of rice varieties (Table 7.3.7.1): Among different varieties of rice, Basmati 386 recorded significantly higher plant height (153.4 cm) which was statistically at par with Basmati 370 (151.5 cm). RYT 3425 recorded significantly higher effective tillers/m^2 (367.3). Effective tillers/m^2 in RYT 3425 was significantly at par with RYT 3677 (359.3), RYT 3649 (351.3), RYT 3727 (361.3), RYT 3722 (357.7) and RYT 3986 (364.7). RYT 3425 recorded significantly higher panicle length (32.0 cm). Panicle length in RYT 3425 was significantly at par with RYT 3677 (359.3). RYT 3425 recorded significantly higher grains/panicle (69.2). Grains/panicle in RYT 3425 was significantly at par with RYT 3677 (66) and RYT 3649 (65.3).

Table 7.3.7.1: Performance of basmati rice varieties/hybrids under organic management at Ludhiana

Rice varieties / hybrids	Plant height (cm)	Effective tillers/m^2	Panicle length (cm)	Grains/ panicle	1000 grain weight (g)	Grain yield (kg/ha)	Straw yield (q/ha)
Punjab Basmati 5	118.2	320.3	26.7	57.7	25.7	31.5	63.8
Punjab Basmati 4	101.4	338.7	28.2	61.7	26.9	35.6	65.2
Punjab Basmati 3	112.9	332.3	28.1	59.7	27.6	34.2	64.9
Punjab Basmati 2	122.7	323.7	27.2	58.2	26.1	33.7	64
Basmati 386	153.4	277	25.1	56.7	25	18.8	56.2
Basmati 370	151.5	273.7	25.4	55.3	23.7	16.6	53.5
CSR 30	139.1	309	25.4	56.7	25.4	22.2	61
Pusa Basmati 1121	115.3	339.7	28.2	63	27.8	36	65.2
Pusa Basmati 1509	109.3	340.7	30.6	64	28.3	36.3	67.3

Rice varieties / hybrids	Plant height (cm)	Effective tillers/m²	Panicle length (cm)	Grains/ panicle	1000 grain weight (g)	Grain yield (kg/ha)	Straw yield (q/ha)
Pusa Basmati 1718	114.6	330.3	28.3	61	26.9	34.9	65.4
RYT 3677*	106.2	359.3	30.8	66	29.5	37.2	69.1
RYT 3425*	120.6	367.3	32	69.2	29.9	38.8	71.3
RYT 3522*	106.4	310.3	26	57.6	25.9	26.7	57
RYT 3649*	110.7	351.3	28.8	65.3	29	36	68.2
RYT 3818*	138.4	326	27.3	58.3	27.1	34	64.4
RYT 3727*	104	361.3	25.6	58.7	26.9	40.8	70.5
RYT 3722*	105.9	357.7	26.5	60	25.9	40	70.1
RYT 3986*	136.6	364.7	26.4	62.3	27.4	39.2	71.6
CD (P=0.05)	7.17	18.7	2.09	4.5	NS	5.5	4.71

Performance of wheat varieties (Table 7.3.7.2): Among different varieties of wheat C 306 recorded significantly higher plant height (127.9 cm) followed by BWL 3498 (110.6 cm). Unnat PBW 550 recorded maximum effective tillers/m² (288.3) followed by BWL 3498 (286) and there was no significance difference among varieties. PBW 766 recorded maximum spike length (9.7 cm) followed by BWL 3500 and there was no significance difference among varieties. Significantly higher grains/spike (45.4) recorded by variety PBW 766 which was statistically at par with Unnat PBW 550 (44.4) and PBW 803 (44.8). Unnat PBW 550 recorded maximum 1000 grains weight (43.9 g) followed by BWL 3498 and there was no significant difference among varieties. PBW 766 recorded significantly higher grain yield (38.8 kg/ha) which was statistically at par with Unnat PBW 550 (36.4 kg/ha) and PBW 803 (38 kg/ha). Significantly higher straw yield (59.2 kg/ha) was recorded with variety Unnat PBW 550 which was statistically at par with BWL 3498 (58.9 kg/ha) and Unnat PBW 343 (57.2 kg/ha).

Table 7.3.7.2: Performance of wheat varieties under organic management at Ludhiana

Wheat varieties/ hybrids	Plant height (cm)	Effective tillers/m²	Spike length (cm)	Grains/ spike	1000 grain weight (g)	Grain yield (kg/ha)	Straw yield (kg/ha)
PBW 1Zn	106.3	270.3	9.3	33.5	38	24.5	41.2
C 306	127.9	284.7	9.1	39.2	40.4	28.1	50.6
BWL 3500	103.3	280.3	9.6	39.2	40.8	30	51.1
PBW 175	103.9	279	9.3	38.6	40.2	28.8	49.5
PBW 660	102	284.7	9.4	40.5	41.2	31.2	54.1
BWL 3498	110.6	286	9.3	42.2	42.8	32.2	58.9
Unnat PBW 343	97.8	285	9.5	40.7	41.3	30.5	57.2
Unnat PBW 550	92.2	288.3	9.7	44.4	43.9	36.4	59.2
PBW 1 Chapati	96.9	278.7	9.2	37.9	40.2	26.8	48.4
PBW 766	99.3	283	9.3	45.4	39.8	38.8	47
Bansi Gold	100.6	277.3	9.4	35.1	37.5	27.3	43.3
PBW 803	97.9	278.3	9.4	44.8	42.7	38	39.8
CD (P=0.05)	5.7	NS	NS	4.2	NS	4.5	4.04

Modipuram

Twelve promising varieties of vegetable pea were evaluated with similar nutrient source and doses under organic condition.

Performance of different vegetable pea varieties: Among different varieties of vegetable pea maximum number of pods/ plant (15.8) was recorded by Prachi 10 followed by PS 1100 (15.1). PSM 3 recorded maximum 10 pod weight (46.7 g) followed by PB 89 (40.8 g), Prachi 10 (39.1 g), Bioseed pea 10 (43.9 g) and PS 1100 (40.1 g). Mahima 3636 recorded maximum pod length (9.0 cm) followed by PB 89 (8.6 cm) and there was no significant difference among varieties. Prachi 10 recorded significantly higher number of seeds/pod (7.2) which was statistically at par with PB 89 (7.1), Improved king 50 (6.9), PS 10 (6.7), Mahima 3636 (7.0), Pusa Prabal (6.6), Kashi Nandini (6.5), Bioseed Pea 10 (6.9) and PS 1100 (7.0). Prachi 10 recorded higher pod yield (5542 kg/ha) followed by PS 1100 (4945 kg/ha). Maximum gross return (138546 Rs/ha) and net return (98896 kg/ha) recorded by Prachi 10 followed by PS 1100. Cost of cultivation (39650 Rs/ha) was found for all varieties.

Table 7.3.8.1: Yield attributes, yield and economics of different of vegetable pea varieties under organic farming at Modipuram

Varieties	No. of pods/ plant	10 pod weight (g)	Pod length (cm)	No. of seeds/d po	Pod yield (kg/ha)	Cost of Cultivation (Rs./ha)	Gross return (Rs./ha)	Net return (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 7.3.9.1 – 7.3.9.4)

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

Performance of rice varieties (Table7.3.9.1)**:** Among different varieties of rice, maximum plant height (171.0 cm) was recorded with variety Hansraj followed by Tilak Chandan (154.3 cm). Significantly higher effective tillers/m^2 (251.3) recorded by variety Kala Namak which was statistically at par with tilak Chandan (237.3), HKR 47 (250.0), PR 121 (249.0), PD 24 (255.3), NDR 359 (244.0), PSD 27 (250.0) and CGZR 1 (243.3). PSD 25 recorded maximum grain weight/panicle (2.82 g) followed by HKR-47 (2.53 g). PD-24 recorded maximum 1000-grains weight (28.2 g) followed by PSD-27 (26.0 g). HKR-47 recorded significantly higher grain yield (5155 kg/ha) which was statistically at par with PR-121 (4869 kg/ha), PD-24 (5106 kg/ ha) and NDR-359 (4914 kg/ha). PD-24 recorded maximum straw yield (6880 kg/ha) followed by HKR-47 (5826 kg/ha). PR-121 recorded maximum harvest index (0.49 %) followed by NDR-359 (0.48) but there was no significant difference among varieties. PSD-27 recorded maximum net return (120408 Rs/ha) followed by PSD-25 (118186 Rs/ha). PSD-27 recorded maximum B:C ratio (3.41) followed by PSD-25 (3.37).

Table 7.3.9.1: Response for yield attributes and yield of rice varieties under organic cultivation at Pantnagar

Rice varieties/ hybrids	Plant Height (cm)	Effective tillers/ m^2	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	154.3	237.3	1.70	20.0	3171	3883	0.45	68957	2.38
Hansraj	171.0	233.0	1.54	20.83	3071	3649	0.45	65223	2.31
Kala Namak	146.0	251.3	1.55	13.0	3464	4189	0.45	79942	2.60
Kesho Pohu	125.0	212.0	1.63	24.0	2590	3084	0.45	47186	1.94
HKR-47	117.0	250.0	2.53	25.4	5155	5826	0.47	77638	2.55
PR-121	126.3	249.0	2.42	24.3	4869	5101	0.49	70549	2.41
PD-24	129.0	255.3	2.39	28.2	5106	6880	0.42	76416	2.53
NDR-359	114.0	244.0	2.45	23.0	4914	5327	0.48	71659	2.43
PSD-25	149.3	203.0	2.82	23.0	4484	5337	0.45	118186	3.37
PSD-27	116.3	250.0	2.36	26.0	4543	5054	0.47	120408	3.41
CGZR-1	106.0	243.3	2.11	21.2	4360	4918	0.47	57950	2.16
Zinco Rice	82.3	215.3	2.01	21.0	3815	4246	0.47	44457	1.89
CD (P=0.05)	8.36	15.04	0.24	0.44	448	760	N/S		

Performance of different wheat (Table 7.3.9.2): Sonalika recorded maximum maximum plant height (102.7 cm) followed by (91.8 cm). Maximum spikes/m^2 (255) recorded by variety Bansi Gold followed by UP 2909. Maximum 1000-grain weight (49.0 g) followed by UP-262 (45.4 g). Significantly higher grain yield (2990 kg/ha) which was statistically at par with UP-2565 (2945 kg/ha). Maximum straw yield (3328 kg/ha) recorded by UP 2565 which was statistically at par with Black wheat (3187 kg/ha), C-306 (3150 kg/ha), Sonalika (3288 kg/ha) and HD2967 (3127 kg/ha. Maximum harvest index (0.48) was recorded by variety HD 2967 followed by Sonalika (0.47), UP-262 (0.47), DBW 62150 (0.47), UP 2909 (0.47) and WB-2 (0.47). Sonalika recorded maximum net return (31176 Rs/ha) and B:C ratio (1.66) followed by UP 2565.

Table 7.3.9.2: Response for yield attributes and yields of wheat_varieties under organic management at Pantnagar

Wheat varieties/ hybrids	Plant height (cm)	spikes/ m^2	1000-grain wt. (g)	Grain yield(kg/ha)	Straw yield (kg/ha)	Harvest Index	Net returns (Rs/ha)	B:C ratio
Bansi	-	-	-	-	-	-	-	-
Black wheat	90.6	222	34.0	2638	3187	0.45	21929	1.46
C-306	89.6	208	44.0	2647	3150	0.45	22182	1.47
Sonalika	102.7	230	49.0	2990	3288	0.47	31176	1.66
HD2967	91.8	203	41..0	2877	3127	0.48	28202	1.60
UP 2565	94.8	225	43.2	2945	3328	0.47	30010	1.63
UP-262	94.4	212	45.4	2503	2827	0.47	18396	1.39
DBW 62150	88.2	217	40.0	2658	2959	0.47	22447	1.47
UP 2909	93.1	237	40.4	2555	2892	0.47	19771	1.42
WB-2	90.5	255	39.0	2474	2721	0.47	17639	1.37
Bansi Gold	-	-	-	-	-	-	-	-
Sarbati	-	-	-	-	-	-	-	-
CD (P=0.05)	2.78	9.84	0.508	92.6	306.4	0.024		

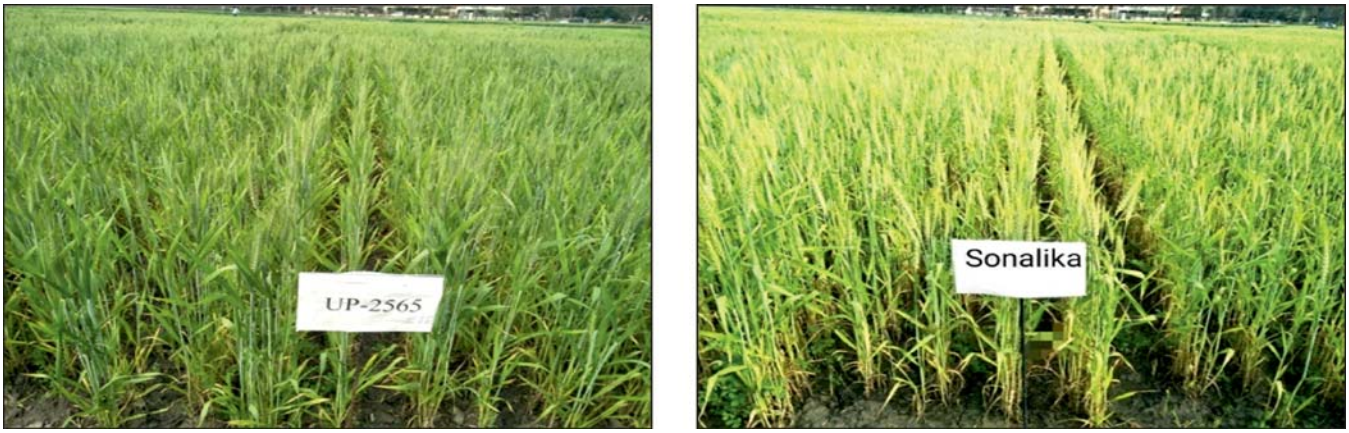
Note: Bansi, Bansi Gold and Sarbati varieties could not germinated

Nutrients uptake by rice and wheat crop (Table 7.3.9.3)**:** Significant difference in N, P, K and S uptake were observed among different rice varieties under organic cultivation. Significantly higher total nitrogen uptake (151.7 kg/ha) was recorded by PD-24 (rice) - UP-262 (wheat) which was statistically at par with HKR-47(rice) - HD2967 (wheat), PR-121 (rice) - UP 2565 (wheat), NDR-359 (rice) - DBW- 62-150 (wheat), PSD-25 (rice) - UP 2909 (wheat) and PSD-27 (rice) - WB-2 (wheat). Significantly higher total phosphorus uptake (52.8 kg/ha) was recorded by PD-24 (rice) - UP-262 (wheat) which was statistically at par with PR-121 (rice) - UP 2565 (wheat). Significantly higher total potassium uptake (169.6 kg/ha) was recorded by PD-24 (rice) - UP-262 (wheat) which was statistically at par with HKR-47(rice) - HD2967 (wheat). Significantly higher total Sulphur uptake (43.4 kg/ha) was recorded by PD-24 (rice) - UP-262 (wheat) which was statistically at par with PSD-25 (rice) - UP 2909 (wheat).

Table 7.3.9.3: Total N, P, K and S uptake in different rice and wheat varieties under organic cultivation

Rice varieties	Wheat varieties	N uptake (kg/ha)			P uptake (kg/ha)			K uptake (kg/ha)			S uptake (kg/ha)		
		Kharif	*Rabi*	Total	*Kharif*	*Rabi*	Total	*Kharif*	*Rabi*	Total	*Kharif*	*Rabi*	Total
Tilak Chandan	Bansi	68.0	-	68.0	21.2	-	21.2	62.8	-	62.8	12.9	-	12.9
Hansraj	Black wheat	62.9	49.4	112.3	20.4	13.9	34.3	60.5	62.3	122.8	12.9	17.1	30.0
Kala Namak	C-306	70.6	50.6	121.2	21.8	12.1	33.9	67.8	61.0	128.8	14.9	14.5	29.4
Kesho Pohu	Sonalika	50.0	58.2	108.2	18.5	17.4	35.9	49.3	68.0	117.3	12.5	19.3	31.8
HKR-47	HD2967	95.5	49.5	145.0	32.0	12.4	44.4	96.2	59.9	156.1	22.7	15.4	38.1
PR-121	UP 2565	90.5	50.5	141.0	34.7	15.1	49.8	87.1	62.2	149.3	20.6	17.6	38.2
PD-24	UP-262	101.9	49.8	151.7	38.5	14.3	52.8	109.7	59.9	169.6	25.7	17.7	43.4
NDR-359	DBW- 62-150	92.4	49.0	141.4	31.5	14.5	46.0	91.5	54.1	145.6	22.7	17.9	40.6
PSD-25	UP 2909	94.5	49.4	143.9	28.9	12.9	41.8	86.3	58.4	144.7	21.5	18.1	39.6
PSD-27	WB-2	89.7	49.4	139.1	29.0	12.4	41.4	85.0	55.6	140.6	23.1	16.3	39.4
CGZR-1	Bansi Gold	89.8	-	89.8	30.9	-	30.9	83.6	-	83.6	20.4	-	20.4
Zinco Rice	Sarbati	78.2	-	78.2	25.7	-	25.7	70.2	-	70.2	18.1	-	18.1
CD (P=0.05)		9.7	4.22	14.0	3.3	2.09	5.4	10.9	3.05	13.9	2.3	1.43	3.7

Best performing rice varieties HKR 47 and PD 24 at Pantnagar



Best performing wheat varieties UP2565 and Sonalika at Pantnagar

Raipur (Table 7.3.10.1 – 7.3.10.3)

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

Traditional short grain aromatic rice (Table 7.3.10.1): Among the traditional short grain aromatic rice, variety Gangabaru recorded tallest plant (194.0 cm) while Lalu 14 recorded smallest plant (122.0 cm). Gopal Bhog recorded maximum panicle

Table 7.3.10.1: Response of different traditional and improved scented varieties of rice under organic production system

Varieties	Plant height at harvest (cm)	Panicle length (cm)	Panicle weight (g)	No.of filled grains / panicle	Test weight (g)	Grain yield (kg/ha)	Straw yield kg/ha	Harvest Index	Net return (Rs/ha)	B:C ratio
Traditional short grain aromatic varieties										
Badshah Bhog Sel.01	190	31.99	3.90	140	16.04	2923	12328	19.17	29583	1.75
Gopapl Bhog	177	32.52	3.13	144	19.10	3054	12129	20.11	32674	1.83
Vishanu Bhog Sel.01	182	26.48	4.20	152	16.27	3421	12745	21.19	41336	2.05
Shyamajeera	167	27.59	3.50	156	15.56	3486	11632	23.24	42870	2.09
Kubri mohar	165	26.77	5.90	120	16.51	2663	12440	17.89	23447	1.60
Dubraj Sel.01	143	26.81	4.77	149	20.63	3516	13324	20.76	43578	2.11
Lohandi	177	27.70	3.03	122	19.86	2478	12574	16.48	19081	1.48
Gangabaru	194	24.82	4.47	166	15.60	3373	13703	19.87	40203	2.02
Karigilas	185	27.41	4.97	150	33.17	4203	13214	24.13	59791	2.52
Lalu 14	122	19.88	3.30	88	15.98	1089	3757	22.59	-13700	0.65
Tarun bhog Sel.01	180	24.80	4.10	148	15.71	3119	15869	16.37	34208	1.87
Improved scented rice varieties										
C.G. Sugandhit Bhog	132	28.76	4.17	200	20.06	5151	11382	31.37	82164	3.09
IndiraSugandhit dhan	132	27.05	4.73	161	20.67	3550	9121	28.04	44380	2.13
Sugandhmati	143	27.08	3.67	163	23.47	5025	12337	28.94	79190	3.01
CR Sugandha dhan 907	186	25.47	3.83	144	18.53	3249	13710	19.17	37276	1.95
CD (P = 0.05)	9.49	2.82	0.85	26.06	1.39	576	1815	3.58	-	-

length (32.52 cm) which was significantly higher than other varieties but statistically at par with Badshah Bhog Sel. 01 (31.99 cm). Higher panicle weight (5.90 g) was recorded by Kubri mohar followed by Karigilas (4.97 g). Gangabaru recorded significantly higher number of filled grains/panicle (166) which was statistically at par with all other varieties except Kubri mohar, Lohandi, Lalu 14. Karigilas recorded highest test weight (33.17 g) followed by Dubrej sel .01 (20.63 g). Highest grain yield (4203 kg/ha) was recorded by Karigilas followed by Shyamajeera (3486 kg/ha). Tarun bhog sel.01 recorded maximum straw yield (15869 kg/ha) followed by Gangabaru (13703 kg/ha). Karigilas recorded significantly higher harvest index (24.13) which was statistically at par with Vishanu Bhog Sel. 01 (21.19), Shyamajeera (23.24), Dubraj Sel.01 (20.76) and Lalu 14 (22.59). Karigilas recorded higher net return (59791 Rs/ha) followed by Dubraj Sel.01 (43578). Karigilas recorded maximum B:C ratio (2.52) followed by Dubraj Sel.01 (2.11).

Improved scented rice (Table 7.3.10.1): Growth and yield attributes of improved scented rice varieties indicate that the plant height was significantly higher in CR Sugandha Dhan-907 which is tall in nature, followed by Sugandhmati (143 cm). C.G. Sugandhit Bhog recorded maximum panicle length (28.76 cm) which was significantly higher than other varieties but statistically at par with Indira Sugandhit dhan (27.05 cm) and Sugandhmati (27.08 cm). Higher panicle weight (4.73 g) was recorded by Indira Sugandhit dhan which was statistically at par with C.G. Sugandhit Bhog (4.17 g). C.G. Sugandhit Bhog recorded higher number of filled grains/panicle (200) followed by Sugandhmati (163). Sugandhmati recorded highest test weight (23.47 g) followed by Indira Sugandhit dhan (20.67 g). Significantly highest grain yield (5151 kg/ha) was recorded by C.G. Sugandhit Bhog which was statistically at par Sugandhmati (5025 kg/ha). C.G. Sugandhit Bhog recorded maximum straw yield (13710 kg/ha) followed by Sugandhmati (12337 kg/ha). C.G. Sugandhit Bhog recorded significantly higher harvest index (31.37) which was statistically at par with Indira Sugandhit dhan (28.04) and Sugandhmati (28.94). C.G. Sugandhit Bhog recorded higher net return (82164 Rs/ha) followed by Sugandhmati (79190 Rs/ha). C.G. Sugandhit Bhog recorded maximum B:C ratio (3.09) followed by Sugandhmati (3.01).

Response of different improved varieties of chickpea (Table 7.3.10.2): Among different varieties of chickpea, Vaibhav recorded significantly higher plant height at harvest (47.00 cm) which was statistically at par with JG-226 (43.23 cm), RG2009-01 (46.22 cm), RG2009-16 (45.39 cm), JG-130 (44.58 cm) and Indira chana-1 (44.97 cm). Vaibhav and Daftari-21 recorded significantly higher number of branches at harvest (3.78) which was statistically at par with Jaki (3.22), RG2009-01 (3.33) and RG2009-16 (3.33). Vaibhav recorded significantly higher amount of pods/ plant at harvest (52.20) which was statistically at par with RG2009-01 (50.20) and RG2009-16 (49.00). Highest number of nodules/plant (49.07) recorded by Indira China-1 followed by RG2009-01 (47.39). Vaibhav recorded significantly higher seed index (25.00) which was statistically at par with all

Table 7.3.10.2: Response of different improved varieties of chickpea under organic production system

Varieties	Plant height at harvest (cm)	No. of branches at harvest	No. of pods/ plant at harvest	No.of nodules/ plant	Seed index	Seed yield (kg/ha) 2020-21	Stover yield kg/ha	Harvest Index	Net return (Rs/ha)	B:C ratio
Vaibhav	47.00	3.78	52.20	46.98	25.00	1494	2026	42.62	64037	3.05
JG-226	43.23	2.89	43.27	44.64	21.35	1264	1922	39.67	49354	2.58
Jaki	40.41	3.22	37.33	45.49	22.50	1081	1318	45.08	37700	2.21
RG2009-01	46.22	3.33	50.20	47.39	24.89	1448	2200	39.87	61112	2.96
RG2009-16	45.39	3.33	49.00	47.04	22.61	1414	1755	44.63	58923	2.89
Vishal	42.35	2.88	39.00	46.39	24.00	1148	1375	45.57	41985	2.35
JG-14	42.52	2.89	45.57	40.80	22.33	1280	1639	43.82	50395	2.61
Daftari-21	40.51	3.78	40.80	46.13	23.92	1191	1664	41.70	44720	2.43
JG-130	44.58	3.00	47.70	45.58	22.94	1385	1869	42.60	57090	2.83
Indira Chana - 1	44.97	2.78	43.23	49.07	22.95	1250	1593	43.98	64037	3.05
CD (P=0.05)	4.13	0.65	3.84	NS	3.11	144	312	3.13	-	-

other varieties except JG-226 (21.35). Significantly higher seed yield was recorded by variety Vaibhav (1494 Kg/ha). Seed yield of variety Vaibhav was statistically at par with RG2009-01 (1448 kg/ha), RG2009-16 (1414 kg/ha) and JG-130 (1385 kg/ha). Significantly higher stover yield (2200 kg/ha) was recorded by variety RG2009-01 which was statistically at par with Vaibhav (2026 kg/ha) and JG-226 (1922 kg/ha). Vishal recorded significantly higher harvest index (45.57) which was statistically at par with Vibhav (42.62), Jaki (45.08) and RG2009-16 (44.63). Highest net return (64037 Rs/ha) and B:C ratio (3.05) was recorded by variety Vaibhav and Indira China-1 followed by RG2009-01.

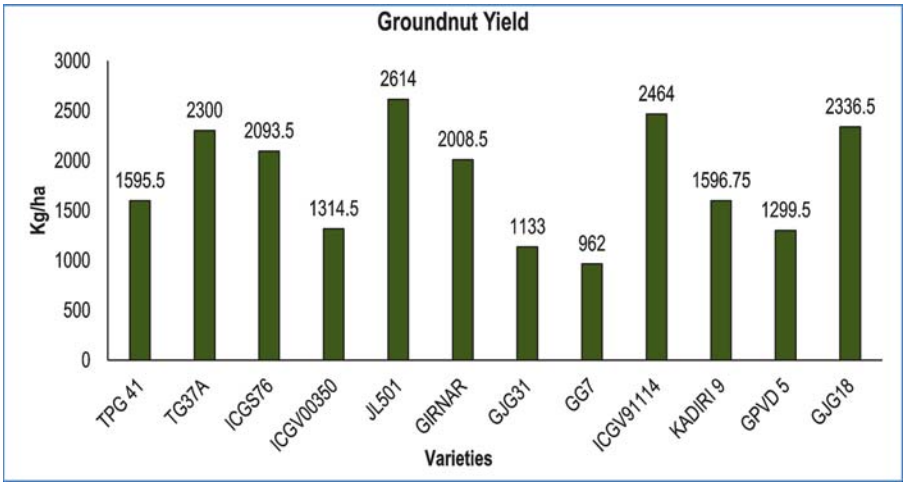
Available Nutrient Status in soil (Table 7.3.10.3): Soil Organic Carbon, Available Nitrogen, Phosphorus and Potassium in soil after harvest of chick pea crop did not influence significantly on availability of these nutrients in soil. The ranged for organic carbon was found to be between 0.78 to 0.75%, whereas, the ranged for available N was from 286 – 278 kg/ha, available P from 24.51 to 22.85 kg/ha and K were in range from 379-369 kg/ha respectively.

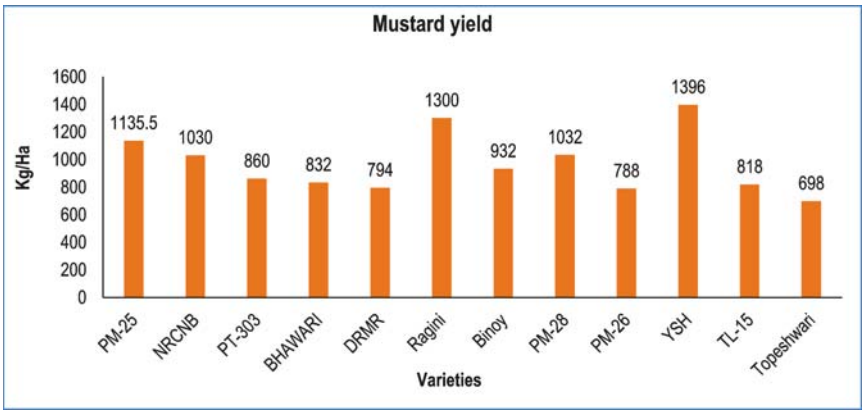
Table: 7.3.10.3 Available nutrients status after harvest of different improved varieties of chickpea under organic production system.

Varieties	Organic Carbon (%)	Available N (Kg ha^{-1})	Available P (Kg ha^{-1})	Available K (Kg ha^{-1})
Vaibhav	0.78	280	23.68	378
JG-226	0.77	278	23.84	370
Jaki	0.76	286	24.29	369
RG2009-01	0.76	281	23.68	370
RG2009-16	0.75	284	23.41	374
Vishal	0.77	278	24.51	375
JG-14	0.77	284	23.35	377
Daftari-21	0.76	280	23.70	379
JG-130	0.76	283	22.85	373
Indira Chana - 1	0.75	282	24.47	371
CD (P=0.05)	NS	NS	NS	NS
Initial status	0.62	212.0	13.2	275.0

Umiam

Performance of different varieties of groundnut and Mustard: Among different varieties of groundnut, maximum yield (2614 kg/ha) was recorded by JL 501 followed by ICGV91114 (2464 kg/ha). Among different varieties of mustard maximum yield was recorded by YSH (1396 kg/ha) followed by Ragini (1300 kg/ha).





Groundnut and mustard crop at Umiam under organic condition

Ajmer (Table 7.3.11.1—7.3.11.2)

Green gram (Table 7.3.11.1)**:** There were significant difference in its performance in terms of growth and seed yield of green gram. Green gram variety Mum-2 performed significantly better in term of number of primary branches (6.20), number of seeds/pod (11.87), number of pods/plant (25.27), seed yield/plot (1.22 kg), seed yield (610.00 kg/ha) biomass yield (1865 kg/ha and Harvest index (24.68). Significantly higher plant height at harvest (76.73 cm) was recorded by variety SML-668 which was statistically at par with all the varieties except RMG-62 (67.27 cm).

Table 7.3.11.1: Performance of green gram varieties under organic management practices during *Kharif* at Ajmer

Green gram Varieties	Plant height at harvest (cm)	No. of primary branches/plant	No. of pods/ plant	No. of seeds / pod	Seed yield /plot (kg)	Seed yield (kg/ha)	Biomass yield (kg/ha)	Harvest index
RMG-975	70.00	5.73	24.67	11.73	1.21	603.33	1843.33	24.64
RMG-62	67.27	5.07	23.93	11.27	0.97	486.67	1603.33	23.31
MSG-118	74.27	4.93	18.27	9.53	0.90	451.67	1503.33	23.30
RMG-492	71.20	4.73	24.07	11.13	0.96	480.00	1766.67	21.34
SML-668	76.73	4.73	23.93	11.47	0.90	451.67	1400.00	24.60
GANGA-1	71.07	5.20	23.33	11.60	0.88	440.00	1385.00	24.32
IPM-02-3	71.00	5.00	19.40	11.40	0.92	461.67	1513.33	23.44
MUM-2	72.47	6.20	25.27	11.87	1.22	610.00	1865.00	24.68
S Em±	2.58	0.30	1.49	0.42	0.06	32.05	93.42	1.73
CD(P=0.05)	7.84	0.90	4.52	1.27	0.19	97.20	283.37	5.25

Cluster bean (Table 7.3.11.2): Among the cluster bean varieties, RGC-1038 variety recorded no of pods/plant (60.07), no. of seeds/pod (8.57), seed yield/plot (3.06 kg), seed yield (1530.00 kg/ha), biomass yield (4021.67 kg/ha) and harvest index (27.67). RGC-1038 recorded higher number of primary branches/plant (9.60) followed by RGC-1055 (7.87). Significantly higher plant height at harvest (142.00 cm) recorded by RGC-1066 which was significantly higher than other varieties except RGC-936 (113.73 cm).

Table 7.3.11.2: Performance of cluster bean varieties under organic management practices during *Kharif* at Ajmer

Cluster bean Varieties	Plant height at harvest (cm)	No. of primary branches/plant	No. of pods/ plant	No. of seeds / pod	Seed yield /plot (kg)	Seed yield (kg/ha)	Biomass yield (kg/ha)	Harvest index
RGC-936	113.73	5.93	40.47	7.67	2.57	1286.67	3495.00	26.90
RGC-1001	135.07	7.53	44.20	7.53	2.68	1340.00	3903.33	25.64
RGC-1003	132.73	6.20	49.40	7.93	2.63	1316.67	3923.33	25.14
RGC-1038	141.40	9.60	60.07	8.57	3.06	1530.00	4021.67	27.67
RGC-986	138.73	6.47	34.93	8.27	1.39	696.67	3508.33	16.60
RGC-1055	137.60	7.87	53.87	8.40	2.97	1483.33	3950.00	27.30
RGC-1066	142.00	0.00	36.80	8.13	2.59	1296.67	3468.33	27.19
RGC-12-1	140.27	5.87	40.53	7.33	2.51	1256.67	3496.67	26.37
S Em±	4.12	0.44	3.13	0.26	0.12	60.00	145.85	1.03
CD(P=0.05)	12.51	1.32	9.50	0.80	0.36	181.99	442.38	3.11

Coriander (Table 7.3.12.3)**:** Among different varieties of coriander, maximum no. of branches/plant (8.87), no. of secondary branches/plant (20.07), no. of umbel/plant (37.47), no. of umbellate/umbel (6.80) and seed yield (1655.00 kg/ha) followed by ACr-1. Azad Dhaniya-1 recorded significantly higher plant height at harvest (106.33 cm) which was statistically at par with ACr-1 (105.47 cm).

Table 7.3.12.3: 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	105.47	8.73	19.73	36.40	6.73	1636.67
Azad Dhania-1	106.33	8.87	20.07	37.47	6.80	1655.00
RCr- 435	76.33	7.20	13.13	34.53	6.33	1388.33
RCr- 436	83.27	6.87	13.87	31.53	5.53	1380.00
RCr- 446	85.20	6.27	15.13	30.87	5.67	1503.33
RCr- 684	87.33	7.93	16.13	33.47	5.93	1383.33
Hissar Sugandha	92.93	7.27	17.07	28.13	6.27	1433.33
Hissar Anand	91.13	7.53	17.20	30.27	6.20	1468.33
CD(P=0.05)	8.57					

Fennel (Table 7.3.12.4)**:** Among all varieties of fennel maximum plant height at harvest (170.00 cm), number of primary branches/plant (10.07), number of secondary branches/plant (20.00), number of umbel/plant (32.27), no. of umbellate/umbel (26.07) Seed yield (3283.33 kg/ha) followed by AF-1.

Table 7.3.12.4: 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	167.87	9.80	19.53	30.13	25.53	3233.33
RF-101	156.20	7.47	14.73	26.67	21.07	2833.33
Co-1	162.27	7.20	15.27	25.47	23.40	3016.67
Rajendra Saurabha	159.27	6.13	14.20	25.27	23.47	3150.00
GF-12	170.00	10.07	20.00	32.27	26.07	3283.33
RF-281	163.33	7.20	16.60	26.53	21.00	3166.67
RF-125	156.87	7.33	16.80	27.07	22.33	2916.67
GF-02	151.27	6.33	14.80	25.27	23.27	3158.33
CD(P=0.05)						

Best performing coriander varieties Azad Dhania-1 and ACr-1



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

Best performing varieties of green gram MUM-2 and RMG-975

Best performing varieties of cluster bean RGC-1038 and RGC-1055

Gangtok (Table 7.3.13.1—7.3.13.3)

Varietal evaluation of maize and buckwheat under organic management in maize-buckwheat cropping system

Maize (Table 7.3.13.1): Among all varieties of maize, significantly higher plant height at flowering stage (307 cm) recorded by Seti Makkai which was statistically at par with Baiguni Makkai (298 cm). Rato Makkai recorded significantly higher Dry matter accumulation at tasselling (82.1 g plant^{-1}) which was significantly at par with Pahenlo Makkai (51.6 g plant^{-1}) and RCM 75 (50.8 g plant^{-1}). Significantly higher LAI at silking stage (4.58) recorded by variety Vivek Sankul-35. LAI at silking stage of variety Vivek Sankul-35 was statistically at par with Rato Makkai (4.48) and Baiguni Makkai (4.57). Seti Makkai recorded significantly higher days to 50% tasseling (76) which was significantly higher than Rato Makkai (74) and Baiguni Makkai (74). RCM 1-1 recorded significantly higher cob length (16.4 cm) among all other varieties. Vivek Sankul-31 recorded significantly higher cob girth (14.6 cm) which was statistically at par with Vivek Sankul-37 (13.2 cm) and Vivek Sankul-35 (14.4 cm). Significantly higher number of rows/ cob recorded by variety Vivek Sankul-35 (14.0). Kalo Makkai recorded significantly higher number of grains/row (37.6) and significantly higher grain yield (4.07 t/ha) was recorded by Vivek Sankul-35.

Table 7.3.13.1. Evaluation of maize composite under organic management condition

Cultivars	Plant height at flowering stage (cm)	Dry matter accumulation at tasseling (g plant^{-1})	LAI at Silking stage	Days to 50% tasseling	Coblength (cm)	Cobgirth (cm)	No. of rows cob^{-1}	No. of grains row^{-1}	Grain yield (t ha^{-1})
Seti Makkai	307	73.5	3.30	76	15.7	12.6	12.5	31.8	3.95
Pahenlo Makkai	239	51.6	3.48	71	14.6	12.8	12.4	34.5	3.58
Rato Makkai	279	82.1	4.48	74	15.8	12.5	12.1	37.4	3.33
Baiguni Makkai	298	44.3	4.57	74	15.1	12.4	12.6	31.2	3.42
Kalo Makkai	260	47.9	3.71	70	13.7	11.6	9.8	37.6	3.10
Satheya	266	46.7	3.74	66	13.1	11.8	10.2	28.8	3.20
RCM 1-1	221	47.6	3.89	69	16.4	11.6	11.7	30.2	3.81
RCM 1-3	227	46.3	3.70	71	14.9	12.8	12.4	27.9	3.84
RCM 75	233	50.8	4.18	71	15.0	12.9	12.7	33.0	3.74
Vivek Sankul-31	151	23.9	3.56	66	13.1	14.6	12.7	35.3	3.99
Vivek Sankul-37	159	25.3	3.97	65	11.0	13.2	13.5	31.2	3.89
Vivek Sankul-35	140	32.5	4.58	64	11.9	14.4	14.0	31.5	4.07
CD (P=0.05)	23.8	3.19	0.14	2.85	1.27	1.57	1.92	3.06	0.32

Economics of different cultivars of maize: Among different varieties of maize significantly higher gross return (88.1 Rs/ha), net return (42.9 Rs/ha) and return/rupee invested (1.95) which was statistically at par with some of the varieties.

Table 7.3.13.2: Economics of different cultivars of maize under organic management condition

Cultivars	GrossReturn(^{1} ×10^3 ha^{-1}	NetReturn(^{1} ×10^3 ha^{-1}	Return $rupee^{-1}$ invested
Seti Makkai	85.5	40.3	1.89
Pahenlo Makkai	77.5	32.3	1.72
Rato Makkai	72.1	26.9	1.60
Baiguni Makkai	74.0	28.9	1.64
Kalo Makkai	67.1	22.0	1.49
Satheya	69.2	24.1	1.53
RCM 1-1	82.4	37.3	1.83
RCM 1-3	83.1	38.0	1.84
RCM 75	80.9	35.8	1.79
Vivek Sankul-31	86.3	41.2	1.91
Vivek Sankul-37	84.2	39.0	1.87
Vivek Sankul-35	88.1	42.9	1.95
CD (P=0.05)	7.78	3.67	0.08

Buckwheat (Table 7.3.13.3): Among different varieties of buckwheat, significantly higher grain yield (2.13 t/ha), gross return (127.8 Rs/ha) and net return (95.5 Rs/ha) recorded by variety IC 109433 which was statistically at par with Local Meethay. IC 49671 recorded significantly higher days of maturity (126) which was statistically at par with IC 36805 (119), IC 109433 (121), IC 2018742 (119), PRB -1 (121) and VL- UGAL (124). IC 109433 recorded maximum return $rupee^{-1}$ invested (2.96) followed by Local Meethay (2.79).

Table 7.3.15.3. Evaluation of varietal Buckwheat under organic management condition

Variety	Days to Maturity	Grainyield (t ha^{-1})	GrossReturn (^{1} ×10^3 ha^{-1})	NetReturn (^{1} ×10^3 /ha^{-1})	Return $rupee^{-1}$ invested
Local Meethay	110	2.04	122.4	90.1	2.79
Local Teethay	113	1.23	73.8	41.5	1.28
IC 104727	108	1.19	71.4	39.1	1.21
IC 36805	119	1.31	78.6	46.3	1.43
IC 109729	117	1.92	115.2	82.9	2.57
IC 15393	110	1.30	78.0	45.7	1.41
IC 109433	121	2.13	127.8	95.5	2.96
IC 49671	126	1.92	115.2	82.9	2.57
IC 2018742	119	1.27	76.2	43.9	1.36
PRB -1	121	0.88	52.8	20.5	0.63
VL- UGAL	124	0.97	58.2	25.9	0.80
SANGLA B-1	116	1.00	60.0	27.7	0.86
SEm ±	3.42	0.03	3.30	2.30	0.02
CD @ 5 %	8.16	0.09	10.8	6.85	0.06

Vivek sankul-35 maize variety at Gangtok

Different Buckwheat cultivars at Gangtok

Sardarkrushinagar (Table 7.3.14.1 – 7.3.14.4)

Groundnut (Table 7.3.14.1)**:** Yield and **y**ield attributes characters and economics showed significant variations among groundnut varieties under organic condition. Significantly higher Pod yield (1728 kg/ha) and haulm yield (2901 kg/ha) was recorded by variety GJG 17 which was statistically at par with GG 20 and TG 37A. GJG 17 recorded maximum gross return (111728 Rs/ha), net return (62403 Rs/ha) and NRPRI (2.27) followed by GG 20.

Table 7.3.14.1: Yield and economics of different groundnut varieties at Sadarkrushinagar

Cultivars	Pod yield (kg/ha)	Haulm yield (kg/ha)	Cost of cultivation(Rs/ha)	Gross return (Rs/ha)	Net return (Rs/ha)	NRPRI
GJG HPS-1(S)	1389	2407	49326	90162	40836	1.83
GG 20 (SS)	1636	2685	49326	105440	56114	2.14
GG 7 (B)	1019	2006	49326	67323	17997	1.36
TG 37A (B)	1543	2593	49326	99769	50443	2.02
GJG 9 (B)	1173	2099	49326	76466	27140	1.55
GG 5 (B1)	988	1481	49326	62963	13637	1.28
GJG 17 (S)	1728	2901	49326	111728	62403	2.27
KDG 123 (B)	1296	2253	49326	84182	34856	1.71
CD (P=0.05)	219	443				

Wheat (Table 7.3.14.2)**:** Among all varieties of wheat maximum Gross return (107824 Rs/ha), Net return (41443 Rs/ha) and B:C Ratio (1.62) was recorded by GW 451 followed by GW 496. Significantly higher haulm yield (5023 kg/ha) was recorded by GW 273 which was statistically at par with GW 451 (4722 kg/ha) and GW496 (4769 kg/ha). Significantly higher pod yield (3935 kg/ha) was recorded by GW 451 which was statistically at par with GW 366 (3206 kg/ha), GW273 (3241 kg/ha) and GW 496 (3542 kg/ha). Cost of cultivation of all varieties was 66381 Rs/ha.

Table 7.3.14.2: Yield and economics of different wheat varieties at Sadarkrushinagar

Cultivars	Pod yield (kg/ha)	Haulm yield (kg/ha)	Cost of cultivation(Rs/ha)	Gross return (Rs/ha)	Net return (Rs/ha)	NRPRI
GW 451	3935	4722	66381	107824	41443	1.62
GW 366	3206	4028	66381	88206	21825	1.33
GW 322	2727	3750	66381	75671	9290	1.14
GW 273	3241	5023	66381	90463	24082	1.36
GW496	3542	4769	66381	97986	31605	1.48
GDW 1255	2975	3727	66381	81817	15436	1.23
GW1139	3067	3889	66381	84456	18075	1.27
HI 8498	2507	3495	66381	69664	3283	1.05
CD (P=0.05)	832	937				

Green gram (Table 7.3.14.3)**:** Among different varieties of green gram gross return (67797 Rs/ha), net return (40909 Rs/ha) and NRPRI (2.44) was recorded by GM 4 followed by GAM 5. GM 4 recorded significantly higher pod yield (679 kg/ha) and haulm yield (2840 kg/ha). Pod yield of GM4 variety was statistically at par with Meha, K 851, GAM 5, PKVAKM 4 and Bgs 9. Haulm yield of GM4 variety was statistically at par with Meha, GAM 5. Cost of cultivation for all varieties of green gram was 28427 Rs/ha.

Table 7.3.14.3: Yield and economics of different green gram varieties at Sadarkrushinagar

Cultivars	Pod yield (kg/ha)	Haulm yield (kg/ha)	Cost of cultivation(Rs/ha)	Gross return (Rs/ha)	Net return (Rs/ha)	NRPRI
GM 4	679	2840	28427	69336	40909	2.44
Meha	617	2670	28427	63210	34783	2.22
K 851	602	2160	28427	60745	32318	2.14
PDM 139	448	1944	28427	45845	17418	1.61
IPM 410-3	417	1651	28427	42365	13938	1.49
GAM 5	664	2793	28427	67797	39370	2.38
PKVAKM 4	556	2068	28427	56219	27792	1.98
BGS 9	540	1975	28427	54587	26160	1.92
CD (P=0.05)	161	527				

Soil fertility status at the end of the crop sequence (Table 7.3.14.4)**:** Statistically higher N-uptake (203.4 kg/ha) and P-uptake (31.8 kg/ha) after completion of cropping sequence was recorded by variety GJG-HPS-1 (kharif) " GW 451 (rabi) "GM 4 (summer) which was statistically at par with variety GG- 20 (kharif)"GW 366 (rabi)"Meha (summer). Highest K-uptake (120.0 kg/ha) was recorded with variety GG- 20 (kharif)"GW 366 (rabi)"Meha (summer) followed by GJG-HPS-1 (kharif) " GW 451 (rabi) "GM 4 (summer).

Table 7.3.14.4: Total uptake of major nutrients after completion of cropping sequence

Kharif	*Rabi*	Summer	N uptake (kg/ha)	P uptake (kg/ha)	K uptake (kg/ha)
GJG-HPS-1 (S)	GW 451	GM 4	203.4	31.8	116.7
GG- 20 (SS)	GW 366	Meha	198.1	31.4	120.0
GG-7 (B)	GW 322	K 851	167.4	26.5	98.0
TG-37 A (B)	GW 273	PDM 139	187.2	28.1	113.4
GJG-9 (B)	GW496	IPM 410-3	174.8	28.4	104.3
GG-5 (B1)	GDW 1255	GAM 5	164.6	26.0	91.3
GJG-17 (S)	GW1139	PKVAKM 4	192.6	30.4	114.8
KDG-123 (B)	HI 8498	BGS 9	160.3	24.6	96.0

Physio-chemical properties of soil after completion of groundnut-wheat-green gram crop sequence: Maximum SOC (0.269 %), Available N (177 kg/ha), Available P(17.45 kg/ha), Available K(178 kg/ha) were recorded by cropping sequence GG-7 (kharif) "GW 322 (rabi)"K-851 (summer). GJG-17 (kharif) "GW1139 (rabi)" PKVAKM 4(summer) recorded maximum EC (0.125 ds/m) followed by GG- 20 (SS) "GW 366"Meha. KDG-123 (kharif) "HI 8498(rabi) "BGS 9(summer) and GG-5 (kharif) "GDW 1255 (rabi)"GM 5 (summer) recorded maximum Ph (7.73) followed by TG-37 (kharif) "GW 273 (rabi)"PDM 139 (summer).

Table 7.3.14.5: Physio-chemical properties of soil after completion of groundnut-wheat-green gram crop sequence under organic farming at Sardarkrushinagar

Kharif	*Rabi*	Summer	SOC(%)	Available N(kg/ha)	Available P(kg/ha)	Available K(kg/ha)	EC (dS/m)	pH
GJG-HPS-1 (S)	GW 451	GM 4	0.242	166	16.71	165	0.114	7.69
GG- 20 (SS)	GW 366	Meha	0.266	177	16.89	174	0.120	7.63
GG-7 (B)	GW 322	K 851	0.269	177	17.45	178	0.111	7.69
TG-37 A (B)	GW 273	PDM 139	0.252	162	17.08	169	0.117	7.71
GJG-9 (B)	GW496	IPM 410-3	0.245	166	16.43	159	0.118	7.68
GG-5 (B1)	GDW 1255	GAM 5	0.245	174	16.89	161	0.112	7.73
GJG-17 (S)	GW1139	PKVAKM 4	0.240	166	16.80	161	0.125	7.68
KDG-123 (B)	HI 8498	BGS 9	0.259	169	16.61	160	0.114	7.73
		Initial	0.190	147	10.920	140	0.090	7.14

Best performing variety Groundnut: GJG 17, Wheat: GW 451 and Green gram: GM 4 at SK Nagar

Thiruvananthapuram (Table 7.3.15.1-7.3.15.2)

yield of cassava (Table7.3.17.1)**:** Sree Reksha (CR-24-4) attained the maximum tuber yield in terms of kg/plant (2.97) and t/ha (36.61) followed by Sree Pavithra. M-4 recorded minimum tuber yield in terms of kg/plant (0.64) and t/ha (7.87).

Table 7.3.15.1: Yield of cassava varieties under organic management at Thiruvananthapuram

Varieties	Tuber yield		Varieties	Tuber yield	
	kg per plant	t ha^{-1}		kg per plant	t ha^{-1}
H-226	1.96	24.15	Vellayani Hraswa	1.10	13.52
H-165	1.52	18.77	Sree Pavithra	2.10	25.93
Sree Athulya	1.38	17.00	Sree Visakham	1.23	15.22
Sree Swarna	0.68	8.44	Sree Reksha (CR-24-4)	2.97	36.61
Sree Jaya	1.79	22.07	M-4 0.64	7.87	
Sree Vijaya	2.08	25.71	CD (0.05)	0.329	4.065
Kalpaka	0.66	8.19			

Economics of cultivation of cassava varieties under organic practice: Among different varieties of cassava, maximum net return (500000 Rs/ha) and B:C ratio (3.0) recorded by Sree Reksha followed by H 226, Sree Vijaya and Sree Pavithra.

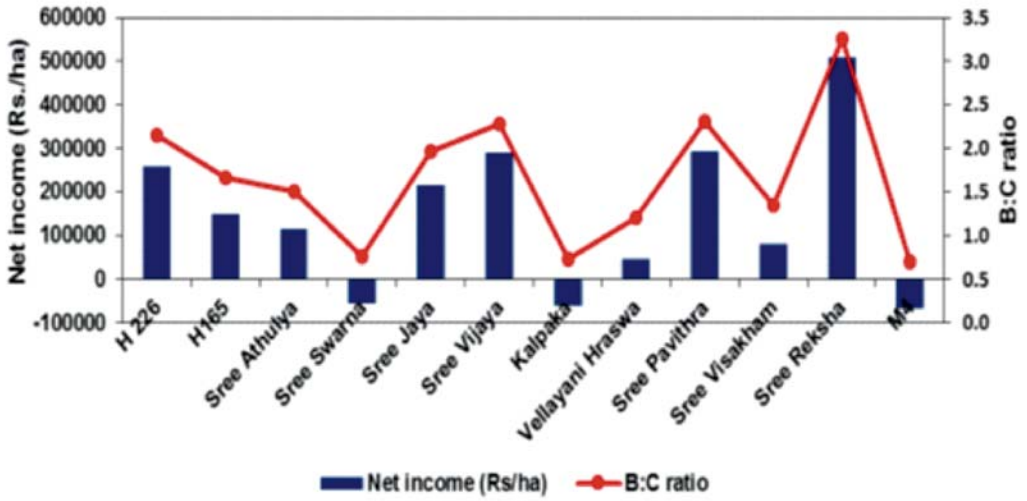
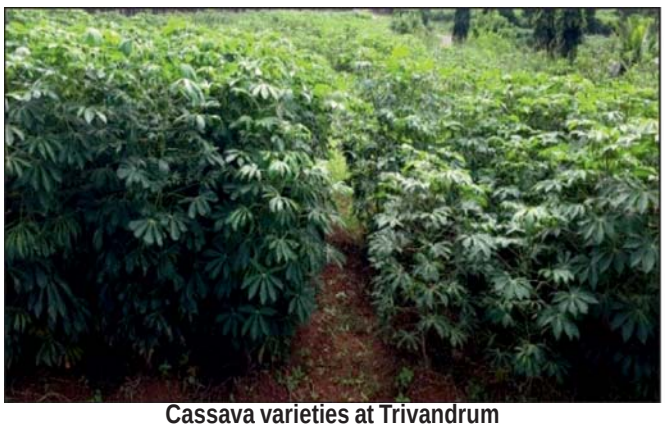


Fig. ..... Economics of cultivation of cassava varieties under organic practice

Best performing variety Groundnut: GJG 17, Wheat: GW 451 and Green gram: GM 4 at SK Nagar



Cassava varieties at Trivandrum

Tuber of cassava

Udaipur (Table 7.3.16.1"7.3.16.4)

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

Yield attributes of maize: Among different varieties of maize, maximum number of cobs/plant (3.0) was recorded by variety PM-3 (Baby corn) and minimum number of cobs/plant recorded by Madhula (1.0) and Farmers selection (1.0). Pratap QPM Hybrid–1 (maize grain), PM – 9 (maize grain), Sugar 75 (Sweet corn), Madhula (sweet corn), recorded maximum number of grain rows/cob (16.0). Number of grain rows/cob in PM-3 (baby corn) and PM-5 (baby corn) was recorded zero (0.0). VL Amber (Popcorn) recorded maximum number of grains/row (35.0) followed by Sugar 75 (sweet corn) and Amber (Popcorn). Sugar 75 (Sweet corn) recorded significantly higher number of grains/cob (513.9) which was statistically at par with Pratap QPM Hybrid–1 (maize), PM – 9 (maize). Pratap QPM Hybrid–3 (maize) recorded significantly higher weight of grain/cob (108.4 g) which was statistically at par with Pratap QPM Hybrid–1 (maize), PM – 9 (maize). Pratap QPM Hybrid–3 (maize) recorded maximum test weight (256.0 g) followed by PM-9 (Maize grain).

Table 7.3.16.1: 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	31.0	496.2	94.4	190.0
PM – 9	2.0	16.0	29.0	465.9	91.1	194.0
Pratap Hybrid Maize–3	2.0	14.0	30.0	421.1	108.4	256.0
Sweet corn						
Sugar 75	2.0	16.0	32.0	513.9	47.1	91.0
Madhula	1.0	16.0	26.0	416.4	25.5	61.0
MAHY-103	2.0	14.0	28.0	392.6	24.8	63.0
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	35.0	490.8	66.5	135.0
Amber	2.0	14.0	32.0	448.1	38.6	86.0
Local varieties						
Navjot	2.0	14.0	30.0	423.3	75.3	175.0
Farmers selection	1.0	14.0	27.0	378.1	71.9	190.0
CD (P=0.05)	0.214	1.419	2.900	87.198	21.919	16.072

Yield and economics of different varieties of maize (Table 7.3.16.2)**:** Among the different maize grain varieties, Pratap Hybrid Maize-3 recorded significantly higher economic yield (5830 kg/ha) which was statistically at par with Pratap QPM Hybrid -1 (5550 kg/ha). Pratap Hybrid Maize–3 recorded maximum fodder yield (8000 kg/ha) followed by Pratap QPM Hybrid–1 (7400 kg/ha). Maximum MEY (8384 kg/ha) and Gross return (190800 Rs/ha) was recorded by variety Sugar 75 followed by Misty. Sugar 75, Madhula, Misty recorded highest cost of cultivation (78820) followed by Pratap QPM Hybrid–1, PM – 9 and

Pratap Hybrid Maize–3. Sugar 75 recorded maximum net return (111980 Rs/ha) followed by Pratap Hybrid Maize–3 (92785 Rs/ha). Significantly highest net return per rupee invested (1.66) which was statistically at par with Pratap QPM Hybrid–1 (1.51),VL Amber (1.57).

Table 7.3.16.2: Maize 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)	Cost of cultivation	Net return (Rs/ha)	Netreturn per rupee invested
Pratap QPM Hybrid – 1	5550	7400	5550	140415	55870	84545	1.51
PM – 9	4300	5500	4300	107600	55870	51730	0.93
Pratap Hybrid Maize – 3	5830	8000	5830	148655	55870	92785	1.66
Sugar 75	5170	7000	8384	190800	78820	111980	1.42
Madhula	3900	5200	6324	143520	78820	64700	0.82
Misty	4400	5700	7135	161070	78820	82250	1.04
PM- 3	1420	1800	3224	68820	55620	13200	0.24
PM- 5	1250	1500	2838	60150	55620	4530	0.08
VL Amber	3000	4200	6486	141420	55060	86360	1.57
Amber	1700	2000	3676	78200	55060	23140	0.42
Navjot	4170	5800	4170	106725	55320	51405	0.93
Farmers selection	3810	4950	3810	95730	55320	40410	0.73
CD (P=0.05)	432.82	584.23	558.59	13226.85		13226.85	0.21

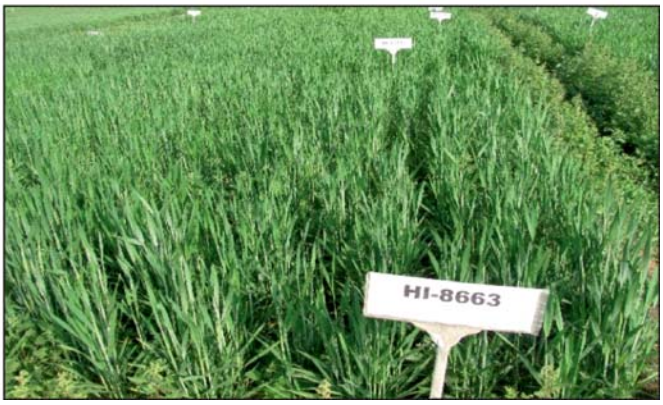
Response of different varieties of wheat under organic farming at Udaipur

Yield and economics of wheat (Table 7.3.16.3)**:** Among Triticum aestivum, Triticum durum and local wheat, significantly higher number of spikelets/ears was recorded by HI-8713 (18.60) followed by HI-1531 (Triticum aestivum), Raj-3765 (Triticum aestivum), HI-8627 (Triticum durum). Maximum ear length (10.70 cm) was recorded by MP-3288 (Triticum aestivum) followed by C-306 (local wheat). HI-8713 (Triticum durum) recorded significantly higher number of grains/ear (53.00) followed by HI-8627 (Triticum durum). Significantly higher test weight (53.00 g) was recorded by variety MPO-1215. HI-8713 recorded significantly higher grain yield (5785 kg/ha) which was statistically at par with HI-8663 (Triticum durum). HI-8713 (Triticum durum) recorded highest straw yield (9500 kg/ha) followed by HI-8663 (Triticum durum). Raj-4037 recorded significantly higher harvest index (41.72 %) which was statistically at par with HI-1531 (Triticum aestivum), MP-3288 (Triticum aestivum), HI-8663 (Triticum durum), MPO-1215 (Triticum durum) , HI-1500 (Triticum durum) and C-306 (Local Wheat). HI-8713 (Triticum durum) recorded maximum gross return (220015 Rs/ha) and Net return (173395 Rs/ha) followed by HI-8663 (Triticum durum). Significantly higher Net return per rupee (3.72) invested was recorded by HI-8713 (Triticum durum) which was statistically at par with HI-8663 (Triticum durum).

Table 7.3.16.3: Yield attributes, yield and economics of wheat varieties grown under organic farming at Udaipur

Varieties	Number of spikelets /ear	Ear length (cm)	Number of grains/ ear	Test weight (g)	Grain yield (kg/ha)	Straw yield (kg/ha)	Harvest index (%)	Gross return (Rs ha^{-1})	Net return (Rs ha^{-1})	Net return per rupee invested
Triticum aestivum										
HI-1531	18.40	7.75	46.30	48.15	4295	6210	40.89	158710	113090	2.48
MP-3288	16.90	10.70	48.60	46.35	4615	7400	38.41	174535	128915	2.83
Raj-3765	17.80	8.45	44.20	48.60	3480	6450	35.05	136395	90775	1.99
Raj-4037	14.20	7.95	36.00	50.40	4080	5700	41.72	149670	104050	2.28
Raj-4120	13.90	8.05	43.40	50.00	3700	6520	36.20	143160	97540	2.14
Triticum durum										
HI-8627	17.50	7.55	52.20	51.00	4410	8210	34.94	173045	126425	2.71
HI-8663	17.60	7.20	48.60	48.50	5400	8522	38.79	203471	156851	3.36
HI-8713	18.60	7.75	53.00	50.00	5785	9500	37.85	220015	173395	3.72
MPO-1215	16.45	7.05	40.00	53.00	4320	6815	38.80	162763	116143	2.49
HI-1500	17.30	8.45	42.50	45.75	3605	5750	38.54	136170	89550	1.92
Wheat (Local)										
Lok-1	14.65	7.60	36.00	45.45	3680	6520	36.08	142580	97460	2.16
C-306	16.15	9.58	42.50	46.20	4210	6135	40.70	155833	110713	2.45
CD at 5 %	1.637	0.843	4.340	4.888	430.18	707.93	3.84	16361.65	16361.65	0.36

Best performing maize variety PHM-1 and PHM-3 at Udaipur



Best performing wheat variety 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: Ajmer and Udaipur (Rajasthan), Almora (Uttarakhand) and Gangtok (Sikkim)

Centre wise results for each centre are presented below

Ajmer

Evaluation of integrated pest management modules against aphid and thrips infestion in coriander and fennel

Evaluation of IPM Modules against sucking pests infesting in seed spices

Descriptions of IPM module

Modules	Treatment combinations
M-1	T_1 Sanitation
	T_2 Sticky traps 25 no./hac.
	T_3 Neem guard 3 ml/lit.
M-2	T_1 Field sanitation
	T_2 NSKE 5ml/lit
	T_3 Ker extract 10 ml/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.

Modules	Treatment combinations
M-4	T_1 Datura leaf extract 10ml/lit.
	T_2 Cow urine + butter milk (fermented) 50%
	T_3 *Verticillium lecanii* 5g/lit.
M-5	T_1 Neem oil 3 ml/lit
	T_2 Castor leaf extact 10ml/lit
	T_3 Tumba fruit extract 10ml/lit. .
M-6	Untreated Control

I) Effect of different organic IPM modules for management on aphid and thrips in coriander and fennel (Table 7.2.3.1 and Fig.1-3)**:**

Six organic based IPM modules (including control) against aphid and thrips on coriander and fennel were evaluated. Significant differences among the different IPM modules were observed that all IPM modules found to be significantly superior over untreated check. The maximum per cent reduction in 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.), which was 74.41, 67.84% on coriander and 75.35 and 77.30% on fennel followed by M-2 (field sanitation + NSKE 5ml/lit + Ker extract 10 ml/li.) of 72.0 and 74.65 in coriander and 65.40 and 74.65% in fennel respectively. In case of yield of seed spice i.e. coriander and fennel followed the same trend and recorded significantly higher with module M3 of 2246 and 2510 kg/ha in coriander and fennel followed by module M2 which recorded of 2170 and 2255 kg/ha in coriander and fennel respectively. Lowest yield recorded with module M6 i.e. untreated check. Yield of coriander higher by 23.9, 31.3, 10.9 and 57.1% compared to module M1, M4, M5 amd M6 (check) respectively and 35.7, 29.6, 33.9 and 58.9% higher yield of fennel was observed against module M1, M4, M5 amd M6 (check) respectively (Table 7.2.3.1 and Fig.1-3).

Table 7.2.3.1: Performance of different IPM module on yield and percent reduction in infestation of sucking-pests

IPM module	Yield (kg/ha)		% reduction in aphid population		% reduction in thrips population	
	Coriander	Fennel	Coriander	Fennel	Coriander	Fennel
M1	1813	1850	65.3	62.4	59.6	59.5
M2	2170	2255	72.2	74.6	65.4	74.6
M3	2246	2510	74.4	75.3	67.8	77.3
M4	1710	1936	63.6	67.4	62.9	69.4
M5	2035	1875	71.9	63.4	57.4	61.7
M6	1430	1580	-			
CD (P=0.05)	75.9	67.3	2.04	1.39	1.48	1.30

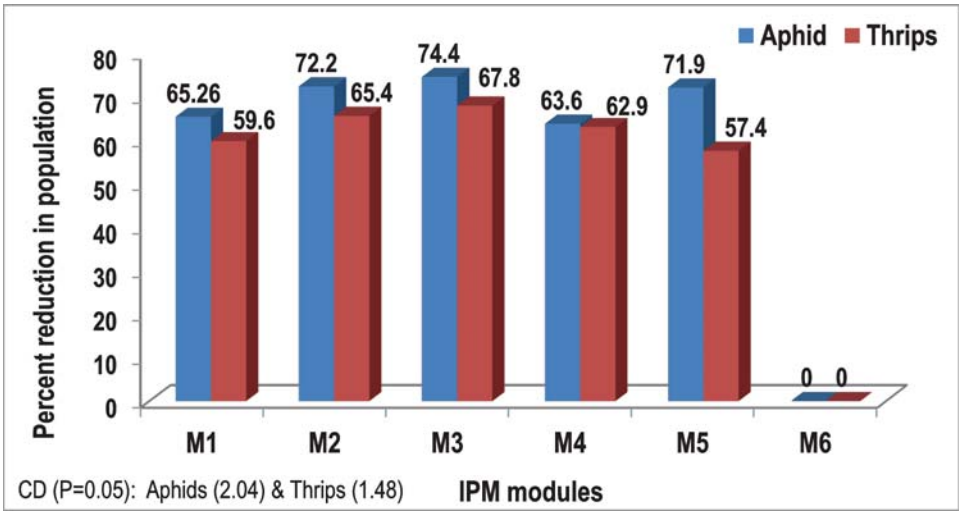


Fig 1: Effect of different organic IPM modules on aphids and thrips of coriander

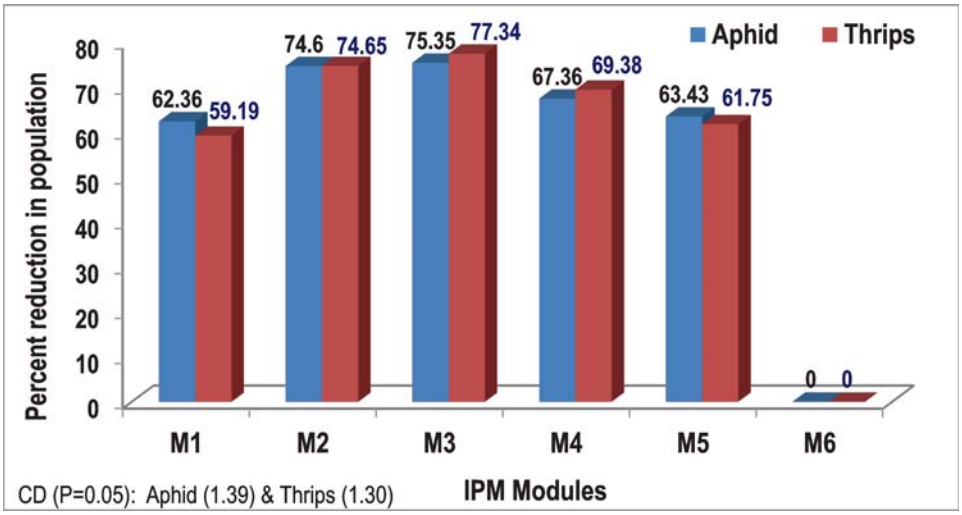


Fig 2: Effect of different organic IPM modules on aphids and thrips of fennel

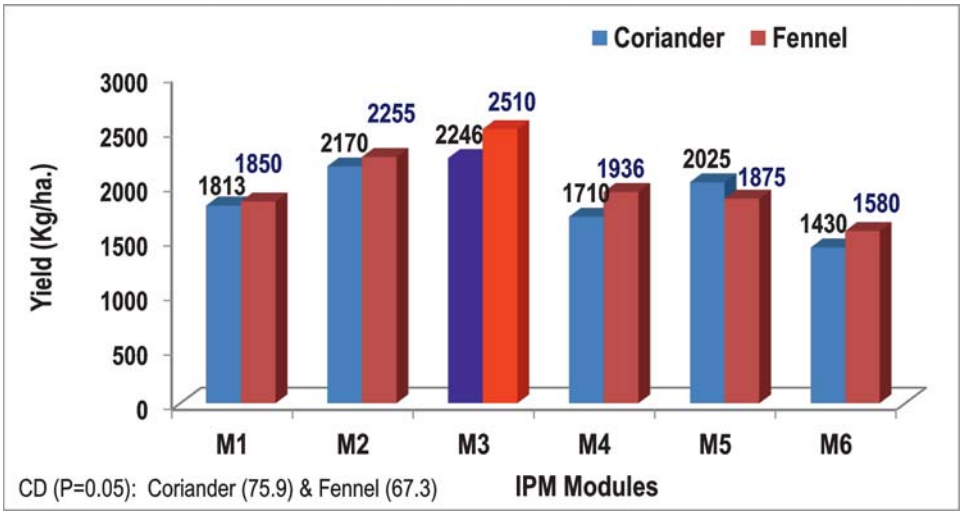


Fig 3: Effect of different organic IPM modules on yield of coriander and fennel

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. Maximum reduction in sucking pest such as thrips, aphids and white fly (66.3, 71.0 and 70.1% respectively) observed significantly with application of Nimbecidine 0.03EC- 5ml/lit. (Standard check) followed by Verticillium lecani- 5g/lit.

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%	45.51	47.69	50.19
T2- Chrysanthemum leaf extract-10%	46.20	43.96	46.33
T3- Datura leaf extract-10%	52.00	55.24	59.85
T-4 Neem leaf extract – 10%	59.13	56.40	61.33
T5- Castor leaf extract-10%	46.12	52.15	47.65
T6- Nimbecidine 0.03EC- 5ml/lit. (Standard check)	66.30	71.05	70.10
T7- Verticillium lecani- 5g/lit.	61.00	68.31	55.72
T8-Cow urine -20%	51.10	44.00	67.20
T9- Control			
CD (P=0.05)	1.99	2.15	1.96

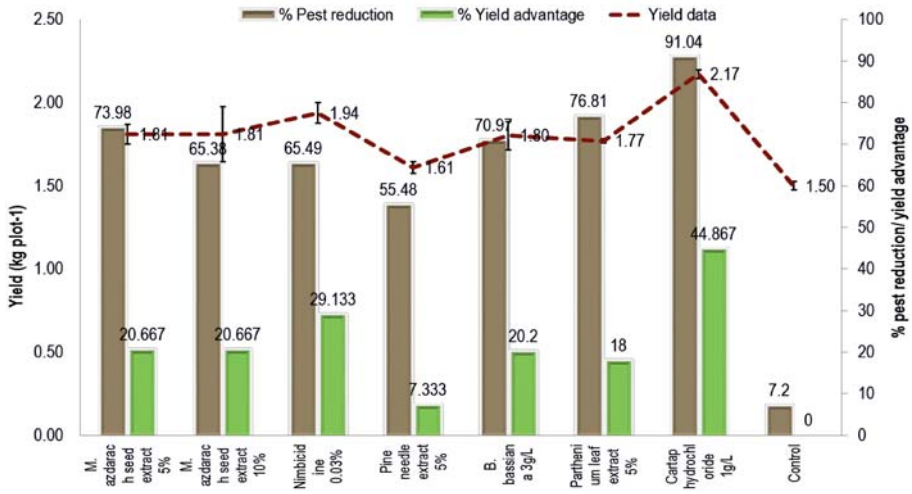
Almora

Evaluation of bio-agents/bio-pesticides for pest management practices in soybean (Table 7.2.3.2): The organic pest management options for soybean sucking pests (*Chauliops choprai*) six, organic plant extract and concentration was e\valuated. The infestation insoybean crop by sucking bug, *Chauliops choprai* and aphids was low to moderate. 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 up to however, against sucking bug (*Chauliops choprai*), Cartap hydrochloride 1g/L resulted in significantly reduced the sucking pest in soybean followed by parthenium leaf extract 5% and 10% extract of *Melia azederach* provided reduction of 91.6, 83.5 and 79.1%, respectively. Among the pest management modules tested, the insecticide *cartap hydrochloride* @ 1g/L provided lowest mortality of 6.11. Extracts of *Parthenium*, *Melia azederach* and commercial *Nimbicidine* caused up to 20-40% mortality after 72 hours after treatment.

Table 7.2.3.2: Effect of organics management of soybean sucking bug

Plant extract and Concentration	Per cent pest reduction sucking bug (*Chauliops choprai)* in soybean		Per cent mortality (Hours after treatments)		Average % mortality
	3rd day after spray	7th day after spray	48 hours	72 hours	
Melia azederach seed extract 5%	68.50±2.93^{c}	79.06±2.40^{c}	23.33	34.44	28.89
Melia azederach seed extract 10%	65.33±3.01^{b}	79.79±1.56^{c}	30.00	51.11	40.56
Nimbicidine 0.03%	60.83±2.84^{b}	82.25±3.29^{c}	26.67	44.45	35.56
Beauveria bassiana 3g/L	65.62±2.32^{b}	83.48±1.72^{c}	11.11	28.89	20.00
Parthenium leaf extract 5%	74.40±2.09^{c}	83.55±2.34^{c}	9.53	30.00	19.77
Cartap hydrochloride 1g/L	96.37±1.63^{d}	91.58±1.06^{d}	3.33	8.89	6.11
Control	10.13±0.63^{a}	8.96±0.33^{a}	4.44	5.56	5.00
CD (P=0.05)	6.38	5.41			

soybean sucking bug (*Chauliops choprai*)



Fig……: Relation between per cent pest reduction and per cent yield advantage vis-a-vis crop yield of soybean after foliar spray of various organic treatments

Performance of different bio-agent/botanical on per cent reduction of sucking pest, yield advantage and yield of soybean (Fig…): Significant effect after foliar spray of various organic botanical mixtures for pest management in soybean were recorded. Highest per cent reduction, yield advantage due to less sucking bug and highest yield of soybean recorded with Cartap hydrochloride application @ 1g/L. Next best performing mixtures recorded of Parthenium leaf extract 5% which significantly reduced the pest infestation by 76.8% against sucking bug (*Chauliops choprai*) of soybean.

Coimbatore

Evaluation of organic production practices for the management of fall armyworm, *Spodoptera frugiperda* (JE Smith) (Noctuidae: Lepidoptera) infesting maize

Treatment details

T_1	: Absolute control
T_2	: Spray of 5% neem leaf extract @ 15 DAS + Use of pheromone traps
T_3	: T_2 + Dusting of silicon powder @ 15 kg/ha
T_4	: T_2 + Dusting of silicon powder @ 25 kg/ha
T_5	: T_2 + Application of silicon granules @ 100 kg/ha
T_6	: T_2 + Application of silicon granules @ 125 kg/ha
T_7	: T_2 + Silicon powder @ 15 kg/ha + Silicon granules @ 100 kg/ha
T_8	: T_2 + Silicon powder @ 15 kg/ha + Silicon granules @ 125 kg/ha
T_9	: T_2 + Silicon powder @ 25 kg/ha + Silicon granules @ 100 kg/ha
T_{10}	: T_2 + Silicon powder @ 25 kg/ha + Silicon granules @ 125 kg/ha

Time of application

- Silicon powder @ 20, 40 and 60 DAS
- Silicon granules @ knee high, tasseling and milking stage

Results (Table 7.2.3.3)**:**

Field experiment was conducted to evaluate organic management practices for the management of fall armyworm infesting maize at Tamil Nadu Agricultural University, Coimbatore with ten treatments replicated thrice with maize hybrid (COHM 6). Silicon powder was applied thrice at 20, 40 and 60 days after sowing (DAS) and silicon granules were applied in the leaf whorl thrice at knee high, tasselling and milking stage. Intensity of damage caused by fall armyworm was assessed using 1-5 scale developed by the Department of Agricultural Entomology, Tamil Nadu Agricultural University, Coimbatore.

Pre-treatment damage intensity assessment at 15 DAS revealed that the damage was in the range of 3.7 to 4.1 scale in different treatments and was statistically non-significant. At 20 DAS, the damage was recorded to be in the range of 3.2 to 4.5 scale, with the lowest damage scale of 3.2 in the plots treated with foliar application of 5% neem leaf extract @ 15 DAS + use of pheromone traps + application of silicon powder @ 25 kg/ha + application of silicon granules @ 125 kg/ha (T_{10}), as against 4.5 in absolute control (T_1).

At 40 DAS, the damage were recorded to be in the range of 2.1 to 4.4 scale, with the lowest damage of 2.1 scale in T_{10}, as against 4.4 scale in T_1. At 60 DAS, the damage were recorded to be in the range of 1.3 to 3.4 scale, with the lowest damage of 1.3 scale in T_{10}, as against 3.4 scale in T_1. Similar trend was observed at 80 DAS with the damage ranging from 1.0 to 2.1 scale. Plant height at harvest was recorded to be the maximum of 219.1 cm in T_{10} as against 165.8 cm in T_1. Maximum number of 15.7 leaves per plant was recorded in T_{10} as against 13.1 leaves per plant in T_1. Grain and straw yield were

recorded to be the maximum in T_{10} (4905 and 6676 kg/ha, respectively) with the B:C ratio of 1.81 as against the lowest grain and straw yield of 3,653 and 4,694 kg/ha, respectively with the B:C ratio of 1.45 in the absolute control (T_1).

Table 7.2.3.3: Evaluation of organic practices for management of fall army worm, *Spodoptera frugiperda* infesting maize

Treatments	Damage caused by fall armyworm (1-5 scale)					Plant height (cm)	No. of leaves / plant	Grain yield (Kg/ha)	Straw yield (Kg/ha)	B:C ratio
	PTC	20 DAS	40DAS	60 DAS	80 DAS					
T_1	4.0	4.5^{e}	4.4^{e}	3.4^{g}	2.1^{d}	165.8^{i}	13.1^{d}	3653^{i}	4694^{g}	1.45
T_2	4.1	4.2^{de}	4.0^{de}	3.4^{fg}	1.9^{cd}	189.9^{h}	13.8^{bcd}	3799^{h}	4974^{fg}	1.49
T_3	4.1	4.0^{cd}	3.8^{de}	3.3^{fg}	1.7^{bcd}	192.8^{g}	13.7^{cd}	4027^{g}	5068^{efg}	1.56
T_4	3.9	3.9^{cd}	3.8^{de}	3.1^{efg}	1.6^{bcd}	198.4^{e}	14.4^{abcd}	4103^{e}	5377^{def}	1.59
T_5	3.9	3.9^{cd}	3.6^{cde}	2.8^{def}	1.6^{bc}	196.6^{f}	14.6^{abcd}	4065^{f}	5439de	1.53
T_6	3.7	3.8^{bcd}	3.5^{cd}	2.7^{de}	1.5^{bc}	198.7^{e}	14.6^{abcd}	4122^{e}	5496^{cd}	1.54
T_7	3.9	3.6^{abc}	3.2^{bcd}	2.4^{cd}	1.4^{abc}	209.4^{d}	14.9^{abcd}	4534^{d}	5909^{bc}	1.69
T_8	3.8	3.6^{abc}	2.8^{abc}	1.9^{bc}	1.4^{abc}	212.5^{c}	15.0^{abc}	4699^{c}	6073^{b}	1.73
T_9	3.8	3.4^{ab}	2.4^{ab}	1.6^{ab}	1.2^{ab}	218.3^{b}	15.2^{ab}	4864^{b}	6238^{b}	1.80
T_{10}	4.0	3.2^{a}	2.1^{a}	1.3a	1.0^{a}	219.1^{a}	15.7^{a}	4905^{a}	6679^{a}	1.81
CD (P=0.05)	NS	0.46	0.91	0.59	0.47	0.34	1.50	25.92	415.59	-

Gangtok

Organic insect pest management in large cardamom (Table 7.2.3.4): Insects that cause infestation in large cardamom are leaf caterpillars, tea mosquito bug, shoot fly, stem borer and root mealy bug. The study was conducted to study the effect of bio-pesticides and organically permitted chemicals on insect pest management in organic large cardamom. All the bio-pesticide treatments showed very significant effect for control of insect pests over control plot. Application of Spinosad 45 SC @ 0.3 ml/l reduced the leaf caterpillar damage (77.72%), tea Mosquito bug damage 74.24%), shoot fly damage (70.58%) and stem borer damage (69.24%) in large cardamom followed by neem oil (1500 ppm) @ 4 ml/l which ranged from 58.88 to 72.32 % reduction of infestation over control and petroleum agro-spray @ 2ml/lit (42.88 to 68.34% reduction of infestation over control).

Table 7.2.3.4: 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	72.32	66.74	58.88	*	61.64
Beauveria bassiana	7 g/l	40.62	9.94	51.08	*	51.14
Metarhizium anisopliae	5 ml/l	43.42	7.29	40.88	*	40.34
Petroleum oil based agro-spray	2ml/lit	58.12	68.34	42.88	*	43.14
Petroleum oil based horticultural spray	10 ml/l	50.82	62.14	50.68	*	52.44
Bacillus thuringiensis	2 g/l	46.32	10.04	55.28	*	57.14
Spinosad 45 SC	0.3 ml/l	77.72	74.24	70.58	*	69.24
CD (P=0.05)		4.55	4.41	5.72	*	9.28

Note: * Treatments not considered for evaluation of root mealy bug incidence

Organic insect pest management in maize-based cropping system (Table 7.2.3.5)

Efficacy of the selected 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 result in case of lowest score (1.05), lowest borer damage before and after spray (5.21 and 3.72%), and controlled highest 78.7% damage. The lowest disease incidence was observed with Spinosad 45 SC @ 0.3 ml/l (15.7%). *Beauveria bassiana* @ 7 g/l been the beast performer which also recorded lower insect score (1.52), damage after spray (4.93%), and disease incidence 21.73%. With application of Spinosad 45 SC @ 0.3 ml/l, yield of soybean recorded significantly higher of 2940 kg/ha followed by using of *Beauveria bassiana* @7 g/l which recorded 2620 kg/ha yield.

Table 7.2.3.5: Effect of bio pesticide on organic insect pest and disease management in maize-based cropping system

Treatments	Stem borer infestation (%)					TLB
	Insect Score (0-9 scale)	Percent damage before spray	Percent damage after spray	Percent damage control	Grain yield (kg/ha)	Disease incidence (%)
Neem oil (1500 ppm @ 4 ml/l)	3.33	8.61	5.59	68.1	1960	39.53
Beauveria bassiana @7 g/l	1.52	7.88	4.93	72.7	2620	21.73
Metarhizium anisopliae @5 ml/l	3.19	8.15	5.61	69.5	2210	24.43
Petroleum oil based agro-spray @ 10 ml/l	4.69	9.43	6.5	65.2	1330	41.43
Petroleum oil based horticultural spray @ 10 ml/l	2.34	7.01	5.32	70.9	2490	23.49
Bacillus thuringiensis @ 2 g/l	4.04	9.2	6.18	66.8	1830	40.13
Spinosad 45 SC @ 0.3 ml/l	1.05	5.21	3.72	78.7	2940	15.73
Control	6.08	8.75	19.9	-	210	52
CD (P=0.05)	0.89	1.06	0.63	-	270	-

Damages caused by Army fall worm

Udaipur

A. Effect of herbal concoctions/concentration on insect-pests of okra

Treatment details and descriptions

T_1	Desi herbal concotions (1 kg neem leaves + 1 kg aak + 1 kg datura paste)
T_2	Desi keetnasak (6 kg neem leaves extract + 1 kg aak leaves + ½ kg tobacco leaves in one earthen pot for 15 days in dung heap & spray in 1:10 ratio)
T_3	Incubates butter milk (100 L butter milk in copper pot for 10-15 days incubation)
T_4	Seed treatment/seedling treatment with babhut amrit pani + desi ark (10 kg neem leaves + 5 kg neem seed kernel + 2 kg aak leaves + 2 kg datura leaves + 10 L water, boil all & sieve & mixed in 100 L water & spray)
T_5	Butter milk herbal concentration (5 kg neem leaves + 5 kg aak leaves + 10 L butter milk + 100 g copper. Keep it for 7 days in pot. Mix in 100 L water & spray
T_6	Water spray
T_7	Control

Table 7.2.3.6: Effect of different herbal concoctions on insect-pest management of okra

Treatment	Pest population (No./plant)				
	Dose (%)	Jassids	White fly	Mealy bug	Red cotton bug
T1:Desi herbal concotions (1 kg neem leaves + 1 kg aak + 1 kg datura paste)	10	2.1	3.1	2.9	3.1
T2:Desi keetnasak (6 kg neem leaves extract + 1 kg aak leaves + ½ kg tobacco leaves in one earthen pot for 15 days in dung heap & spray in 1:10)	10	1.1	1.5	1.3	1.2
T3: Incubates butter milk (100L buttermilk in copper pot for 10-15 days incubation)	10	3.0	4.1	3.6	3.7
T4: Seed treatment/seedling treatment with babhut amrit pani + desi ark (10 kg neem leaves + 5 kg neem seed kernel + 2 kg aak leaves + 2 kg datura leaves + 10 L water, boil all & siev & mix in 100 L water & spray)	20	0.37	0.54	0.28	0.41
T5: Butter milk herbal concotions (5 kg neem leaves + 5 kg aak leaves + 10 L buttermilk + 100 g copper. Keep it for 7 days in pot. Mix in 100 L water & spray	20	1.5	2.1	1.9	2.1
T6: Water spray	-	4.4	5.7	4.6	4.8
T7:Control	-	4.4	5.8	4.6	4.9

Results (Table 7.2.3.6 and 7.2.3.7): Among the different herbal concoctions, treatment T4 i.e. seed treatment/seedling treatment with babhut amrit pani + desi ark (10 kg neem leaves + 5 kg neem seed kernel + 2 kg aak leaves + 2 kg datura leaves + 10 L water, boil all & sieve & mixed in 100 L water & spray) significantly performed better and recorded lowest population of jassids, white fly, mealy bug and red cotton bug followed by application of Desi keetnasak (6 kg neem leaves extract + 1 kg aak leaves + ½ kg tobacco leaves in one earthen pot for 15 days in dung heap & spray in 1:10). Yield attributing characters such as, plant height at harvest, number of branches/plants, fruit length, number of fruits/plant and fruit yield/ha (123 cm, 6.00, 16.00 cm, 22.00 and 3704 kg/ha, respectively) were also recorded maximum with treatment T4 i.e. seed treatment/seedling

treatment with babhut amrit pani + desi ark followed by application of desi keetnasak treatment (118 cm, 6.00, 15.50 cm, 20.00 and 3241 kg/ha, respectively) along with gross return, net return and BC ratio (Rs.111111/ha, Rs.69511/ha and 1.67, respectively). Next best performing treatment been T2 i.e. T2:Desi keetnasak (6 kg neem leaves extract + 1 kg aak leaves + ½ kg tobacco leaves in one earthen pot for 15 days in dung heap & spray in 1:10) in term of pest population, yield and monetary return.

Table 7.2.3.7: Effect of different herbal concentration growth, yield attributes and yield of okra

Treatment	Plant height at harvest (cm)	No. of branches/ plant	Fruit length (cm)	No of fruits per plant	Fruit yield (kg/ha)	Gross return (Rs./ha)	Net return (Rs./ha)	BC ratio
T1: Desi herbal concotions (1 kg neem leaves + 1 kg aak + 1 kg datura paste)	114	5.00	15.00	17.00	2685	80556	38956	0.94
T2: Desi keetnasak (6 kg neem leaves extract + 1 kg aak leaves + ½ kg tobacco leaves in one earthen pot for 15 days in dung heap & spray in 1:10)	118	6.00	15.50	20.00	3241	97222	55622	1.34
T3: Incubates butter milk (100L buttermilk in copper pot for 10-15 days incubation)	112	4.50	14.00	16.00	2407	72222	30622	0.74
T4: Seed treatment/seedling treatment with babhut amrit pani + desi ark (10 kg neem leaves + 5 kg neem seed kernel + 2 kg aak leaves + 2 kg datura leaves + 10 L water, boil all & siev & mix in 100 L water & spray)	123	6.00	16.00	22.00	3704	111111	69511	1.67
T5: Butter milk herbal concotions (5 kg neem leaves + 5 kg aak leaves + 10 L buttermilk + 100 g copper. Keep it for 7 days in pot. Mix in 100 L water & spray	116	5.50	15.00	15.00	2870	86111	44511	1.07
T6: Water spray	109	4.00	12.50	15.00	2130	63889	22289	0.54
T7: Control	102	3.00	11.00	13.00	1852	55556	13956	0.34
CD (P=0.05)	4.583	0.236	0.664	0.832	133.602	4008.062	4008.06	0.096


Desi herbal concotions


Desi keetnasak


Incubates butter milk

Seed treatment/seedling treatment with babhut amrit pani + desi ark

Butter milk herbal concentration

Control

Effect of different herbal concoctions on insect-pest management of okra

Effect of different herbal concoctions on yield and economics of okra

Description of treatment

T_1	Butter milk (10 L butter milk fermented for 10 days and mixed in 100 L water for spray in 1 acre) at 45 DAS and 10 days interval
T_2	Red chilli concoction (Red chilli powder 100 g+ 3 kg Aloe Vera extract+10 L cow urine in 100L water) at 45 DAS and 10 days interval
T_3	Application of cow urine (Spray of cow urine and water (1:10) at 45 DAS and 10 days interval)
T_4	Application of cow dung slurry (Spraying of cow dung slurry and water (1:10) at 45 DAS and 10 days interval)
T_5	Application of cow dung slurry + cow urine (Spraying of cow dung slurry and cow urine (1:1) then the mixed with water (1:5) at 45 DAS and 10 days interval)
T_6	Application of dung and wood ash (Dusting on leaves @ 50g/plant at 45 DAS and 10 days interval)
T_7	Control (No pest management) but spraying of water

Result (Table 7.2.3.8 and 7.2.310): Six herbal concoctions along with control treatment (no any pest management only water spray) was evaluated to test their efficacy and for management of sucking peat in okra. Among the different herbal mixtures, application of cow dung slurry (spray of cow dung slurry and water (1:10) at 45 DAS with10 days interval) resulted in maximum reduction of pest population per plant as compared to other treatments followed by application of butter milk (10 L butter milk fermented for 10 days and mixed in 100 L water for spray in 1 acre) at 45 DAS and 10 days interval.

Yield contributing characters such as plant height at harvest, number of branches/plants, fruit length, number of fruits/plant and fruit yield/ha (122 cm, 6.50, 15.50 cm, 20.00 and 2407 kg/ha, respectively) were also recorded highest with application of Cow dung slurry + cow urine (Spraying of cow dung slurry and cow urine (1:1) then the mixed with water (1:5) at 45 DAS and 10 days interval) followed by application of Butter milk (10 L butter milk fermented for 10 days and mixed in 100 L water for spray in 1 acre) at 45 DAS and 10 days interval (118 cm, 6.00, 14.40 cm, 18.50 and 1852 kg/ha, respectively) at 45 DAS and 10 days interval. Gross return, net return and BC ratio (Rs. 72222/ha, Rs28500/ha and 0.65, respectively) were also followed the same trend with the application of cow dung slurry + cow urine in 1:1 ratio mixed with water in 1:5 ratio twice at 45 DAS and 10 days interval followed by application of butter milk (Rs. 55556/ha, Rs13956/ha and 0.34, respectively).

Table 7.2.3.9: Effect of different ITKs on insect pest management of okra

Treatmentdetails	Dose	Pest population (No./plant)			
		Jassids	White fly	Mealy bug	Red cotton bug
Butter milk (10 L butter milk fermented for 10 days and mixed in 100 L water for spray in 1 acre) at 45 DAS and 10 days interval	10%	1.3	1.4	1.3	1.5
Red chilli concoction (Red chilli powder 100 g+ 3 kg Aloe Vera extract+10 L cow urine in 100L water) at 45 DAS and 10 days interval	10%	2.9	2.4	3.2	2.6
Cow urine (Spraying of cow urine and water (1:10) at 45 DAS and 10 days interval)	10%	3.5	2.7	4.1	3.8
Cow dung slurry (Spraying of cow dung slurry and water (1:10) at 45 DAS and 10 days interval)	10%	0.42	0.68	0.36	0.49
Cow dung slurry + cow urine (Spraying of cow dung slurry and cow urine (1:1) then the mixed with water (1:5) at 45 DAS and 10 days interval)	20%	1.9	1.7	1.8	1.9
Dung and wood ash (Dusting on leaves @ 50g/plant at 45 DAS and 10 days interval)	50g/ plant	2.2	1.9	2.5	2.1
Control (No pest management) but spray of water	-	4.8	3.7	5.3	4.6

Application of Cow dung slurry + Cow urine

Application of dung and wood ash

Application of Cow dung slurry

Application of Butter milk

Application of Red chilli concoction

Application of Cow urine

Effect of different ITKs on pest management in okra

Table 7.2.3.10: Effect of different ITKs on growth, yield attributes and yield of okra

Treatment	Plant height at harvest (cm)	No. of branches/ plant	Fruit length (cm)	No of fruits per plant	Fruit yield (kg/ha)	Gross return (Rs./ha)	Net return (Rs./ha)	BC ratio
Butter milk (10 L butter milk fermented for 10 days and mixed in 100 L water for spray in 1 acre) at 45 DAS and 10 days interval	118	6.00	14.40	18.50	1852	55556	13956	0.34
Red chilli concoction (Red chilli powder 100 g+ 3 kg Aloe Vera extract+10 L cow urine in 100L water) at 45 DAS and 10 days interval	114	4.50	13.20	16.00	1204	36111	-5539	-0.13
Cow urine (Spraying of cow urine and water (1:10) at 45 DAS and 10 days interval)	112	4.00	12.40	15.40	1019	30556	-12844	-0.30
Cow dung slurry (Spraying of cow dung slurry and water (1:10) at 45 DAS and 10 days interval)	117	6.00	14.10	17.60	1574	47222	5522	0.13
Cow dung slurry + cow urine (Spraying of cow dung slurry and cow urine (1:1) then the mixed with water (1:5) at 45 DAS and 10 days interval)	122	6.50	15.50	20.00	2407	72222	28522	0.65
Dung and wood ash (Dusting on leaves @ 50g/plant at 45 DAS and 10 days interval)	108	5.00	13.60	17.10	1389	41667	67	0.00
Control (No pest management) but spray of water	105	3.50	11.60	13.00	926	27778	-13422	-0.33
CD (P=0.05)	4.30	0.23	0.62	0.77	71.0	2132	2132	0.05

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: 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 *Trichoderna* (soil & seed application) on *Sclerotium* rot was found most effective (PDI, 5.0) followed by 21 days soil solarisation (PDI, 5.12), whereas effect on powdery mildew, it found to be minimum significantly with 21 days soil solarisation (PDI, 3.12) followed by neem cake @ 0.5 t/ha (PDI, 6.18). Numbers of weed/m2 were recorded significantly lower (47.2) with soil solarization followed by in neem cake (101.7) while the maximum weed /m2 (127.0) recorded in control. The maximum yield (754 kg/ha) was recorded with the treatments 21 days summer soil solarization followed by *Trichoderma (soil & seed application)* of 724 k/ha

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

Treatments	*Sclerotium* Rot (per cent disease incidence)	Powdery mildew (per cent disease incidence)	Numbers of weed per M^2	Yield (kg/ha)
Soil solarisation (21 days)	5.12	3.12	47.2	754
Trichoderma (soil & seed application)	5.00	7.61	116.7	724
Neem cake (0.5 t/ha)	5.50	6.18	101.75	713
Caster cake (0.5 t/ha)	6.75	7.44	109.7	617
Control	7.25	13.50	127.0	460
CD (P=0.05)	1.01	0.76	4.3	218

ii) Management of *Ramularia* blight of fennel and powdery mildew in coriander (Table 7.2.4.2): Five treatments comprising arial 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. The spray schedule of different botanicals was adopted. Among all the treatments with respect to *Ramularia* blight, garlic extract was found most effective (PDI, 0.55) followed by onion extract (PDI, 0.93) where the disease incidence was reduced to the tune of 172.7and 61.3% than control treatment (PDI, 1.50). The maximum yield of fennel (2580 kg/ha) was also recorded with botanical extract i.e. garlic extract (0.5%) followed by castor oil (2440 kg/ha). In case of powdery mildew, it was found 143.7 and 129.4% effective than control with garlic extract (0.5%) followed by neem oil (0.5%) resulted highest yield of coriander 755 and 710 kg/ha 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%)	1.00	2330	3.40	710
Castor oil (0.5%)	1.20	2440	5.10	624
Garlic extract (0.5%)	0.55	2580	3.20	755
Onion extracts (0.5%)	0.93	2250	5.20	650
Control	1.50	2140	7.80	470
CD (P=0.05)	0.57	166	0.57	201

Coimbatore

Evaluation of organic management practice for diseases in crops: In bhendi, the IPDM module with foliar spray of 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 (63.5% reduction over control). In brinjal, the IPDM module recorded the maximum reduction in the incidence of little leaf diseases (74.8% reduction over control). In tomato, the IPDM module with foliar spray of *Bacillus subtilis* @ 0.5% was effective against early blight (67.5 % reduction over control) which resulted in higher yield of 18611 kg/ha. In chilli, the IPDM module performed better in reducing the incidence of yellow leaf curl disease (78.5 % reduction over control) and the yield was also higher (11238 kg/ha) in the IPDM module.

Table 7.2.4.5: 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)	IPDM	63.5	11470
Brinjal	Little leaf disease (MLO)	IPDM	74.8	20134
Tomato	Early blight (Fungal)	IPDM	67.5	18611
Chilli	Yellow leaf curl disease (Virus)	IPDM	78.5	11238

Gangtok

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

Results

Evaluation of the botanicals, bio-control agents and organically permitted fungicides against three major diseases, study for both in vitro and in vivo trials were undertaken to evaluate the efficacy of the treatments. The 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 complex associated with group of pathogenic fungi including *Colletotrichum* spp, *Pestaliopsis* spp, *Fusarium spp, Pestalotia* spp. Both in vitro and in vivo trials were undertaken to evaluate the efficacy of the treatments. Under in vivo studies, a total of 11 treatments were used including control plot the details of which are mentioned below.

Treatments used against the diseases under in vivo studies

Treatments		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 of 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 7.2.4.1: Inhibition of pathogen growth against the treatments under *in vitro* condition

Treatment		Mean growth of pathogen mycelia (mm)	Percentage recovery over control (PROC)
T_1	Garlic (*Allium sativum*) 2.5%	23.5	72.7
T_2	Common Mugwort (*Artemisia vulgaris*) 2.5%	26.1	69.6
T_3	Needlewood (*Schiima wallichii*) 2.5%	19.7	77.1
T_4	Commercial neem based formula (Azadirachtin 1500ppm)	13.1	84.7
T_5	*Trichoderma viride*6.5%	20.7	75.6
T_6	ICAR-TV7	13.7	84.1
T_7	*Pseudomonas fluorescens* 0.5%	37.4	56.1
T_8	Copper oxychloride 50% WP	33.4	60.8
T_9	Copper hydroxide 75% WP	67.1	21.2
T_{10}	Bordeaux Mixture	84.7	0.55
T_{11}	Sulphur 80% WP	14.1	83.5
T_{12}	Control	86.1	0.00
	CD (0.05%)	6.49	

Result: Among the treatments, significant difference was observed. The maximum recovery of disease over control of 84.7% was observed in neem based compound *(Azadirachtin* 1500 ppm*)* and ICAR-TV7 (84.1%) followed by sulphur 80% WP of 82.5%. Among the botanicals, Garlic (Allium sativum) 2.5% and *Trichoderma viride*6.5% treatment which could be due to the fact that neem based formula inhibited the insect vector involved in the spread of disease with its antibiotics and growth promoting role enhanced the host defence. In other study, a positive correlation was also observed between the treatments and the yield parameters of the plants.

The results of the *in vitro* studies were also in accordance to the *in-vivo* studies and mentioned in Table 7.2.4.1. Among the treatments the best performance was showed by neem based formulation with only 13.21 mm growth of pathogen followed by sulphur 80% WP 14.1 mm of growth. The least performance was shown by Bordeaux mixture and copper hydroxide 75% WP with maximum pathogen growth of 84.7 mm and 66.0 mm, respectively.

Effect of different botanicals on the yield and disease incidence of large cardamom (Table 7.2.4)**:** 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 in case of *Pseudomonas fluorescens* with 8 flowers/plants followed by *Trichoderma viride* with 7 flowers/plants. Similarly in case of total number of tillers, mature tillers these were also found in *Trichoderma viride and Pseudomonas fluorescens* with total numbers of tillers 21 and 18 and 20 and 16 respectively. Likewise the immature tillers were found to be more in case of Garlic with 8 immature followed by *Pseudomonas fluorescens*. The fresh weight of the tillers were more in *Trichoderma viride* followed by (Artemisia vulgaris) 2.5% and Garlic (Allium sativum) 2.5% and the 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 88.4% followed by *Pseudomonas fluorescens* with 87%.the number of seeds/fruit were maximum in Commercial neem based formula (Azadirachtin 1500 ppm)(22.5), followed by *Trichoderma viride* (20.4). It was recorded that the minimum disease incidence was recorded in Commercial neem based formula (*Azadirachtin* 1500 ppm) with 27% followed by Garlic (*Allium sativum*) with 31% disease incidence.

Table 7.2.4.4: Effect of different botanicals on the yield and disease incidence of large cardamom

Treatment	Treatment details	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%	21	14	8	300	54	82.3	18.7	16	7	31
T2	Common Mugwort (*Artemisia vulgaris*) 2.5%	13	11	2	301	47	84.2	13.4	9	6	39
T3	Needle wood (*Schima wallichii*) 2.5%	17	13	3	260	47	81.7	13.0	11	6	35
T4	Commercial neem based formula (Azadirachtin 1500 ppm)	15	13	2	244	47	80.8	22.5	11	4	27
T5	*Trichoderma viride*	21	18	3	312	54	82.9	20.5	14	7	34
T6	*Pseudomonas fluorescens*	20	16	4	200	26	87.0	10.2	11	9	44
T7	Copper oxychloride 50% WP	17	14	3	233	27	88.4	16.1	10	7	40
T8	Copper hydroxide 75% WP	17	14	3	150	23	84.3	14.2	9	8	43
T9	Bordeaux Mixture	15	12	3	136	37	72.5	12.3	7	8	53
T10	Sulphur 80% WP	15	13	2	213	43	79.6	20.5	11	4	27
T11	Control	20	16	4	133	23	82.6	11.0	7	13	65
	CD (P=0.05)	NS	NS	2.77	111	18.81	-	4.90	4.82	3.54	12.7

Spraying of botanicals, bio control agents and organically permitted fungicides

Leaf blight damage

Foorkey Infection

Chirkey infection

Large cardamom field under spray and incidence of major diseases in field

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

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 (4.17) significantly higher recorded with the application of vermicompost @ 10 kg/clump + bio-fertilizer which was on par with FYM @7.5 kg + VC @2.5 kg/clump + BF (4.01). The dry weight of capsules per clump and the productivity of the large cardamom i.e., 19.98 g and 417 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 (18.96 & 410 kg/ha respectively), FYM @10 kg + VC @2.5 kg/clump +BF (18.9 and 404 kg/ha respectively). The soil organic carbon, available N and K showed significant variation among the different organic nutrient management package and recorded highest under vermicompost @ 10 kg/clump + biofertilizer (1.19 %, 368 and 220kg/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 for 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	3.03	14.8	332	1.11	318	22.1	211
FYM @ 7.5 kg/clump + BF	3.14	16.0	318	1.13	327	22.4	212
FYM @ 10 kg/clump + BF	3.36	16.4	343	1.17	326	22.9	215
FYM @ 5 kg + VC @ 2.5 kg/clump + BF	3.95	16.4	368	1.16	337	22.7	211
FYM @ 7.5 kg + VC @ 2.5 kg/clump + BF	4.01	18.0	388	1.22	344	23.2	214
FYM @ 10 kg + VC @ 2.5 kg/clump + BF	4.17	18.9	404	1.22	348	24.4	210
VC @ 5.0 kg/clump + BF	2.75	17.6	396	1.12	331	21.8	210
VC @7.5 kg/clump + BF	3.11	18.96	410	1.17	358	22.1	220
VC @ 10 kg/clump + BF	3.13	19.98	417	1.19	368	23.9	220
Control	1.01	5.32	102	0.96	231	15.8	185
CD (P=0.05)	0.27	0.56	22.3	0.08	9.37	1.51	9.39

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

Micronutrients showed that the available boron, zinc and molybdenum under foliar application is much effective as compared to soil application. The best soil treatment i.e. foliar application that significantly increased the vegetative buds of large cardamom was boron0.20%, zinc 0.25% and molybdenum 0.20% (2.76, 2.68, 2.64 respectively) as compared to control. Application of boron significantly affected the immature, mature tillers and vegetative buds. Among the foliar application of boron treatments, foliar application of Borax @ 0.30% recorded the maximum values of immature tillers per clump (3.79 numbers) and mature tillers per clump (3.55). It might be due to the positive role of boron in meristem tic tissue development, whether these were root tips, tips of upper plant parts (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 (numbers)	Mature tiller	Vegetative buds (numbers)
Soil application						
T_1	Boron	1.0 kg/ha	0.154	3.17	3.04	2.38
		2.0 kg/ha	0.165	3.22	3.14	2.42
		3.0 kg/ha	0.167	3.31	3.23	2.50
T_2	Zinc	1.0 kg/ha	3.29	2.88	2.90	2.35
		1.5 kg/ha	3.46	3.14	3.09	2.39
		2.0 kg/ha	3.69	3.02	2.97	2.45
T_3	Molybdenum	5.0 kg/ha	0.118	2.74	2.98	2.26
		7.5 kg/ha	0.122	2.82	3.07	2.31
		10.0 kg/ha	0.123	3.06	3.14	2.40
Foliar application						
T_4	Boron	0.10%	0.175	3.62	3.39	2.76
		0.20%	0.176	3.73	3.44	2.76
		0.30%	0.179	3.79	3.55	2.74
T_5	Zinc	0.10%	3.56	3.68	3.31	2.66
		0.25%	3.68	3.75	3.36	2.68
		0.50%	3.76	2.83	3.21	2.60
T_6	Molybdenum	0.05%	0.116	1.97	3.10	2.56
		0.10%	0.117	2.15	3.13	2.64
		0.20%	0.122	1.63	2.11	1.79
T_7	Control	Control	1.06	0.61	0.616	0.53
	CD (P=0.05)		0.33	0.33	0.47	0.28

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

Results: Studied the effect of different treatments against three major diseases in large cardamom consisting of 11 treatments including botanicals, bio-control agents and organically permitted fungicides. The diseases included chirkey disease caused by Chirke Virus (*Maclura virus*), Foorkey disease caused by \Bushy Dwarf virus (*Nano virus*), leaf blight disease complex associated with group of pathogenic fungi including *Colletotrichum spp, Pestaliopsis spp*, *Fusarium spp, Pestalotia spp*. Among the treatments, significant difference was observed. The maximum recovery of disease over control of 84.7% was observed in neem based compound (Azadirachtin 1500 ppm) and ICAR-TV7 (84.1%) followed by sulphur 80% WP of 82.5%. Among the botanicals, Garlic (Allium sativum) 2.5% and Trichoderma viride6.5% treatment which could be due to the fact that neem based formula inhibited the insect vector involved in the spread of disease with its antibiotics and growth promoting role enhanced the host defence. In other study, a positive correlation was also observed between the treatments and the yield parameters of the plants.

The results of the in vitro studies were also in accordance to the in-vivo studies and mentioned in Table 7.2.5.3. Among the treatments the best performance was showed by neem based formulation with only 13.21 mm growth of pathogen followed by sulphur 80% WP 14.1 mm of growth. The least performance was shown by Bordeaux mixture and copper hydroxide 75% WP with maximum pathogen growth of 84.7 mm and 66.0 mm, respectively.

Table 7.2.5.3: Inhibition of pathogen growth against the treatments under *in vitro* condition

	Treatment	Mean growth of pathogen mycelia (mm)	Percentage recovery over control (PROC)
T1	Garlic (*Allium sativum*) 2.5%	23.5	72.7
T2	Common Mugwort (*Artemisia vulgaris*) 2.5%	26.1	69.6
T3	Needlewood (*Schiima wallichii*) 2.5%	19.7	77.1
T4	Commercial neem-based formula (Azadirachtin 1500ppm)	13.21	84.7
T5	*Trichoderma viride* 6.5%	20.7	75.6
T6	ICAR-TV7	13.7	84.1
T7	*Pseudomonas fluorescens* 0.5%	37.4	56.1
T8	Copper oxychloride 50% WP	33.4	60.8
T9	Copper hydroxide 75% WP	67.1	21.2
T10	Bordeaux Mixture	84.7	0.55
T11	Sulphur 80% WP	14.1	83.5
T12	Control	86.1	0.00
	CD (0.05%)	2.38	-

Effect of different botanicals on the yield and disease incidence of large cardamom (Table 7.2.5.4)**:** 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 in case of *Pseudomonas fluorescens* with 8 flowers/plants followed by *Trichoderma viride* with 7 flowers/plants. Similarly in case of total number of tillers, mature tillers these were also found in *Trichoderma viride and Pseudomonas fluorescens* with total numbers of tillers 21 and 18 and 20 and 16 respectively. Likewise the immature tillers were found to be more in case of Garlic with 8 immature followed by *Pseudomonas fluorescens*. The fresh weight of the tillers were more in *Trichoderma viride* followed by (Artemisia vulgaris) 2.5% and Garlic (Allium sativum) 2.5% and the dry weight was more in Trichoderma viride and Garlic (Allium sativum) 2.5% . The recovery (%) were

Table 7.2.5.4: Effect of treatments on the yield parameters and disease incidence of large cardamom under field conditions

Treatment	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 % fruit	No. of seeds/ tillers	Disease free infected	Disease tillers	Disease incidence %
T 1	Garlic (*Allium sativum*) 2.5%	5	21	14	8	300	54	82.3	18.7	16	7	31
T 2	Common Mug wort (*Artemisia vulgaris*) 2.5%	6	13	11	2	301	47	84.2	13.4	9	6	39
T 3	Needle wood (*Schima wallichii*) 2.5%	5	17	13	3	260	47	81.7	13.0	11	6	35
T 4	Commercial neem-based formula (Azadirachtin 1500 ppm)	6	15	13	2	244	47	80.8	22.5	11	4	27
T 5	*Trichoderma viride* 6.5%	7	21	18	3	312	54	82.9	20.5	14	7	34
T 6	*Pseudomonas fluorescens* 0.50%	8	20	16	4	200	26	87.0	10.2	11	9	44
T 7	Copper oxychloride 50% WP 0.25%	4	17	14	3	233	27	88.4	16.1	10	7	40
T 8	Copper hydroxide 75% WP 0.25%	4	17	14	3	150	23	84.3	14.2	9	8	43
T 9	Bordeaux mixture 0.25%	4	15	12	3	136	37	72.5	12.3	7	8	53
T10	Sulphur 80% WP 0.10%	7	15	13	2	213	43	79.6	20.5	11	4	27
T11	Control	4	20	16	4	133	23	82.6	11.0	7	13	65
	CD (0.05%)	2.33	NS	NS	2.77	111	18.81	-	4.90	4.82	3.54	12.7

also recorded which was found to be maximum in case of copper oxychloride with 88.4% followed by *Pseudomonas fluorescens* with 87%.the number of seeds/fruit were maximum in Commercial neem based formula (Azadirachtin 1500 ppm)(22.5), followed by *Trichoderma viride* (20.4). It was recorded that the minimum disease incidence was recorded in Commercial neem based formula (*Azadirachtin* 1500 ppm) with 27% followed by Garlic (*Allium sativum*) with 31% disease incidence.

Spraying of botanicals, bio control agents and organically permitted fungicides

Leaf blight damage

Foorkey Infection

Chirkey infection

Large cardamom field under spray and incidence of major diseases in field

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 present study was conducted to study the effect of bio-pesticides and organically permitted chemicals on insect pest management in organic large cardamom. All the bio-pesticide treatments showed very effective results for control of insect pests over control treatment. Application of Spinosad 45 SC @ 0.3 ml/l reduced the infestation of insect pests in crop which ranged from 69.24 to 77.72 % over control followed by neem oil (1500 ppm) @ 4 ml/l (58.88 to 72.32 % reduction of infestation over control) and petroleum agro-spray @ 2ml/lit (42.88 to 68.34 % 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	72.32	66.74	58.88	*	61.64
Beauveria bassiana	7 g/l	40.62	9.94	51.08	*	51.14
Metarhizium anisopliae	5 ml/l	43.42	7.29	40.88	*	40.34
Petroleum oil based agro-spray	2ml/lit	58.12	68.34	42.88	*	43.14
Petroleum oil based horticultural spray	10 ml/l	50.82	62.14	50.68	*	52.44
Bacillus thuringiensis	2 g/l	46.32	10.04	55.28	*	57.14
Spinosad 45 SC	0.3 ml/l	77.72	74.24	70.58	*	69.24
CD (P=0.05)		4.55	4.41	5.72	*	9.28

* Treatment no considered for root mealy bug incidence

7.2.6: Evaluation of weed management practices under organic production system

Objectives

- To evaluate the cultural and mechanical weed management practices under organic production system.
- To study the efficacy of non-conventional approaches of weed management using oilcakes under organic production system.
- To find out the economically viable and practically applicable alternative to hand weeding for organic weed management in different cropping systems

Year of start: The experiment was planned and finalized in Annual Group Meeting held during 2016-17 and start from 2017-18.

Locations: Bajaura, Calicut and Coimbatore reported the results whereas remaining centres concluding the experiments

Treatments: The treatments may be differed from centre to centre as per their respective cropping systems based on the overall treatment structure given below

Treatments symbol	Treatment details/Management Practice (To be imposed in all crops in the cropping system)
T_1	Hand weeding (Two)
T_2	One mechanical weeding + one hand weeding
T_3	Intercropping with pulses/green manure (location and crop specific intercropping)
T_4	Stale seed bed + reduced spacing (up to 22-25%) + mulching with previous crop residues + one HW
T_5	Locally available weed mulch (water hyacinth/lantana etc) + one hand pulling
T_6	Incorporation of any one of castor / mahua / mustard seed meal / neem cake/ karanj/ tumbha cake/sal de-oiled cake 15 days before planting/sowing @ 5 t/ha + one hand weeding
T_7	Soil solarization with 8-25 microns polythene mulch during summer + one HW
T_8 (optional)	ITK treatment on weed control practiced by farmers (like mulching with leaf of mango/ jackfruit etc.)

Results

The results for each center are presented and discussed.

Bajaura

Evaluation of weed management practices under organic vegetable based production systems

Weed management practices in black gram (Table 7.2.6.1): seven treatments of weed management practice were evaluated in black gram crop under organic conditions. Among the seven weed management practices, significantly lower fresh weed weight (39.5 g/m^2), weed density (21.3 number/ m^2) and weed index (-23.1%) of black gram was observed with T_4 (Stale seed bed technique + reduced spacing up to 25% +mulching with wheat straw + one hand pulling at 20DAS) at 40 days after sowing resulted in maximum yield (760 kg/ha), net returns (1,25,190 Rs/ha) and B:C (1.74). T3 Inter cropping with Sunhemp fb mulching + one hand pulling at 40DAS been the next performing treatment in term of yield, net return and B:C ratio of 680 kg/ha, Rs1,06,945/ha and 1.58 respectively. The weed index (17.7%) was found maximum with treatment Hand weeding (Two) at 20 and 40 DAS while minimum (-23.1%) being T4 (stale seed bed technique + reduced spacing up to 25% +mulching with wheat straw + one hand pulling at 20DAS). The dry weed weight at 40 DAS was not significantly influenced due to any treatment

Table 7.2.6.1: Effect of various weed management practices in black gram under organic condition at Bajaura

Weed management practices	Fresh weed weight at 40 DAS (g/m^2)	Dry weed Weight at 40 DAS (g/m^2)	Weed density (number/ m^2)	Weed index (%)	Yield (kg/ha)	Net returns (Rs/ha)	B: Cratio
T_1: Hand weeding (Two) at 20 and 40 DAS	43.8	4.3	26.7	17.7	510	60455	0.85
T_2: One Mechanical weeding at 20 DAS+ one Hand weeding at 40 DAS	41.4	4.2	25.3	3.8	600	88790	1.36
T_3: Inter cropping in blackgram with Sunhemp (1:1 row of blackgram and sunhemp at 20cm row spacing) fb mulching with sunhemp biomass to be harvested at knee height stage. + one hand pulling at 40DAS	52.4	4.9	32.0	-9.1	680	106945	1.58
T_4: Stale seed bed technique (standing water for 3-4weeks) + reduced spacing up to 25% i.e., 22.5 cm in black gram as against 30cm recommended row spacing+ mulching with wheat straw + one hand pulling at 20DAS	39.5	4.3	21.3	-23.1	760	125190	1.74
T_5: Mulching with local weed i.e., cannabis and congress grass + hand pulling at 40DAS	44.6	4.3	26.7	-2.2	630	99240	1.55
T6: Soil solarisation for 3weeks with 8-25micron transparent poythene sheet + hand weeding at 20DAS	43.2	4.4	28.0	3.2	600	84375	1.20
T_7: ITK-Hand weeding at 20 DAS *fb* mulching with all weed incorporation obtained from hand weeding	41.1	4.3	30.7	10.7	550	74294	1.08
CD at 5%	5.09	NS	5.41	13.4	84	21479	0.31

Weed management practices in cauliflower (Table 7.2.6.2)**:** Similar seven weed management practices were also evaluated in cauliflower crop during *rabi*. Significantly lower fresh and dry weight of weed (13.7 and 1.7 g/m^2) was recorded with T3 i.e. inter rows polyethylene mulching with mulch sheet at 40 days after sowing whereas weed density (11.0 number/ m^2) was observed with T5-mulching with local weed *gechinocloa* and *galinscoga* + hand pulling at 20 DAT. Significantly lowest weed index (0.9%) in cauliflower was observed with T7-ITK-Hand weeding at 20 DAS fb mulching with all weed incorporation obtained from hand weeding resulted in maximum yield of cauliflower curd (11890 kg/ha), net returns (2,23,983 Rs/ha) and B:C ratio (3.05) followed by T4-stale seed bed technique + reduced spacing up to 25% + mulching with blackgram crop residues + one hand weed pulling at 20DAT of 9090kg/ha of yield, Rs.149133/ha net return and 1.91 of BC ratio. The different weed management practices show non-significant effect on weed density and weed index. Maximum weed density (21%) recorded under T_1 Hand weeding (Two) at 20 and 40 DAT while weed index was under T_3 Inter rows polyethylene mulching with mulch sheet

Table 7.2.6.2: Effect of various weed management practices in cauliflower under organic condition at Bajaura

Weed management practices	Fresh weed weight at 40 DAS (g/m^2)	Dry weed Weight at 40 DAS (g/m^2)	Weed density (number/ m^2)	Weed index (%)	Yield (kg/ha)	Net returns (Rs/ha)	B: Cratio
T_1 Hand weeding (Two) at 20 and 40 DAT	23.2	2.2	21.7	39.6	7250	93917	1.08
T_2 One Mechanical weeding at 20 DAT+ one Hand weeding at 40 DAT	18.8	2.0	19.0	38.4	7400	100667	1.19
T_3 Inter rows polyethylene mulching with mulch sheet	13.7	1.7	15.0	54.1	5510	47083	0.52
T_4 Stale seed bed technique + reduced spacing up to 25% + mulching with blackgram crop residues + one hand weed pulling at 20DAT	24.5	2.2	18.7	24.2	9090	149133	1.91
T_5 Mulching with local weed *gechinocloa* and *galinscoga* + hand pulling at 20DAT	16.2	1.8	11.0	28.4	8590	141400	1.93
T_6 Soil solarization + hand weeding at 20 DAT	17.1	1.9	16.3	35.5	7740	98833	1.04
T_7 ITK- FYM Mulching at 10 DAT	25.8	3.0	17.7	0.9	11890	223983	3.05
CD at 5%	2.94	0.44	2.69	1.88	225	5625.5	0.07

Weed management practices for summer squash (Table 7.11.1.3)**:** Significantly lower fresh weed weight (19.6 g/m^2), dry weed weight (2.1 g/m^2) was recorded under T6-soil solarisation + hand weeding at 20DAT in summer squash. Weed density as influenced by different weed management practices found to be non-significant but recorded lowest (20%) with T2: One Mechanical weeding at 20 DAT+ one Hand weeding at 40 DAT. Significantly lowest weed index (19.6%) in summer squash crop was observed with T7- ITK- FYM Mulching at 10 DAT at 40 days after sowing of crop resulted in significantly higher yield (15010 kg/ha), net returns (91,746 Rs/ha) and B:C (1.45) of summer squash with T7 (ITK- FYM Mulching at 10 DAT), followed by T4 (stale seed bed technique + reduced spacing up to 25% + mulching with blackgram crop residues + one hand weed pulling at 20DAT) in term of yield, net return and B:C ratio 9880 kg/ha, 31,561 Rs/ha and 0.47 respectively. The weed index (62.4%) was found maximum with treatment T3 (Inter-cropping in squash with cow pea 1:1 fb mulching with cowpea biomass after 20DOS of cowpea)

Best weed management techniques under organic practice at Bajaura

Table 7.2.6.3: Effect of various weed management practices in summer squash under organic condition

Weed management practices	Fresh weed weight at 40 DAS (g/m^2)	Dry weed Weight at 40 DAS (g/m^2)	Weed density (number/ m^2)	Weed index (%)	Yield (kg/ha)	Net returns (Rs/ha)	B: Cratio
T_1: Hand weeding (Two) at 20 and 40 DAS	22.6	2.5	21.3	55.9	8520	14923	0.21
T_2: One Mechanical weeding at 20 DAT+ one Hand weeding at 40 DAT	20.6	2.3	20.0	54.5	8790	13639	0.18
T_3: Inter-cropping in squash with cow pea 1:1 fb mulching with cowpea biomass after 20 DOS of cowpea	25.1	2.4	22.7	62.4	7250	10224	0.16
T_4: Stale seed bed technique+ reduced spacing + mulching + one hand weed pulling 20DAT	22.4	2.5	21.3	48.8	9880	31561	0.47
T_5: Mulching with local weed *cannabis* and *congress grass* + hand pulling at 40 DAT	26.3	2.6	25.3	52.2	9230	28942	0.46
T_6: Soil solarization + hand weeding at 20DAT	19.6	2.1	24.0	51.6	9330	8590	0.10
T_7: ITK- FYM Mulching at 10 DAT	28.4	2.8	25.3	19.6	15510	91746	1.45
CD at 5%	2.09	0.26	NS	3.26	625	6280.5	0.09

Calicut

Evaluation of weed management practices under organic production system for Turmeric: Experiment with following six treatments and turmeric was evaluated. Maximum yield and net return per ha was recorded by application of dried coconut leaf application at the time of planting, Hand weeding at 45&90 DAP (T6). Followed by the treatment green leaves mulch at the time of planting,45&90 DAP + Hand weeding at 45&90 DAP(T1Control).

Table 7.2.6.4: Effect of weed management practices under organic production system Kharif Turmeric at Calicut

Treatment	Yield (dry kg/ha)	Cost of cultivation (Rs./ha)	Net returns (Rs./ha)
T1-Green leaves mulch at the time of planting, 45&90 DAP + Hand weeding at 45&90 DAP(Control)	4830	263996	122404
T2-Intercropping cow pea + Incorporation of cow pea at 45 DAP, Green leaf mulching 90 DAP, + Hand weeding 45&90 DAP	4130	263996	66404
T3-Intercropping cowpea +Incorporation of cow pea at 45 DAP, Green leaf mulching 90 DAP, Hand weeding at 90 DAP	3520	237196	44404
T4- Soil solarisation + Green leaves application 45& 90 DAP, Hand weeding at 45&90 DAP	3702	263996	32164
T5-Soil solarisation + Green leaves application 45&90 DAP, Hand weeding at 90 DAP	4620	237196	132404
T6-Dried coconut leaf application at the time of planting, Hand weeding at 45&90 DAP	5300	223996	200004

Coimbatore

Nine weed management practices with weed free and un-weeded check were evaluated. Among the different weed management practices in tomato, mulching with dried mango leaves @ 5 t ha^{-1} followed by one hand weeding on 45 DAT recorded the highest fruit yield (35388 kg ha^{-1}) of tomato. Highest net returns per hectare of Rs. 4,20,713 ha^{-1} was also fetched in plots maintained under mulching with dried mango leaves @ 5 t ha^{-1} followed by one hand weeding on 45 DAT. Cost of cultivation per hectare (Rs. 110535) was lower in foliar spraying of cow urine @ 10% at 4-5 leaf stage of weed practices adopted plots (Table 7..2.6.5).

Table 7.2.6.5: Effect of weed management practices in tomato under organic production system

Treatments	Tomato		
	Yield (kg/ha)	Cost of cultivation (Rs/ha)	Net returns (Rs/ha)
SSB technique + One HW on 45 DAT	24435	116565	257090
Inter cropping with vegetable cowpea	18913	120635	175673
Inter cropping with vegetable marigold	17952	118765	162147
Mulching with dried mango leaves @ 5 t ha^{-1} + one HW on 45 DAT	35388	118845	420713
Foliar spraying of lemongrass leaf extract @ 10% at 4-5 leaf stage of weed + One HW on 45 DAT	14575	116185	111112
Post emergence application of vinegar @ 10% + One HW on 45 DAT	28117	120485	309378
Multi-varietal seed technique and in situ incorporation on 45 DAT	20904	116645	210122
Application of weed compost @ 5 t/ha during last ploughing + One HW on 30 DAT	12845	117325	85460
Foliar spraying of cow urine @ 10% at 4-5 leaf stage of weed	16951	110535	152436
Foliar spraying of non-edible oilcake extract @ 10% at 4-5 x HW on 30 DAT	10783	112985	59384
Weed free check	38783	142885	446171
Un weeded check	7863	110485	10316

Udaipur

Evaluation of weed management practices under organic production system for soybean-cauliflower system

Treatment details

T1 :	Hand weeding at 20 and 40 DAS
T2 :	One mechanical weeding at 20 DAS +one hand weeding at 40 DAS
T3 :	Intercropping with horsegram
T4 :	Stale seed bed +reduced spacing (upto 25%) +mulching with previous crop residues + one hand weeding at 20 DAS
T5 :	Locally available weed mulch (lantana) + one hand pulling at 20 DAS
T6 :	Incorporation of any one of castor / neem de-oiled cake 15 days before planting/sowing @ 2 t/ha + one hand weeding at 20 DAS
T7 :	Soil solarisation with polythene mulch during summer + one HW at 20DAS
T8 :	ITK on weed control (like mulching with weed biomass/farm waste etc.)

Weed density, dry matter, yield attributing characters and yield of soybean as influenced by different weed management practices (Table 7.2.6.6 & 7)**:** Weed density, dry matter, and yield of soybean was significantly influenced by weed management practices**.** Significantly lower weed density (9.28 no./m^2 and 12.07 no./m^2) and total weed dry matter (1.24 no./m^2 and 2.24 no./m^2) in soybean crop at 30 & 60 DAS respectively recorded with stale seed bed + reduced spacing (up to 25%) + mulching with previous crop residues + one hand weeding at 20 DAS followed by soil solarization with polythene mulch during summer + one HW at 20DAS. Growth and yield attributes of soybean was significantly affected by organic weed management practices. Among organic weed management practices, plant height at harvest (60 cm), number of pods per plant (55), number of branches per plant (6.50) and test weight (96 g) of soybean was recorded with soil solarization with polythene mulch during summer + one HW at 20 DAS followed by Stale seed bed +reduced spacing (up to 25%) + mulching with previous crop residues + one hand weeding at 20 DAS (57 cm, 52, 6.3 and 95.5 g, respectively). Likewise, maximum yield (1050 kg/ha), net return (Rs. 34,040/ha) and net return per rupee invested (2.67) of soybean crop were recorded with Stale seed bed +reduced spacing (up to 25%) +mulching with previous crop residues + one hand weeding at 20 DAS followed by soil solarization with polythene mulch during summer + one HW at 20DAS which recorded yield (1000 kg/ha) but net return of Rs. 27,881/ha) and net return per rupee invested (2.37) recorded higher in One mechanical weeding at 20 DAS +one hand weeding at 40 DAS.

Table 7.2.6.6: Effect of organic weed management practices on weed density and weed dry matter in soybean at Udaipur

Weed management practices	Total weed density (No./m^2)		Weed dry matter (g/m^2)	
	30 DAS	60 DAS	30 DAS	60 DAS
Hand weeding at 20 and 40 DAS	30.79	33.14	21.92	25.02
One mechanical weeding at 20 DAS +one hand weeding at 40 DAS	20.42	23.21	11.88	14.08
Intercropping with horse gram	51.55	53.69	41.92	46.59
Stale seed bed +reduced spacing (up to 25%) +mulching with previous crop residues + one hand weeding at 20 DAS	9.28	12.07	1.24	2.24
Locally available weed mulch (lantana) + one hand pulling at 20 DAS	23.55	26.19	14.60	16.74
Incorporation of any one of castor / neem de-oiled cake 15 days before planting/sowing @ 2 q/ha + one hand weeding at 20 DAS	38.32	41.11	29.61	32.61
Soil solarization with polythene mulch during summer + one HW at 20DAS	14.73	17.52	6.02	8.72
ITK on weed control (like mulching with weed biomass/farm waste etc)	47.52	49.87	37.72	41.72
CD (P=0.05)	1.182	1.113	1.099	1.099

Table 7.2.6.7: Yield and yield attributing characters of soybean as influenced by different weed management practices at Udaipur

Treatments	Plant height at harvest (cm)	No. of branches/ plant	No. of pods/ plant	Test weight (g)	Soybean yield (kg/ha)	Cost of cultivation (Rs/ha)	Net return (Rs/ha)	Net return per rupee invested
Hand weeding at 20 and 40 DAS	56.0	6.10	50.0	95.0	880	20740	26259	2.27
One mechanical weeding at 20 DAS +one hand weeding at 40 DAS	52.0	5.80	45.0	94.0	930	19940	27881	2.40
Intercropping with horse gram	44.0	4.60	38.0	92.0	810	18040	24550	2.36
Stale seed bed +reduced spacing (up to 25%) +mulching	57.0	6.30	52.0	95.5	1050	20440	34040	2.67

Treatments	Plant height at harvest (cm)	No. of branches/ plant	No. of pods/ plant	Test weight (g)	Soybean yield (kg/ha)	Cost of cultivation (Rs/ha)	Net return (Rs/ha)	Net return per rupee invested
with previous crop residues + one hand weeding at 20 DAS								
Locally available weed mulch (lantana) + one hand pulling at 20 DAS	54.0	5.90	48.0	95.0	900	19940	27382	2.37
Incorporation of any one of castor / neem de-oiled cake 15 days before planting/ sowing @ 2 q/ha + one hand weeding at 20 DAS	50.0	5.40	42.0	93.6	865	22740	22742	2.00
Soil solarization with polythene mulch during summer + one HW at 20DAS	60.0	6.50	55.0	96.0	1000	41540	11430	1.28
ITK on weed control (like mulching with weed biomass/farm waste etc)	47.0	5.10	40.0	93.0	835	18340	25564	2.39
CD (P=0.05)	2.26	0.247	2.0	4.01	39.33		2095.81	0.09

Weed density, dry matter, yield attributing characters and yield of cauliflower as influenced by different weed management practices (Table 7.2.6.8 & 9)**:** Weed density and dry matter in cauliflower crop was significantly influenced by weed management practices**.** Significantly lower weed density at 30 & 60 DAS (13.07 no./m^2 and 15.85 no./m^2 respectively) and total weed dry matter (3.30 and 4.75 no./m^2 respectively) in soybean crop recorded with stale seed bed + reduced spacing (up to 25%) + mulching with previous crop residues + one hand weeding at 20 DAS followed by soil solarization with polythene mulch during summer + one HW at 20DAS which recorded weed density (18.30 and 21.59 nos./m^2) and weed dry matter (7.88 and 11.10 g/m^2) at 30 and 60 DAS respectively. Growth and curd yield attributes of cauliflower was significantly affected

Table 7.2.6.8: Effect of organic weed management practices on weed density and weed dry matter in cauliflower at Udaipur

Treatments	Total weed density (No./m^2)		Weed dry matter (g/m^2)	
	30 DAS	60 DAS	30 DAS	60 DAS
Hand weeding at 20 and 40 DAS	34.58	37.07	23.81	27.45
One mechanical weeding at 20 DAS +one hand weeding at 40 DAS	24.20	26.98	13.93	16.59
Intercropping with horse gram	54.59	57.76	43.79	49.05
Stale seed bed +reduced spacing (up to 25%) +mulching with previous crop residues + one hand weeding at 20 DAS	13.07	15.85	3.30	4.75
Locally available weed mulch (lantana) + one hand pulling at 20 DAS	27.27	30.03	16.35	19.08
Incorporation of any one of castor / neem de-oiled cake 15 days before planting/sowing @ 2 q/ha + one hand weeding at 20 DAS	41.90	44.61	31.33	34.90
Soil solarization with polythene mulch during summer + one HW at 20DAS	18.30	21.59	7.88	11.10
ITK on weed control (like mulching with weed biomass/farm waste etc)	51.31	53.30	39.46	44.04
CD (P=0.05)	1.019	1.154	1.023	1.041

by organic weed management practices. Among organic weed management practices, plant height at harvest (57 cm), and dia meter of curd (15.5 cm) was recorded with soil solarization with polythene mulch during summer + one HW at 20 DAS followed by stale seed bed +reduced spacing (up to 25%) + mulching with previous crop residues + one hand weeding at 20 DAS (55 cm, and 15.0 cm, respectively). Likewise, maximum curd yield of cauliflower (19500kg/ha), net return (Rs. 2,56,600/ ha) and net return per rupee invested (7.15) were also recorded with stale seed bed +reduced spacing (up to 25%) +mulching with previous crop residues + one hand weeding at 20 DAS followed by soil solarization with polythene mulch during summer + one HW at 20DAS in term of yield which recorded of 19000 kg/ha.

Table 7.2.6.9: Yield and yield attributing characters of soybean as influenced by different weed management practices at Udaipur

Treatments	Plant height at harvest (cm)	Diameter of curd (cm)	Curd yield (kg/ha)	Cost of cultivation (Rs/ha)	Net return (Rs/ha)	Net return per rupee invested
Hand weeding at 20 and 40 DAS	54.0	14.4	17750	36200	230050	6.35
One mechanical weeding at 20 DAS +one hand weeding at 40 DAS	50.0	14.0	18600	35400	243600	6.88
Intercropping with horse gram	41.0	12.5	16000	33500	206500	6.16
Stale seed bed +reduced spacing (up to 25%) +mulching with previous crop residues + one hand weeding at 20 DAS	56.0	15.0	19500	35900	256600	7.15
Locally available weed mulch (lantana) + one hand pulling at 20 DAS	52.0	14.2	18000	35400	234600	6.63
Incorporation of any one of castor / neem de-oiled cake 15 days before planting/sowing @ 2 q/ha + one hand weeding at 20 DAS	48.0	13.4	17100	38200	218300	5.71
Soil solarization with polythene mulch during summer + one HW at 20DAS	57.0	15.5	19000	57000	228000	4.00
ITK on weed control (like mulching with biomass/farm waste etc)	45.0	13.0	16400	33800	212200	6.28
CD (P=0.05)	2.17	0.60	765.5		11483.1	0.299

Soil solarization with polythene mulch during summer + one HW at 20DAS

Stale seed bed +reduced spacing (up to 25%) +mulching with previous crop residues + one hand weeding at 20 DAS

Intercropping with horse gram

Hand weeding at 20 and 40 DAS

One mechanical weeding at 20 DAS +one hand weeding at 40 DAS

ITK on weed control

Field view of weed management practices under organic production of soybean-cauliflower system

7.2.7: Evaluation and Validation of Natural Farming Practices in Different Agro-ecologies

Objectives

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

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

A total 95 natural farming farmers located in 77 blocks under 11 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 regions

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 7.2.7.1 & 7.2.7.5)

Ajmer

Cow pea + maize - coriander + fenugreek cropping system were evaluated. Complete natural farming recorded system equivalent yield of 1222 kg/ha which is 28.9 and 15.5% increase than organic and integrated crop management +chemical pesticides (ICMCP) respectively. Soil organic carbon in the soil complete natural farming recorded numerically higher (0.27%) compared to control (0.26%). Complete natural farming recorded net return of Rs. 2,32,473 with cost of cultivation of Rs. 25,640. Natural farming resulted in reduction in cost of cultivation by 60.7% and 50.5% over organic and integrated crop management respectively.

Cowpea +maize under Complete NF, AINP-OF package and Integrated Crop Management

Coriander +fenugreek under Complete NF, AINP-OF package and Integrated Crop Management (50% organic and 50% inorganic with need-based pesticides)

Udaipur

Cowpea + maize - fennel + cauliflower cropping system were evaluated. Under complete natural farming system equivalent yield recorded 18318 kg/ha which is 260 and 273% increased than organic and integrated crop management +chemical pesticides (ICMCP) respectively. Soil organic carbon (0.71%) was recorded with complete natural farming which slightly higher over control (0.70%) however it was 2.8% lower than organic. Complete natural farming recorded net return of Rs. 2,85,247/ha with cost of cultivation of 2,09,400/ha. Natural farming resulted in reduction in cost of cultivation by 2.7% organic package.

Cowpea+ maize under Complete NF, AI-NPOF package and Integrated Crop Management (50% organic and 50% inorganic with need-based pesticides)

Fennel+ cauliflower comparison among Complete NF, AI-NPOF package and Integrated Crop Management (50% organic and 50% inorganic with need-based pesticides)

Sardarkrushinagar

Cowpea +maize -fennel+ cauliflower cropping system were evaluated. Under complete natural farming, system equivalent yield of 2407 kg/ha was recorded which was 39.7 and 44.5% decreased than organic and integrated crop management respectively. Soil organic carbon was recorded with complete natural farming (0.13%) which was 18.2% higher over control

(0.11%). Complete natural farming recorded net return of Rs. 3517/ha with cost of cultivation of 41,623/ha which found to be a positive in term of return whereas rest of the practices recorded in negative in term of return.

Almora

Soybean + maize - vegetable pea + green coriander systems were evaluated. Complete natural farming recorded system equivalent yield of 9400 kg/ha which recorded only 40kg/ha higher than organic package while about 10% higher compared to Integrated crop management + chemical pesticides (ICMCP). Soil organic carbon recorded 0.83 under complete natural farming which is 2.5% higher over control but 17.85% was decreased over organic package. Complete natural farming practice recorded net return of Rs 2,87,100/ha with cost of cultivation of 87,400. Natural farming resulted in reduction in cost of cultivation by 21.8% and 7.02% over organic and integrated crop management respectively.

Bajaura

Complete natural farming recorded system equivalent yield of 6808 kg/ha which is 10.9 and 26.6% increase than organic and integrated crop management +chemical pesticides (ICMP) respectively. Soil organic carbon (0.87%) recorded under complete natural farming which is 26.1% higher over control. Complete natural farming practice recorded net return of Rs 2,78,1200/ ha with cost of cultivation of 84,000 in soybean+ maize - vegetable pea + green coriander systems. Natural farming resulted in reduction in cost of cultivation about 6.0% over organic.

Soybean+ maize system under NF & INM at Bajaura

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

Gangtok

Complete natural farming recorded system equivalent yield of 6253 kg/ha which is 44.6% higher compared to organic package Soil organic carbon (1.51%) recorded under complete natural farming which is numerically higher compared to control (1.50%). Complete natural farming practice recorded of Rs 2,64,989/ha with cost of cultivation of 1,18,600 in soybean+

maize - vegetable pea + green coriander systems. Natural farming resulted in reduction significantly in cost of cultivation by 32.0% and 7.02% over organic.

Bhopal

Soybean+ maize - wheat + mustard recorded system equivalent yield of 4478 kg/ha which is 88.4 and 73.8% higher compared to organic package and integrated crop management +chemical pesticides (ICMP) respectively. Soil organic carbon (0.68%) recorded higher by 6.25% under complete natural farming practice over control. Net return of Rs. 22,131/ha recorded in complete natural farming with cost of cultivation of Rs.51,788/ha. Complete natural farming practice resulted in reduction in cost of cultivation by 36.3 and 39.6% over organic and integrated crop management (ICMCP) practice respectively.

Raipur

Complete natural farming practice recorded system equivalent yield of 2199 kg/ha which was found to be 88.4 and 44.1% lower compared to organic package and integrated crop management +chemical pesticides (ICMP) respectively. Complete natural farming recorded soil organic carbon of 0.63% which is 14.6% higher over control. Net return of Rs. 59,252/ha recorded in complete natural farming with cost of cultivation of Rs.41,822/ha. Complete natural farming practice resulted in reduction in cost of cultivation by 40.9 and 33.4% over organic and integrated crop management (ICMCP) practice respectively.

Coimbatore

Cotton + green gram - sorghum + chickpea cropping system was evaluated. Complete natural farming practice recorded system equivalent yield of 2020 kg/ha which was 58.2 and 71.9% lower compared to organic package and integrated crop management +chemical pesticides (ICMP) respectively. Complete natural farming recorded soil organic carbon of 0.69% which was 11.3% higher over control. Net return of Rs. 1023/ha recorded in complete natural farming with cost of cultivation of Rs.49,830/ha. Complete natural farming practice resulted in reduction in cost of cultivation by 31.1 and 32.0% over organic and integrated crop management (ICMCP) practice respectively.

Dharwad

Complete natural farming practice recorded system equivalent yield of 1468 kg/ha which was 6.1 and 12.5% lower compared

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

to organic package and integrated crop management +chemical pesticides (ICMP) respectively. Net return of Rs. 29,516/ha recorded under complete natural farming with cost of cultivation of Rs.41,981/ha in cotton + green gram - sorghum + chickpea cropping system. Complete natural farming practice resulted in reduction in cost of cultivation by 25.6 and 19.2% 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 11448 kg/ha which is 91.8 and 75.7% lower than organic package and integrated crop management +chemical pesticides (ICMCP) respectively. Complete natural farming recorded net return of Rs. 85,765/ha with cost of cultivation of 59,675/ha. Natural farming resulted in reduction in cost of cultivation by 27.0 and 33.9% over organic practice and integrated crop management (ICMCP) respectively.

Karjat

Rice-cowpea cropping system was evaluated. Complete natural farming practice recorded system equivalent yield of 8378 kg/ha which was 49.1 and 33.8% lower compared to organic package and integrated crop management +chemical pesticides (ICMP) respectively. Complete natural farming recorded soil organic carbon of 1.01% which was at par with control but about 3% lower than organic package. Net return of Rs. -2974/ha in minus recorded in complete natural farming with cost of cultivation of Rs.1,46,764/ha.

Ranchi

Rice-sweet corn cropping system was evaluated. Complete natural farming practice recorded system equivalent yield of 4451 kg/ha which was 44.7 and 108.6% lower compared to organic package and integrated crop management +chemical pesticides (ICMP) respectively. Complete natural farming recorded soil organic carbon of 0.51% which was significantly higher by 82.1% over control. Net return of Rs. 52,775/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 25.1% 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 5014 kg/ha which was 40.3 and 99.0% lower compared to organic package and integrated crop management +chemical pesticides (ICMP) respectively. Complete natural farming recorded soil organic carbon of 0.42% which was about 2.44% higher over control. Net return of Rs. 46,565/ha with cost of cultivation of Rs.51,340/ha recorded in complete natural farming. Complete natural farming practice resulted in reduction in cost of cultivation by 80.4 and 15.7% over organic and integrated crop management (ICMCP) practice respectively.

Performance of maize crop under complete natural farming, AINP-OF and ICM at Ludhiana

Modipuram

Complete natural farming practice recorded system equivalent yield of 4748 kg/ha which was 73.2 and 83.7% lower compared to organic package and integrated crop management +chemical pesticides (ICMP) respectively. Complete natural farming recorded soil organic carbon of 0.21% which was 61.9% lower over control (0.41%). Net return of Rs. 8721/ha with cost of cultivation of Rs.79,980/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 19.4 and 9.2% 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 45051 kg/ha which was about 3.1 lower compared to organic package but at par to integrated crop management +chemical pesticides (ICMP) of 45491 kg/ha. Complete natural farming recorded soil organic carbon of 0.77% which was 11.7% lower over control (0.86%). Net return of Rs. 7,21,922/ha with cost of cultivation of Rs.1,79,080/ha recorded in complete natural. Complete natural farming practice resulted in reduction in cost of cultivation by 26.6 and 23.3% over organic and integrated crop management (ICMCP) practice respectively.

Table7.2.7.1: 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 intercrop-ping)	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)	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	410	521	3470	540	3439	571	3481	500	590	3498	524	552	586	-	-
	Coriander + fenugreek	176	238	2010	181	1867	133	2162	110	410	1962	424	486	509		
Udaipur	Vegetable cowpea +maize	1350	1480	28472	1435	19702	1406	24213	1460	1463	21516	1700	1675	1650		
	Fennel + cauliflower	1332	1635	13500	1612	7800	1586	10300	1670	1690	11900	1851	1810	1780		
S K Nagar	Vegetable cowpea + maize	813	959	4067	777	1769	905	2910	1382	962	5473	1802	1799	1888		
	Fennel + cabbage	79	107	1075	60	562	101	728	142	109	1131	397	394	400		
Almora	Soybean + maize	1857	1509	3644	1485	3355	2154					2058	2033	2112		
	Garden pea + green coriander	13613	11710	240	12168	229	110421					13172	14354	13234		
Bajaura	Soybean+ maize	1290	1960	3150	1770	2540	1830	3050	1860	1840	2950	2510	2790	2830	138	196
	Green pea+ green coriander	6050	7500	1230	6640	840	7090	1040	7130	7130	1010	9340	10380	10410	573	109
Gangtok	Soybean + maize	1620	2141	3590	1860	3132	1920	3270	2040	1960	3320	2610			218	
	Vegetable pea + coriander	5620	6140	512	5860	410	5902	442	6004	5906	487	7000				
Bhopal	Soybean+ maize	213	373	1433	266	1222	272	1308	355	333	1338	397	438	457	80.0	
	Wheat + mustard	2097	3010	1577	2440	1337	2560	1368	2860	2717	1471	3890	4007	4163	316.0	
Raipur	Soybean + maize	1033	767	1388	607	1002	701	1171	1330	744	1373	1189	1358	1388		
	Wheat + mustard	1967	1231	398	1205	234	1157	245	2335	1253	347	3158	3496	3561		

Centres	Crops/treatments	Control	Complete NF		NF-1 (without -Beejamrit + Ghanjeevamrit + Jeevamrit)		NF-2 (without -crop residue mulching)		NF-3 (without intercrop-ping)	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)	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
Coimbatore	Cotton + green gram	596	785	368	505	246	545	232	1188	823	416	1854	1977	2026		
	Sorghum + chick pea	684	904	285	690	225	665	266	1792	984	330	2466	2518	2660		
Dharwad	Cotton + green gram	337	420	38.9	384	34.2	407	37.1	397			467	467	503	66.0	
	Rabi sorghum + chickpea	1483	1830		1623		1777		1757			2040	2080	2107	254.0	
Umiam	Turmeric + cowpea	9600	11400	117	12920	121	14750	119	18180	15570	117	21960	20810	20110		
	Green gram		-	-	-	-	-	-	-	-	-	-	-	-		
Karjat	Rice	2018	2590		2547		2586		2674	2561		4195	4004	3945	557.0	
	Groundnut	622	844		765		806		916	767		1174	1115	1012	166.0	
Ranchi	Rice	1980	2341		2253		2280		2370	2165		2749	2867	2767	274.0	
	Sweet corn	1960	2110		2053		1980		2060	2077		3827	6347	6517	538.6	
Ludhiana	Maize + cowpea	1880	1780	8950	1310	8050	1460	10050	1510	1730	12180	3150	4650	4550	320.0	
	Wheat + chickpea	1940	2020	40	1050	40	1280	50	1390	1880	70	3630	4980	4900	350.0	
Modipuram	Maize + fodder cowpea	3400	2354	1241	2433	1614	3017	1422	1907	2475	1530	6594	7869	7770	692.5	
	Wheat + chickpea	1591	1136	408	1098	424	739	375	1271	1098	383	2870	3965	4293	307.6	
Thiruvanthapuram	Cassava - cowpea	29563	32906	3036	34442	2275	34173	3019	37459	41405	2369	46455	43666	45491	10231	

Table7.2.7.2: System equivalent yield of various cropping systems as influenced by different natural farming practices at different locations

Centres	Cropping system	Control NF	Complete	NF-1 (without - Beejamrit + Ghanjeevamrit + Jeevamrit)	NF-2 (without- crop residue mulching)	NF-3 (without - intercropping)	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)	CD (P=0.05)
Ajmer	Cow pea + maize - Coriander + fenugreek	586	1222	1173	1179	610	1464	948	1038	1095	
Udaipur	Cowpea + maize - fennel + cauliflower	3792	18318	12940	15297	4522	16152	5094	4993	4913	
S K Nagar	Cowpea + maize - fennel + cabbage	1172	2407	1502	2026	1978	2664	3363	3339	3479	350
Almora	Soybean + maize - veg. pea + green coriander	8880	9400	9470		7840	8850	9360	8850	8550	NS
Bajaura	Soybean+ maize - veg. pea+ green coriander	3706	6808	5746	6290	4488	6564	6140	6681	5379	
Gangtok	Soybean + maize - veg. pea + green coriander	2996	6253	5507	5699	3510	5843	4324	-	-	
Bhopal	Soybean+ maize - Wheat + mustard	1280	4478	3693	3838	1811	4117	2377	2478	2576	
Raipur	Soybean + maize - Wheat + mustard	2017	2199	1739	1865	2498	2126	2768	3106	3169	167.2
Coimbatore	Cotton + green gram - sorghum + chickpea	968	2020	1409	1455	2163	2206	3195	3292	3473	
Dharwad	Cotton + greengram - rabi sorghum + chickpea	1159	1468	1302	1401	1344		1563	1565	1677	
Umiam	Turmeric + Cowpea - green gram	9600	11448	12970	14799	18180	15618	21960	20810	20110	
Karjat	Rice - cowpea	6355	8378	7874	8160	8890	7905	12489	11890	11209	
Ranchi	Rice - sweet corn	3940	4451	4242	4306	4306	4306	6576	9214	9284	243.17
Ludhiana	Maize + Cowpea - Wheat + chickpea	3956	5014	3406	4057	2998	5246	7035	9794	9980	
Modipuram	Maize + fodder cowpea - Wheat + chckpea	4388	4748	4902	4604	2965	4775	8225	8426	8721	
Thiruvanthapuram	Cassava - cowpea (TEY)	29563	45051	43544	46250	37459	50882	46455	43666	45491	

Table7.2.7.3: 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 - intercrop ping)	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)	CD (P=0.05)
Ajmer	Vegetable cowpea maize - fennel + cauliflower	0.26	0.27	0.26	0.28	0.26	0.28	0.29	0.28	0.29	
Udaipur	Vegetable cowpea+ maize - fennel + cauliflower	0.70	0.71	0.64	0.61	0.66	0.65	0.73	0.69	0.67	
S K Nagar	Vegetable cowpea + maize - fennel + cabbage	0.11	0.13	0.12	0.12	0.12	0.12	0.13	0.12	0.13	0.101
Almora	Soybean + maize - garden pea + green coriander	0.81	0.83	0.84		0.88		1.01	0.99	0.86	0.060
Bajaura	Soybean+ maize -veg. pea+ coriander	0.69	0.87	0.80	0.86	0.87	0.85	0.95	0.92	0.90	0.009
Gangtok	Soybean+ maize -veg. pea+ coriander	1.50	1.51	1.51	1.50	1.53	1.51	1.53			
Bhopal	Soybean+ maize - wheat + mustard	0.64	0.68	0.68	0.67	0.67	0.68	0.69	0.68	0.68	
Raipur	Wheat + mustard	0.55	0.63	0.51	0.56	0.56	0.53	0.58	0.57	0.54	0.03
Coimbatore	Sorghum + chick pea	0.62	0.69	0.65	0.67	0.70	0.71	0.74	0.68	0.68	
Dharwad	Not reported										
Umiam	Not reported										
Karjat	Rice - groundnut	1.00	1.01	1.03	1.04	1.01	1.04	1.04	1.05	1.07	
Ranchi	Rice + sweet corn	0.28	0.51	0.49	0.56	0.56	0.56	0.57	0.41	0.45	0.12
Ludhiana	Maize + cowpea- wheat + chickpea	0.41	0.42	0.40	0.43	0.41	0.42	0.42	0.43	0.42	
Modipuram	Maize + fodder cowpea- wheat + chickpea	0.34	0.21	0.29	0.40	0.32	0.40	0.38	0.41	0.34	
Thiruvanthapuram	Cassava - cowpea	0.86	0.77	0.75	0.76	0.75	0.82	0.71	0.74	0.80	NS

Table7.2.7.4: 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 - intercrop ping)	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	142000	209400	159400	169400	192000	179400	215200	186752	176752
S K Nagar	Cowpea + maize - fennel + cabbage	43,246	41,623	39,271	39,639	40,636	46,023	82,173	65,974	65,974
Almora	Soybean + maize - veg. pea + green coriander	60700	87400	80100	73300			111700	91600	94000
Bajaura	Soybean+ maize - veg. pea+ green coriander	75100	84000	81900	81500	82550	82550	89310	87030	84140
Gangtok	Soybean + maize - veg. pea + green coriander	73000	118600	105700	110400	83800	119500	80600		
Bhopal	Soybean+ maize - wheat + mustard	52863	51788	47836	50814	49305	50110	81260	83010	85687
Raipur	Soybean + maize - wheat + mustard	41310	41822	32952	37242	43930	41822	70825	62118	62828
Coimbatore	Cotton + green gram - sorghum + chickpea	50516	49830	44626	36426	49680	47078	72376	69420	73280
Dharwad	Cotton + green gram - rabi sorghum + chickpea	32980	41981	37345	41663	40720		56460	49099	51983
Umiam	Turmeric + cowpea - green gram	54786	59675	55875	52146	50987	55875	81768	92453	90330
Karjat	Rice - cowpea	148658	146764	146261	144601	148658	148658	148658	148658	816662
Ranchi	Rice - sweet corn	50500	58500	57210	55300	57400	59060	76500	80700	78100
Ludhiana	Maize + cowpea - wheat + chickpea	49010	51340	42250	48340	46390	51340	100080	53670	60940
Modipuram	Maize + fodder cowpea - Wheat + chickpea	50300	79980	64960	63980	75330	79980	99200	88101	88101
Thiruvanthapuram	Cassava - cowpea	157450	179080	148950	173380	169280	179080	244000	233498	233498

Table7.2.7.5: 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 - intercrop ping)	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	8401	232473	219678	240117	12200	245524	-4176	15892	19022
Udaipur	Cowpea + maize - fennel + cauliflower	128400	285247	249030	268406	143340	254762	152600	152702	147952
S K Nagar	Cowpea + maize - fennel + cabbage	-21277	3517	-11111	-1658	-3541	3935	-19110	-3302	-734
Almora	Soybean + maize - veg. pea + green coriander	288800	287100	296800	235900	-	-	237200	277500	255500
Bajaura	Soybean+ maize - veg. pea+ green coriander	197302	278200	241382	259426	261895	260647	367271	419594	422654
Gangtok	Soybean + maize - veg. pea + green coriander	157455	264989	240105	245243	175366	344345	229292	-	-
Bhopal	Soybean+ maize - wheat + mustard	-3203	22132	10688	10313	20941	16464	10972	13116	14270
Raipur	Soybean + maize - wheat + mustard	35299	59252	46960	49056	70843	55879	56498	56347	58062
Coimbatore	Cotton + green gram - sorghum + chickpea	-24502	1023	-4621	5876	12309	10557	12337	16743	17179
Dharwad	Cotton + green gram - rabi sorghum + chickpea	25021	29516	26234	26685	26572		21862	29345	32130
Umiam	Turmeric + cowpea - green gram	69231	85765	81823	79532	80564	76874	178610	145300	146760
Karjat	Rice - cowpea	499	-2974	1672	12143	3498	-105	68974	56355	24352
Ranchi	Rice - sweet corn	48000	52775	50440	51200	52350	46990	87900	149650	154000
Ludhiana	Maize + cowpea - wheat + chickpea	24085	46565	20335	25282	22826	45481	62336	130710	120010
Modipuram	Maize + fodder cowpea - Wheat + chickpea	31667	8721	26618	22034	-19551	9224	54445	69289	74816
Thiruvanthapuram	Cassava - cowpea	433803	721922	721916	751618	579900	838568	685109	631817	676332

7.2.8: Farmer participatory validation of Organic and Natural Farming practices in farmers' field under SCSP 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, out of which 4 centres i.e. Bajaura (HP), Coimbatore (TN), Udaipur (RJ) and Trivandrum (KL) reported the results whereas, Ranchi (JH), Umiam (ML), Gangtok (SK) not reported the result.

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 Jhiri, Hat and Bajaura villages located in Kullu, Sadar Mandi blocks in Kullu & Mandi district covering 5 farmers. Natural farming practices resulted in reduction in yield of tomato and cauliflower by 25.2 & 21.5% over organic (AINP-OF) and 38.4 and 32.9% over farmers practice respectively with cost of cultivation of Rs. 80000/ha. Cost of cultivation was reduced to the tune of 5.1 and 18.0% than AINP-OF and farmers practice respectively.

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

Treatments	*kharif* Tomato yield (kg/ha)	*Rabi* Cauliflower yield (kg/ha)	Cost of cultivation (Rs/ha)	Net return (Rs.)
Farmers package	14600	13572	97500	398083
AI-NPOF package	12040	11564	84300	329960
Natural Farming practice (Beejamrit, Ghanjeevamrit, Jeevamrit, Neemaster, Brhamaster and Dashparni ark)	9000	9111	80000	236665

Coimbatore:

Cotton – sorghum cropping system was undertaken Pudur colony, Ayyappa Reddy Pudur villages located in *Annur* block in Coimbatore district of Tamil Nadu. Total 8 farmers were covered. Natural farming practice recorded yield of cotton of 994 and 1250 kg/ha which was 46.4 and 19.1% lower than AINP-OF and farmers practice and likewise sorghum yield was also reduced by 19.7% while over farmers practice it was increase to the tune of 30.7%. Cost of cultivation recorded of Rs. 88, 895/ ha which resulted in reduction by 32.2 and 22.1% over AINP-OF and farmers practice respectively.

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

Treatments	*Kharif* Cotton yield (kg/ha)	*Rabi* Sorghum yield (kg/ha)	Cost of cultivation (Rs/ha)	Net return (Rs.)
Farmers package	1228	956	114460	32695
AI-NPOF package	1854	1950	135180	70883
Natural Farming practice (Beejamrit, Ghanjeevamrit, Jeevamrit, Neemaster, Brhamaster and Dashparni ark)	994	1250	88895	43888

Farmer 1: Kanagaraj | Farmer 2: Subramaniyan | Farmer 3: Ramasamy | Farmer 4: Moorthy

Farmer 5: Arumugam | Farmer 6: Ponnusamy | Farmer 7: Karuppusamy | Farmer 8: Kumarasamy

Farmer participatory validation of Natural Farming practices under SCSP at Coimbatore

Udaipur:

Maize-wheat cropping system was undertaken at 4 villages namely Birothi, Basiwada Judali, Rohimala located in Jhadole block in Udaipur district of Rajasthan. Total 5 farmers were covered. Natural farming practice recorded yield of maize and wheat (994 and 1250 kg/ha respectively) which was 26.7 and 30.8% higher than farmers practice whereas resulted in reduction in yield of maize and wheat recorded by 13.6 and 15% over AINP-OF package respectively. Cost of cultivation recorded of Rs. 62, 000/ha which resulted in reduction by 18.4% over AINP-OF but it was 19.3% higher over farmers practice.

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

Treatments	*kharif* Maize yield (kg/ha)	*Rabi* Wheat yield (kg/ha)	Cost of cultivation (Rs/ha)	Net return (Rs.)
Farmers package	1500	2600	52000	68310
AI-NPOF package	2200	4000	76000	104290
Natural Farming practice (Beejamrit, Ghanjeevamrit, Jeevamrit, Neemaster, Brhamaster and Dashparni ark)	1900	3400	62000	92220

Trivandrum:

Cassava + vegetable cowpea-green gram cropping system was undertaken covering10 farmers in Kariyil village located in block Kazhakkuttam inThiruvananthapuram district of Kerala. Cassava yield resulted in increased by 12.01% over farmers practice but recorded reduction by 11.4% over AINP-Of package. Cost of cultivation recorded of Rs. 1,34,575/ha under natural farming practice which resulted in reduction about 6% compared to farmers practice.

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

Treatments	*Kharif* Cassava yield (kg/ha)	*Rabi* Vegetable cowpea yield (kg/ha)	Cost of cultivation (Rs/ha)	Net return (Rs.)
Farmers package	25575		127325	384175
AI-NPOF package	32335		185275	461425
Natural Farming practice (Beejamrit, Ghanjeevamrit, Jeevamrit, Neemaster, Brhamaster and Dashparni ark)	28654	1865	134575	587705

Umiam

Programme 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), Umiam (Meghalaya) and Udaipur (Rajasthan). Centres Ludhiana (Punjab) and Pantnagar (Uttarakhand) did not report the results.

Year of start: 2013-14

Results:

Calicut and Thiruvananthapuram (Kerala)

Table 7.4.1: Area, yield and income from IOFS at Calicut

Enterprise	Crop/Livestock	Area(ha)	Area share (%)	Yield (Kg) /L/Nos	Unit Rate (Rs)	Income (Rs.)	Income share (%)
Cropping Systems	Coconut(55 Nos)	0.26		1210	42	50820	32.22
	Fodder(Co3,Co4)	0.06		12080	3.5	42280	
	Turmeric	0.04		1200	50	60000	
	Total	0.36	90			153100	
Livestock (2 Cows)	Milk			4430	60	26580	5.59
	Cow dung						
	Total	0.01	2.5			26580	
Horticulture	Banana	0.01		625	40	25000	36.85
	Tapioca	0.005		900	20	18000	
	Veg cow pea	0.0025		240	55	132000	
	Total	0.03	7.5			175000	
Grand Total						4,75,100	
Total Expenditure (Rs)						2,58,751	
Net Profit (Rs)						2,13,651	
Employment generation Man days/year						295	

Calicut

The plot with spices, fodder and vegetables combination was evaluated at Chelavoor farm under IOFS model. The crops turmeric, fodder grasses (CO-3, CO-4), tapioca, banana, cowpea, coconut, were planted and established. 2 cows and their calves were maintaining. Turmeric 1200 kg, banana 625 kg, tapioca 900 kg and vegetable cowpea 240 kg and coconut 1210 nos., were harvested. Fodder grass fed to the cows that are maintained at IISR farm. A profit of Rs 2.13 lakhs was received from one acre IOFS model. Employment generated Man days/year was 295 (Table 7.4.1).

Thiruvananthapuram

Net returns of Rs. 15,030 and cassava tuber equivalent yield of 20.2 tons could be obtained from a newly established IOFS model involving tuber crops from an area of 75 cents. The milk yield was low and stopped during few months as the cows were pregnant. Taking into account both the aspects (unproductive initial establishment phase of crops and low milk yield) the returns were low.

Table 7.4.2: Cost and income from the various components of IOFS

Farming System	Area (ha)	Details (Name or value as applicable)
Crops	0.14	Maize (68kg), Hybrid Napier grass (15 tonnes), pulses (green gram, black gram, soybean: total 22 kg), oilseeds (groundnut 24kg)
Horticulture	0.10	Cassava (87kg), taro (138kg), banana (346kg), elephant foot yam, pineapple, vegetables (amaranthus 290 kg), bhindi (130kg), cucumber (126 kg), cluster bean (32kg), cowpea (32kg), winged bean, agathi (180kg), moringa)
Dairy	0.01	4 indigenous cows & 1 calfMilk: 4328 litres Cow dung: 28 tonsCow urine: 14 litres
Fishery (to be established)	0.01	
Pest repellent plants	0.02	Lemon grass
Other components (to be established)	0.02	Vermi compost unit
Production from IOFS model Base crop: Cassava		20.2 tons on equivalent basis from 0.3 ha
Market input cost excluding labour (Rs)		90,000
Value of recycling excluding family labour (Rs)		NIL
Cost of labour (Rs)		2,99,000
Total Cost (Rs)		3,89,000
Net returns (Rs)		15,030
B:C ratio		1.04
Energy input (MJ)		30394
Energy output (MJ)		113128

Yield in IOFS model at Thiruvananthapuram

Coimbatore (Tamil Nadu)

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. Annual crops were raised on system based approach where two cropping systems viz., green manure (*Dhaincha*) - okra - maize and green manure (Dhaincha) - cotton - sorghum each with an allotted area of 0.35 ac. In every year the green manure crop was raised during summer and incorporated in-situ at 50% flowering. Before incorporation the biomass yield and nitrogen added by the crop to the soil was quantified. After decomposition of the green manure the crops like okra and cotton were raised during *Kharif*. The crops like maize and sorghum were raised during *Rabi* and part of the residues were used as dry fodder to the cattle, a part for production of compost and a part for mulching and in-situ incorporation in to the soil.

Components of IOFS model at Coimbatore

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

Bhendi variety hybrid CO (Bh) 4, maize variety hybrid CO 6, cotton variety Surabhi and sorghum variety CO 30 was grown in the system mode 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. Yield of Bhendi and cotton during *kharif* recorded 11470 and 1585 kg/ha respectively. During *rabi*, maize and sorghum recorded

Table 7.4.3: Component wise area, yield and income of IOFS model at Coimbatore

Components	Yield			Gross return (Rs.)	Cost of cultivation (Rs.)	Net return (Rs.)
	Crop 1	Crop 2	CEY			
Bhendi – maize - *dhaincha*	11470	4752	5028	39357	22,556	16801
Cotton - sorghum - *dhaincha*	1585	3246	2685	27210	18,839	8371
Fodder grass (CumbuNapier Hybrid CO (CN) 5), and legume fodder -*Desmanthus*	24.4 tonnes			25194		
Dairy	3379 litre @ Rs. 50/litre			1,68,950	72,088	96,862
Value of recycling from livestock module (dung, cow urine etc.)						6196
Crop residue composting	Value of compost produced under IOFS model					4383
Perennial border crops (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				2792	10962
Total nos. of man-days	623					
Economics				2,60,711	1,16,275	1,44,141

grain yield of 4752 and 3246 kg/ha respectively. System productivity in term of cotton equivalent was recorded higher with bhendi-maize-*dhaincha* of 5028 kg/ha as compared to cotton-sorghum-*dhaincha* cropping system which recorded CEY of 2685 kg/ha. Through crop component, an income of Rs.26,493 per annum was obtained. Two numbers of Jersey cross bred were maintained at IOFS model and produced 3379 litre of milk which gave of Rs. 1,68,950 as gross return. Fodder obtained from crop component (maize and cumbu Napier) is being fed to the animals. Annually 12.03 tonnes of cow dung and 9307 litres of cow urine were obtained from livestock which in turn they were applied to the crops to boost the yield. From this manure annually 79 kg of N, 33 kg of P_2O_5 and 107 kg of K_2O with the value of Rs.6196 was saved. Recycling of the on-farm resources such as crop residues and litters collected from the IOFS model were converted into compost with the value of Rs. 4383. Fodder grass cumbu napier CO (CN) 5 and desmanthus (*Deamanthus varigatus*) was raised in the IOFS model field harvested total 24.4 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 936 nuts per year was obtained with the average cost of Rs.9 per nut. The annual net income realized was Rs.10,692 with the cost of cultivation of Rs.2,792. From the IOFS model, gross income of Rs. 2,60,711 was obtained with total cost of the Rs. 1,16,275 per annum and the net return of Rs.1,44,141 was realized (Table 7.4.2).

Sardarkrushinagar (Gujarat)

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	0.10
Complimentary enterprises	Boundary plantations: Ardusa, lemon grass, napier grass Repellent plants: Lemongrass, Coriander, Marigold, Onion, Basil, Chrysanthemums, Citronella grass	

Table 7.4.4: Yield and economics of IOFS Model at Sardarkrushinagar (Gujarat)

Components		Yield (kg)	Straw yield (kg)	Total return (Rs.)	Cost of cultivation (Rs.)	Net return (Rs.)
	Groundnut	194	330	10380	7020	3360
	wheat	908	1260	20,680	10,941	9739
	green gram	96	150	7650	5269	2381
	Total			**38750**	**23,230**	**15,480**
	Fodder pearl millet	5600		22,400	5080	17320
	Fodder maize+ oat	5650		22,600	7116	15484
	Fodder pearl millet	2600		8240	6256	1984
	Total			**53,240**	**18,452**	**34,788**
Total crop component				**91950**	**41682**	**50,268**
Dairy			1,13,531	73,386	40,145	
Boundary Plantation				3380	260	3120
Total				**208861**	**115328**	**93533**
Net return per rupee invested				1.27		
System productivity (kg/Acre)				3.77		
System profitability (Rs./day)				146		

IOFS model is comprised of different components viz., crops (0.24 ha), green fodder crops (0.15 ha), dairy + vermicompost (0.01 ha) and boundary plantation. From one acre IOFS model, net profit of ¹ 50,268 was received by crop component from 0.24 ha area. A profit of Rs 40,145 was received from dairy. Ardusa, napier grass and lemon grass have been planted around the border & bunds and Rs.3120 was realized. Among the different enterprises, maximum gross and net return was recorded under crop component followed by dairy. The IOFS system has generated total gross return (Rs. 2,08,861/-) and net return (Rs. 93,533/-)._The highest contribution towards the total net return was contributed by crop component of the model followed by dairy and fishery component. Under the IOFS model, net return per rupee invested (1.27), system productivity (3.77kg/Acre) and system profitability (Rs 146./day) was achieved.

Udaipur (Rajasthan)

An integrated organic farming system model for 0.45 ha consisting of field crops in 0.25 ha (sweet corn + black gram during *kharif* and wheat during *rabi*), fodder crops in 0.05 ha. (fodder maize + cowpea during *kharif* and berseem in *rabi* and *sesbania* green manuring during *zaid*), vegetables in 0.10 ha (clusterbean in *kharif* and potato in *rabi*), fruit crop in 0.04 ha (guava) and compost unit in 0.01 ha were evaluated during 2020-21. The l maize equivalent yield of 6209 kg/ha and a net return of Rs. 76,528 /ha was obtained from the farming system model.

Table 7.4.5: Yield and economics of different components of organic farming system at Udaipur

Farming System components		Total 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 (390) + Black gram (80)	1021	12322	26130	13,808	1.12
Rabi	Wheat		1513	2320	12,000	47,800	35,800	2.98
2. Fodder								
Kharif	Fodder Maize+Cowpea	0.05	Fodder maize (1750) +Cowpea (250)	555	5,000	10,275	5,275	1.05
Rabi	Berseem		4000	1440	3,780	19,380	15,600	4.12
Zaid	*Sesbania*		Used as green manuring					
3. Vegetable								
Kharif	Clusterbean	0.10	Crop failed due to water logging					
Rabi	Potato		475	633	5,050	9,495	4,445	0.88
4. Fruits	Guava	0.04	90	240	2,000	3,600	1,600	0.80
	Total			**6209**	**40,152**	**1,16,680**	**76,528**	
5. Com-	NADEP compost	0.01	3500 kg					
post	Vermicompost		7500 kg					
unit	Compost		2000 kg					
	Vermiwash		180 lit					
	BD 500		1.4 kg					
	BD 501		1.1 kg					
	Earthworms		580 kg					

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 (a milch cow + calf), fodder crops, central farm pond, farmyard manure pits and vermicomposting unit. 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 fishpond 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. 56,835/- per year under the IOFS model. A total net return of Rs. 76,573/- per year was achieved under the IOFS model with an area of 0.43 ha which is about to Rs. 1,77,663/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 component of the model followed by dairy and fishery component. The fish production was 115 kg.

On farm nutrient recycling in IFOS could produce an amount of 64.9 kg N, 19.8 kg P2O5and 54.7 kg K2O. Hence, 98.03 % of the total N requirement, 83.89 % of the total P2O5 requirement and total of 99.45 % K2O requirement could be met within the model itself and only 1.97% of the total N requirement, 16.11% of the total P2O5 requirement and 0.55 % of K2O is required to be met from the external source to sustain the model.

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	5.60	26,235	50,123	-
Dairy (1 milch cow + 1 calf)	0.004	2.72	21,450	19,350	-
Fishery (Composite)	0.046	1.08	4,950	11,300	-
Nutrient cycling (Vermicompost/FYM/ etc.)	0.007	-	4,200	-4,200	-
Total	0.431	9.32	56,835	736,573	1,77,663
Net income/day	-	-	-	210	509

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

7.4: 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: 2021-22

Calicut

Name of the village	Chelannur
Name of block	Chelannur
Name of District	Kozhikode
Name of State	Kerala
Number of farmers identified	52
Name of group if formed	Parapara colony
Crops/Commodities covered	Turmeric
Brief progress of interventions and activities	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).

Coimbatore

Name of the village	Annikatti, Karakorai
Name of block	Kothagiri and Ooty
Name of District	The Nilgiris
Name of State	Tamil Nadu
Number of farmers identified	100
Name of group if formed	TNAU Organic Farmers Group
Crops/Commodities covered	Cabbage, Carrot, Beans, Tea and Coffee
Brief progress of interventions and activities	• Pilot survey was done to assess the need of the farmers • Indentified beneficiaries • Organized interactive meeting for the formation of Organic Clusters • Trainings and demonstrations were carried out on the production and value chain development on 07.12.20, 09.12.20, 08.01.21, 18.01.21, 05.02.21 and 15.07.21. • Online trainings on organic farming was given to the farmers of Organic Clusters under “Knowledge Sharing is Caring” programme on 23.05.2021, 24.05.202 and 14.07.21

Umiam

Name of the village	Mynsain
Name of block	Bhoirymbong
Name of District	Ri Bhoi District
Name of State	Meghalaya
Number of farmers identified	15
Name of group if formed	
Crops/Commodities covered	Maize, Rice, Cabbage, Brocolli, Cauliflower, Pea, Brinjal, Carrot, Ginger, Tumeric
Brief progress of interventions and activities	

PUBLICATIONS/HUMAN REOURCE DEVELOPMENT AND WORKSHOPS/MEETINGS

8

8.1 Publications

8.1.1 Research Papers

Bhopal

Aher, S.B., Lakaria, B.L., Swami, K., and A. B. Singh (2022). Concentration and Uptake of Micronutrients (Fe, Zn, Cu and Mn) in Soybean and Wheat under Organic, Biodynamic and Inorganic Nutrient Management in Semi-arid Tropical Conditions of Central India, *Communications is Soil Science and Plant Analysis,* DOI:10.1080/00103624.2022.2071434

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.

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.

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 Cd contaminated soils. *Environmental Monitoring and Assessment*, 193:186. https://doi.org/10.1007/s10661-021-08976-5.

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 systems under various nutrient management protocols. *Indian Journal of Agronomy,* 67 (2) ;102-108.

Coimbatore

Chinnaiah Senthilraja, Varagur Ganesan Malathi, Sevugapperumal Nakkeeran, Mariappan Suganthy, Uthandi Sivakumar and perumal Renukadevi (2020). Biological and Molecular Characterization of tomato spotted wilt virus (TSWV) infecting chrysanthemum in India, Canadian Journal of Plant Pathology, 43 (4): 641-650.

Jabalpur

Sahu, Rajendra Prasad, Sharma P.B. and Upadhyay V.B. 2020. Doubling the income of small and marginal farmers through integrated farming systems approach. In J. of Environment and Ecology (NAAS Score 4.18). Communicated & accepted.

Sahu, Rajendra Prasad, Sharma P.B. and Upadhyay V.B. 2020. Intensification and Diversification of Need Based Cropping Systems for Kymore Plateau and Satpura hills zone of Madhya Pradesh. In Int. J. of Agri. Sci. ISSN 0975-3710 and E-ISSN: 0975-9107 (NAAS Score 4.18). Communicated & accepted. Bioinfo Ref. No. : IJAS-170420-25282815

Ludhiana

Aulakh, C.S., Sidhu, A.S., Singh, S., Rani. N., Walia, S.S., and Salaria, A. 2020. Zero Budget Natural Farming: Research experiences and adoption in Punjab. *Indian J Agric Sci* (Accepted)

Nima, D., Aulakh, C.S., Sharma, S. and Kukal, S.S. 2020. Assessing soil quality under long-term organic vis-a-vis chemical farming after twelve year in north-western India. *J Plant Nutr* (Accepted)

Pantnagar

D.K. Singh, P.C. Pandey, Gangadhar Nanda and Shilpi Gupta (2018) Long-term effect of inorganic fertilizer and farmyard manure application on productivity, sustainability and profitability of rice-wheat system in Millisols. Archives of Agronomy and Soil Science. 65(2): 139-151. (DOI:1080/03650340.2018.1491032).

Debashis Dutta, D.K. Singh, N Subhash, N. Ravishankar, Vinod Kumar, A.L. Meena, R.P. Mishra, Sweta Singh, Vaibhav Kumar and A.S. Panwar 2018. Effect of long-term use of organic, inorganic and integrated management practices on carbon sequestration and soil carbon pool in different cropping systems in Tarai region of Kumayun hills. Indian Journal of Agricultural Sciences 88(4): 523-529.

Gangadhar Nanda, D.K.Singh, Subhash Chandra, P.C.Pandey, Shilpi Gupta and Yogesh Sharma. 2018. Growth, phenology and yield of Basmati rice as influenced by mode of production and Cropping Systems in Mollisols. International Journal of Current Microbiology and Applied Sciences. 7(9): 675-684.

Nitin Rawat, Mansi Sharma, D. C. Suyal, D.K. Singh, Divya Joshi, Pranjali Singh and Reeta Goyel (2019) Psyhcrotolerant Bio-inoculants and their Co-inoculation to imrove Cicer arietinum growth and soil nutrient status for sustainable mountain agriculture. Journal of Soil Science Plant Nutrition. (DOI: 10.1007/s42729-019-00064-5).

Zenab Akhtar, Sumana Roy, D.K. Singh, Shilpi Gupta and Ashish Srivastava (2018) Methane emission studies in rice (Oryza sativa) under different stand establishment techniques and nutriet source. Journal of Agrometeorology 20(I): 68-73.

Raipur

Alice Tirkey*, Vibha Ramtake, S. S. Porte1, P. K. Joshi, N. Khare2 , A. Tandon3 and T. Tirkey4 (2019) Stability, correlation and path coefficient analysis for yield and quality traits in betelvine (Piper betle L.) genotypes under three different sets of conditions Indian J. Genet., 79(2) 474-484

Anil Kumar Netam, SS Porte and Chainu Ram Netam (2020). On farm response of nutrient management practices on soil, yield and economics of rice- chickpea cropping system in Chhattisgarh. International Journal of Chemical Studies 2020; 8(4): 3322-3326

Bajaj, Sakshi, Chowdhury, Tapas, Bhambri, M.C. Shrivastava, G.K. and Pandey, N. (2019) Changes in soil dehydrogenase activity and herbicide efficiency index as influenced by different tillage and weed management practices under rice-maize cropping system based on conservation agriculture. International Journal of Current Microbiology and Applied Sciences. 8 (09) 1253-1264.

Bajaj, Sakshi, Bhambri, M.C. and Shrivastava, G.K. (2019). Economics of direct transplanted rice as influenced by tillage and weed management practices under rice-maize cropping system based on conservation agriculture. International Journal of Current Microbiology and Applied Sciences. 8 (09) 1106-1119.

Kolhe, Bhagyashri and Bhambri, M.C. (2019). Effect of different nutrient sources and weed management practices on economics of short grain aromatic rice (*Oryza sativa* L.) under organic farming. International Journal of Chemical studies.

Kumar, S., Shrivastava, G.K. Pandey, N., Chitale, S and Jha, S.K. (2018) Comparative studies of different organic sources of nitrogen on economics and energetic of scented rice (Oryza sativa L.). Journal of Agricultural Issues 23(1):14-17

Jha, S.K., Pandey, N. and Kumar, S (2018) Effect of different seed rates and weed management practices on dehydrogenase activity on direct seeded rice. Journal of Agricultural Issues 23(1):10-13

S. NAVRANG, S. KUMAR, M. C. BHAMBRI, A. TIWARI, R.R. SAXENA, K.L. NANDEHA AND M. TANDON (2019). Physico-Chemical and Biological Properties of Soils of Soybean as Influenced by Nutrient Management Practices and Cropping Systems. Trends in Biosciences 12(12) : 909-912

S. NAVRANG, S. KUMAR , M. C. BHAMBRI , A. TIWARI , R.R. SAXENA , K.L. NANDEHA AND M. TANDON (2019). Assessment of Biometrics and Productivity of Soybean with Reference to Nutrient Management Practices and Cropping Systems in Vertisols of Chhattisgarh Plains. Trends in Biosciences 12(12) : 887-890.

Ajmer

Lal, G., Meena, N.K., Chaudhary, N. and Choudhary, M.K. 2019. "Performance of fennel varieties under organic production system" *International Journal of Seed Spices*, 9(1): 21-26, ISSN: 2278-8417

Meena, N.K. Lal, G., Meena, R.D. and Choudhary, M.K. 2019. Field evaluation of IPM modules for thrips management in fennel under integrated organic farming system. *International Journal of Seed Spices*, 9(1): 85-90, ISSN: *2278-8417*

Lal, G., Chaudhary, N., Lal, S. and Choudhary, M. K. 2019. "Production of seed spices organically: A review" *Annals of Horticulture* 12(1):11-19.

Lal, G., Lal, Shiv, Choudhary, M.K. and Chaudhary, N. 2019. Organic Coriander Production: A Review. *Current Investigation Agri. Current Res.* 8(1): 1046-1049. DOI: 10.32474/CIACR.2019.08.000279

S K Nagar

Ahir, N.B., Desai, L.J., Usadadiya U.P. and Patel, H.F (2019). Integrated nitrogen management in maize (Zea maize L.) for profitable production with sustainability. International Journal of chemical studies, 7(4): 322-324.

A. M. Patel, K. M. Patel and P. K. Patel (2019). Sustainability of farm and farmers through integrated nutrient management. Indian Journal of Agronomy, 64(3): 320-323.

Chaudhari, D.I., Desai, L.J. and Kalal P.H (2019). Effect of integrated weed management on growth, yield, yield attributes and economics of grain amaranth (Amaranthus hypochondriacus L.) under south Gujarat condition. International Journal of current Microbiology and applied sciences, 8(7): 2598-2604.

Desai, L.J., Patel, R.R., Patel, P.K., Patel, A.M., and Patel, K.M. (2019). Impact of intervention/diversification in farming system on profitability and sustainability of small farmers of Mehsana district. GAU Research Journal, 44(3): 162-166.

Desai, L.J., Patel, R.R., Patel, P.K., Patel, A.M., and Patel, K.M. (2019). Crop response to plants nutrients in predominant cropping system of Mehsana district of Gujarat. GAU Research Journal, 44(3): 156-161.

K.M. Patel, P.K. Patel, K.N. Patel, H.L. Chaudhari and S.A. Patel (2019). Influence of different cropping system on carbon sequestration and soil organic carbon stock after eight years in loamy sand. International Journal of Chemical Studies, 7(4): 497-499.

G.S. Damor, P.P. Chaudhary, N.H. Desai and K.M. Patel (2019). Effect of crop geometry and integrated weed management on chemical and bio assay studies of kharif groundnut (Arachis hypogaea). International Journal of Chemical Studies, 7(4): 1659-1662.

Damor G.S., Chaudhary P.P., Desai N.H. and Patel K.M. (2019). Effect of crop geometry and integrated weed management in kharif groundnut (Arachis Hypogaea). International Journal of Agriculture Sciences, 11(13): 8733-8737.

Kalal P.H., Desai, L.J. and Chaudhari, D. (2019). Effect of integrated weed management on growth, yield, yield attributes and economics of Linseed (Linum usitatissimum L.) under south Gujarat condition. International Journal of current Microbiology and applied sciences, 8(7): 1265-1271.

Kalal P.H., Desai, L.J., Chhaganiya, H.J. and Patel, J.V. (2019). Effect of integrated weed management on weed flora, weed population, weed control efficiency, weed index and economics of Linseed (Linum usitatissimum L.) under south Gujarat condition. International Journal of chemical studies, 7(4):1186-1189.

K.M. Patel, P.K. Patel, L.J. Desai, K.N. Patel, S.A. Patel and H.L. Chaudhary (2020). Integrated farming systems for livelihood security of small and marginal farmers. Multilogic in science, 10(33): 600-603.

L.J.Desai, R.R.Patel, P.K.Patel, A.M.Patel & K.M.Patel (July 2019). Crop response to plants nutrients in predominant cropping system of Mehsana district of Gujarat. Gujarat Agricultural Universities Research Journal, vol 44(3), July, 2019 pp: 156-161.

L.J.Desai, R.R.Patel, P.K.Patel, A.M.Patel & K.M.Patel (July 2019). Impact of intervention / diversification in farming system on profitability and sustainability of small farmers of Mehsana district. Gujarat Agricultural Universities Research Journal, vol 44(3), July, 2019 pp : 162-166

Patel, T. U., Vihol, K. J. Thanki, J. D., Gudadhe, N. N. and Desai, L. J. (2019). Weed and nitrogen management in direct seeded rice. Indian Journal of Weed Science, 50(4): 320-323.

Udaipur

Bagotiya, N., Choudhary, R., Sharma, S. K., Choudhary, R. and Choudhary, R.S. 2019. Weed management in soybean with broad spectrum herbicides. *International Journal of Chemical Studies*, 7 (4): 2485-2488.

Choudhary, R. S., Sharma, S. K., Choudhary, R. and Jat, G .2020. Divergent way of sustaining soil health through organic farming. *Progressive Research-An International Journal* 15 (1): 1-5.

Choudhary, J., Sharma, S. K. and Kumar, R. 2020. Consequence of fertility levels and row spacing ongrowth, yield and economics of quinoa (*Chenopodium quinoa*) under saline- sodic soil conditions of Southern Rajasthan. *Journal of Pharmacognosy and Phytochemistry,* 9(4):1204-1206.

Hari Singh, M. K. Jangid, G. L. Meena & S. K. Sharma. 2019. Enhancement of productivity and profitability through Integrated Farming System in Rajasthan. *Journal of Animal Science*. 9(3):01-19.

Jajoria, D. K., Kaushik, M. K., Sharma, S. K. and Narolia, G. P. 2019. Validation of ceres- maize model for growth, yield attributes and yields of kharif maize for southern Rajasthan. *Bulletin of Environment, Pharmacology and Life Science*. 8(9); 91-97.

Jajoria, D. K., Sharma, S. S., Sharma, S. K. and Narolia, G. P. 2020. Effect of chemical defoliation on boll opening and yield of cotton. *International Journal of Chemical Studies,* 8 (2): 1980-1983.

Pooja, Choudhary, R., Sharma, S. K., Jat, G., Choudhary, R. S., Yadav, S. K., Jain, R. K. and Neha. 2019. Growth, yield and uptake of wheat (*Triticum aestivum* L.) as influenced by doses of silicon and its time of application under organic farming. *International Journal of Chemical Studies*, 7 (5): 4498-4501.146 || All India Network Project on Organic Farming.

Patidar, K. K., Meena, R. H., Jat, G., Sharma, S. K., Jat, H. and Meena, V. S. 2019. Split application of vermicompost: strategies to improve nitrogen use efficiency and productivity of chickpea. *Climate Change and Environmental Sustainability*, 7(2):137-142.

Pandia, S., Trivedi, A, Sharma, S. K. and Yadav, S. K. 2019. Evaluation of jeevamrut and its constituents against *alternaria* leaf spot of mungbean in –vitro and under cage house condition in Rajasthan. *International Journal of Current of Current Microbiology & Applied Sciences* 8(9): 2240-2251.

Singh, H, Jangid, M. K., Meena G. L., Sharma, S. K. and Ameta, K. D. 2020. Economic empowerment of tribal farmers through integrated farming system approach in southern Rajasthan, India. *International Achieves of Applied Sciences and Technology*, 11 (1): 85-94.

Vyas, R, Sharma, S. K., Bajpai, N.K. and Tripathi A. K. 2019. Achieving food security in India: need for an integrated approach. *Current Advances in Agricultural Sciences,* 11 (1): 11-18.

Yadav, S. K., Sharma, S. K., Choudhary, Roshan, Jain, R. K., Jat, Gajanand and Choudhary, R. S. 2020. Comparison of nutrient content, uptake and protein content in varieties of different types of maize growing under organic farming. *International Journal of Current Microbiology and Applied Science*, 9 (6): 37983812.

8.1.2 Popular article/folders/ Palmphletp

Bhopal

Coimbatore

- Ganesan, K., Sanbagavalli, S and Somasundaram, E. (2020). Botanicals in organic farming. Agri Business, January 2020 issue. Sri Muththan Printers, Madurai.p.32-36.
- Ganesan, K and Somasundaram, E (2020). Eco friendly pesticides for the management of insect pests in organic rice. Souvenir cum abstract on International Seminar on Tran's boundary Pest Management (ISTPM 2020) during 4-5th March, 2020 at TNAU, Coimbatore, TNAU, offset Printers, Pp.336-337.
- Ganesan, K and Somasundaram, E (2020). Management of palm civet in coconut, Souvenir cum abstract on International Seminar on Tran's boundary Pest Management (ISTPM 2020) during 4-5th March, 2020 at TNAU, Coimbatore, TNAU offset Printers, Pp.371-372.
- Somasundaram, E., Udhaya nandhini, D., and N. Ravisankar (2020) Metabolomic analysis, functional group identification and complete characterization of Panchagavya (organic foliar nutrition) (Prepared for submission to IJAS after University approval)
- Somasundaram, E., Ganesan, Ravisankar, N and A. S. Panwar (2020). Integrated organic farming system approach to sustain productivity, income and employment of marginal farm holdings of Southern India (Prepared for submission to IJAS after University approval)
- Udhaya nandhini, D., Somasundaram, E and N. Ravisankar (2020) Identification of organic functional groups and proximate analysis of crop residues for sustainable organic farming (Prepared for submission to IJAS after University approval)
- TNAU Newsletter on One day training programme on organic agriculture
- Mandate of Department of Sustainable Organic Agriculture
- Objectives of PGS
- Panchagavya preparation
- Vermicompost article.

Ludhiana

- Sidhu, A.S., Aulakh, C.S. and Singh S. 2019. Go for organic cultivation of wheat. Progressive Farming 55 (10): 14-15
- Sidhu, A.S., Aulakh, C.S. and Singh S. 2019. Kanak di jevik kashat de nukte. Changi Kheti 55 (10): 14-15
- Walia, S.S., Aulakh, C.S. and Kaur T. 2019. Jhona-kanak de mukable vdhere labhkari hai makki-kanak chakkar. Changi Kheti 55 (5): 10-11
- Walia, S.S., Kaur T. and Aulakh, C.S. 2019. Rice residue management: An environment friendly approach. Progressive Farming 55 (11): 9-12
- Walia, S.S., Kaur T. and Aulakh, C.S. 2019. Jhone di rehind-khuhnd di sambhal vatavarn hiteshi hai. Changi Kheti 55 (11): 6-7

Raipur

- डॉ. एन.जी.मित्रा, डॉ. एस.एस.पोर्ते एवं कृतिका डोगरे (2019) स्वयं बनायें फसल सुरक्षा के लिए जैविक कीटनाशाक फिर करें नियंत्रण कीटों का । (फोल्डर) कृषक बंदना 2019
- डॉ. एस.एस. पोर्ते, डॉ.जी.पी.बंजारा एवं सुनील अग्रवाल (2019) किसान भाई अधिक उपज के लिए अपनाए अरहर की वैज्ञानिक खेती । पृ.क्र.29 छत्तीसगढ़ कृषि वानिकी, जुलाई 2019
- कृतिका डोंगरे ,डॉ.एल.के.रामटेके एवं एस.एस.पोर्ते (2019) छत्तीसगढ़ में मक्का की उन्नत खेती एवं खाद प्रबंधन पृ.क्र.25 छत्तीसगढ़ कृषि वानिकी ,जुलाई 2019
- डॉ वैशाली शर्मा ,कृतिका डोंगरे एवं डॉ. एस.एस. पोर्ते (2019) फसल उत्पादन में सूक्ष्म पोषक तत्वों का उपयोग सूक्ष्म लेकिन आवश्यक । पृ.क्र.13 छत्तीसगढ़ कृषि वानिकी, जुलाई 2019
- कृतिका डोंगरे, डॉ. डी.एस. ठाकुर एवं एस.एस.पोर्ते (2019) किसान भाई धान फसल की खेत में खरपतवार का प्रबंधन कब और कैसे करें पृ.क्र.14 छत्तीसगढ़ कृषि वानिकी, जुलाई 2019
- डॉ. एस.के.पाण्डे, डॉ.एस.एस. पोर्ते एवं डॉ. तृप्ती ठाकुर (2019) कृषि में सूक्ष्म पोषक तत्वों की महत्ता एवं उपयोगिता । (फोल्डर) कृषक बंदना
- कृतिका डोंगरे , डॉ. डी.एस. ठाकुर एवं एस.एस.पोर्ते (2019) किसान भाई ,जिमीकन्द का अचार वैज्ञानिक तकनीकि से बनाकर अधिक लाभ कैसे पाए पृ.क्र.17. छत्तीसगढ़ कृषि वानिकी ,जुलाई 2019
- डॉ.एस.एस. पोर्ते,डॉ.कोमल सिंह केराम एवं कृतिका डोंगरे (2019) किसान भाई धान के खेत में हरी खाद का प्रयोग कब और कैसे करें । प्.क्र.28.छत्तीसगढ़ कृषि वानिकी ,जुलाई 2019
- डॉ.एस.एस. पोर्ते,कृतिका डोंगर एवं डॉ. एल.के.रामटेके (2019) गाजर घास बेसरम से भी खतरनाक –उन्मूलन करना अति आवश्यक पृ.क्र.10 कृषक बंदना
- डॉ. एस.के.पाण्डे ,डॉ.एन.जी.मित्रा, डॉ एस.एस.पोर्ते एवं कृतिका डोंगरे (2019) जैविक खेती आज की आवश्यकता । कृषक बंदना
- डॉ. एस.के.पाण्डे ,डॉ.एन.जी.मित्रा, डॉ एस.एस.पोर्ते एवं कृतिका डोंगरे (2019) जैविक कीटनाषकों द्वारा कीट नियंत्रण । कृषक बंदना

Ajmer

- Chaudhary, N., Mishra, B.K. and **Lal, G.** (2019). Production of seed spices by organic means (In Hindi). In: Farmers Training Manual-2019: Bijiye Mashala Phasaloutpadan (Edited by Verma, A. K., Meena, M.D., Mishra, B. K. and Lal, G.). Published by Dr. G. Lal, Director, ICAR-NRCSS, Ajmer, pp 40-43.
- G. Lal, N.K. Meena, R.D. Meena, N. Choudhary, M.K. Choudhary and Neha Shekhawat. 2019. Performance of coriander varieties under organic production system. Published by Dr. Gopal Lal, Director & PI, AI-NPOF, ICAR-NRCSS, Ajmer.
- G. Lal, N.K. Meena, R.D. Meena, N. Choudhary, M.K. Choudhary and Neha Shekhawat. 2019. Best Performing varieties of green gram under organic production system. Published by Dr. Gopal Lal, Director & PI, AI-NPOF, ICAR-NRCSS, Ajmer.
- G. Lal, N.K. Meena, R.D. Meena, N. Choudhary, M.K. Choudhary and Neha Shekhawat. 2019. Best Performing varieties of fennel under organic production system. Published by Dr. Gopal Lal, Director & PI, AI-NPOF, ICAR-NRCSS, Ajmer.
- G. Lal, N.K. Meena, R.D. Meena, N. Choudhary, M.K. Choudhary and Neha Shekhawat. 2019. Best Performing varieties of cluster bean under organic production system. Published by Dr. Gopal Lal, Director & PI, AI-NPOF, ICAR-NRCSS, Ajmer.
- G. Lal, A.S. Panwar, N. Ravisankar, N. Choudhary, Neha Shekhawat and M.K. Choudhary. 2019. Different products of organically produced cumin. Published by Gopal Lal, Director & PI, AI-NPOF, ICAR-NRCSS, Ajmer.

- Lal, G. Meena, S.S. Lal, S. and Verma, A.K. 2019. Post harvest management and value addition in seed spices. Souvenir In: State Level Seminar on "Clean and Safe Production of Seed Spices for Enhancing Farmers Income" 27-28 March, 2019 at ICAR-NRCSS, Ajmer. Pp., 125-135.
- जी. लाल, एन. के.मीना, नेहा शेखावत एवं एम. के. चौधरी. 2019. कृषि पारंपरिक तकनीक से वर्तमान जैविक परिपेक्ष्य एवं मूल्य संवर्धन तक। मसाला सरभि पकाशकः डॉ गोपाल लाल, निदेशक, भा.कृ.अनु –राष्ट्रीय बीजीय मसाला अनुसंधान केन्द्र, तबीजी, अजमेर, (1):45-46.
- Lal G., Choudhary M.K., Meena N.K., Shekhawat Neha, Chaudhary N., Tripathi G.K. 2019. Jaivik kheti ka abinna ang : Kenchua khad. *Masala surbhi.* (2):21-22.
- Lal G., Tripathi G.K., Choudhary M.K., Meena S.S., Chaudhary N. 2019. Lemongrass ki ekal va mishrit kheti kisano ki aay badhane ka ek strot". *Masala surbhi.* (2):33-35.
- Choudhary S., Choudhary M.K., Jakhar G.R. 2019. Jaivik kheti me jaiv urvarkon ka yogdaan. *Masala surbhi.* (2):40-41.
- Lal, G., Shekhawat Neha, Choudhary, M.K., Choudhary, G.R. and Chaudhary, N. 2020. Jal-Jeera: Jeere ka sayhatmand sasyother prabandhan. *Masala surbhi,* (1): 62-64.
- Lal, G., Shekhawat Neha, Lal, S., Choudhary, G.R. and Choudhary, M.K. 2020. Javik bhojan ki paramparye avam tathya. *Masala surbhi,* (1): 96-99.
- Meena, R.D., Lal, G., Meena, N.K., Chaudhary, N. and Tripathi, G.K (2019). Ecofriendly management of diseases in fennel (in Hindi). In: *Masala Surabhi* (Hindi Rajbhasa Patrika), July- December, 2019, Published by Director, ICAR-NRCSS, Ajmer. pp 46-49.

S K Nagar

- A. H. Chaudhary, R. M. Patel and R. R. Patel (2019). Impacts of Sprinkler Irrigation System on Groundnut Production in Deesa Taluka of Banaskantha District. Compendium, SEEG-2019, Gujarat, pp: 268.
- Dr. H. L. Chaudhari, Dr. L. J. Desai, Dr. K. M. Patel, Dr. S. A. Patel and Dr. K. N. Patel (2019). Sendriy Khetina Dharadhorano ane pramanan angeni karya paddhati. Sajiv kheti, Book Chapter (ISBN NO., 978-93-5382-551-5), Pp. 138-144.
- Dr. K. N. Patel, Dr. L. J. Desai, Dr. K. M. Patel, Dr. S. A. Patel and Dr. H. L. Chaudhari (2019). Sajivkhetima Sankalit Pak Vyavstapan. Sajiv kheti, Book Chapter (ISBN NO., 978-93-5382-551-5), Pp. 91-96.
- Dr. K. M. Patel, Dr. L. J. Desai, Dr. K. N. Patel, Dr. S. A. Patel and Dr. H. L. Chaudhari (2019). Jaivik Khataronu Sajivkhetima Mahatva. Book Chapter (ISBN NO., 978-93-5382-551-5), Pp. 45-55.
- Dr. L. J. Desai, Dr. K. M. Patel, Dr. S. A. Patel, Dr. H. L. Chaudhari and Dr. K. N. Patel (2019). Sendriya Khetima Lila Padvashnu Mahatva. Book Chapter (ISBN NO., 978-93-5382-551-5), Pp. 40-44.
- Dr. L. J. Desai, Dr. K. N. Patel, P. K. Patel, V. K. Patel and H. L. Chaudhary (2020). Azolla: Sankalit Kheti Padhhati nu Ghatak, Published by: Chief Agronomist, IFS, SDAU, Sardarkrushinagar. University Publication No. 3:4:981/2020. Pp. 1-8.
- Dr. A. M. Patel, Dr. K.M. Patel, Dr. A.K. Saini and Shri P. K. Patel (2019). Vadhu avak mervva mate sankalit khet paddhati (IFS) model. Krushi tajagnatao, SDAU Booklet, Pp 2-6.
- P. K. Patel, L. J. Desai and K. N. Patel (2019). Soil Management and CO2 Sequestration to Enhance Water Productivity. Winter School on Enhancing Water Productivity in Agriculture for Scarcity Zones (November 20, 2019 to December 10, 2019). Pp, 195-198.

- Desai L. J., Patel P.K., Chaudhari H. L. and Patel K. N. (2019). Enhancing Water Use Productivity through Cropping System Management. Winter School on Enhancing Water Productivity in Agriculture for Scarcity Zones (November 20, 2019 to December 10, 2019). Pp, 116-121.
- K. S. Patel, R. R. Patel and R.C. Prajapati (2019). Training Need Assessment of Farmers regarding Organic Farming in North Gujarat. Compendium, SEEG-2019, Gujarat, pp: 305
- K. S. Patel, R. C. Prajapati and R. R. Patel (2019). Training Need Assessment of Castor Growers of Palanpur taluka in Banaskantha District. Compendium, SEEG-2019, Gujarat, pp: 168.
- Purvi Kalal Lalji Desai (2019). Integrated weed management in linseed under south Gujarat condition. Book, Lambert Academic publishing. Pp: 1-70.
- R. R. Patel, R. M. Patel and K. S. Patel (2019). Personnel and Socio-Economic Characteristics of Farmers of Patan district. Compendium, SEEG-2019, Gujarat, pp: 169.
- P. R. Gameti, R. M. Patel and R. R. Patel (2019). Market Analysis and Farmers' Purchasing Behaviour of Summer Groundnut Seed in Sabarkantha District. Compendium, SEEG-2019, Gujarat, pp: 267.
- R. R. Patel, P.K.Patel and K. M. Patel (2019). Major constraints Faced by farmers of Patan district. Compendium, SEEG-2019, Gujarat, pp: 315.

Udaipur

- Arvind Verma, Roshan Choudhary and Gangaram Mali (2019). Rabi ki Faslo main Kharpatwar prabjanan, Rajastahn Kheti Pratap, pp 11-13.
- Arvind Verma, Roshan Choudhary and Gangaram Mali (2019) Gajar ghas kharpatwar ka prabhandan, Rajastahn Kheti Pratap, pp 22-23.
- अरविंद वमा एवं रोशन चौधरी गाजरघास का समन्वित प्रबंधन, Folder/डी ओ आर, एमपीयूएटी 2020/03.
- B.S.S. Siddartha Naik, Sharvan Kumar Yadav, Shanti Kumar Sharma, Roshan Choudhary, Ravindra Kumar Jain and Rekha Vyas (2019). Panchagavya: A Better Way to Enhance the Income of Farmer, डी ओ आर,एमपीयूएटी, 2019/05.
- B.S.S. Siddartha Naik, Sharvan Kumar Yadav, Shanti Kumar Sharma, Roshan Choudhary, Dr B. G. Chippa, Dr Ravindra Kumar Jain and Dr Rekha Vyas (2019). Vermitechnology: An Eco-friendly Approach of Composting, डी ओ आर,एमपीयूएटी, 2019/01.
- डॉ. आर. एस. चौधरी, हेमन्त बंशीवाल' डॉ. रोशन, डॉ. गजानन्द जाट एव ंओमिका चौधरी कृषि के औद्योगीकरण से रोजगार की संभावनाए फसल क्रांति Pp:38-40.
- Garima Vaishnava and S. K. SharmA (2019) Jaivik Beej Utpadan, kheti, ICAR, New Delhi, pp 17-20.
- Roshan Choudhary, R. S. Choudhary and J. L. Choudhary (2019). खरीफ फसलों मे वैज्ञानिक पररपक्वता के आधार पर कटाई कषि भारती Sept. 17 pp16,
- Roshan Choudhary, Arvind Verma, S. K. Sharma, R. S. Choudhary & Rajesh Chaudhari (2019). Swasthiya prahari aum gunvattapurn Jayad Moong ki fasal- Samnivit kharpartwar prabhandan, Krishi Bharati, PP.6-9.
- Sharvan Kumar Yadav, B.S.S. Siddartha Naik, Shanti Kumar Sharma, Roshan Choudhary, Ravindra Kumar Jain and Rekha Vyas (2019). NADEP Compost Technology: Preparation of Large Amount of Compost by Using Less Amount of Cowdung, डी ओ आर,एमपीयूएटी, 2019/06.

- Shanti Kumar Sharma, B.S.S. Siddartha Naik, Dr Sharvan Kumar Yadav, Dr Ravindra Kumar Jain, Dr Roshan Choudhary, and Dr Rekha Vyas (2019). Jeevamrut and Beejamrut: The Great Part and Parcel of Soil and Seed, डी ओ आर,एमपीयूएटी, 2019/06.

8.1.3 Books/ Book Chapter/ Bulletins/Mannual

Bhopal

- Vishwakarma, A K, 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, 4(1) pp 3-6.
- Patra, Ashok K., 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.
- Patra, Ashok K., Choudhari, S.K., N. K. Sinha and Singh, A.B. (2022). The Science of Bhumi Suposhan and Agriculture-The Present situation, Challenges and Future Direction. Bhumi Suposhan. (Akshay Krishi Pariwar), pp. 53-175.
- Lenka, Narendra K., 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.

Coimbatore

- Developed organic farming technologies for the Rice, Maize and Cotton crops to the Crop Production Guide 2019.
- Hilly organic vegetables crop production guide was prepared and submitted to Director of Research and Dean (Horti), TNAU, Coimbatore.

Jabalpur

- Dr. P.B. Sharma (2020). Practical manual on Rainfed Agriculture and Watershed Management, JNKVV publication under publication.
- Dr. P.B. Sharma, M.L. Kewat and Neelam Bisen (2020). Practical Manual on Water Management, JNKVV publication under publication.
- Dr. Vinita Parte and Dr. Rajendra Prasad Sahu (2020). A practical manual on crop production technology-I (Kharif Crops), JNKVV publication pp. 44.
- Dr. Rajendra Prasad Sahu (2020). Cost of cultivation under organic production system chapter in Manual on organic farming, JNKVV publication under publication.

Ludhiana

- Aulakh, C.S. and Walia, S.S. 2019. Jevik Kheti. Punjab Agricultural University, Ludhiana. pp 64.

Udaipur

- Devendra Jain, Ram Hari Meena, Arunabh Joshi, Gajanand Jat, Ali Asger Bhojiya and Surya Chauhan (2019). Manual on Biofertilizer Research (Laboratory to commercial Production), Apex publication House, Udaipur, ISBN (10) 81-301-00874.

- Dr. S. K. Sharma, Dr. Latika Vyas, Dr. Vishaka, Dr. Roshan Choudhary, Dr. Arvind Verma, Dr. R. N. Bunkar, Dr. Hari Singh, Dr. P. S. Dudi & Er. Manjeet Singh (2019). Cultivating Emotional intelligence among Students for Achieving Success, under IDP, NAHEP, RCA, MPUAT, Udaipur, MPUAT /DR/ 01/50.
- Dr. S K Sharma, Dr Roshan Choudhary, Dr Gajanand Jat, Dr R.S. Choudhary etc. (2020). Organic Farming: Introduction, Input Production, Protocol, Input Quality and Techniques under RKVY, DoR, MPUAT, 02/2020/115.
- Dr. S K Sharma et al. (2020). कृषि मौसम सम्बन्धि जानकारी, under ICAR-SCSP, MPUAT, Udaipur, MPUAT/DR/SCSP/01/30.
- Dr. S K Sharma et al. (2020). कृषि मौसम की जानकारी के लिए आवश्यक वैज्ञानिक पहल, under ICAR-SCSP, MPUAT, Udaipur, MPUAT/DR/SCSP/02/50.
- Jagdish Choudhary, S.K. Sharma, S. S. Lakhawat, D. P. S. Dudi, Gajanand Jat and Urmila (2020). लवणीय एंव क्षारीय मृदा में फसलोत्पादन हेतु नवीन तकनीक, DOR, MPUAT, Udaipur, pg. 45.
- R S Choudhary, S K Sharma, Arunabh Joshi and Roshan Choudhary (2019) Krishi me Udhmita-Navachar evm Bhavi Stat Krishi Rannitiya, under IDP, NAHEP, RCA, MPUAT, Udaipur, pag. 35.
- Srivastava, M., Vyas, R and Sharma. S. K. 2020. Gender Sensitization: Prospects, Challenges and Strategies.IDP, NAHEP, Social & Environmental Safeguards, ICAR New Delhi, CCAS, MPUAT, Udaipur.
- S.K. Sharma, Roshan Choudhary, GajananadJat, R. S. Choudhary, Amit Triwedi, B.G. Chhipa, Hemant Swami, R. K. Jain and S. K. Yadav (2019) Bulletin: Knowledge and skill development in organic farming, IDP, NAHEP MPUAT, Udaipur.
- Vyas, R and Sharma. S. K. 2019. Krishi Udhymita: KoshalaivmAajivika Vikas, MPUAT, Udaipur pp 136.
- Vyas, R and Sharma. S. K. 2020. Technologies and Innovations in Agriculture, MPUAT, Udaipur. pp 248.

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

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

- Attended Farmer's-scientist discussion/interaction (DES hall) on dated 16-10-2019.
- A review meeting attended to discuss the administrative, technical and financial issues related to AICRP-IFS and NPOF centres operated at JNKVV, Jabalpur.
- Meeting by Hon'ble VC on ZBNF at ELP 'Organic Farming' JNKVV on dated 9-10-2019
- Meeting for ZBNF by Hon'ble VC (DRS hall) of all heads, Deans, Directors on dated 4-11-2019
- Workshop on teaching improvement (Agronomy), held at Biofertilizer Lab podium 8 & 9 August 2019.
- ZBNF model visited at Kurutshetra, Hariyana on dated 20-23, October 2019

Ludhiana

- AICRP-IFS and AINPOF review meeting by DDG (NRM)-ICAR, Modipuram, 26 May, 2020.
- Annual Project Review meeting of Biotech-KISAN project, 'Establishment of Biotech-KISAN hub at PAU Ludhiana, DBT, New Delhi, 29 April 2020.
- Brain storming on Technologies for promotion of organic and natural farming practices in Islands, Port Blair, A&N Islands, 14 Nov., 2019
- Interactive video conference on, "Changing dimensions of Agri marketing in post COVID-19", PHDCCI, Chandigarh, 14 May, 2020.
- Webinar on 'NeGD LMS Workshop for Agricultural Universities in ICAR' under Digital India Programme, Govt of India, ICAR, New Delhi.
- Workshop on "Awareness for Environment protection" PAU, Punjab Pollution Control Board, Department of Science, Technology and Environment, Govt. of Punjab, Feb., 2020.

Pantnagar

- D.K.Singh, Shilpi Gupta, S.K.Yadav, Gangadhar Nanda and Yogesh Sharma. 2018. Economic Sustainability of small and marginal farmers through Organics. In: XXI Binneal National Symposium of Indian Society of Agronomy organized by MPUAT, Udaipur, Rajasthan during 24-26 October. pp 533-534.
- D.K.Singh, Shilpi Gupta, Yogesh Sharma, Dipti Bisariya, and Gangadhar Nanda. 2018. Organic farming: A probable way towards second green revolution in low productive areas of India. In: Proceedings of National Agronomy Congress on Redesigning Agronomy for Nature Conservation and Economic empowerment organized by College of Agriculture, G.B. Pant University of Agriculture and Technology, Pantnagar during 20-22 February. pp 216-219.

Ajmer

- Lal, G., Lal, S., Shekhawat, and Neha Choudhary, M.K. 2019. Value addition in cumin for higher profitability and entrepreneurship development. In: Souvenir of 3rd Global meet on science and technology for ensuring food and nutritional security (GMST-2019), organised by Hi Tech Horticultural Society during 01-03, December, 2019 at ICARNRCSS, Ajmer. Pp.184.
- Lal, G., Meena, N.K., Chaudhary, N., Choudhary, M.K. and Shekhawat, Neha. 2019. Performance of coriander (*Coriandrum sativum* L.) varieties under organic production system. In: Souvenir of 3rd Global meet on science and technology for ensuring food and nutritional security (GMST-2019), organised by Hi Tech Horticultural Society during 0103, December, 2019 at ICAR-NRCSS, Ajmer.Pp.182.
- Meena, N. K., Lal, G., Kant, K. and Meena, R. S. 2019. Pollination management in seed spices. In Souvenir of State Level Seminar on Clean and Safe Production of Seed Spices for Enhancing Farmers' Income, jointly organized by ICAR-NRC on Seed Spices, Ajmer and DASD, Calicut held at ICAR-NRCSS, Ajmer during 27-28 March, 2019, pp 91-95.
- Meena, R. S., Lal, G. and Meena, N. K. 2019. Quality seed production of seed spices. In Souvenir of State Level Seminar on Clean and Safe Production of Seed Spices for Enhancing Farmers' Income, jointly organized by ICAR-NRC on Seed Spices, Ajmer and DASD, Calicut held at ICAR-NRCSS, Ajmer during 27-28 March, 2019, pp 22-26.

S K Nagar

- ZREAC and Agresco meeting were attended

Uaipur

- Dr. Roshan Choudhary, Assistant Professor, Participation & Oral presentation in International Conference on 27th Asian-Pacific Weed Science Society Conference on topic ""Three Tier Management Practices for effective Organic Weed Management in Sweet Corn held at Riverside Majestic Hotel, Kuching, Sarawak, Malaysia from 3-6 September, 2019.
- Dr. Roshan Choudhary participated in International Conference on 27th Asian-Pacific Weed Science Society Conference on Weed Science for Sustainable Agriculture and Environment at Riverside Majestic Hotel, Kuching, and Sarawak, Malaysia from 3-6 September, 2019.
- Dr. Roshan Choudhary Participated in in Agronomist meet and student contest at CCSHAU, Hisar from 30-31 January, 2020 organized by Haryana Agronomist Association (Agronomy), CCSHAU, Hisar & International Weed Science Society's.
- Dr. Roshan Choudhary participated in ISWS Biennial Conference on "Weed management for enhancing farmers' income and food security" being organized at ICAR- Central Coastal Agricultural Research, Institute, Goa (India) from 5-7 February 2020.
- Dr. Roshan Choudhary attended in five days Faculty Development Programme (Online Short Term) on Teaching tools to Knockdown the lockdown organized by College of Agriculture, Balaghat Jawaharlal Nehru Krishi Vishwa Vidyalaya from 16 to 20 May, 2020.
- Dr. S.K. Sharma, Dr. Roshan Choudhary, Devendra Jain, Hemant Swami and Dr. Gajanand Jat Participated in National webinar on Scope and Scenario of Agriculture after COVID-19 organized by MPUAT, Udaipur on 29 May, 2020.
- Dr. Roshan Choudhary, participated in the World food safety day commemorative webinar on Pandemics and Hunger Mainstreaming Millets for addressing Food and Nutritional Security on 08 June, 2020 organized by Department of Plant Sciences, School of life Sciences, university of Hyderabad, Telangana, India.
- Dr. S.K. Sharma, Dr. Roshan Choudhary, Devendra Jain and Dr. Gajanand Jat participated in National webinar on Agriculture and Food security beyond COVID-19 organized by Rajasthan College of Agriculture, MPUAT, Udaipur on 22 June, 2020.

- Dr. S.K. Sharma, Dr. Roshan Choudharyand Dr. Gajanand Jat Participated in two days National workshop on National Workshop on Research Methodology: Concepts & Applications organized by Directorate of student's welfare, MPUAT, Udaipur from 2627 June, 2020.
- Dr. S.K. Sharma, Dr. Roshan Choudharyand Dr. Gajanand Jat Participated in Organic Mahotshav during 29th November to 1st December, 2019 organized by Organic Farming Association of India (OFAI) & Banyan Roots at Shilap Gram, Udaipur (Raj.)
- Roshan Choudhary, Arvind Verma, S.K. Sharma and R.S. Choudhary Three tier management practices for effective organic weed management in sweet corn In 27th Asian-Pacific Weed Science Society Conference on "Weed science for sustainable agriculture and environment" at Sarwak, Malasia. 3-6 September, 2019.
- R. S. Choudhary, Roshan Choudhary, S. K. Sharma and P. B. Singh Sustainability soil health through organic farming International Conference on "Innovative and Current Advances in Agriculture and Allied Sciences (ICAAAS-2020)" held at Bangkok, Thailand from 27 January – 01 February, 2020.
- Roshan Choudhary, S. K. Sharma, Rajesh Chaudhari, R. S. Choudhary, Arvind Verma, Gajanand Jat, B. G. Chhipa and S. K. Yadav Reorientation of Local Food System for Better Wellbeing and Quality Resources: A need of Post COVID-19 National webinar on Scope and Scenario of Agriculture after COVID-19 at MPUAT, Udaipur on 29th May,2020.

8.1.5. AWARDS

Udaipur

- Best Thesis Award under Organic farming Dr. Sharvan Kumar Yadav received during International Conference on "Innovative and Current Advances in Agriculture and Allied Sciences (ICAAAS-2020)" held at Bangkok, Thailand from 27 January – 01 February, 2020.
- Best Article Award For article id 31451 entitled "Options and Way Forward for Reducing the Menace of Parthenium" to Roshan Choudhary, R. S. Choudhary, S. K. Sharma and Arvind Vermapublished in Agriculture & Food: eNewsletter
- Best Article Award For article id 31144 entitled "Agricultural Productivity and Challenges in Sustaining Resource Base" to R. S. Choudhary, Roshan Choudhary, S. K. Sharma and Omika Choudhary published in Agriculture & Food: e-Newsletter.
- Young Scientist Travel Grant Award Dr. Roshan Choudhary received by Indian Society of Weed Science, ICAR-Directorate of Weed Research (ICARDWR), Jabalpur For attending a conference in the subject of weed science for the year 2019-20 to attend International conference on weed Science for Sustainable Agriculture and Environment at Kuching, Sarawak, Malaysia during 36 September 2019.
- Reviewer Excellence Award Dr. Roshan Choudhary received by Indian Journal of Agriculture Research, In recognition of significant and outstanding contribution to the Journal and reviewing the article. Article Title:- Weed dynamics and productivity of direct wet seeded rice under different weed management practices, 2020.
- Woman Scientist Award Dr. Roshan Choudhary received for outstanding contribution in the field of Agronomy during International Conference on "Innovative and Current Advances in Agriculture and Allied Sciences (ICAAAS-2020)" held at Bangkok, Thailand from 27 January – 01 February, 2020.

8.1.6. Lecturers

Jabalpur

- Dhan/pigeonpea/SRI/SPI/Rabi season field preparation/water management/organic farming/organic manures Utpadan Taknik in ATMA Pathshala in different villages (Bheeta, Kudan, Nichi) of, Jabalpur in July, Sept., Oct., November 2019.

- Field visit on Integrated Farming Systems in Refresher Training on New Production Techniques for Agriculture Development under RKVY, DES, JNKVV (17-19, Feb 2020).
- Training on Natural Resource Management organized by COAE, Jabalpur on 20-22 Jan 2020. Integrated Farming System; Principles and advantages with field visit, management of major rabi crops.
- Training on Integrated Nutrient Management for sustainable soil health organized by KVK, Jabapur w.e.f. 29 Jan to 7 Feb 2020. Water management in wheat, Field visit to IFS.
- Vocational Training on Organic Farming organized by RCOF, Jabalpur, Field visit to IFS.
- Training lecture on Integrated Farming Systems in Refresher Training on New Production Techniques for Agriculture Development under RKVY, DES, JNKVV (24-26 Feb 2020).
- Field visit on Integrated Farming Systems of Professors, Scientists and scholars of Archetacture, Institute Bhopal (Feb 2020).
- Lectures in Business Planning and Development MANAGE programme at JNKVV, Jabalpur during the year.
- Training lecture on Organic farming and field visit in Certification course organized by Regional centre for Organic Farming, Jabalpur.
- Training lectures (05) on Organic farming, vermiculture and their species, feeding materials, composting methods, structure, pest & predators, collection and storage field visit of trainees of skill development training on 'vermicompost producer' organized at KVK, Jabalpur dated 10, Feb 2020 to 10, March 2020.
- Year round Fodder/azolla production, bhusa making plan for Instructional Dairy Unit, JNKVV, Jabalpur.

Ludhiana

- Major problems in organic agriculture: Experience transmission. In: Winter school on Ecological perspectives in Arthropod pest management for sustainable crop production. Deptt of Entomology, PAU Ludhiana, 19.11.19 - 9.12.19.
- Natural farming research in PAU Ludhiana. In: 2nd meeting (Online) of Committee on empirically validating the results of SPNF model. ICAR Committee 20 June, 2020.
- Natural farming: Prospects and constrains. In: 10th Regional Advisory Group deliberations on farm and rural sector organized by NABARD at Chandigarh, 4 Feb., 2020.
- Role of organic farming for enhancing soil health and food quality. In: CAFT on Assessing soil plant atmosphere continuum (SPAC) for enhanced input use efficiency. Deptt of Soil Science, PAU Ludhiana, 1-21, 14 Oct., 2019.
- Organic farming for producing safe food. In: Training programme on "Food safety and nutritional security" organized by PAMETI, PAU campus, Ludhiana
- Organic Farming: Concept and Principles. In: Training programme on "Organic and Integrated farming for sustainable development in livestock sector" organized by PAMETI, PAU campus, Ludhiana, 21 January, 2019.
- Organic farming: Research experiences and prospects in India. In: National webinar on "Approaches towards development of rural and agriculture sector in the present scenario". 8-9.5.2020. Organised by JNKVV College of Agriculture Tikamgarh, JNKVV Jabalpur (MP)
- Organic food: Challenges and opportunities in post COVID-19 scenario. In: Interactive video conference on, 'Changing dimensions of Agri marketing in post COVID-19 by PHDCCI, Chandigarh, 14 May, 2020.

- Prospects and constraints of organic farming in high input agricultural areas. In: National Webinar on Organic Farming-2020. Organized by College of Agriculture Balaghat, JNKVV Jabalpur, MP. 16-20 June, 2020

Ajmer

- Meena, N.K., Lal, G., Kant, K. and Meena, R.S. 2019. Pollination management in seed spices. In: State Level Seminar on "Clean and Safe Production of Seed Spices for Enhancing Farmers' Income" Jointly organized by ICAR-NRC on Seed Spices, Ajmer and DASD, Calicut held at ICAR-NRCSS, Ajmer during 27-28 March, 2019.
- Lal, G., Choudhary, N., Lal, S. And Verma, A.K. 2019. "Organic seed spices: challenges and opportunities" In: State Level Seminar on "Clean and Safe Production of Seed Spices for Enhancing Farmers' Income" Jointly organized by ICAR-NRC on Seed Spices, Ajmer and DASD, Calicut held at ICAR-NRCSS, Ajmer during 27-28 March, 2019.
- Lal, G. And Verma, A.K. 2019. "Value Chain in Seed Spices" in technical session VI –B (Production Technology-Conventional Horticulture). In: 8th Indian Horticulture CongressShaping Future of Indian Horticulture at IGKV, Raipur, Chattishgarh, 17-21st , January, 2019 organized by Horticulture Society of India, New Delhi.
- Lal, G., Meena S.S. and Lal, S. 2019. "Seed Spices as Medicine in Wellness Industry" In: National Seminar cum Interactive Workshop on "Noni and Medicinal Plants in Human Wellness during, 23 - 24 March, 2019.
- Lal, G., Choudhary, N., Lal, S. And Verma, A.K. 2019. "Organic seed spices: challenges and opportunities" In: State Level Seminar on "Clean and Safe Production of Seed Spices for Enhancing Farmers' Income" Jointly organized by ICAR-NRC on Seed Spices, Ajmer and DASD, Calicut held at ICAR-NRCSS, Ajmer during 27-28 March, 2019.
- Lal, G., Verma, A.K. and Choudhary, M.K. 2019. "Climate resilient technologies for seed spices" technical session VII-Sustainable intensification & Diversifications (Arid Horticulture, Aquaculture, Protected Agriculture) Production Technology-Conventional Horticulture). In: 13th International conference on development of drylands: Converting Dryland Areas from Grey into Green during 11-14 February, 2019. Pp. 157-161.
- Lal, G., Meena, R.S. and Lal, S. 2019. "Biodiversity of seed Spices: Status and opportunities under changing climatic scenario". In: 13th International conference on development of drylands: Converting Dryland Areas from Grey into Green during 11-14 February, 2019. Pp. 45-47.

Udaipur

- Application, IASRI, Pusa, New Delhi. Dr. Roshan Choudhary, Dr. S.K. Sharma and Dr. R.S. Choudhary NADEP Compost Method of Preparation and Uses, CAFT on Org. Farming, 1-21 June, 2019
- Chhipa, B. G., Sharma, S.K., Choudhary, R. and Yadav, S. K. 2019. Practices for Cultivation of Guava. In: Productivity, Economics and Environmental Performance in Organic Agriculture ICAR, New Delhi Division of Computer Application, IASRI, Pusa, New Delhi.
- Choudhary, R., Sharma, S. K. and Dudhwal, K. 2019. Vermicomposting in Organic Farming. In: Productivity, Economics and Environmental Performance in Organic Agriculture ICAR, New Delhi Division of Computer Application, IASRI, Pusa, New Delhi.
- Choudhary, R., Sharma, S. K. and Dudhwal, K. 2019. Use of NADEP Compost in Organic Farming. In: Productivity, Economics and Environmental Performance in Organic Agriculture ICAR, New Delhi Division of Computer Application, IASRI, Pusa, New Delhi.
- Choudhary, R and Sharma, S. K. 2019. Use of Plastic Mulch to Enhance Productivity and Profitability in Agriculture. In: Productivity, Economics and Environmental Performance in Organic Agriculture ICAR, New Delhi Division of Computer Application, IASRI, Pusa, New Delhi.

- Sharma, S. K., Choudhary, R. and Chhipa, B. G. 2019. Organic Food and Impact on Human Health. In: Productivity, Economics and Environmental Performance in Organic Agriculture ICAR, New Delhi Division of Computer Application, IASRI, Pusa, New Delhi.
- Sharma, S. K., Choudhary, R. Jain, D and Praveen. 2019. Use of Panchagavya in Organic Farming. In: Productivity, Economics and Environmental Performance in Organic Agriculture ICAR, New Delhi Division of Computer Application, IASRI, Pusa, New Delhi.
- Sharma, S. K., Choudhary, R., Chhipa, B. G., Praveen and Yadav, S. K. 2019. Role of Organic Agriculture to Adapt and Mitigate Effect of Climate Change. In: Productivity, Economics and Environmental Performance in Organic Agriculture ICAR, New Delhi Division of Computer Application, IASRI, Pusa, New Delhi.
- Sharma, S. K. and Choudhary, R. 2019. Use of PROM in Organic Agriculture. In: Productivity, Economics and Environmental Performance in Organic Agriculture ICAR, New Delhi Division of Computer Application, IASRI, Pusa, New Delhi.
- Sharma, S. K, Choudhary, R., Yadav, S. K. and Jain, R.K. 2019. Organic Certification: Concept and Management Aspects. In: Productivity, Economics and Environmental Performance in Organic Agriculture ICAR, New Delhi Division of Computer Application, IASRI, Pusa, New Delhi.
- Sharma, S. K, Choudhary, R. and Chhipa, B. G. 2019. Organic Agriculture and Participatory Guarantee Systems: Present Status & Way Forward. In: Productivity, Economics and Environmental Performance in Organic Agriculture ICAR, New Delhi Division of Computer Application, IASRI, Pusa, New Delhi.
- Sharma, S. K, Choudhary, R., Gajanand, Chhipa, B. G. and Jain, R. K. 2019. Public Standards and Legislation in Organic Agriculture. In: Productivity, Economics and Environmental Performance in Organic Agriculture ICAR, New Delhi Division of Computer Application, IASRI, Pusa, New Delhi.
- Sharma, S. K and Choudhary, R. 2019. Policies in Organic Agriculture. In: Productivity, Economics and Environmental Performance in Organic Agriculture ICAR, New Delhi Division of Computer Application, IASRI, Pusa, New Delhi.
- Sharma, S. K, Choudahry, R., Jain, R. K., Yadav, S. K. and Praveen. 2019. World Organic Food Market, Challenges & Outlook. In: Productivity, Economics and Environmental Performance in Organic Agriculture ICAR, New Delhi Division of Computer Application, IASRI, Pusa, New Delhi.
- Sharma, S. K, Choudhary, R and Chhipa, B. G. 2019. Organic Agriculture: History, Concept and Principles. In: Productivity, Economics and Environmental Performance in Organic Agriculture ICAR, New Delhi Division of Computer

8.1.7. Details of M.Sc. and Ph.D degree awarded based on the project work

Bhopal

- As Co-guide, guiding Ph.D. Student Mr. Shubham Singh M.Sc. Soil Science and Agricultural Chemistry, RVSKVV College of Agriculture, Gwalior, Madhya Pradesh. Title of thesis is “Effect of various nutrient management practices on nutrient availability and uptake in soybean-wheat cropping system and microbial diversity under Vertisol of Central India“.

Jabalpur

M. Sc. Students guided

Name of student	Title of thesis
Ms. Iram Naj	Response of soybean to irrigation and nitrogen management for higher growth and yield
Ms Priya Kochle	Efficacy of post emergence herbicides for weed control in transplanted rice
Bankerlang Khengwir	Effect of weed control treatments on growth and yield of transplanted rice
Shyamali Upadhyay	Evaluation of nicosulfuron (SL-950) 6% OD in maize crop against weeds
Mahendra Anjana	Productivity and grain quality parameters of different varieties of rice
Girdhari Nargave	Influence of varying environment on rice varieties under upland condition
Pinki Mehra	Evaluation of Productivity and grain quality parameters of different rice varieties
Pratap Jamre	Bio-efficacy of herbicide mixtures against mixed weed flora and seed yield of soybean [Glycine max (L.) Merril.]
Shritama Bhunia	Irrigation and Sulphur management in linseed
Richa Singh	Evaluation of Productivity and grain quality parameters of different wheat varieties
Rahul Verma	Diversification of Rabi crops for higher productivity and economics in Central India
Jitendra Sisodiya	Wheat + mustard intercropping

Ph. D Students Guided

Name of student	Title of thesis
Vijay Kumar	Diversification and intensification of rice based cropping system for higher productivity and economics in Central India
Ms. Aparna Sharma	Evaluation of Productivity and grain quality parameters of different rice varieties
U.S. Dhakad	Response of Quinoa to weed and nutrient management
Manas Mohan Setha	Productivity of Wheat + mustard intercropping under varying levels of irrigation and row proportions
Ms. Anamika Jain Badkul	Response of linseed to varying irrigation levels and nutrient management
Puspendra Singh Yadav	Response of Berseem to weed management practices under varying environment

Raipur

S. No.	Name	M. Sc. (Ag)		Ph. D	
		Chairman	Member	Chairman	Member
1	Dr. M.C. Bhambri, Chief Agronomist	2	3	3	3
2	Dr. Sunil Kumar, Sr. scientist (Agronomy)	2	6	2	2
3	Dr. S.S. Porte, Sr. scientist (Soil science)	3	12	-	5

S K Nagar

SN	Particulars	Awarded Degree	Responsibilities
1	Guide one Student of Agronomy	Ph.D. (Agronomy)	*Act as Minor Advisor*
2	Guide one Student of Agronomy	M.Sc (Agronomy)	*Act as Minor Advisor*
3	Guide one Student of MBA (Agri- business Management)	MBA (ABM)	*Act as Minor Advisor*
4	Guide two Student of M.Sc. (Agricultural Economics)	M.Sc. (Agril. Economics)	*Act as Major Advisor*

8.2.1. Human Resource Development

Bhopal

ICAR IISS Bhopal 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.

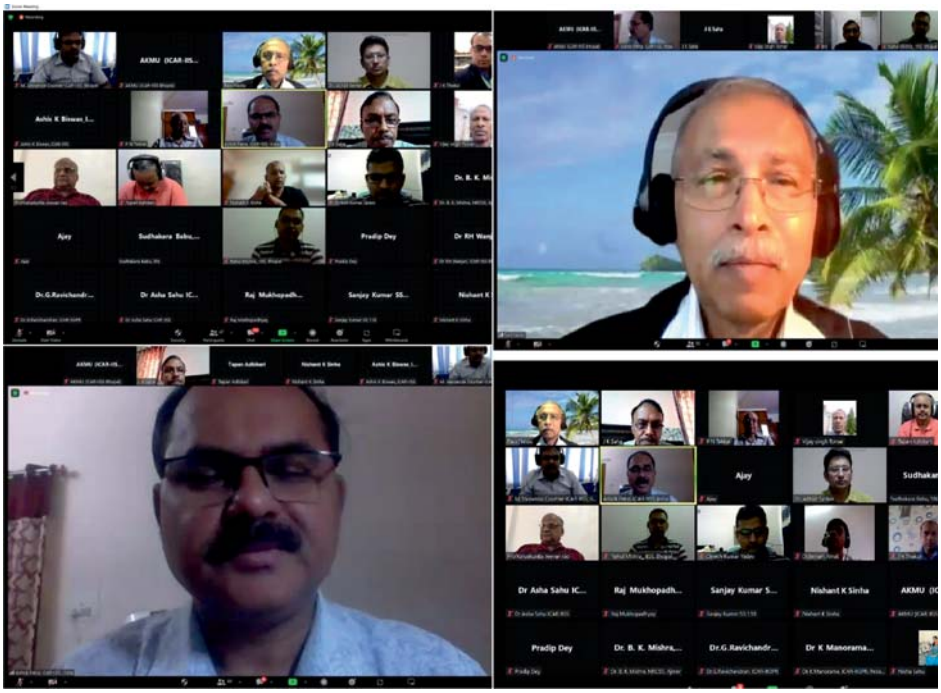
ICAR IISS Bhopal celebrated "Kisan Bhagidari, Prathmikta Hamari" 75 Azadi Ka Amrit Mahotsav Campaign on "Biofortification, Nutrient Grooming and Crop Diversification" on 28thApril 2022

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 Environmental Remediation, The University of Newcastle, Australia. Dr. A.K. Patra, Director of Indian Institute of Soil Science, expressed concern 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 and Agricultural 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.

8.2.2. Training/workshop /programme conducted:

Bhopal

- Organized 01 day 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 01 day farmer's training under "International Year of Millets 2023" at ICAR-IISS, Bhopal on 17/09/2021 (Virtual).
- Organized 01 day 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.
- 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.

Coimbatore

Trainings	Sponsor	Date	No.of participants
Organic Agriculture training	SPC TANII	27.06.2019	35
Organic Agriculture training	SPC TANII	04.07.2019	39
Organic Agriculture training to organic farmers under RKVY Agri -entrepreneurships programme	RKVY	05.07.2019	20
Organic Agriculture training to organic farmers	SPC TANII	19.07.2019	33
Organic Agriculture training to organic farmers	SPC TANII	02.08.2019	31
Organic Agriculture training to organic farmers	SPC TANII	09.08.2019	30
Organic Agriculture training to organic farmers	SPC TANII	22.08.2019	40
Organic Agriculture training to organic farmers –field day	SPC TANII	07.01.2020	150
Organic agriculture stakeholder meet	Core project	21.02.2020	68

Coimbatore

- Organized "Special lecture on Nutrient buffer power concept" by Dr.K.Prabakaran Nair, Formerly Professor, National Science Foundation, Kerala on 24.4.2019.
- Training on Organic Agriculture to Agricultural Officers of Maldives from 21.10.2019 to 26.10.2019.
- Organized special lecture by Sarvdaman Patel, President, Bhaikaka Krishi Kendra, Ravipura, Anand, Gujarat, on seminar on organic farming and bio dynamic India on 30.10.2019.

- Organized three days training programme on Organic Agriculture from 10.012.19 to 12.12.19 to extension officials of Tamil Nadu under SAMETI scheme.
- Organized three days training programme on Organic Agriculture from 22.01.2020 to 24.1.2020 to extension officials of Tamil Nadu under SAMETI scheme.
- Organized Organic Stakeholder Meet on 21.02.20 with coronation of TNOCD.
- Skill training in organic agriculture were conducted all over the State of Tamil Nadu in coordination with TNAU KVKs during 27.06.19, 4.07.19, 19.07.19, 02.08.19, 09.08.19 and 22.08.19. About 211 farmers were participated.
- Organized 'Field day on organic agriculture' on 07.02.20 and 09.03.20 under TANII programme. Around 400 farmers were participated in the field day.

Ludhiana

- Agronomic practices for organic cultivation of rabi crops. In: Training camp of members of PAU organic farmers club organized by School of organic farming and Skill development center, PAU, Ludhiana. 17 Oct., 2019, and participants' no-30.
- Good Agricultural Practices (GAP) standards. In: Farmers' training on Good Agricultural Practices (GAP) in wheat, PAU Ludhiana, 10 Oct., 2019, and participants' no-65.
- Marketing strategies for organic produce of club members. In: *Training camp for PAU-Organic Farmers Club*, PAU Ludhiana, 15 January 2020, and participants' no-65.
- Organic Farming: An Overview. For *RAWE students of College of Agriculture*. Department of Extension Education, PAU Ludhiana, 1 Aug. 2019, participant's farmer's no.-100.
- Organic farming standards and certification: In: Three-month skill development integrated crop production training course organized by Skill development center, PAU, Ludhiana. 19 Aug., 2019, and participants' no-20.
- Organic farming. In: *Training cum exposure visit of farmers of Jammu division of J & K UT* organized by Skill development center, PAU, Ludhiana, 01 January 2020, and participants' no-55.
- Organic standards and cultivation of field crops. In: Training on PKVY for farmer clusters of districts of Amritsar, Faridkot, Hoshiarpur, Pathankot 15 January 2020, and participants' no-65.
- PGS Certification system for organic produce. In: *Training on PKVY for farmer clusters of districts of Amritsar, Faridkot, Hoshiarpur, Pathankot*, 15 January 2020, and participants' no-65.
- Organic farming standards and certification. In: Three-month training course on integrated crop production for young farmers organized by Skill development center, PAU, Ludhiana. 16 January 2019, and participants' no-55.
- Scope of Organic cultivation. In: Training course on, "Scope of Aromatic, Medicinal and Spice crops" for farmers and farm women organized by skill development center, PAU, Ludhiana. 17 January 2020, and participants' no-20.
- Importance of Good Agricultural Practices (GAP). In: Training course on, "Pack house worker" organized by Skill development center, PAU, Ludhiana. 03 Feb., 2020, and participants' no-35.
- Organic Standards and crop production. In: Two-day training cum exposure visit of organic growers adopted by HPCL Mittal Foundation, Bathinda organized by School of Organic Farming, PAU, Ludhiana, 04 Feb., 2020, and participants' no-35.
- Tips for successful organic farming. In: Two-day training cum exposure visit of organic growers adopted by HPCL Mittal Foundation, Bathinda organized by School of Organic Farming, PAU, Ludhiana, 04 Feb., 2020, and participants' no-35.

- Organic seed production. In: *Training course on "Quality seed grower"* organized by Skill development center, PAU, Ludhiana in collaboration with ATARI-ICAR, 06 Feb., 2020, and participants' no-40.
- Scope of organic farming. In: *Training course for farmers of Kathua (J&K)* organized by skill development center, PAU, Ludhiana, 11 Feb., 2020, and participants' no-70.
- Scientific organic farming: Concepts and Principles. In: *Model training course on Integrated Farming system - An approach for climate change mitigation and natural resource management"* organized by Skill development center, PAU, Ludhiana. 18 Feb., 2020, and participants' no-30.
- Organic farming: Standards and certification. In: *Two-day training course on "Organic farming & vermicomposting" for farmers and farm women"* organized by School of Organic Farming, PAU, Ludhiana in collaboration with Skill development center, PAU, Ludhiana, 18 Feb., 2020, and participants' no-33.
- Organic cultivation of field crops. In: *Two-day training course on "Organic farming & vermicomposting" for farmers and farm women"* organized by School of Organic Farming, PAU, Ludhiana in collaboration with Skill development center, PAU, Ludhiana, 18 Feb., 2020, and participants' no-33.
- Scope of organic farming. In: *Exposure visit of 45 students of KVM School, Ludhiana* to School of Organic Farming, PAU, Ludhiana in collaboration with skill development center, PAU, Ludhiana, 25 Feb., 2020, and participants' no-45
- Organic standards and cultivation of field crops. In: *Exposure visit of farmers of Samrala tehsil* to School of Organic Farming, PAU, and Ludhiana in collaboration with KVK, Samrala (Ludhiana), 06 March 2020, and participants' no-20.

Umiam

- Field day on "No-Till Vegetable Production under AICRP - IFS (TSP) on 30 March, 2019.
- Field Day on "No-till Cultivation of Pea and Lentil in Rice Fallow and Integrated Organic Farming System (IOFS), 25 February 2020.
- Integrated Organic Farming System for Improving System Productivity and Profitability, 05 March 2020.
- Training cum awareness programme on "Integrated organic farming system for improving system productivity and profitability" at Lowland Agronomy Farm, Umiam, and 26 March, 2019.
- Two days Training Programme on "Integrated Farming Systems for Livelihood Improvement" 14-15 March, 2019.

S K Nagar

- Training programme on "Production technology of oilseed crops", "Livestock management and importance of feed and fodder", "Production technology of oilseed crops and livestock management" and "Preparation of vermin compost and management of problematic soil and water" at Aritha and Dev on 20/02/2020 and 04/03/2020.

Udaipur

- Agriculture Education Day at DOR, MPUAT, Udaipur on 3 December, 2019 and no of participants 86.
- Celebrated Mahila Kisan Diwas under Rashtriya Krishi Vikash Yojna on Organic Farming on 15 October, 2020, and no of participants 68.
- Entrepreneurship Opportunities for Agri-Students in Organic Agriculture at Directorate of Research, MPUAT, Udaipur (Raj.) on 25 January, 2020, and no of participants 70.
- Organized ICAR-CAFT 21 days Training Programme on "Productivity, Economics and Environmental Performance in Organic Agriculture" from 525 September, 2019 at MPUAT, Udaipur (Raj.) and no of participants 25.

- जैविक आदान उत्पादन हेत प्रोटोकोल एवं तकनीकों पर प्रशिक्षण on 3 Feb 2020 of state govt., officials, and no of participants 25.
- जैविक आदान उत्पादन हेत प्रोटोकोल एवं तकनीकों पर प्रशिक्षण on 6 Feb 2020 of state govt., officials, and no of participants 25.
- One Day Online Awareness Programme on Organic Farming for Quality Foods & Safe Ecosystem on the Occasion of World Food Day under Rashtriya Krishi Vikash Yojna on Organic Farming on 16 October, 2020, and no of participants 257.
- Entrepreneurship Development in Production & Marketing of Lemon Grass based Products, and no of participants 72.
- Organized one day national webinar on Scope and Scenario of Agriculture after COVID-19 at MPUAT, Udaipur on 29th May, 2020, and no of participants 890..
- One day training programme on Organic input production at Jhadole on 16 March, 2020, and no of participants 75.
- 73 exposure visits and training of farmers, extension functionaries and other stakeholders June, 2019 to June, 2020, and no of participants 3173.
- World Soil Day" at MPUAT, Udaipur on 5 December, 2019, and no of participants 110.

8.2.3. List of Radio talk/Television talks

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.

Jabalpur

- For Television talks Reliance Foundation Channel on 1st Feb 2020
  - ✓ Conservation Technology in maize crop production.
  - ✓ Integrated Farming Systems
  - ✓ Organic Farming
- For E-Tv Anndata on May 2019
  - ✓ Cotton production technology
  - ✓ Groundnut production technology
  - ✓ Pulses production technology

Ludhiana

- Television talk Jevik kheti de miar ate kisana layee sujaa, AIR, Jalandhar, 16.05.2020
- Radio talk Jevik kheti de miar ate kisana layee sujaa, AIR, Jalandhar, 16.05.2020

Udaipur

- Dr. S. K. Sharma delivered talk on topic “Locust problem and their management” in Aakashvani, Udaipur
- Dr. Roshan Choudhary delivered talk on topic “Rabi Faslon main Vegyanic paripakvata kadhar par katai” on 12.03.2020. Aakashvani, Udaipur

8.2.4. Gosthis

S K Nagar

- One Kishan gosthi & Shibir at Aritha on 20/02/2020
- One Kishan gosthi & Shibir at Dev on 04/03/2020

A training programme on soil health management under SCSP at ICAR-IISS was organized on 6th December, 2019 under the ‘Soil Health Awareness Week’ with the aim to create awareness about the importance of soil health and its prime significance for sustaining crop productivity. Training was imparted to about 50 SC farmers from different villages. Dr. Ashok K. Patra, Director, ICAR-IISS Bhopal emphasized the balance nutrient management for improvement of soil health to enhance soil productivity. He also mentioned the role of organic input for improving soil and crop quality for sustaining food and nutritional quality for the future generation. In this training programme scientist of this institute delivered lectures on different topics related the soil health and crop productivity namely best agriculture management practices, organic farming, composting technologies, soil quality, agro-techniques etc. On this occasion, field visits to the field experiments and composting unit at IISS, Bhopal were also organized for the farmers.

A Training on soil health management at ICAR-IISS (6th December, 2019)

Training-cum-farmer-Scientist interactive meet was organized at Khamkheda village (Dist Bhopal) on 7/12/2019 under the umbrella of “Soil Health Awareness Week”. About 100 farmers from Khamkheda as well as nearby villages participated in this training cum interactive meet with a focus on soil health. A series of discussions were conducted by scientists/experts from ICAR- Indian Institute of Soil Science, Bhopal, ICAR- Central Institute on Agriculture Engineering, Bhopal and State department of agriculture. Some farmers pointed out the problems related to agriculture which were adequately addressed by the experts. On this occasion, soil health cards were distributed to the farmers. Experts elaborated parameters mentioned on soil health cards including critical ranges and suggested the nutrient application strategies. The remedial measures were suggested based on the symptoms of plant samples brought in by a farmer.


Training-cum-Farmer-Scientist interaction organisedatKhamkheda village (Dist Bhopal) on 7/12/2019

SwachchhataPakhwada (16-31 Dec 2019):

As per the assigned activity by nodal officer of the SBM, the team led by Dr. A. B. Singh (I/C HOD Soil Biology Division) took up cleanliness drive in and around the IISS campus and waste management activity on 20.12.2019. Door to door collection of kitchen waste from IISS colony quarters was done. While collecting, the residents were requested to segregate the household waste to the possible extent and store dry waste in blue and decomposable waste in a green box. The collected waste was segregated and decomposable material was kept in family net vessel vermicomposting unit developed by the division for recycling of kitchen waste. Also prepared vermicompost from kitchen waste of previous batch was a processed and packed in biodegradable bag mainly for kitchen gardening. The plastics and poly bags spread around the farm pond, composting pits, overhead water supply tank and children's park of residential colony were collected and placed in specified dust bean. Agro waste such as corn stalk were collected and kept in composting pit for decomposition.


Segregation of kitchen watse for vermicomposting in family net vessel


Feeding the kitchen waste in family net vessel


Feeding the kitchen waste in family net vessel


Composting of agro wastes (Maize stalk)

Processing and packing of vermicompost in biodegrdable bags

Coimbatore

Name of the Training	Name of the Scientist	Date	Sponsor	Host Institution
Information and communication technologies for empowering farm women	Dr.R.Sunitha Asst. Prof. (ENS)	1.2.2019 to 06.2.2019	NAARM, Hyderabad Hyderabad	NAARM, Hyderabad Hyderabad
Winter school on Technological advance made, priorities and future strategies on Organic Agriculture for Sustainable farm production and doubling farmers Income	Dr. R. Sunitha Asst. Prof.(ENS	03.12.2019 to 23.12.2019	UAS, Organic Farming Research Institute, University of Agricultural Sciences, Raichur, North Karnataka	UAS, Organic Farming Research Institute, University of Agricultural Sciences, Raichur, North Karnataka
Automated Weather Forecasting –Web through App	Dr.R.Jansirani Professor (Agrl.Extension)	20.2.2019	ACRC,TNAU Coimbatore	TNAU Coimbatore
On farm production of biological agents and microbial bio pesticides	Dr.K.Ganesan Asst. Prof.(Ento)	13.5.2019 to 22.5.2019	IMPH, Hyderabad	IMPH, Hyderabad
Information and communication technologies for empowering farm women	Dr.R.Sunitha Asst. Prof. (ENS)	1.2.2019 to 6.2.2019	NAARM, Hyderabad Hyderabad	NAARM, Hyderabad Hyderabad
Winter school on Technological advance made, priorities and future strategies on Organic Agriculture for Sustainable farm production and doubling farmers Income	Dr. R. Sunitha Asst. Prof.(ENS)	03.12.2019 to 23.12.2019	UAS, Organic Farming Research Institute, University of Agricultural Sciences, Raichur, North Karnataka	UAS, Organic Farming Research Institute, University of Agricultural Sciences, Raichur,
Automated Weather Forecasting –Web through App	Dr.R.Jansirani Professor (Agrl.Extension)	20.2.2019	ACRC,TNAU Coimbatore	TNAU Coimbatore
On farm production of biological agents and microbial bio pesticides	Dr.K.Ganesan Asst. Prof.(Ento)	13.5.2019 to 22.5.2019	IMPH, Hyderabad	IMPH, Hyderabad

Dr. N. Ravisankar's visit to AINPOF trails, Coimbatore

Jabalpur

- Monitoring visit of Sub centres (Rewa, Powarkheda, Umaria and Anuppur).
- Meeting with honorable Finance Minister Govt. of M.P. on 10-9-2019 regarding sugarcane production in Jabalpur District.
- Contingent crop plan for Kharif 2020 submitted to DRS as desired by Govt. of M.P.
- Submitted best practices under Agriculture- Integrated Farming System, as desired by NEETI Ayog Govt. of India.

S K Nagar

Many scientists, Dignitaries, Scholars and farmers visited to the Integrated Farming Systems, S.D.A.U., Sardar krushi nagar during 2019-20. Knowledge of farming systems was imparted to RAWE students of different universities and field expose was shared with farmers of different districts who occasionally visited to centre.

S. No.	Date	Visitors address/Institutes/ Place	Type of Beneficiaries
1	29th April 2019	DON BOSCO, Kapadvanj and Dakor	160 Farmers +2 staff
2	20th July 2019	FTC, Patan	60 Farmers
3	23th July 2019	ATMA, Kheda	51 Farmers+ 1 staff
4	7th Aug 2019	ATMA, Patan	100 Farmers+ 3 staff
5	8th Aug 2019	SSK, SKnagar	37 Farmers
6	19th Aug 2019	KVK, Tharad	46 Farmers
7	27th Aug 2019	FTC, Bhuj	35 Farmers
8	28th Aug 2019	ATMA, Navsari	54 Farmers+ 1 staff
9	30th Aug 2019	FTC, Deesa	44 Farmers
10	31st Aug 2019	Vadanagar	50 Farmers
11	12th Sep 2019	FTC, ATMA	30 Farmers
12	13th Sep 2019	FTC, Patan	60 Farmers
13	16th Sep 2019	ATMA, Jaipur	50 Farmers+ 2 staff
14	17th Sep 2019	Polytechnic students	20 students + 2 staff
15	17th Sep 2019	ATMA, Chhota Udaipur	50 Farmers+ 3 staff
16	20 Sep 2019	ATMA	20 Farmers + 1 staff
17	26th Sep 2019	ATMA	30 Farmers + 1 staff
18	7th Oct 2019	RAVE students, Navsari	120 students + 3 staff
19	10th Oct 2019	FTC, Khedbrahma	48 Farmers
20	10th Oct 2019	FTC, Deesa	30 Farmers
21	23rd Oct 2019	KVK, Deesa	21 Farmers
22	24th Oct 2019	FTC, Patan	60 Farmers
23	7th Nov 2019	Karol, Prantij	32 Farmers
24	15th Nov 2019	FTC, Deesa	31 Farmers
25	21st Nov 2019	KVK, Tharad	34 Farmers
26	22nd Nov 2019	ATMA, Shirohi	27 Farmers + 1 staff
27	26th Nov 2019	FTC, Deesa	59 Farmers
28	2nd Dec 2019	FTC, Junagadh	35 Farmers

S. No.	Date	Visitors address/Institutes/ Place	Type of Beneficiaries
29	7th Dec 2019	Danta	16 Farmers
17	12th Dec 2019	Lunavada, Mahisagar	114 Farmers
18	18th Dec 2019	Social Welfare Foundation, Radhanpur	10 Farmers
19	31st Dec 2019	ATMA, SDAU	41+ 3 staff
20	7th Jan 2020	Aravalli	36 Farmers
21	16th Jan 2020	KVK, Tharad	34 Farmers
22	17th Jan 2020	BRS students	35 students + 2 staffs
23	31st Jan 2020	GSFC and SSK, FYTP program	38 Farmers + 2 Staffs
24	10th Feb 2020	ATMA, Tapi	54 Farmers + 2 Staff
25	18th Feb 2020	Jambusar	44 Farmers
26	2nd March 2020	Mahesana	75 Farmers
27	3rd March 2020	SSK, SKNagar	11 Farmers
28	13th March 2020	ICDP, Patan	29 Farmers

Farmers, students, scientists and trainers visited AICRP-IFS centre (2019-20)

Umiam

Organic production technologies of 30 crops (cereals, pulses, oilseeds, vegetables etc.) were standardized under cropping system mode and a book published

Release of organic book by Hon'ble Union Minister of State for Agriculture &Farmers Welfare, Shri Kailash Choudhary and DG, ICAR, Dr T. Mohapatra

Farm Visits

Union Minister of State for Agriculture and Farmers Welfare, "Shri Parshottam Rupala

S. Bhaskar, ADG (Agronomy, Agro-Forestry and Climate Change)

Visits of college students

Udaipur

A. Visits: During 2019-20, 73 exposure visits and training of farmers, extension functionaries and other stakeholders were conducted and 3173 stakeholders participated in these programmes

Technology dissemination (Visits)

Students from MMVM, Udaipur (Rajasthan)
12th October 2019

Students from Junagarh Agriculture University, Junagarh (Gujarat) 08th October 2019

Farmers of ATMA Bharuch (Gujarat)
24th September 2019

Farmers from ATMA, Chota Udaepur,(Gujarat),
08th August 2019

Farmers from Jobner (Rajasthan) 19Th July 2019

Farmers of ATMA, Jhunjhnoo (Rajasthan) 16th October 2019

Dignitaries visits: The details of dignitaries visiting organic farming experiments and unit are given in table.

S. No.	Date	Govt. Officials/Scientist
1.	18th May 2018	Dr Kalp Verma, Assistant Director of Agriculture,Agriculture Department, Udaipur Divison, Rajasthan
2.	02th September 201	Monika Panjwani, Rockwoods High School Udaipur
3.	24th July 2019	Prof John Varghese, St Stephens College, New Delhi
4.	04th October 2019	Dr P K Singh, Director, ICAR-DWR, Jabalpur
5.	09th November 2019	Dr. P S Pandey, ADG (Agri. Education), ICAR, NewDelhi
6.	12th December 2019	Delegates from Uganda
7.	21th November 2019	Dr. G S Chundawat, Sr Scientist & HOD, KVK,Mandsaur, M.P.
8.	28th November 2019	Suresh Chand, CGM, NABARD
9.	11th March 2020	Neeraj Kumar Prajapati, Bycyle Man of IndianAgriculture.


Dr. P S Pandey, ADG (Agri. Education), ICAR, New Delhi

Neeraj Kumar Prajapati, Bycyle Man of Indian Agriculture


Mr. Suresh Chand, CGM, NABARD& Team

Delegates from Uganda

Fig. Dignitaries visits at NPOF Udaipur

Technology demonstration through exhibition in Kisan mela and other programmes:

- ICAR Sponsored 21 days CAFT training programme entitled "Productivity, Economics and Environmental Performance in Organic Agriculture" was organized during 5-25 September, 2019 at Directorate of Research, MPUAT, Udaipur. Prof. S. S. Sarangdevot, Vice-chancellor, JRN Rajasthan Vidhyapeeth University, Udaipur andDr. N. S. Rathore, Vice-chancellor, MPUAT, Udaipurwere present during the Inaugural function held on September 05, 2019 and Dr. N. S. Rathore, Vice-chancellor, MPUAT, Udaipurwas the Chief Guest during the Valedictory Function held on September 25, 2019. Twenty-five scientists of 08 disciplines (Agricultural Entomology, Agronomy, Plant Pathology, Plant Physiology (Agricultural/ Horticultural Crops), Soil Science-Soil Chemistry/Fertility/Microbiology, Agricultural Economics, Agricultural Extension & Horticulture) from 09 states (Assam, Bihar, Gujrat, Haryana, Jammu & Kashmir, Madhya Pradesh, Maharashtra,

Punjab & Rajasthan) participated in the CAFT training programmes. Eminent Resource persons delivered 49 lectures including exposure of scientists to field and laboratory work during the training programme.

- Celebration of "World Soil Day" on December 5, 2019 at MPUAT, Udaipur. 110 Scietinsts, students & farmers were participated in this programme. The programme was inaugurated by Dr N S Rathore, Hon'ble Vice Chancellor, MPUAT, Udaipur.

- Celebration of "Agriculture Education Day" on December 3, 2019 at MPUAT, Udaipur. 86 Scietinsts, students & farmers were participated in this programme. The programme was inaugurated by Dr N S Rathore, Hon'ble Vice Chancellor, MPUAT, Udaipur.

8.2.5. Linkage and collaborations

Coimbotore

- Organic Stakeholders Meet was conducted in coordination with Tamil Nadu Organic certification Department (TNOCD).

Udaipur

Sl. No.	Collaboration with	Purpose
1.	AICRP on Weed Management, MPUAT, Udaipur	• Experiment on organic weed management in Sweet corn· Experiment on organic weed management in Fennel
2.	AICRP on IFS, MPUAT, Udaipur	Geo-referenced on – farm characterization of organic growers of Rajasthan.
3.	All India Network Project on Soil Biodiversity and Biofertilizers	CFU analysis and molecular characterization
4.	Rajasthan College of Agriculture, MPUAT, Udaipur	• Growth, yield, fruit quality and economics of organic management practices on guava (Ph. D. thesis)
		• Effect of organic manures on growth, yield and quality of pomegranate (Ph. D. thesis)
		• Effect of organic manures and liquid formulations on growth, yield and quality of cauliflower (Ph. D. thesis)
		• Effect of different liquid organic manures on biochemical properties of soil and plant growth of blackgram under pot culture (M. Sc. thesis)
		• Effect of soil and foliar application of compost tea on growth, yield and quality of soybean (M.Sc. thesis)
		• Effect of aerated and non-aerated liquid manures on growth, yield and quality of organic blackgram (M. Sc. thesis)
		• Effect of cow urine-based bio stimulant on growth, yield and quality of onion (M. Sc. thesis)
		• Effect of organic manures and liquid formulations on growth, yield and quality of okra (M. Sc. thesis)
5.	Madhyantar Start up, udaipur	To provide marketing linkage to organic growers
6.	Seema Metals & Minerals, Udaipur	Research and awareness on use of silica in organic agriculture.
7.	Department of FarmMachinery, CTAE, Udaipur	Experiment regarding testing of drilling of organic manure through combined seed drill by Ph. D. student.

APPENDIX

9

Details of crops and varieties used in evaluation of organic, inorganic and integrated production systems for crops and cropping systems at various locations

Location	Crop	Variety
Bajaura	Black gram (*Kharif*)	Palampur- 93
	Bajaura	Black gram (*Kharif*) Palampur- 93
	Lady's Finger (*Kharif*)	P-8
	Tomato (*Kharif*)	Hybrid 2853
	Cauliflower (*Rabi*)	PSBK-1
	Pea (*Rabi*)	Azad P-1
	French bean (*Summer*)	Vaishnavi 264
	Tomato (*Summer*)	Hybrid Himalaya
	Summer Squash (*Summer*)	Australian Green
Bhopal	Soybean	JS-335
	Durum wheat	HI-8737
	Mustard	Pusa Bold
	Chickpea	RVG-203
	Linseed	JL-9
Calicut	Ginger	Varada, Rejatha
	Turmeric	Prathibha , Alleppey Supreme,Varna, Sobha, Sona, Kanthi, Suvarna, Suguna, Sudarsana, Kedaram, Prabha, Pragati
	Black Pepper	Sreekara, Panniyur-1
Coimbatore	G M (Daincha)	Local
	Brinijal	CO-2
	Pearl millet	CO-10
	Chillies	Co 1 Hybrid
	Barnyard millet	MDU 1
	Tomato	PKM 1
	Finger millet	CO(Ra)-15
Dharwad	Pigeonpea	TS-3R
	Greengram	DGGV 2
	Sorghum	M 35-1
	Groundnut	GPBD 4
	Hy. cotton	ARBH-813
	Maize	NK-6240
	Chickpea	Jaki-9218
	Safflower	A1
Karjat	Rice	Karjat–4
	Brinijal	Krishna F1
	Chickpea	Vijay

Location	Crop	Variety
	Field bean	Konkanwal-1
	Onion (White)	Alibag local
Jabalpur	Basmati rice	Pusa Basmati -1
	Wheat	MPO-1106
	Chickpea	JG-322
	Berseem	JB - 1
	Vegetable pea	Arkel
	Maize fodder	African Tall
	Sorghum fodder	MP Chari
Ludhiana	Basmati rice	Panjab basmati 1509
	Kharif moong	ML 2056
	Summer Moong	SML 832
	Soyabean	SL 958
	Wheat	PBW 343
	Sunhemp	Local
	Chickpea	PBG 7
Modipuram	Basmati rice	PB-6
	Coarse rice	Saket-4
	Maize Grain	Bajaura pop corn
	Maize (Green cob)	Madhuri sweet corn
	Wheat (durum)	HI - 8498
	Okra	Arka Anamika
	Potato	Chipsona-3
	Barley	DWRB-91
	Green gram	Pusavishal
	Mustard	Pusa bold
Pantnagar	*Sesbania*	Pant Ses-1
	Basmati rice	Pusa basmati-1
	Wheat	UP-2572
	Chickpea	Pant kabuli chana-1
	Vegetable Pea	Arkel
	Potato	Kufri jyoti
	Coriander	Harit RS-5
Raipur	Soybean	JS – 9752
	Maize	Sugar-75
	Vegetable pea	Pant sabji matar" (PSM 3)
	Chilli	Agnirekha
	Onion	Nasik red
Ranchi	Rice	Birsamati
	Wheat	K- 9107
	Onion	Arka niketan
	Potato	Kufri Ashoka
	Okra	Aprajita
Umiam	Rice (sunken bed) *kharif*	Megha Aromatic-2, Shahsarang-1,Lampnah, Ngoba

Location	Crop	Variety
	Broccoli	Green Magic
	Carrot	New Koroda
	Potato	Kufri jyoti
	French bean	Naga local
	Tomato	Rocky
	New Centres	
Ajmer	Green gram	SML-668
	Fennel	-
	Cluster bean	RGC-1038
	Coriander	-
Gangtok	Maize	RCM-1-1
	Ginger	*Gorubuthane*
	Turmeric	RCT-10
	Soybean	RCS-1-10
	Buckwheat	Local Teethay
	Rajmash	SKR-57
	Blackgram	SK-PD-3 (Pahenlo dal)
	Toria	TS-38
Narendrapur	Paddy	Shatabdi/Pusa Basmati 1
	Brocolli	Princess
	Veg. Pea	MS10
	Mustard	B9
	French Beans	Falguni
	Green gram	Samrat
	Sesame	Tilotomma
Sardar Krushinagar	Groundnut	TG 37
	Kharif Green gram	GM 4
	Wheat	GW 451
	Fennel	GF 12
	Summer Green gram	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	PHM-3
	Wheat (Durum)	HI 8713
	Wheat (Aestivum)	Raj 4120
	Gram	GNG 1581
	Fenugreek	RMT-305
	Soyabean	RKS-24

ANNEXURES

10

Contact Address of NPOF Centres (as on 31 March 2021)

ICAR-IIFSR, Modipuram

Name and address	Phone no.	Email
Dr. Sunil Kumar, Director ICAR-Indian Institute of Farming Systems Research, Modipuram, Meerut-250 110	(Off.) 0121- 295 6318 (Fax) 0121-288 8546 (Mob.) 09415719637	director.iifsr@icar.gov.in
Dr. N. Ravisankar, Project Coordinator (AICRP-IFS) & National Principal Investigator, AI-NPOF, ICAR-Indian Institute of Farming Systems Research, Modipuram, Meerut-250 110	(Off.) 0121-288 8571 (Fax) 0121-288 8546 (Mob.) 08755195404	npinpof.iifsr@gmail.com; npinpof.iifsr@icar.gov.in
Dr M. Shamim, Senior Scientist (Agricultural Meteorology) & Associate (NPOF), Project Coordination Unit, ICAR-Indian Institute of Farming Systems Research, Modipuram, Meerut-250 110, U.P.	(Fax) 0121-288 8546 (Mob.) 08171812619	shamimagrimet@gmail.com
Dr Meraj Alam Ansari, Senior Scientist (Agronomy) & Associate (NPOF), Project Coordination Unit, ICAR-Indian Institute of Farming Systems Research, Modipuram, Meerut-250 110, U.P.		
Dr. Raghuveer Singh, Scientist (Agronomy) & Associate (NPOF), Project Coordination Unit, ICAR-Indian Institute of Farming Systems Research, Modipuram, Meerut-250 110, U.P.	(Fax) 0121-288 8546 (Mob.)	rsbicar@gmail.com
Dr Vipin Kumar, Chief Technical Officer, Project Coordination Unit, ICAR-Indian Institute of Farming Systems Research, Modipuram, Meerut-250 110, U.P.	(Fax) 0121-288 8546 (Mob.) 09457267100	vipin.kumar2@icar.gov.in, vipinpdfsr@gmail.com

Principal Investigators at Centres

Sl. No.	State	Location	Name & Designation	University / Institute	Phone no.	Email
1.	Ajmer	Dr. Shiv Lal,	Sr. Scientist & PI (AI-NPOF)	ICAR-National Research Centre on Seed Spices, Tabiji Farm, Beawar Road, Ajmer 305 206	94693 39841	ajmer.npof@gmail.com shivcith@gmail.com
2.	Almora	Dr. Amit Kumar	Scientist & PI (AI-NPOF)	Scientist & PI (AI-NPOF), ICAR- Vivekananda Parvatiya Krishi Anusandhan Sansthan, Mall Road, Almora -263 601	08527184228	amit.kumar2@icar.gov.in Almora.npof@gmail.com
3.	Bajaura (Kukku)	Dr D.K. Parmer	Principal Scientist and Principal Investigator	CSKHPKV, Hill Agricultural Research and Extension Centre Bajaura, Kullu-175125	9418193270	skthpkv@gmail.com bajaura.npof@gmail.com
4.	Bhopal	Dr. A.B. Singh,	Principal Scientist & PI (AI-NPOF)	ICAR-Indian Institute of Soil Science, Nabibagh, Berasia Road, Bhopal -462 038	9425013470	bhopal.npof@gmail.com a.singh@icar.gov.in, abs980649@gmail.com.
5.	Calicut	Dr. (Mrs) C.K. Thankamani,	Principal Scientist & PI (AI-NPOF)	ICAR-Indian Institute of Spices Research, Kozhikode (Calicut)-673 012	9495083552	calicut.npof@gmail.com thankamani@spices.res.in
6.	Coimbatore	Dr R. Krishnan	Prof & Head and PI (AI-NPOF)	Sustainable Organic Agriculture, Tamil Nadu Agricultural University, Coimbatore-641 003	9443209452	organic@tnau.ac.in
7.	Dharwad	Dr. R. A. Negalur	Principal Scientist & PI (AI-NPOF)	Institute of Organic Farming, University of Agricultural Sciences, Dharwad, 580 005	8362214314/ 2955809 (O)	dharwad.npof@gmail.com, rajeevnb8910@gmail.com iofdwd@uasd.in
8.	Gangtok	Dr. Shaon Kumar Das	Sr. Scientist & Principal Investigator (AI-NPOF)	ICAR-RC-NEH, Sikkim Centre, Tadong, Gangtok 737102	9475680474	gangtok.npof@gmail.com jdsikkim.icar@gmail.com
9.	Jabalpur	Dr. P.B. Sharma,	Chief Agronomist & PI (AI-NPOF) Krishi Nagar Colony, Adhartal, Jabalpur482004	Jawaharlal Nehru Krishi Vishwa Vidyalaya,	94251 63385 94251 63385	kkagrawal59@gmail.com jabalpur.npof@gmail.com Jabalpur.main@gmail.com
10.	Karjat	Dr. S.B. Bhagat,	Chief Agronomist & PI (AI-NPOF)	Dr. Balasaheb Sawant Konkan Krishi Vidyapeeth, Regional Agricultural Research Station, Karjat, Dist. Raigadm	8879247408,	sbbhagat1791@gmail.com karjat.npof@gmail.com

Sl. No.	State	Location	Name & Designation	University / Institute	Phone no.	Email
11.	Ludhiana	Dr. C.S. Aulakh,	Principal Agronomist & PI (AI-NPOF)	School of Organic Farming, Punjab Agricultural University, Ludhiana-141 004	9888350044	ludhiana.npof@gmail.com csaulakh@rediffmail.com aulakhcs@pau.edu
12.	Modipuram	Dr. R. P. Mishra,	Principal Scientist & PI (AI-NPOF)	ICAR- Indian Institute of Farming Systems Research, Modipuram, Meerut-250110	9412578625	modipuram.npof@gmail.com rp_min@yahoo.co.in
13.	Narendrapur	Dr. Gautam Chatterjee,	Asst. Prof. & PI (AI-NPOF)	SA&RD, RKMVU, PO Belur Math, District: Howrah-700 103	9972301930	gutamchatterjee84@ gmail.com
14.	Pant Nagar	Dr. D.K. Singh,	Prof. & PI (AI-NPOF)	G. B. Pant University of Agriculture and Technology, Pantnagar, Udham Singh Nagar-263145	9411320066	dhananjayrahul@ rediffmail.com
15.	Raipur	Dr. M.C Bhambri,	Chief Agronomist & PI (AI-NPOF)	Indira Gandhi Krishi Vishwavidyalaya, Krishak Nagar, Raipur-492 012	9406470437	mcbhambri@yahoo.co.in raipur.npof@gmail.com
16.	Ranchi	Dr. Mohmmad Nayar Ali	Assist Prof. & PI (AI-NPOF)	Birsa Agricultural University Kanke, Ranchi - 834 006	9801241156	ranchi.npof@gmail.com nali@bauranchi.org
17.	Sardar krushinagar	Dr. L.J. Desai,	Chief Agronomist & PI (AI-NPOF)	Dantiwada Agricultural University, Sardar krushinagar - 385 506. Dist: Banaskantha	9429310273	sknagar.main@gmail.com sknagar.npof@gmail.com
18.	Thiruvanan-thapuram	Dr. (Mrs) G. Suja,	Principal Scientist & PI (AI-NPOF)	ICAR-Central Tuber Crops Research Institute, Sreekariyam, Thiruvananthapuram 695 017	9847248697	thiruvananthapuram. npof@gmail.com sujagin@yahoo.com
19.	Udaipur	Dr. S.K. Sharma,	Director of Research & PI (AI-NPOF)	Maharana Pratap University of Agriculture & Technology, Udaipur-313 001	9414430757, 7568830757	udaipur.npof@gmail.com shanti_organic@ rediffmail.com
20.	Umiam	Dr. Jayanta Layak,	Senior Scientist & PI (AI-NPOF)	ICAR-RC-NEH Region. Umroi Road, Umiam, 793 103 4.	9101011194	umiam.npof@gmail.com jayanta.icar@gmail.com

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