Annual Report 2016-17

Organically Managed Soil

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 (U.P.), 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 resources for 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.
- Coordinate and monitor integrated farming systems research in the country.

All India Coordinated Research project on Integrated Farming Systems (AICRP on IFS) is an integral part of ICAR-IIFSR with 75 centres to undertake on-station main (25 no's), on-station sub (12 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 (NPOF) with 20 centres.

Annual Report
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भाकृअनुप
ICAR

ALL INDIA NETWORK PROGRAMME ON ORGANIC FARMING

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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 13 centres functioning from 2004-05 and 7 new centres started from 2015-16 and ICAR-IIFSR, Modipuram (compilation, report writing, editing and printing).
- The Annual Report 2016-17 is based on experimental data generated during *kharif*, *rabi* and *summer* seasons of 2015-16. The other details are relevant up to 31 March 2017.
- 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).

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All India Network Programme on Organic Farming (AI-NPOF) was initiated in 2004 with 13 co-operating centres in 12 states. During XII plan, in the year 2015-16, the numbers of centres have been increased to 20 from 13. Presently, the scheme covers 16 states by involving 11 State Agricultural Universities, 7 ICAR institutes and 1 deemed (special heritage) university. The results of the experiments conducted during 2015-16 at 20 co-operating centres are processed and compiled in the Annual Report 2016-17 of the scheme. I take this opportunity to record my sincere thanks to **Dr T. Mohapatra**, Secretary, Department of Agricultural Research and Education and Director General, Indian Council of Agricultural Research, New Delhi for offering critical comments and guidance for improving the activities of the scheme constantly. I extend my gratitude to **Dr. K. Alagusundaram**, Acting Deputy Director General (Natural Resource Management) for his constant support extended to the scheme. The time to time guidance and specific inputs on technical and administratve matters of the scheme received from **Dr S. Bhaskar**, Assistant Director General (Agronomy, Agroforestry and Climate Change) for improving the performance and output of the scheme is duly acknowledged. Scientific inputs received from **Quinquennial Review Team (QRT), Research Advisory Committee (RAC)** and **Institute Management Committee (IMC)** are thankfully acknowledged as those inputs provided valuable help in taking new initiatives, shaping and improvement of the programme for practical applications.

I am highly thankful to each and every one of the scientists and research fellows involved in the scheme at 20 centres for putting the meticulous effort to conduct the field experiments, lab analysis and generating data. The sincere efforts put forth by **Dr. N. Ravisankar**, Principal Scientist and National Principal Investigator deserves appreciationfor overall super vision of preparing the report. I also extend my appreciation to **Dr M. Shamim,** Scientist and **Dr Vipin Kumar**, Chief Technical Officer for their sincere efforts in compilation of the data, its statistical analysis, drafting and proof correction.

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 also acknowledged. I am sure; the significant findings obtained from the experiments especially Integrated Organic Farming System (IOFS) modelsare of practical in nature and can be adopted by organic growers for reducing external inputs under organic production system.

(AS Panwar)
Director

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जैविक खेती पर अखिल भारतीय नेटवर्क कार्यक्रम के अंतर्गत वर्ष 2015–16 के दौरान किए गए मुख्य शोध निष्कर्ष नीचे दिये गये है।

1- tSfod] jlk;fud vkj ,dhd`r ¼tSfod dh vkj½ mRiknu ç.kkyh¸ksa dk eY;kdu

- **ckt kjk** (हिमाचल प्रदेश) मे गर्मी में उगाए जाने वाले टमाटर की अधिकतम उपज (10360 किग्रा./हे.) जैविक प्रबंधन के तहत 75 प्रतिशत जैविक उर्वरक और 25 प्रतिशत अभिनव प्रयोग से प्राप्त की जो रसायनिक की तुलना में 110 प्रतिशत अधिक थी। एकीकृत प्रबंधन के तहत 50 प्रतिशत प्रत्येक जैविक और रसायन के साथ फूलगोभी (11560 किग्रा./हे.), उड़द (990 किग्रा./हे.), भिंडी (10510 किग्रा./हे.) और मटर (7007 किग्रा./हे.) की अधिकतम उपज दर्ज की गई जबकि फ्रेंचबीन और कद्दू की अधिकतम उपज क्रमशः 7270 और 15310 किग्रा./हे. 75 प्रतिशत जैविक और 25 प्रतिशत अजैविक (एकीकृत प्रबंधन) के तहत दर्ज की। रबी फसल फूलगोभी और मटर, खरीफ फसल उड़द और भिंडी की उपज में क्रमशः 27.6, 17.5, 10.0 और 37.7 प्रतिशत की वृद्धि एकीकृत प्रबंधन (50 प्रतिशत प्रत्येक जैविक और रसायन) का प्रयोग करने पर पाई गई। ग्रीष्म फ्रेंचबीन और कद्दू की उपज में 26.6 और 49.6 प्रतिशत की वृद्धि 25 प्रतिशत कम जैविक खाद के रूप में देने पर दर्ज की गई। विभिन्न फसल प्रणालियों में फूलगोभी–कद्दू प्रणाली ने अधिकतम फूलगोभी समतुल्य उपज 23170 किग्रा./हे. दर्ज की। जैविक, अजैविक और रासायनिक प्रबंधन के बीच में अधिकतम उपज 21530 किग्रा./हे. एकीकृत प्रबंधन (50 प्रतिशत प्रत्येक जैविक और रसायन) का प्रयोग के साथ दर्ज की गयी।

- **Hkksiky** (मध्य प्रदेश) में सोयाबीन की अधिकतम औसत उपज 100 प्रतिशत जैविक प्रबंधन के तहत 652 किग्रा./हे. दर्ज की गई जो अजैविक प्रबंधन की तुलना में 27.8 प्रतिशत अधिक थी। 100 प्रतिशत जैविक पोषक तत्वों के प्रबंधन से सरसों, गेहूँ, चना और अलसी की अधिकतम उपज क्रमशः 3181, 1196, 1515 और 1526 किग्रा./हे. दर्ज की गई थी और उपज में क्रमशः 20.3, 23.7, 16.9, और 11.6 प्रतिशत का अंतर पाया गया। 100 प्रतिशत जैविक पोषक तत्व प्रबंधन के द्वारा सोयाबीन समतुल्य उपज अधिकतम (2306 किग्रा./हे.) दर्ज की गई। कृषि प्रणालियों में सोयाबीन–अलसी ने (2291 किग्रा./हे.) के साथ अधिकतम उपज दर्ज की थी इसके बाद सोयाबीन–गेहूँ (2188 किग्रा./हे.) प्रणाली ने अपनी उपज दर्ज की।

- **dkyhdV** (केरल) में हल्दी की अधिकतम उपज (29300 किग्रा./हे.) एकीकृत पैकेज 50 प्रतिशत जैविक+50 प्रतिशत रसायनिक के साथ दर्ज की गई उसके बाद जैविक खादों के माध्यम से 75 प्रतिशत जैविक खाद+25 प्रतिशत रासायनिक खाद के प्रयोग परिणामस्वरूप हल्दी की उपज (27300 किग्रा./हे.) तथा जैविक खाद के माध्यम से 100 प्रतिशत पोषक तत्वों की आपूर्ति करने पर उपज (26000 किग्रा./हे.) पाई गई। हल्दी की सभी किस्मों ने एकीकृत प्रबंधन 75 प्रतिशत जैविक खाद+25 प्रतिशत रासायनिक के तहत अच्छा प्रदर्शन किया।

- **dk;EcVj** (तमिलनाडु) में एकीकृत पैकेज के अंतर्गत 75 प्रतिशत पोषक तत्वों की आपूर्ति जैविक खाद के रूप में करने पर कपास की उपज में 23.6 और 7.23 प्रतिशत की वृद्धि होना पाया गया जबकि मक्का (10.2 और 16.0 प्रतिशत), सूरजमुखी (18 और 20.1 प्रतिशत) और चुकंदर (15.9 और 18.6 प्रतिशत) की उपज

में वृद्धि क्रमशः जैविक और रासायनिक प्रबंधन की तुलना में एकीकृत प्रबंधन के साथ होना दर्ज किया गया।

- /kkjokM (कर्नाटक) में अरहर, मूंग और मूंगफली ने 100 प्रतिशत अजैविक प्रबंधन के साथ अधिकतम उपज क्रमशः 1588, 2443 और 2443 किग्रा./हे. दर्ज की जबकि सूरजमुखी, ज्वार और मक्का की अधिकतम उपज क्रमश 1266, 2989 और 7116 किग्रा./हे. राज्य द्वारा सिफारिश के तहत दर्ज हुई। लोबिया और चने ने जैविक प्रबंधन पैकेज के तहत अधिकतम उपज 173 और 1251 किग्रा./हे. 75 प्रतिशत जैविक+25 प्रतिशत अभिनव प्रयोग के साथ दर्ज की। पोषक तत्व प्रबंधन के बीच में एकीकृत की तुलना में 100 प्रतिशत जैविक प्रबंधन के साथ लोबिया और चने की फसल ने लगभग 2.5 गुना अधिक उपज और लगभग 7 गुना अधिक उपज रासायनिक की तुलना में प्राप्त की थी। कुसुम, अरहर, मूंग, ज्वार और मूंगफली की उपज में क्रमशः 7.7, 10. 3, 12, 1.2 और 14 प्रतिशत की गिरावट जैविक प्रबंधन के साथ पाई गई।

- tcyiqj (मध्य प्रदेश) में धान की अधिकतम औसत उपज (3724 किग्रा./हे.) रसायनिक पोषक तत्व प्रबन्धन के तहत दर्ज की गई जो जैविक और एकीकृत पोषक प्रबन्धन के साथ क्रमशः 8.1 और 10.5 प्रतिशत घटी थी। रबी सीजन के दौरान गेहूँ (4880 किग्रा./हे.), चना (6.54 किग्रा./हे.) बरसीम (300 किग्रा./हे. बीज ओर 62500 किग्रा./हे. चारा), सब्जी मटर (4680 किग्रा./हे.) तथा ग्रीष्म सीजन के दौरान मक्का चारा (40410 किग्रा./हे.) और ज्वार चारा (44690 किग्रा./हे.) की अधिकतम उपज 100 प्रतिशत रसायनिक पोषक तत्व प्रबन्धन के साथ दर्ज की गई। रसायनिक पोषक प्रबन्धन की तुलना में जैविक प्रबन्धन के साथ उपज में 19.9, 17.3, 4.3, 4.8, 26.6, 13.4 और 20.9 प्रतिशत की गिरावट क्रमशः गेहूँ, चना, बरसीम बीज और चारा, सब्जी मटर, चारा मक्का, और चारा ज्वार में होना पायी गयी। फसल अनुक्रमों (प्रणाली) के बीच में धान–मटर–चारा ज्वार प्रणाली ने अधिकतम समतुल्य उपज (9908 किग्रा./हे.) दर्ज की उसके बाद धान–बरसीम, धान–गेहूँ और धान–चना–मक्का चारा घटते क्रम में धान समतुल्य उपज दर्ज की।

- dtV (महाराष्ट्र) मे धान की अधिकतम पैदावार (4511 किग्रा./हे.) एकीकृत प्रबन्धन के तहत दर्ज की गई उसके बाद 100 प्रतिशत रसायनिक प्रबन्धन के अर्न्तगत 4506 किग्रा./हे. उपज दर्ज की। अन्य फसल जैसे मूगंफली, सरसों, और डॉलीकॉशबीन ने अधिकतम उपज जैविक प्रबन्धन के तहत दर्ज की जो रसायनिक की तुलना में 7.3, 12.5 और 3.6 प्रतिशत अधिक थी। 100 प्रतिशत रसायनिक स्त्रोत द्वारा पोषक प्रबन्धन, मक्का के लिये (15675 किग्रा./हे.) के साथ अच्छा पाया परन्तु रसायनिक की तुलना में जैविक के साथ 6.9 प्रतिशत की गिरावट दर्ज की गई। फसल प्रणालियों में धान–मूंगफली और धान–मक्का (मीठी मकई) द्वारा जैविक प्रबन्धन के तहत अधिकतम उपज क्रमशः 26963 और 26387 किग्रा./हे. दर्ज की गई। पोषक तत्व प्रबन्धन के बीच मे जैविक प्रबन्धन द्वारा रसायनिक की तुलना में 25.4 और 18.4 प्रतिशत अधिक धान समतुल्य उपज दर्ज की गई।

- yf/k;kuk (पंजाब) में 100 प्रतिशत जैविक खाद के प्रयोग द्वारा धान–चना–मूंग प्रणाली मे धान की अधिकतम उपज (4820 किग्रा./हे.) दर्ज की गई। सोयाबीन की भी अधिकतम उपज (3180 किग्रा./हे.) जैविक पोषक तत्व प्रबन्धन के तहत प्राप्त की गई जो एकीकृत और रसायनिक की तुलना में क्रमशः 15.9 और 59.8 प्रतिशत अधिक थी। रबी के दौरान चना ने अधिकतम उपज (2880 किग्रा./हे.) 75 प्रतिशत जैविक+25 प्रतिशत अभिनव प्रयोग द्वारा अपनाने पर प्राप्त की जो 100 प्रतिशत रसायनिक और राज्य द्वारा सिफारिश पैकेज की

तुलना में क्रमशः 4.0 और 8.9 प्रतिशत अधिक थी। गेहूँ की अधिकतम उपज (56.80 किग्रा./हे.) एकीकृत पोषक प्रबन्धन के तहत प्राप्त की जो लगभग 7.2 प्रतिशत कम दर्ज की गई। गेहूँ समतुल्य उपज (11075 किग्रा./हे.) 100 प्रतिशत जैविक प्रबन्धन के अर्न्तगत दर्ज की गई। उसके बाद एकीकृत प्रबन्धन में प्राप्त हुई। विभिन्न फसल प्रणालियों के बीच में बासमती धान–चना द्वारा (13650 किग्रा./हे.) धान समतुल्य उपज दर्ज की गई इसके बाद बासमती धान–गेहूँ प्रणाली ने (11733 किग्रा./हे.) गेहूँ समतुल्य उपज दर्ज की।

- **ekuhijs** (उत्तर प्रदेश) में रासायनिक पोषक तत्व प्रबन्धन की तुलना में जैविक प्रबन्धन के साथ बासमती धान की अधिकतम उपज (5017 किग्रा./हे.) पाई गई जो क्रमश 65.4 और 28.4 प्रतिशत (जैविक प्रबन्धन और 75 प्रतिशत जैविक+25 प्रतिशत अभिनव प्रयोग) के साथ अधिक थी जबकि मोटे धान की अधिकतम उपज (3621 किग्रा./हे.) एकीकृत प्रबन्धन में पाई गई। पॉपकार्न मक्का की अधिकतम उपज (1850 किग्रा./हे.) जैविक की और 75 प्रतिशत जैविक + 25 प्रतिशत रसायनिक के तहत दर्ज की गई जो 34.6 प्रतिशत रासायनिक की तुलना में अधिक थी जबकि मीठी मकई की अधिकतम उपज एकीकृत प्रबन्धन के तहत दर्ज हुयी। जैविक के साथ उपज में 27 प्रतिशत की कमी दर्ज की गई। जबकि जैविक की और प्रबन्धन में 22. 5 प्रतिशत की वृद्धि होना पाया गया। रबी और ग्रीष्म सीजन के दौरान गेहूँ, जौ, सरसों और मूंग की अधिकतम उपज (क्रमशः 5583, 4583, 2207 और 1035 किग्रा./हे.) एकीकृत प्रबन्धन के तहत या तो (50 प्रतिशत प्रत्येक जैविक और रासायनिक) और या (75 प्रतिशत जैविक 25 प्रतिशत रासायनिक) के साथ दर्ज की गई। आलू और भिण्डी की अधिकतम उपज 100 प्रतिशत जैविक खाद के उपयोग से जैविक प्रबन्धन के अर्न्तगत क्रमशः 23740 और 780 किग्रा./हे. दर्ज की गई।

- **izuxj** (उत्तराखंड) में रासायनिक और एकीकृत की तुलना में बासमती धान की अधिकतम उपज (6222 किग्रा./हे.) 100 प्रतिशत जैविक पैकेज के तहत पायी गयी उसके बाद 75 प्रतिशत जैविक+अभिनव प्रयोग के साथ 6150 किग्रा./हे. रही जो क्रमशः 11.8 और 4.5 प्रतिशत अधिक थी। रबी में गेहूँ की अधिकतम उपज (5096 किग्रा./हे.) एकीकृत पोषक तत्व प्रबन्धन (50 प्रतिशत जैविक+50 प्रतिशत रासायनिक) जो 7.6 प्रतिशत रासायनिक की तुलना में अधिक थी। अन्य फसले जैसे चना, धनिया और आलू की अधिकतम उपज (क्रमशः 1032, 1272 और 13961 किग्रा./हे.) जैविक प्रबन्धन के तहत पायी गई जो रासायनिक प्रबन्धन की तुलना में क्रमशः 19.4, 21.7, 23.2 प्रतिशत अधिक थी तथापि सब्जी मटर की उधिकतम उपज एकीकृत प्रबन्ध के साथ 5136 किग्रा./हे. प्राप्त हुई। विभिन्न पोषक तत्वों प्रबन्धन में से अधिकतम धान समतुल्य उपज (11612 किग्रा. /हे.) जैविक प्रबन्धन के साथ पायी गई। फसल प्रणालीयों में यह धान–चना+धनियॉ–हरी खाद प्रणाली में 12979 किग्रा./हे. दर्ज की गई।

- **jk;ijs** (छत्तीसगढ़) में सोयाबीन आधारित फसल प्रणालीयों में फसलें, जैसे सोयाबीन, मक्का, मटर और मिर्च की अधिकतम उपज क्रमशः 2143, 13994, 7906 और 9742 किग्रा./हे. जैविक प्रबन्धन के साथ 75 प्रतिशत जैविक+25 प्रतिशत अभिनव प्रयोग (वर्मीवॉस का स्प्रे) के साथ दर्ज की गई। जबकि खाद की अधिकतम उपज 16857 किग्रा./हे. राज्य द्वारा सिफारिश पैकेज के साथ दर्ज की गई जैविक से अजैविक की तुलना में उपज में अन्तर 74, 13.8, 20 और 22 प्रतिशत क्रमशः सोयाबीन, मक्का, चना और मिर्च में होना पाया गया विभिन्न फसल प्रणालियों में सोयाबीन प्याज प्रणाली ने सबसे अधिक सोयाबीन समतुल्य 10178 किग्रा./हे. दर्ज की अपितु अधिकतम सोयाबीन उपज 9556 किग्रा./हे. जैविक प्रबन्धन के तहत 75 प्रतिशत जैविक+25 प्रतिशत

अभिनव प्रयोग (वर्मीवॉस स्प्रे) के प्रयोग द्वारा होना पाया गया जो रासायनिक और राज्य द्वारा सिफारिश पैकेज की तुलना में 7.1 और 26.3 प्रतिशत अधिक थी।

- **jkph** (झारखंड) में धान की अधिकतम उपज (3602 किग्रा./हे.) जैविक प्रबन्धन के साथ 75 प्रतिशत जैविक और 25 प्रतिशत अभिनव प्रयोग (अजोला+वर्मीवॉश स्प्रे) के साथ दर्ज की गई थी तथा 100 प्रतिशत जैविक से जैविक की और (75 प्रतिशत जैविक+25 रासायनिक) का अन्तर 15 प्रतिशत था। गेहूँ की अधिकतम उपज रासायनिक पैकेज के साथ (2836 किग्रा./हे.) दर्ज की गई थी जो 100 प्रतिशत जैविक और जैविक की और प्रबन्धन के साथ रसायनिक की तुलना में 15.0 और 6.0 प्रतिशत कम थी। आलू और अलसी की अधिकतम उपज 19635 और 847 किग्रा./हे. क्रमशः जैविक पैकेज के तहत 100 प्रतिशत जैविक पोषक तत्व स्त्रोत के प्रयोग से दर्ज की थी जबकि मसूर की अधिकतम उपज (428 किग्रा./हे.) एकीकृत पैकेज (50 प्रतिशत+50 प्रतिशत रासायनिक) के साथ दर्ज की गई। रासायनिक और एकीकृत पैकेज की तुलना मे जैविक पैकेज के साथ आलू और अलसी की उपज में क्रमशः (61.8 और 48.6 प्रतिशत) तथा (34.0 और 30.1 प्रतिशत) की वृद्धि अधिक होना पायी गई। धान समतुल्य उपज (70.67 किग्रा./हे.) अधिकतम जैविक पैकेज के साथ थी यद्धपि, फसल प्रणाालियों में धान–आलु प्रणाली ने (10178 किग्रा./हे.) के साथ सबसे अधिक उपज दर्ज की जबकि धान–मसूर प्रणाली ने सबसे कम (3753 किग्रा./हे.) समतुल्य उपज दर्ज की।

- **mfe;e** (मेघालय) में ब्रोकली की अधिकतम उपज (15760 किग्रा./हे.) ऊँची क्यारी तकनीक में ब्रोकली–फ्रेंचबीन प्रणाली के साथ दर्ज की गई। विभिन्न पोशक प्रबन्धन में से, एकीकृत द्वारा अधिकतम ब्रोकली उपज (14030 किग्रा./हे.) दर्ज कराई इसके बाद जैविक प्रबन्धन के तहत (13970 किग्रा./हे.) दर्ज की गई। ऊँची क्यारी पर गाजर व आलू की अधिकतम उपज क्रमशः 15740 और 16330 किग्रा./हे. एकीकृत पैकेज में 75 प्रतिशत पोषक तत्व जैविक के रूप में देने पर प्राप्त हुई। जबकि फ्रेंचबीन और टमाटर को ऊँची क्यारी पर उगाने से अधिकतम उपज क्रमशः 9870 और 1750 किग्रा./हे. जैविक प्रबन्धन के अर्न्तगत प्राप्त की गई। फ्रेंचबीन और टमाटर की उपज में वृद्धि जैविक प्रबन्धन के साथ अजैविक की तुलना में 14.5 और 15.8 प्रतिशत तक थी वही एकीकृत प्रबन्धन में जैविक की और पैकेज के साथ आलू की उपज जैविक की तुलना में 6.2 और 3. 5 प्रतिशत अधिक पाई गई थी। नीची क्यारी विधि में धान की अधिकतम उपज (4580 किग्रा./हे.) एकीकृत प्रबन्धन के साथ दर्ज की गई इसके बाद 100 प्रतिशत जैविक के साथ उपज (4460 किग्रा./हे.) दर्ज की गई। धान की विभिन्न किस्मों के बीच में, किस्म साहसारगं नें अधिकतम उपज (4600 किग्रा./हे.) दर्ज की इसके बाद लैम्पनेह (4460 किग्रा./हे.), मेधा सुगंधित 2 (4305 किग्रा./हे.) और नगोवा (3908 किग्रा./हे.) पाई गई।

- **vtej** (राजस्थान) में धनिया और सौंफ की अधिकतम उपज एकीकृत प्रबन्धन के अर्न्तगत (75 प्रतिशत जैविक और 25 प्रतिशत अजैविक) 1219 और 2285 किग्रा./हे. क्रमशः पायी गई। इसके बाद में राज्य द्वारा सिफारिश पैकेज के तहत 1136 और 1183 किग्रा./हे. दर्ज की गई। राज्य की सिफारिश पैकेज से जैविक की और धनिया और सौंफ की उपज में क्रमशः 7.3 और 4.7 प्रतिशत की वृद्धि होना पाया गया था।

- **ujUnij** (पश्चिम बंगाल) में धान की किस्म से सोहीनी और शताब्दी ने अधिकतम उपज 5933 और 6252 क्रमशः एकीकृत प्रबन्धन के तहत दर्ज की। एकीकृत प्रबन्धन से 100 प्रतिशत जैविक और रसायनिक के बीच क्रमशः 16.5 और 10.3 प्रतिशत का अन्तर पाया गया। विभिन्न प्रणालियों में फसल जैसे, ब्रोकली और सरसों

ने अधिकतम उपज रासायनिक प्रबन्धन के तहत 1008 और 1230 किग्रा./हे. क्रमशः रबी सीजन के दौरान दर्ज की। मूंग, शिमला मिर्च, तिल ने अधिकतम उपज 100 प्रतिशत जैविक प्रबन्धन के साथ दर्ज की।

- **ljnkj Ø"kh uxj** (गुजरात) में फसलें, जैसे मूंगफली, बाजरा, मूंग, सब्जी लोबिया और सौंफ की अधिकतम उपज क्रमशः 3056, 4861, 664, 5688 और 1556 किग्रा./हे. राज्य द्वारा सिफारिश पैकेज के तहत दर्ज की गई। जो 100 प्रतिशत जैविक के साथ राज्य द्वारा सिफारिश पैकेज की तुलना में क्रमशः 38.2, 16.6, 18.1, 24.6 और 30.4 प्रतिशत कम होना पाया गया। आलू की अधिकतम उपज (31750 किग्रा./हे.) एकीकृत पैकेज (50 प्रतिशत प्रत्येक जैविक एंव रासायनिक) के तहत दर्ज होना पाया गयी तथा उपज में वृद्धि एकीकृत प्रणाली के साथ अन्य की तुलना में 77.2 प्रतिशत तक थी।

- **fr#oukeiqje** (केरल) में कसावा कन्द की अधिकतम उपज (33080 किग्रा./हे.) रासायनिक प्रबन्धन के तहत दर्ज की गई इसके बाद में एकीकृत प्रबन्धन (75 प्रतिशत जैविक एंव 25 प्रतिशत रासायनिक) के साथ उपज 31300 किग्रा./हे. दर्ज हुई थी। यद्धपि टेरो (अरबी) की अधिकतम उपज (15580 किग्रा./हे.) एकीकृत प्रबन्धन (50 प्रतिशत प्रत्येक जैविक एंव रासायनिक) के तहत दर्ज की गई। कसावा कन्द की उपज में जैविक के साथ रासायनिक और एकीकृत के उपर क्रमशः 6.5 प्रतिशत और 5.4 प्रतिशत का अन्तर पाया गया । अरबी की उपज में अन्तर जैविक से एकीकृत की ओर 28.4 प्रतिशत दर्ज किया गया।

- **mn;iqj** (राजस्थान) में मक्का और उसमें अन्त फसल उड़द की अधिकतम उपज (1333 और 93 किग्रा./हे.) एकीकृत पैकेज में पायी गयी। जहॉ तक गेहूँ की फसल (डयूरम 4167 किग्रा./हे. एस्टीवम 3000 किग्रा./हे.) और सोयाबीन (667 किग्रा./हे.) का संबन्ध है इन्होंने 100 प्रतिशत रासायनिक प्रबन्धन के तहत अच्छा प्रदर्शन किया। मीठी मकई और अन्त फसल उड़द में अधिकतम उपज जैविक प्रबन्धन के साथ दर्ज की गई जबकि अकेले उड़द में अधिकतम उपज (417 किग्रा./हे.) जैविक के अन्तर्गत 75 प्रतिशत जैविक और 25 प्रतिशत अभिनव प्रयोग के साथ दर्ज की गई। 75 प्रतिशत पोषक तत्व की आपूर्ति जैविक खाद के साथ+अभिनव प्रयोग करने पर अकेले उड़द की अधिकतम उपज प्राप्त हुई जो रासायनिक और जैविक प्रबन्धन की तुलना में क्रमशः 66.1 और 25.2 प्रति ात से अधिक थी।

2- tfod [krh dh fy;s e[; Qly dh fdLeksa dh çfrfØ;k dk eY;kdu

- **ctkjk** (हिमाचल प्रदेश) में खरीफ के दौरान टमाटर की किस्म हीमसोना ने 1948 किग्रा./हे. की अधिकतम उपज दर्ज की और किस्म आरके–123 ने अधिकतम फल/पौधा (24) के साथ अधिकतम उपज 15830 किग्रा./हे. दर्ज करायी। फली मटर की अधिकतम उपज किस्म टेनप्लस ने 6119 किग्रा./हे. दर्ज की जो किस्म निराली (5627 किग्रा./हे.) के साथ बराबरी पर थी किन्तु अन्य किस्मों की तुलना में अधिक फली/पौधा (21), दाने/फली (7) और फली की लम्बाई (8.9 सेमी) के साथ अधिकतम थी। भिंडी की किस्म चमेली–015 ने उल्लेखनीय रूप से अधिकमत उपज 12600 किग्रा./हे. फली की अधिक लम्बाई (9.1 सेमी) के कारण दर्ज की। इसके बाद इन्द्रानिल ने अधिक उपज और फल की लम्बाई क्रमशः 12099 किग्रा./हे. और 9.0 सेमी के साथ अन्य की तुलना में अधिकतम उपज दर्ज की। फूलगोभी की किस्म यूएस 178 ने उल्लेखनीय रूप से 11279 किग्रा./हे. के साथ अन्य की तुलना में अधिकतम उपज दर्ज की साथ ही साथ किस्म चन्द्रमुखी ने भी उल्लेखनीय रूप से अधिकतम फूल की उपज 10600 किग्रा./है. दर्ज की थी।

- Hkkiky (मध्य प्रदेश) में सोयाबीन की विभिन्न किस्मों में आरवीएस–2062–4 ने उल्लेखनीय रूप से 814 किग्रा./हे. की अधिकतम उपज, फलीयाँ/पौधा (36.3) के कारण से दर्ज की थी जबकि जेएस–20–34 की उपज 681 किग्रा./हे. सबसे कम पायी गई। किस्म आरवीएस– 2002–07 में उल्लेखनीय रूप से सबसे अधिक तेल की मात्रा 20.17 प्रतिशत पायी गई इसके बाद आरबीएस–2002–6 ने 19.94 प्रतिशत दर्ज की जबकि न्यूतम तेल की मात्रा किस्म जेएस–20–34 में 18.23 प्रतिशत दर्ज की गयी। सोयाबीन में प्रोटीन की मात्रा 37.89 प्रतिशत सबसे अधिक किस्म जेएस–93–05 में उल्लेखनीय रूप से पाई गई इसके बाद किस्म जेएस–20–29 में 37.87 प्रतिशत प्रोटीन पाई गयी। गेंहूँ की विभिन्न किस्मों के बीच में जीडब्लू– 366 ने अधिक दाने/बाली (75), बालियाँ/मीटर (96) और कटाई सूचकांक (47.6 प्रतिशत) के कारण 3221 किग्रा. अधिकतम उपज दर्ज की जबकि किस्म सी–306 ने सबसे कम गेहूँ की उपज 1983 किग्रा./हे. पैदा की। मक्का की किस्म कंचन ने सबसे अधिक अनाज और भूसे की उपज क्रमशः 2308 और 5234 किग्रा./हे. दर्ज की। प्रोएग्रो–4412 अन्य किस्मों की सापेक्ष अच्छी पाई गई जिसमें 10.11 प्रतिशत प्रोटीन,1.54 प्रतिशत राख और 0.9 ग्राम/16 ग्राम एन ट्रयटोफन सबसे अधिक पाया गया। चने की किस्म जेजी–130 ने सबसे अधिक उपज 1839 किग्रा./हे. दर्ज की इसके साथ में कुल जैव पदार्थ (4758 किग्रा./हे.) और पैदावार सूचकांक 39 प्रतिशत दर्ज की।

- dkyhdV (केरल) मे हल्दी की विभिन्न किस्मों की बीच में किस्म, सुर्दशना ने सबसे अधिक 36100 किग्रा./हे. की उपज दर्ज की इसके बाद किस्म सुर्वणा और कांथी की पैदावार क्रमशः 29200 और 28600 किग्रा./हे. रही। हल्दी की किस्मों से सबसे अधिक करक्यूमिन की मात्रा (4.7 प्रतिशत) किस्म प्रतिभा में पाई गई इसके बाद एलैपी सुप्रीम और केदाराम में करक्यूमिन की मात्रा दर्ज की गई। सबसे कम मात्रा 2.03 प्रतिशत किस्म सुर्वणा में पाई गई।

- dk;EcVwj (तमिलनाडु) में धान की सभी किस्मों के मूल्यांकन में, किस्म सीबी 05022 सबसे अच्छी पाई गई जिसने सबसे अधिक दाने/बाली, बालीयों में भरे दानों की अधिक संख्या के परिणामस्वरूप सबसे अधिक उपज (4780 किग्रा./हे.) दर्ज कराई। मैपिल्लई साम्बा, सीओ (आर) 48 और व्हाइट पोन्नी ने भी क्रमशः 4670, 4290 और 4200 किग्रा./हे. उपज के रूप में अच्छा प्रर्दशन किया।

- /kkjokM (कर्नाटक) में चने की किस्मों एमएबीसी–37 (2384 किग्रा./हे.), बीजीडी–103 (2361 किग्रा./हे.), एआई (2147 किग्रा/है.) और एमएबीसी–27 (2088 किग्रा/है.) की तुलना में किस्म जाकी–9218 ने क्रमशः 4.28, 5.25,15.74 और 19.03 प्रतिशत अधिक उपज दर्ज की। गेहूँ की किस्म एनआईएडब्लू (ब्रैड व्हीट) ने क्रमशः 2.73, 4.64, 5.26 और 6.98 प्रतिशत अधिक उपज किस्मों यूएएस 347 (1208 किग्रा/है.), डीडब्लूआर–2006 (1186 किग्रा./हे.), यूएएस (1179 किग्रा/है.) और बीजागा यैलो (1160 किग्रा/है.) की तुलना में दर्ज की।

- tcyiqj (मध्य प्रदेश) में धान की किस्मों में किस्म पीएस–3 ने 3525 किग्रा./है कि उपज दर्ज की उसके बाद पी एस–5 (3450 किग्रा/है.) की उपज पाई गयी इसके बाद पीएस'5 (3450 किग्रा/है.) रही। सबसे कम उपज बीवीडी–109 में (2563 किग्रा/है.) दर्ज की गई। गेंहूँ की उल्लेखनीय रूप से उच्च उपज (3921 किग्रा/है.) एचआई 1500 के साथ पाई गई जबकि न्यूनतम उपज (3345 किग्रा/है.) जेडब्लू–3020 के साथ दर्ज की गई थी। सबसे अधिक धान समतुल्य उपज धान (माधुरी)–गेहूँ (एचआई1500) के साथ 6367 किग्रा/है. थी इसके बाद जेआर–201 (धान)–जेडब्लू 3288 (गेहूँ) में (6258 किग्रा/है.) होना पाई गयी। पूसा 1–एचडी 4672 के साथ न्यूनतम धान समतुल्य उपज (5124 किग्रा/है.) दर्ज की गई।

- **dtV** (महाराष्ट्र) में अगेती बुआई की दशा में धान की किस्म साहयाद्रि–4 ने उल्लेखनीय रूप से अधिकतम उपज 6390 किग्रा/है. दर्ज की। मध्य–पछेती बुआई की दशा में साहयाद्रि–3 ने बेहतर प्रदर्शन करते हुई 6573 किग्रा/है. की उपज दर्ज की। धान की किस्मों में कर्जट–4 ने सबसे कम 3897 किग्रा/है. की पैदावार दर्ज की। मूंगफली के संदर्भ में उल्लेखनीय रूप से अधिकतम फली की पैदावार 3172 किग्रा/है. कोकंण गौरव द्वारा की गई इसके बाद जेएल 776, टीजी–26, वेस्टर्न 66 और टीए जी–24 जो सांख्यकीय रूप में एक दूसरे की बराबरी पर थी की पाई गई। जेएल–220 ने सबसे कम मूंगफली की उपज (2098 किग्रा/है.) पैदा की। फसल प्रणाली, धान (जया) और मूंगफली (कोकंण गौरव) ने उल्लेखनीय रूप से सबसे अधिक धान समतुल्य उपज 29049 किग्रा/है., शुद्ध प्रतिफल रू. 2,51,313 और प्रति रूपया खर्च पर शुद्ध प्रति फल (2.59) अन्य प्रणालियों की तुलना में प्राप्त किया।

- **yf/k;kuk** (पंजाब) में बासमती धान की किस्म एवीटी–1 (वीटी 2507) ने उल्लेखनीय रूप से सबसे अधिक पैदावार (5653 किग्रा./हे.) दर्ज की इसके बाद किस्म ईएनटी–6001, 5063 किग्रा./हे. रही जबकि पूसा बासमती–2 ने सबसे कम अनाज की उपज (3607 किग्रा./हे.) दर्ज की। गेहूँ की किस्मों में अधिकतम उपज 3750 किग्रा./हे. बीडब्लूएल–720 के द्वारा अन्य की तुलना में दर्ज की गयी। पीबीडब्लू 660 नें सबसे कम गेहूँ की पैदावार (2847 किग्रा./हे.) दर्ज की।

- **eknhiqje** (उत्तर प्रदेश) में मक्का की किस्म पीएमएच–4 (8083 किग्रा./हे.) और सीड टैक (2324 किग्रा./हे.) बाद किस्म पीएमएच–3 ने सबसे अधिक उपज (8600 किग्रा./हे.) दर्ज की जबकि सबसे कम उपज विवेक क्यूपीएम–9 ने (5116 किग्रा./हे.) दर्ज करायी। कुल आय (रूपये 1,42,442/हे.), शुद्ध आय (रूपये 90,467/हे.) और प्रति रूपये खर्च प्रतिफल (1.74) के रूप में पीएमएच–3 द्वारा अधिकतम दर्ज किया गया। सरसों की फसल में आरजीएन–229 ने उल्लेखनीय रूप से अधिकतम उपज (1975 किग्रा./हे.) दर्ज की जो सांख्यकीय के रूप में पूसा बोल्ड की बराबरी पर थी। अधिकतम कुल और शुद्ध आय और प्रति रूपये खर्च प्रतिफल भी सरसों की किस्म आजी एन–229 ने क्रमशः रूपये 82,504/हे., रूपये 45,284/हे. और 1.22 दर्ज किया था।

- **iruxj** (उत्तराखंड) में मोटे अनाज वाली धान की किस्मों में एनडीआर–359 ने (5934 किग्रा./हे.) की उपज दर्ज की जोपीडी–19 (5932 किग्रा./हे.) पीडी–18(5913 किग्रा./हे.) और यूपी आर–3425–11–1–1 (5905 किग्रा./हे.) के बराबर थी। पतले अनाज वाली धान की किस्मों में पंत बासमती धान–1 ने (4742 किग्रा./हे.) अन्य की तुलना में उल्लेखनीय रूप से अधिकतम उपज दर्ज की। गेहूँ की किस्म एचडी–2967 ने उल्लेखनीय रूप से अधिकतम उपज (3580 किग्रा./हे.) दर्ज की जो यूपी–2565 (3539 किग्रा./हे.) और पीबीडब्लू–550 (3508 किग्रा./हे.) के सांख्यकीय रूप से बराबर थी।

- **jk;ijj** (छत्तीसगढ़) में धान की सबसे ज्यादा अनाज उपज दुबराज (3722 किग्रा./हे.) में दर्ज की गई थी जो श्यामाजीरा कारीगिलस और सीआर सुगंधा धान 907 को छोड़कर बाकी किस्मों पर काफी बेहतर थी जिन्होने क्रमशः 3602, 3579 और 3423 किग्रा./हे. उपज दर्ज की। लालू–14 (1408 किग्रा./हे.) में सुगन्धित धान की सबसे कम उपज दर्ज की गई। चने की उल्लेखनीय रूप से उच्च उपज (1719 किग्रा./हे.) किस्म पीकेवी काबुली ने प्राप्त की जो आरजी–2009–01 (1692 किग्रा./हे.) जेजी–226 (1587 किग्रा./

हे.) और जेजी–11 (1505 किग्रा./हे.) को छोड़कर बाकी किस्मों की अपेक्षा अधिक थी। सबसे कम उपज चने की किस्म आरजी–2003–28 में (990 किग्रा/हे.) दर्ज की गई।

- jkph (झारखंड) में धान की किस्म एमटीयू–10 के साथ 4259 किग्रा./हे. की अधिकतम उपज प्राप्त की गई जो ललत (4099 किग्रा./हे.), बासमती (3907 किग्रा./हे.), नवीन (3889 किग्रा./हे.), पूसा सुगन्धा (3668 किग्रा./हे.) और बिरसा विकास धान–203 को छोडकर अन्य के मुकाबले उल्लेखनीय रूप से अधिक थी। गेहूँ की किस्मों में के–0307 ने उल्लेखनीय रूप से सबसे अधिक उपज 3206 किग्रा./हे. दर्ज की जो सांख्यकीय रूप से राज–4229 (3100 किग्रा./हे.), जीडब्लू–366 (2959 किग्रा./हे.) डीबीडब्लू–39 (2926 किग्रा./हे.) और बीजी–3 (2803 किग्रा./हे.) के बराबरी पर पाई गई। धान–गेहूँ प्रणाली में उत्पादकता के सन्दर्भ में, धान (एमटीयू–10)–गेहूँ (डब्लूआर–544) ने उल्लेखनीय रूप से सबसे अधिक उत्पादन (6837 किग्रा./हे.) शुद्ध आय (रूपये 67,239 किग्रा./हे.) और लाभ लागत अनुपात 1.97 दर्ज कराया जबकि सबसे कम शुद्ध आय (रूपये 49411 किग्रा./हे.) और लाभ लागत अनुपात (0.70) धान (अक्षम) –गेहूँ (बीजी–3) ने प्राप्त की।

- mfe;e (मेघालय) में टमाटर की किस्म एमटी.–2 ने अन्य की तुलना में अधिकतम उपज (22590 किग्रा./हे.) पैदा की जो ओ–17, पतंटी–10, एमटी–3, टीएमसी–9, टीएमटी–1, आरसीटी–3, टीएमटी–5 और एमसीटीआर–4 की उपज के बराबर पाई गई थी। सबसे कम टमाटर की उपज किस्म एच–86 द्वारा पैदा की गई थी। फ्रेचबीन फलियों की उल्लेखनीय रूप से अधिकतम उपज (5570 किग्रा/हे.) किस्म नागा लोकल के साथ प्राप्त हुई और सबसे कम हरी फली की उपज (10500 किग्रा/हे.) किस्म मरम के साथ दर्ज हुई। मक्का के हरे भूट्टे की अधिकतम उपज डीए 61–ए के साथ (5850 किग्रा./हे.) दर्ज हुई इसके बाद आसीएम–75 (5760 किग्रा./हे.) तथापि सबसे कम उपज (2850 किग्रा./हे.) लोकल व्हाइट के साथ दर्ज हुई थी।

- vtej (राजस्थान) में धनिया बीज की अधिकतम उपज 1247 किग्रा./हे. उल्लेखनीय रूप से आजाद धनिया–1 के साथ पाई गई इसके बाद एसीआर–1 और हिसार आन्नद की उपज दर्ज हुई जबकि आरसीआर–446 द्वारा सबसे कम उपज 989 किग्रा./हे. दर्ज की गई थी। सौंफ की फसल में, किस्म जीएफ–12 ने अधिकतम उपज (2366 किग्रा./हे.) दर्ज की जबकि किस्म सीओ–1 द्वारा सबसे कम उपज (1805 किग्रा./हे.) दर्ज की गई।

- xaxVkd (सिक्किम) में कुट्टु की उपज लोकल वीटो (1462किग्रा/हे.) और आईसी 109433 एनबीपीजीआर एचपी (1405 किग्रा/हे.) के बाद आईसी 26600 एनबीजीआर एचपी द्वारा (2978 किग्रा/हे.) अधिकतम दर्ज की गई थी।

- Lkjnkj Ø"khuxj (गुजरात) में मूँगफली की उपज उल्लेखनीय रूप से जीजी–2जी के साथ (2978 किग्रा./हे.) अधिकतम दर्ज की गई जो जीजेजी–17 (2770 किग्रा./हे.) और जीजी–5 (2682 किग्रा./हे.) की उपज की बराबरी कर रही थी। अधिकतम शुद्ध आय और लाभ–लागत अनुपात (क्रमशः रू. 130,449 किग्रा./हे. और 4.28) किस्म जीजी–2 जी के साथ पाया गया जो नजदीकी से जीजीजी–17 के साथ (रू. 1,20301/हे. और 3.95) बराबरी पर पाया गया। आलू कंद की अधिकतम उपज कुल आय और लाभ लागत अनुपात (क्रमशः 17185 किग्रा./हे., रू. 74,538/हे. और 0.75) कुफरी ज्योति कि साथ होना पाया गया जो अन्य की तुलना में उल्लेखनीय रूप से अधिक थी परन्तु कुफरी चिपसोना के बराबर थी। बाजार की अधिकतम

उपज किस्म 86एम84 के साथ (5244 किग्रा./हे.) दर्ज की गई जो 86एम.19 (4705 किग्रा./हे.) की उपज के साथ साख्येकीय रूप से बराबर थी।

- **mn;ij** (राजस्थान) में मक्का कि विभिन्न किस्मों में से प्रताप शंकर–3 में अधिकतम अनाज उपज (7021 किग्रा./हे.), शुद्ध आय (रू. 95855/हे.) और निवेश रूपये प्रति शुद्धलाभ (2.19) के रूप में अन्य किस्मों की तुलना में दर्ज की। मीठी मकई की किस्मों में किस्म, शुगर–75 ने उल्लेखनीय रूप से अधिकतम अनाज उपज (6339 किग्रा./हे.), शुद्ध आय (121734 रू./हे.) और रूपये प्रति निवेश शुद्ध लाभ (2.22) दिया था। बेबीकोर्न मक्का कि किस्मों में मामले में, पी.एम.–3 में उच्च अनाज उपज (1315 किग्रा./हे.), शुद्ध आय (रू. 56021/हे.) और प्रति रूपये निवेश शुद्ध लाभ (1.29) दर्ज किया था। पॉपकोर्न किस्मों में से वी.एल.–अम्बर में अनाज की अधिकतम उपज (4139 किग्रा/हे.), शुद्ध प्रतिफल और रूपये निवेश प्रति शुद्ध लाभ (क्रमशः रू. 128428/हे. और 2.99) दर्ज किया था। स्थानीय किस्मों में किसान द्वारा चयनित किस्म ने अधिकतम उपज (5226 किग्रा./हे.), शुद्ध आय (रू. 65800/हे.) और निवेश रूपये प्रति शुद्ध लाभ (1.52) उल्लेखनीय रूप से प्राप्त किया।

3- to mRiknu ç.kkfy;k d vrxr to&l?ku ekukFk Qly ç.kkfy;k dk eY;kdu

- **/kkjokM** (कर्नाटक)% जैविक प्रबन्धन के तहत विभिन्न कृषि संरक्षण प्रथाओं, भूमि विन्यास और फसल अवशेषों के साथ और बिना द्वारा प्रभावित विभिन्न फसल प्रणालियों के प्रदर्शन का मूल्यांकन

चौंड़ी क्यारी और कूड़ बुआई विधि में फसल अवशेष समावेशन के साथ सोयाबीन की अधिकतम उपज (1769 किग्रा./हे.) दर्ज कि गई थी जो परम्परागत समतल क्यारी बुआई विधि की तुलना में 7.4 प्रतिशत बढ़ी थी। मूँगफली, कपास और अरहर की अधिकतम उपज क्रमशः परम्परागत समतल क्यारी विधि में फसल अवशेष समावेशन के साथ क्रमशः 2656, 468 और 488 किग्रा./हे. दर्ज कि गई। जबकि मूँग कि अधिकतम उपज (1744 किग्रा./हे.) इसी विधि में बिना फसल अवशेष समावेशन के प्राप्त हुई। परम्परागत रोपण विधि में मूँगफली, कपास, अरहर और मूँग की उपज में क्रमशः 25.5, 4.5, 6.6 और18.5 प्रतिशत कि वृद्धि पाई गई। रबी के दौरान गेहूँ ने अधिकतम उपज (666 किग्रा./हे.) परम्परागत रोपण विधि में फसल अवशेष समावेशन के साथ दर्ज की। जबकि ज्वार की अधिकतम उपज चौड़ी क्यारी कूड़ विधि में फसल अवशेष समावेशन के साथ (2784 किग्रा./हे.) प्राप्त हुई। फसल अवशेष समावेशन के साथ परम्परागत रोपण विधि ने कुल प्रतिफल, शुद्ध आय और लाभ लागत अनुपात (क्रमशः रू. 1,60,821 रू. 95587, और 2.4) अधिकतम रूप में मूँग–ज्वार प्रणाली के साथ प्राप्त की। इसके बाद चौड़ी क्यारी कूड़ रोपण विधि फसल अवशेष समावेशन के साथ ने अधिकतम कुल और शुद्ध आय और लाभ लागत अनुपात (क्रमशः रू.153936, रू.85921/हे. और 2.6) प्राप्त किया। विभिन्न फसल प्रणालीयों में फसल अवशेषों का प्रयोग आच्छादन के रूप में करने पर और मिट्टी में मिलाने के उपरान्त चौड़ी क्यारी कूड़ रोपण विधि में अगली फसलों पर इसका प्रभाव अच्छा देखा गया था।

- **iruxj** (उत्तराखंड): जैविक खेती के तहत विभिन्न फसलों और फसल प्रणालियों में संसाधन संरक्षण व तकनीक का मूल्यांकन

धान की सीधी बुवाई (डी.एस.आर.)+सोयाबीन–सब्जीमटर+सरसों ने कूड़ में उच्चीकृत क्यारी प्रणाली के अन्तर्गत अन्य सभी संसाधन संरक्षण तकनीको में बासमती धान की अधिकतम उपज (4581 किग्रा./हे.) दर्ज

की जो कि बासमती धान–गेहूँ–ढेंचा प्रणाली की तुलना में 13.9 प्रतिशत अधिक थी। रबी के दौरान गेहूँ की अधिकतम उपज (3772 किग्रा./हे.) धान–गेहूँ–ढेंचा में दर्ज की गई थी जबकि सबसे कम गेहूँ की उपज (3103 किग्रा./हे.) डी.एस.आर.– गेहूँ (जीरो टिलेज)–ढेंचा मे प्राप्त हुई। डी.एस.आर.+सोयाबीन–सब्जीमटर+सरसों प्रणाली में सब्जी मटर की हरी फली की उपज (7612 किग्रा./हे.) डी.एस.आर.–सब्जीमटर–लोबिया (7154 किग्रा./हे.) की तुलना में चौड़ी क्यारी और कूड़ विधि से अधिक पाई गई। चने की अधिकतम उपज (1556 किग्रा./हे.) चौड़ी क्यारी और कूड़ पद्धति पर डी.एस.आर.–चना–मूंग के तहत पाई गई थी। चौड़ी क्यारी और कूड़ पद्धति पर अधिकतम प्रणाली उत्पादकता (11017 किग्रा./हे.) डी.एस.आर.–चना–मूंग में उल्लेखनीय रूप से दर्ज की गई थी जो कि डी.एस.आर.+सोयाबीन–सब्जीमटर+सरसों (9897 किग्रा./हे.) में ऊँची क्यारी और कूड़ सिंचाई विधि के बराबर थी। फसल प्रणाली डी.एस.आर.–चना–मूंग चौड़ी क्यारी और कूड़ पद्धति के तहत अधिकतम शुद्ध आय (रू. 214042/हे.) और लाभ लागत अनुपात (3.49) दर्ज किया गया इसके अनुसरण में प्रणाली डीएसआर+सोयाबीन–सब्जीमटर+सरसों ऊची क्यारी और कूड़ सिचांई विधि का स्थान था। डीएसआर–गेहूँ–मूंग ने सबसे कम शुद्ध आय (रू. 64258/हे.) और लाभ लागत अनुपात (0.92) चौड़ी क्यारी और कूड़ तकनीक के अन्तर्गत दर्ज किया।

- **mfe;e** (मेघालय): ऊँची और नीची क्यारी तकनीक के तहत जैव–गहन मानार्थ फसल प्रणालियों का मूल्यांकन

नीची क्यारी तकनीक में धान की औसत उपज धान–मसूर और धान–मटर प्रणाली में (क्रमशः 4060 और 3960 किग्रा./हे.) दर्ज की गयी थी। धान की किस्मों में से, शाहसरंग–1 ने धान–मसूर अनुक्रम के तहत सबसे ज्यादा अनाज उपज 4640 किग्रा./हे. दर्ज की। मसूर की उच्च उपज 1220 किग्रा./हे. धान की किस्म (विवेक धान–82) के साथ धान–मसूर प्रणाली में पायी गई। अतैव मटर की भी अधिकतम उपज धान की किस्म (विवेक धान–82) के साथ धान–मटर अनुक्रम में 4830 किग्रा./हे. दर्ज की गई थी। अधिकतम धान समकक्ष उपज (13320 किग्रा./हे.) धान (लैंपना)–मटर अनुक्रम में दर्ज की गई थी इसके बाद धान (वीडी–82)–मटर में 12690 किग्रा/है. की समकक्ष उपज पाई गई। ऊँची क्यारियों पर सब्जियों की पैदावार, आलू, फ्रेचंबीन और गाजर (क्रमशः 16800, 17600 और 27900 किग्रा./हे.) उल्लेखनीय रूप से अधिकतम दर्ज की गई। खरीफ के दौरान भिण्डी की अधिकतम उपज (9100 किग्रा./हे.) फ्रेचंबीन के साथ पायी गई थी जबकि धान समकक्ष उपज (36500 किग्रा./हे.) गाजर–भिण्डी फसल प्रणाली के तहत अधिक दर्ज की गई।

4- lefdr tSfod –f"k ç.kkyh ¼IOFS½ e,My dk fodkl

- एक एकड़ में मसाला आधारित समेकित जैविक कृषि प्रणाली मॉडल से जिसमें हल्दी (0.2 है.), केला (0.01 है.), अनानास (0.02 है.), सब्जी लोबिया (0.01 है.) और चाराघास यानि सीओ–3, सीओ–4 संकर नेपियर, कोगोंजिनल (0.14 है.) और डेयरी (दो गाय, 0.02 ह.) को स्थापित किया जा रहा है, 375 किग्रा. हल्दी, 100 किग्रा. अदरक, 683 किग्रा. चारा घास, 5 किग्रा सब्जी लोबिया की फली और 75 किलोग्राम टैपियोका का उत्पादन हुआ। दो गायों (जर्सी और जर्सी क्रॉस) और उनके बछडो वाली एक डेयरी इकाई ने प्रतिदिन 15 लीटर दूध पैदा किया। **dkyhdV** (केरल) में एकीकृत कृषि प्रणाली मॉडल (1 एकड़) से रुपये 79631 की आय प्राप्त हुई थी।

- एक एकड़ समेकित जैविक कृषि प्रणाली मॉडल जिसमें (0.12 है.) में फसल प्रणाली, भिण्डी+धनिया पत्ती–मक्काचारा+लोबिया (0.12 है.), हरीखाद–कपास–ज्वार (0.12 है.) और चाराघास (सीओसीए4) *डैसमेन्थस* (0.1 है.)+कृषिवानिकी (ढैंचा, *थैसपिसिया पोपिलिनिया, ल्यूसीमिया ल्यूकोसेफला* 0.03 है.) +डेयरी (दो गाय एक बछड़ा 0.01 है.)+वर्मीकम्पोस्ट (0.01 है.)+सीमावर्ती पेड़ (*डेसमेन्थस*, केला, *ग्लाईरिसीडिया*)+समर्थन क्षेत्रफल (खाद गढ्ढा, खलिहान फर्श, 0.01 है.) को **dk;EcVj** (तमिलनाडू) में स्थापित किया गया है। भिंडी+धनियापत्ती–मक्काचारा+लोबिया प्रणाली के अंतर्गत भिंडी की अधिकतम उपज (8313 किग्रा./हे.) और शुद्ध आय (रुपये 5794/हे.) प्राप्त हुई थी। मक्का की किस्म सीओएच (एम)–6 मॉडल प्रणाली में बोई गई थी जिसनें 4633 किग्रा./हे. अनाज की उपज, 4656 किग्रा. भूसा की उपज और शुद्ध आय रुपये 24914/हे. दर्ज कराई। मक्का की क्यारी में जैविक कार्बन की मात्रा 0.41 प्रतिशत पायी गई थी। हरी खाद–कपास–ज्वार प्रणाली में कपास की पैदावार (1558 किग्रा./हे.), शुद्ध आय (रूपये 32762/हे.) दर्ज की गई थी। ज्वार के अनाज और भूसा की उपज (क्रमशः 2658 और 5127 किग्रा./हे.) दर्ज हुई और इसने रुपये 13142 का शुद्ध लाभ अर्जित किया।

- **Lkjnkj Ø"khuxj** (गुजरात) में फसल घटक द्वारा 0.24 हेक्टेयर क्षेत्र से कुल शुद्ध लाभ रु. 42,751 प्राप्त किया गया था। अर्दुशा, नेपियर घास और नींबू घास सीमा के चारों ओर लगाया गया है जिसके खर्च की लागत रु. 1051 आई इसलिए, आईओएफएस मॉडल के सभी घटकों से कुल शुद्ध लाभ रु. 41,700 अर्जित किया गया।

- **mfe;e** (मेघालय) में समेकित जैविक कृषि प्रणाली मॉडल के तहत 0.43 हेक्टेयर क्षेत्र के साथ खेती की कुल लागत रु. 56,654/वर्ष दर्ज की गयी। खेती की कुल लागत का अधिकतम 46.6 प्रतिशत मॉडल की फसल घटक के साथ व्यय किया गया था। एक वयस्क गाय और एक बछड़े के साथ डेयरी इकाई खेती की कुल लागत का 37.7 प्रतिशत व्यय है, जबकि मत्स्यपालन घटक के लिए खेती की कुल लागत का 8.7 प्रतिशत दर्ज किया गया है। 72 वर्गमी. क्षेत्र की वर्मीकंपोस्टिंग इकाई और अन्य महत्वपूर्ण क्रियायें जैसे बाड़ रोपण, अवशेष पुर्नचक्रण, रॉक फॉस्फेट और चूने का प्रयोग पर कुल लागत का 5.5 प्रतिशत तक व्यय आया। आईओएफएस मॉडल से प्रति वर्ष रुपये 71,442 की कुल शुद्ध आय हासिल की गयी जो कि किसान की सामान्य प्रथाओं जैसे एकल धान प्रणाली या धान–सब्जियों की उन्नत फसल प्रणाली से काफी अधिक है। सबसे ज्यादा योगदान मॉडल के फसल घटक (66.5 प्रतिशत) के बाद डेयरी (23.9 प्रतिशत) और मत्स्यपालन घटक (15.2 प्रतिशत) द्वारा दिया गया था। आईओएफएस मॉडल के लाभों को ध्यान में रखते हुए 0.43 हेक्टेयर क्षेत्र से प्रति वर्ष 71,442 रुपये की शुद्ध आय के साथ रुपये 5954 प्रति माह या रुपये 196 प्रति दिन प्राप्त किया गया था जो पारिवारिक सदस्य (2 वयस्क और 2 बच्चे) द्वारा रहने के लिए मामूली राशि है।

- **mn;ij** (राजस्थान) में दक्षिणी राजस्थान के लिए एकीकृत जैविक खेती प्रणाली मॉडल स्थापित किया गया था जिससें कुल 5155 किग्रा./हे. मक्का की उपज और रुपये 43,202/हेक्टेयर की शुद्ध आय वर्ष 2015–16 के दौरान प्राप्त की गयी थी।

ABSTRACT

The salient research findings made during 2015-16 under All India Network Programme on Organic Farming is given below.

1. Evaluation of organic, inorganic and integrated production systems

- **Bajaura:** Higher tomato fruit yield was observed under organic package with 75% organic + innovative organic practices during *summer* (10360 kg/ha) and the yield difference over inorganic was to the tune of 110%. Response of cauliflower (11560 kg/ha), black gram (990 kg/ha), okra (10510 kg/ha) and pea (7060 kg/ha) were found to be higher in integrated package consisting of each 50% organic and inorganic nutrient while, *summer* frenchbean and summer squash recorded higher yield (7270 and 15310 kg/ha) with 75% nutrient from organic + 25% nutrient from inorganic. Yield was increase of 27.6 and 17.5, 10 and 37.7% with 50% reduced application of nutrients in *rabi* cauliflower and pea, *kharif* black gram and okra respectively, whereas, reverse was observed in *summer* frenchbean and squash where yield was increased of 26.6 and 49.6% with 25% reduced application of nutrients in the form of organic manures under integrated management. Blackgram-cauliflower-summer squash resulted in higher cauliflower equivalent yield (23170 kg/ha) among the cropping systems however, integrated management with 50% organic+50% inorganic dose of nutrients resulted in higher equivalent yield (21530 kg/ha) across the cropping systems.

- **Bhopal:** Higher mean yield of soybean (652 kg/ha) was recorded under 100% organic management. The yield of soybean was found to be higher by 27.8% compared to inorganic package. The yield of *duram* wheat, mustard, chickpea and linseed was recorded maximum in 100% organic management of 3181, 1196, 1515 and 1526 kg/ha respectively. The yield difference between organic and inorganic management was 20.3, 23.7, 16.9, and 11.6% for *durum* wheat, mustard, chickpea and linseed respectively. Organic management registered higher yield with 100% nutrients through organic manures (2306 kg/ha) and It was increased with organic management of 20.3 and 12.3% over inorganic and integrated practices. Among the cropping systems, soybean-linseed recorded higher yield (2291 kg/ha) followed by soybean-wheat (2188 kg/ha).

- **Calicut:** Integrated package consisting of 50% organic+50% inorganic recorded higher yield of turmeric (29300 kg/ha) followed by reduced application of nutrients (75% through organic manures+25% inorganic) 27300 kg/ha than organic management with 100% nutrients supply through organic (26000 kg/ha). All the turmeric varieties performed better with integrated package of 75% organic+25% inorganic.

- **Coimbatore:** Cotton yield was increased to the tune of 23.6 and 7.23% with reduce dose of manure with 75% nutrient only through manure under integrated package whereas the yield of maize (10.2 and 16%), sunflower (18 and 20.1%) and beetroot (15.9 and 18.6%) was increased compare to organic and inorganic package respectively.

- **Dharwad:** Pigeon pea (sole), green gram and groundnut recorded maximum yield (1588, 2443 and 2443kg/ha respectively) with 100% inorganic management while, safflower, sorghum and maize

recorded higher yield (1266, 2989 and 7116 kg/ha respectively) under state recommendation package. Cowpea and chickpea recorded maximum yield (173 and 1251 kg/ha) with organic and 75% organic +innovative practice. Among the nutrient management, crops cowpea and chickpea yield was increase with organic package more than 2.5 times over integrated and more than 7 times with inorganic. The yield reduction under 100% organic management were found to be in safflower, pigeon pea, green gram, sorghum, groundnut and maize were 7.7, 10.3, 12, 1.2and 14% respectively over inorganic nutrient packages.

- **Jabalpur:** Mean yield of rice (3724 kg/ha) was recorded under 100% inorganic management which slightly decreased with 100% organic and integrated to the tune of 8.1 and 10.5%. Yield of wheat (4880 kg/ha), chickpea (654 kg/ha), berseem seed and fodder (300 and 62500 kg/ha), vegetable pea (4680 kg/ha) during r*abi* and maize fodder (40410 kg/ha) and sorghum fodder (44690 kg/ha) during *summer* recorded higher under inorganic nutrient package with 100% inorganic nutrient management. The reduction in the yield of wheat, chickpea, berseem fodder and seed, vegetable pea maize fodder, and sorghum fodder with organic management under 100% organic manure was found to be 19.9, 17.3, 13.3 & 4.8, 26.6, 13.4 and 20.9% respectively over inorganic nutrients management. Among the crop-sequences, rice-vegetable pea-sorghum fodder led to record the highest rice equivalent yields (9908 kg/ha/year) followed by rice-berseem (fodder and seed), rice-wheat and rice-chickpea-maize fodder in descending order.

- **Karjat:** Higher mean yield of rice (4511 kg/ha) was recorded with integrated (50% organic +50% inorganic) followed by 100% inorganic management (4506 kg/ha). Other crops such as ground nut, mustard and dolichos bean recorded higher yield with organic nutrient package having 100% nutrient supply through organic sources and yield was found to be higher only 7.3, 12.3 and 3.6% over inorganic nutrient management. Inorganic nutrient management practices were found to be better for maize with 100% nutrient supply through inorganic sources (15675 kg/ha) and reduction in yield was recorded to the tune of 6.9% with organic package. Rice-ground nut and rice-maize (sweet corn for cob) system with organic package produced maximum rice equivalent yield (26963 and 26387 kg/ha) compared to other treatments. Among the management package, organic management recorded 25.4 and 18.4% higher equivalent yield over inorganic management practice respectively.

- **Ludhiana:** Maximum basmati rice yield (4820 kg/ha) was recorded with application of 100% organic manure in basmati rice-chickpea-green manure system. Seed yield of soybean (3180 kg/ha) was also obtained higher under 100% organic package and it was 45.9 and 59.8% higher to integrated and inorganic packages. During *rabi, c*hickpea (2880 kg/ha) performed better under organic with 75% organic + 25% innovative practice and produced significantly 70.4 and 78.9% more seed yield compared to 100% inorganic and state recommendation practices respectively. Wheat recorded higher yield (5680 kg/ha) in integrated package with 50% each organic and inorganic management. About 7.2% less yield was recorded with 100% organic management over towards organic management with 75% nutrient supply with organic sources+25% from inorganic sources. 100% organic practices resulted in higher wheat equivalent yield (11075kg/ha) followed by integrated with 50% organic+50% inorganic source of nutrient as compared to other nutrient packages. Among the cropping systems, wheat equivalent yield was found to be higher (13650 kg/ha) in basmati rice-chickpea followed by basmati rice-wheat (11733 kg/ha).

- **Modipuram:** Basmati rice yield was increased by 65.4 and 28.4% with organic management along with highest grain yield (5017 kg/ha) while, higher grain of coarse rice was found to be higher under integrated nutrient management (3621 kg/ha). Highest grain (popcorn maize 1850 kg/ha) was found better towards organic (75% organic + 25% inorganic) which was 34.6% higher as compared to inorganic production system, however, maize cob yield (sweet corn) recorded also higher under integrated with 50% each nutrient sources (organic and inorganic). The reduction in yield with organic was found by 27% while towards organic it was increased by 22.5% as compared to inorganic management system. During *rabi and summer*, wheat, barley, mustard and greengram recorded higher yield (5583, 4583, 2207 and 1035 kg/ha respectively) under integrated management either with 50% each organic and inorganic nutrient or 75% organic + 25% inorganic nutrient (towards organic). Potato and okra recorded higher yield (23740 and 7800 kg/ha respectively) under organic management with 100% nutrient supply through organic sources.

- **Pantnagar:** Grain yield of basmati rice (6222 kg/ha) was higher with 100% organic package followed by 75% organic +innovative practices (6150 kg/ha) as compared to inorganic and integrated management, It was found to be higher by 11.8 and 4.5% over inorganic and integrated. In *rabi*, wheat yield (5096 kg/ha) was highest under integrated package (50% each organic and inorganic) and it was increased by 7.6% compare to inorganic. Other crops like chickpea, coriander and potato also recorded higher yield of 1032, 1273 and 13961 kg/ha under organic management respectively and increase in yield was found to be 19.4,21.7 and 23.2% respectively over inorganic management however, vegetable pea was recorded higher with integrated (5136 kg/ha). The rice equivalent yield was found to be higher (11612 kg/ha) with organic management. Among all the cropping systems, higher system productivity was recorded with rice-chickpea +coriander-*sesbania* system (12979 kg/ha).

- **Raipur:** In soybean based cropping systems, crops such as soybean, maize (green cob), pea, and chilli also recorded higher yield (2143, 13794, 7906 and 9742 kg/ha respectively) under organic with 75% organic manures+ innovative practices (foliar spray of vermiwash) while, onion bulb yield resulted in higher with state recommendation (16857 kg/ha). The yield differences from 100% organic to inorganic were found to be 7.4, 13.8, 20 and 22% with soybean, maize, pea and chilli respectively. Among the cropping systems, soybean-onion registered higher soybean equivalent yield (10178 kg/ha) compared to other cropping systems however, highest SEY (9556 kg/ha) recorded under organic with 75% organic manures+ innovative practices (foliar spray of vermiwash) and was higher 7.1 and 26.3% to inorganic and state recommendation respectively.

- **Ranchi:** In rice, higher yield (3602 kg/ha) was found under organic management with 75% organic nutrient sources+ innovative practices (*Azolla* along with vermiwash spray) across the system, the differences from 100% organic to towards organic (75% organic maures+25% inorganic source) was found to be 15.0%. Wheat recorded highest yield (2838 kg/ha) under inorganic package and yield was decrease by 15.0 and 6.0% respectively with 100% organic and towards organic (75% organic+25% inorganic). Potato and linseed recorded higher yield (19635 & 847 kg/ha) under organic package with 100% nutrient supply through organic sources while, lentil recorded higher yield (428 kg/ha) under integrated package (50% organic+50% inorganic).The yield was found to be higher in potato and linseed to the tune of 61.8 & 48.6% and 34.0 & 30.1% respectively under organic management over inorganic and integrated nutrient package. Systems equivalent yield was higher (7067 kg/ha) with

organic nutrient package. Among the cropping systems, rice-potato recorded higher system equivalent yield (10178 kg/ha) while rice-lentil recorded lower equivalent yield (3753 kg/ha).

- **Umiam:** Under raised beds, higher broccoli yield (15760 kg/ha) was recorded with broccoli-frenchbean cropping system and among the management practices, integrated recorded maximum broccoli yield (14020kg/ha) followed by 100% organic (13970 kg/ha). Carrot and potato recorded highest yield 15740 and 16330 kg/ha under integrated nutrient package with 75% nutrient supplied through organic manures however, frenchbean and tomato grown on raised bed recorded highest yield (9870 and 17650 kg/ha) under organic package with 100% organic manures. The yield of frenchbean and tomato was increased with organic management to the tune of 24.5 and 15.8% over inorganic whereas, integrated management towards organic, carrot and potato produced 6.2 and 3.5% more yield compared to 100% organic. In sunken beds, the higher rice grain yield (4580 kg/ha) was recorded with integrated package having 50% organic+50% inorganic nutrients followed by 100% organic (4460 kg/ha). Among the rice varieties, Shahsharang-1 produced maximum grain yield (4600 kg/ha) followed by Lampnah (4460 kg/ha), Megha Aromatic 2 (4305 kg/ha) and Ngoba (3908 kg/ha).

- **Ajmer:** Seed yield of coriander and fennel was found to be higher in integrated approach towards organic with 75% organic+25% inorganic (1219 and 2285 kg/ha respectively) followed by state recommendation (1136 and 2183 kg/ha). The increase in yield of coriander and fennel was found to be 7.3 and 4.7% respectively from state recommendation to towards organic (75% organic +25% inorganic).

- **Narendrapur:** Paddy variety sohini and shatabdi recorded maximum grain yield under integrated nutrient management having 50% each nutrient sources organic and inorganic (5933 and 6225 kg/ha respectively). The differences in yield of paddy were found to be 16.5 and 10.3% from integrated to organic and inorganic nutrient package. Other crops in the systems such as broccoli and mustard recorded higher yield under 100% inorganic management (10008 and 1230 kg/ha respectively) during *rabi*. Green gram, capsicum and sesame recorded maximum yield under 100% organic and reduced dose of organic manure.

- **Sardarkrushinagar:** Crops groundnut, pearl millet, green gram, vegetable cowpea and fennel resulted in higher yield (3056, 4861, 664, 5688 and 1556 kg/ha respectively) with state recommendation and reduction from state recommendation to 100% organic management were found to be 38.2, 16.6, 18.1 24.6 and 30.4 % respectively. Response of potato (31750 kg/ha) was found to be higher in integrated package consisting of 50% organic + 50% inorganic management approach however, yield is increase with integrated management by 77.2%.

- **Thiruvananthapuram:** The tuber yield of cassava was highest in 100% inorganic package (33080 kg/ha) followed by integrated with 75% organic + 25% inorganic (31300 kg/ha). However, taro was recorded higher under integrated 50% each nutrient from organic and inorganic sources (15580 kg/ha). The yield difference in cassava with organic over inorganic was 6.5% and with integrated (75% organic +25% inorganic) was 5.4%. Taro yield difference from organic to integrated (towards organic) was recorded to the tune of 28.4%.

- **Udaipur:** Maize and inter crop blackgram resulted in higher yield (1333 and 93 kg/ha) under integrated packages whereas, wheat crop (*duram* 4167 kg/ha, *aestivum* 3000 kg/ha) and soybean (667 kg/ha) performed better with 100% inorganic management. Sweet corn and its intercrop black gram recorded higher yield with organic condition, while sole blackgram recorded maximum (417 kg/ha) with reduced dose of manure 75% organic+25% innovative practice. However, 75% nutrient supply through organic manure +innovative practices recorded higher yield for sole blackgram and produced 66.8 and 25.2% more yield compared to inorganic and integrated management packages.

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

- **Bajaura:** Maximum fruit yield of tomato was recorded with variety Heem Sohna (1948 kg/ha) in *kharif* and RK-123 (15830 kg/ha) in *summer* with higher number of fruits/plant (24). Maximum pod yield of pea (6119 kg/ha) was recorded with variety Ten Plus, which was statistically at par with Nirali (5627 kg/ha) but significantly higher than the all other varieties owing to higher number of pods/plant (21), number of seeds/pod (7) and pod length (8.9 cm). Okra variety Chameli-015 recorded significantly higher fruit yield (12608 kg/ha) owing to higher fruit length (9.1 cm) followed by and Indranil of yield and fruit length (12099 kg/ha and 9.0cm) compared to others. Cauliflower variety US-178 resulted in significantly higher curd yield per hectare (11279 kg) as compared to all other varieties. Chandramukhi also recorded significantly higher curd yield (10600 kg/ha) than other entries tested.

- **Bhopal:** Among the soybean varieties, RVS-2002-4 resulted significantly higher seed yield (814 kg/ha) owing to higher pods/plant (36.3) than others while, JS 20-34 recorded lowest soybean yield (631 kg/ha). The oil content (20.17%) was significantly higher in RVS 2002-7 followed by RVS 2002-6 (19.94%) and lower (18.23%) in the variety JS 20-34. Significantly higher protein (37.89%) was recorded with JS-93-05 followed by JS 20-29 (37.87%). Among the wheat varieties, GW-366 recorded significantly higher yield (3221 kg/ha) owing to higher seeds/spike (75), number of spikes/meter row length (96) and harvest index (47.6) while, C-306 produced poor yield (1983 kg/ha). Maize variety Kanchan recorded higher grain and straw yield of 2308 and 5234 kg/ha respectively. Pro agro-4412 was superior over all the varieties/hybrids evaluated it recorded higher protein (10.11%), ash% (1.54) and tryptophan (0.90 g/16gN). The chickpea varieties JG 130 was recorded higher seed yield (1839 kg/ha), correspondingly higher biomass yield of 4758 kg/ha and harvest index 39%.

- **Calicut:** Maximum yield of turmeric was recorded by Sudarshana (36100 kg/ha), followed by Suvarna and Kanthi (29200 and 28600 kg/ha respectively). Among different management packages, Alleppey Supreme was performed superior (29800kg/ha) under inorganic condition. In regard to curcumin content, variety Prathibha recorded maximum (4.7%) followed by Aleppey supreme and Kedaram. Least curcumin content was noticed in Suvarna (2.03%).

- **Coimbatore:** In all the varieties assessed, CB 05022 outperformed and superior over all the cultivars evaluated it produced more grains/panicle with more filled grains and correspondingly recorded higher yield (4760 kg/ha). Mappillai samba, CO(R)48 and white ponni also performed well in yield and recorded 4670, 4290 and 4200 kg/ha respectively.

- **Dharwad:** Cultivars JAKI 9218 produced 4.24%, 5.25%, 15.74% and 19.03% higher seed yield over cultivars MABC 37 (2384 kg/ha), BGD 103 (2361 kg/ha), A1 (2147 kg/ha) and MABC 27 (2088 kg/ha),

respectively. Cultivar NIAW (Bread wheat) produced 2.73%, 4.64%, 5.26% and 6.98% higher seed yield over cultivars UAS 347 (Bread wheat) (1208 kg/ha), DWR 2006 (Durum wheat) (1186 kg/ha), UAS 446 (Durum wheat) (1179 kg/ha) and Bijaga Yellow (Durum wheat) (1160 kg/ha), respectively.

- **Jabalpur:** Among the rice cultivars, the maximum grain yield was recorded with PS-3 (3525 kg/ha) followed by PS-5 (3450 kg/ha). The lowest yield was recorded in BVD-109 (2563 kg/ha). Significantly higher wheat yield was recorded with HI 1500 (3921 kg/ha) while, JW 3020 recorded minimum grain yield (3345 kg/ha). Rice equivalent yield (REY) recorded maximum with Mdhuri (rice)-HI 1500(wheat) of 6367 kg/ha followed by JR 201 (rice)-JW 3288 (wheat) of 6258 kg/ha. Rice (Pusa 1)- wheat (HD 4672) recorded minimum equivalent yield of 5124 kg/ha.

- **Karjat:** Significantly higher grain yield (6390 kg/ha) and straw yield (6924 kg/ha) of rice was recorded by Sahyadri-4 under early sown conditions. Sahyadri-3 outperformed better under mid-late sown condition with the yield of 6573 kg/ha. Karjat-4 (3897 kg/ha) produced significantly Lower grain yield among the rice varieties. In case of groundnut, significantly higher pods yield (3172 kg/ha) recorded in Konkan Gaurav followed by JL 776, TG 26, Western 66 and TAG 24 which is statistically at par to each other. JL 220 produced lower yield (2098 kg/ha) among the varieties. Cropping system rice (Jaya) and groundnut (Konkan Gaurav) recorded significantly higher system equivalent yield (REY 29049 kg/ha), net return (Rs. 2,51,313/ha) and net return per rupees invested (2.59) compared to other varieties evaluated in the system.

- **Ludhiana:** Basmati rice variety AVT1BT2507 recorded significantly higher grain yield of 5653 kg/ha followed by Ent-6001 (5063 kg/ha) while, Pusa Basmati-2 recorded lowest grain yield (3607 kg/ha). Among the wheat varieties, maximum grain yield of wheat (3750 kg/ha) was observed in BWL -720 than the other varieties of wheat. The lowest grain yield was recorded with PBW 660 (2847 kg/ha).

- **Modipuram:** Higher grain and stover yield of maie recorded in PMH-3 (8600 kg/ha respectively) followed by PMH-4 (8083 kg/ha) and seed tech-2324 (7517 kg/ha) while lowest yield recorded in Vivek QPM-9 (5116 kg/ha). Gross return, net returns and net return per rupee invested was recorded higher with PMH-3 of Rs.1,42,442, Rs.90,467/ha and 1.74 respectively. In mustard crop, significantly higher yield of was recorded with RGN-229 (1975 kg/ha) and it was statistically at par with Pusa Bold. Variety Pusa Tarak gave minimum yield of 1567 kg/ha. Maximum gross, net return and net return per rupee invested was recorded with RGN-229 (Rs. 82,504, 45,284/ha and 1.22.

- **Pantnagar:** Among coarse grain rice varieties, significantly higher grain yield was observed in NDR-359 (5934 kg/ha) which was found to be at par with PD-19 (5923Kg/ha), PD-18 (5913 kg/ha) and UPR-3425-11-1-1 (5905 kg/ha). Significantly higher grain yield among fine grain rice varieties was observed in Pant Basmati-1(4742 kg/ha) over all other fine grain rice varieties. Significantly higher grain yield of wheat recorded in HD-2967 (3580 kg/ha) and being at par with UP-2565 (3539 kg/ha) and PBW-550 (3508 kg/ha).

- **Raipur:** The highest grain yield of rice was recorded in Dujai (3722 kg/ha) which was significantly superior over rest of the varieties except Shyamajeera, Karigilas, Dubraj and CR Sugandha Dhan 907 which produced 3602, 3579, 3506, and 3423 kg/ha respectively. The lowest grain yield of scented rice was observed in Lalu 14 (1408 kg/ha). Significantly higher seed yield of chickpea was obtained from

variety PKV kabuli (1719 kg/ha) which was significantly higher over other varieties except RG 2009-01 (1692 kg/ha), JG-226 (1675 kg/ha), Daftari-21 (1685 kg/ha), JG-16 (1587 kg/ha) and JG-11 (1505 kg/ha) whereas lowest seed yield was with RG-2003-28 of 990 kg/ha.

- **Ranchi:** Maximum grain yield of rice (4259 kg/ha) was obtained with rice variety MTU-10 which was significantly superior over all the rice varieties except Lalat (4099 kg/ha), Birsamati (3907 kg/ha), Naveen (3889 kg/ha), Pusa Sugandha (3668 kg/ha) and Birsa Vikash Dhan-203 (3617 kg/ha). Among the wheat cultivars, K-0307 recorded significantly higher wheat yield (3206 kg/ha) which was statistically at par with Raj 4229 (3100 kg/ha), GW 366 (2959 kg/ha), DBW 39 (2926 kg/ha) and BG-3 (2803kg/ha). In terms of system productivity of rice-wheat, rice (MTU-10) - wheat (WR 544) system gave significantly higher system productivity (6837 kg/ha), net return (Rs. 67,239/ha) and B:C ratio 1.97 while, the lowest system net return (Rs. 49411/ha) and B:C ratio (0.70) was obtained in Akhchhai – BG-3 cropping sequence.

- **Umiam:** Tomato cultivars MT-2 produce higher fruit yield (22590 kg/ha) compared to other cultivars and being at par with 0-17, Pant T 10, MT 11, MT 3, TMC 9, DMT 1, RCT 3, DMT5 and MCTR 4**.** The lowest yield of tomato was recorded in the cultivar H 86 (6060 kg/ha). Significantly higher green pod yield of frenchbean was recorded in Naga local (8770 kg/ha) followed by RCM-FB-18 (7880 kg/ha) and RCM-FB-19 (5570 kg/ha). Lowest green pod yield was recorded in Maram (1050 kg/ha). Green cob yield of maize was recorded maximum with DA 61-A (5850 kg/ha) followed by RCM-75 (5760 kg/ha) whereas, lower grains yield was recorded in the local white (2850 kg/ha).

- **Ajmer:** In case of coriander, significantly higher seed yield (1247) found to be higher in Azad dhania-1 followed by ACr-1 and Hissar Anand while lowest was recorded in RCR- 446 (989 kg/ha). In fennel crop variety GF-12, recorded higher seed yield (2366 kg/ha) while, lowest performance for seed yield (1805 kg/ha) was observed in variety CO-1.

- **Gangtok:** Maximum yield of buckwheat was recorded in IC 26600 from NPBGR, HP (1533 kg/ha) followed by Local Teethey (1462 kg/ha) and IC 109433 from NPBGR, HP (1405 kg/ha).

- **Sardarkrushinagar:** Significantly higher pod yield of groundnut was found in variety GG- 2G (2978 kg/ha) which is at par with GJG-17 (2770 kg/ha) and GG-5 (2682 kg/ha). Highest Net return and B: C ratio was obtained in GG- 2G (Rs.130449/ha and 4.28) which is closely followed by variety GJG-17 (Rs.120301/ha and 3.95). Higher tuber yield, net return and B:C ratio in potato was found with variety Kufri Khyati (17185 kg/ha and Rs.74,538/ha/year and 0.75) which is significantly higher than other varieties but was on par with Kufri Chipsona. Pearl millet yield was found higher in variety 86 M 84 (5244 kg/ha) which is at par with 86 M 19 (4705 kg/ha).

- **Udaipur:** Among the different maize varieties, Pratap hybrid maize-3 recorded significantly higher grain yield (7021 kg/ha), net return (Rs. 95,855/ha/year) and net return per rupees invested (2.19) as compared to other varieties. Among sweet corn varieties, sugar-75 gave significantly higher grain yield (6339 kg/ha), net return (Rs. 1,21,734/ha) and net return per rupees invested (2.22). In case of baby corn varieties, PM-3 recorded higher grain yield (1315 kg/ha), net return and net return per rupees invested of Rs. 56,021 and 1.29 respectively. Among popcorn varieties, VL- Amber observed significantly higher grain yield (4139 kg q/ha), net return and net return per rupees invested of Rs. 1,28,482 and

2.99 respectively. Among local varieties, farmer selection gave significantly higher grain yield (5226 kg/ha) net return (Rs. 65,800/ha) and net return per rupees invested (1.52).

Among wheat (*Triticum aestivum*) varieties, variety HI-1531 recorded significantly higher grain yield (4407 kg/ha), gross and net return (Rs. 162309/ha and Rs. 116573/ha). In case of *Triticum durum* varieties, variety HI-8713 gave significantly higher grain yield (4481 kg/ha), gross return and net return (Rs. 175796/ha and Rs. 130060/ha, respectively). In local wheat varieties, variety C-306 recorded significantly higher grain yield (4278 kg/ha), gross and net return (Rs. 157468/ha and Rs. 111732/ha, respectively) as compared to Lok-1 (Rs. 117373/ha and Rs.71637/ha, respectively).

3. Evaluation of bio-intensive complimentary cropping systems under organic production systems

- **Dharwad:** Evaluation of performance of different cropping systems influenced by different conservation agriculture practices and different land configuration with or without crop residues under organic management

Soybean yield (1769 kg/ha) was higher in broad bed and furrow planting method with crop residue which is increased by 7.4% than conventional flat bed with residue. Groundnut, cotton and pigeon pea recorded higher yield in conventional method of planting with crop residue of 2656, 468 and 488 kg/ha respectively while, greengram (1744 kg/ha) was higher without crop residue. Conventional planting method produced 25.5, 4.5, 6.6 and 18.5% higher yield for groundnut, cotton, pigeon pea and greeengram respectively. During *rabi,* wheat resulted in higher yield (666 kg/ha) in conventional method with crop residue while, sorghum recorded higher on broad bed and furrow with crop residue (2784 kg/ha). Conventional flatbed method of planting without crop residue produced higher gross return, net monetary returns and B:C ratio (Rs. 1,60,821, Rs. 95,587/ha and 2.43 respectively) in greengram sorghum system followed by broad-bed and furrow (BBF) method of planting with crop residues (Rs. 1,53,936, Rs. 85,921/ha and 2.06, respectively). The use of crop residues as a mulch for existing crop in different cropping systems and incorporation for succeeding crop was found more beneficial under broad bed and furrow (BBF) method of planting.

- **Pantnagar:** Resource conservation techniques in different crops and cropping systems under organic cultivation

DSR + soybean-vegetable pea + mustard on furrow in raised-bed system recorded significantly higher basmati rice grain yield (4581 kg/ha) over all other resource conservation techniques and increased by 13.9% compared to basmati rice-wheat-*sesbania*. During *rabi*, Maximum grain yield of wheat (3742 kg/ha) was recorded in basmati rice- wheat- *sesbania* while lowest grain yield (3103 kg/ha) was observed in DSR-wheat-(ZT)–*sesbania*. Green pod yield of vegetable pea was found to be higher (7612 kg/ha) in DSR+ soybean-vegetable pea+ mustard system as compared to in DSR-vegetable pea-cowpea on broad bed and furrow (7154 kg/ha). Chickpea yield recorded under DSR-chickpea-moong on broad-bed and furrow system (1565 kg/ha). Significantly higher system productivity (11017 kg/ha) was observed in DSR-chickpea–moong on broad bed and furrow which was at par with DSR+ soybean –vegetable pea + mustard in furrow irrigated raised-bed system (9897 kg/ha). Maximum net returns (Rs.2,14,042 /ha) and B:C ratio (3.49) was recorded in DSR- chickpea–moong on broad bed and furrow system followed by DSR+ soybean-vegetable pea +mustard in furrow irrigated raised bed system (FIRB). Minimum net returns (Rs. 64,258 /ha) and B: C ratio (0.92) was observed in DSR-wheat-moong on broad bed and furrow techniques.

- **Umiam:** Evaluation of bio-intensive complimentary cropping systems under raised and sunken bed techniques

  The mean productivity of rice in sunken bed was 4060 kg/ha and 3960 kg/ha under rice-lentil and rice-pea cropping system, respectively. Among the rice varieties, Shahsarang-1 recorded the highest grain yield (4640 kg/ha) under rice-lentil cropping sequence. Higher yield of lentil was recorded with rice variety (Vivek dhan-82) of 1220 kg/ha among rice-lentil system whereas, pea yield (4830 kg/ha) was also higher with rice (Vivek dhan-82) in rice-pea system. The highest rice equivalent yield was recorded under rice (Lampnah)–pea (13320 kg/ha) followed by rice (VD-82) –pea 12690 kg/ha. Yield of vegetables on raised-bed *viz*, potato, french bean and carrot recorded on raised bed of 16800, 17600 and 27900 kg/ha respectively. The yield of okra during *kharif* season was higher with frenchbean (9100 kg/ha) in the system whereas, rice equivalent yield was recorded higher under carrot–okra cropping system (36500 kg/ha).

4. Development of integrated organic farming system (IOFS) models (Area: 0.4 ha)

- **Calicut:** A yield of 375 kg turmeric, 100 kg ginger, 683 kg fodder grass, 5 kg vegetable cowpea, 75 kg Tapioca were produced. A diary unit with two cows (Jersey and Jersey cross) and their calves yielded 15 liters of milk daily. An income of Rs 79,631 was received from an area of one acre under integrated farming system model.

- **Coimbatore:** Yield (8313 kg/ha) and net return of Rs. 57,946/ha was obtained through okra in okra + leaf coriander - maize + cowpea (fodder) system under integrated organic farming model. Maize var. COH (M) 6 was sown in the system and it gave 4633 kg/ha of grain yield with 4656 kg/ ha, straw yield and net income of Rs. 24,914/ha. Organic carbon of 0.48% was recorded in maize plot. Cotton recorded 1558 kg/ha seed cotton yield and net return of Rs. 32,762/ha in green manure–cotton–sorghum system. The grain and straw yield of sorghum was recorded of 2658 and 5127 kg/ha respectively, it gave Rs. 13142 as net return in the model.

- **Sardarkrushinagar:** Total net profit Rs. 42,751 was received by crop component from 0.24 ha area. Ardusa, Napier grass and lemon grass have been planted around the border and bunds incurred cost Rs. 1051 so, total net profit from all the components of IOFS Model was Rs. 41,700 per year.

- **Udaipur:** Development of integrated Organic Farming System Model for Southern Rajasthan**.** The total maize equivalent yield of 5155 kg/ha and a net return of Rs. 43,202/ha was obtained from the farming system crop component during 2015-16.

- **Umiam:** The total cost of cultivation was recorded at Rs. 56,654/year under the IOFS model with an area of 0.43 ha. Maximum expenditure was incurred in crop component of the model with 46.6% of the total cost of cultivation. Dairy unit with one adult cow and one calf registered 37.7 % of the total cost of cultivation, while fishery component recorded 8.7% of the total cost of cultivation. From vermicomposting unit of 72 m^2 area and other important operations like hedgerow planting, residue recycling, rock phosphate application and liming account to 5.5 % of the total cost. A total net return of Rs. 71,442/- per year was achieved under the IOFS model which is much higher than the region's farmer common practices of rice mono-cropping or improved practice of rice-vegetables cropping system. The highest contribution towards the total net return was contributed by crop component of the model (66.5%) followed by dairy (23.9%) and fishery component (15.2%). Considering the benefits from the IOFS model with a net return of Rs. 71,442/- per year from 0.43 hectare area, a net income of Rs. 5954/- per month or Rs. 196 /- per day was achieved which is a modest amount for living by a four member family (2 adults and 2 children).

1. INTRODUCTION

Organic farming system is a native practice to Indian Agriculture. As of now also, in more than 85% of the farm-households, crop + livestock farming system is prevailing. Nevertheless, during pre-green revolution period (up to 1960s) the rate of national agricultural growth was not able to keep pace with population growth and virtually '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 use. As a result, the total food grain production increased phenomenally from mere 50.83 million tonnes in 1950-51 to 273.38 million tonnes in 2016-17 – indicating a 5.38 times increase. 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 95.77 million ha in 2013-14) and increase in fertilizer nutrient consumption (0.07 million tonnes in 1950-51 to 26.75 million tonnes in 2015-16). All of them put together have led to substantial increase in the productivity of crops, especially food grains (from 522 kg/ha in 1950-51 to 2028 kg/ha in 2014-15) culminating into the change in the status of India from a food importer to net food exporter in many commodities.

However, 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. India's average fertilizer and pesticide consumption stands at 130.8 kg/ha and 0.29 kg a.i./ha, respectively during 2016-17. Moreover, despite all technological advancements, the nutrient use efficiency is on lower side. On the other hand, it has been proved scientifically and convincingly that integrated use of organic manures with chemical fertilizers improves the use efficiencies of the latter owing to concurrent improvement of soil physical, chemical and biological properties. The water holding capacity of the soil also gets improved on account of regular use of organic manures. It is estimated that various organic resources having the total nutrient potential of 32.41 million tonnes will be available for use in 2025. Out of these organic resources, considerable tapable potential of nutrients (N + P_2O_5 + K_2O) from human excreta, livestock dung and crop residues have been worked out to be 7.75 million tonnes.

Area under organic farming, production and export

In world, 97.7 million ha area in 178 countries is under organic agriculture which includes both cultivated (57.8 million ha) and wild harvest (39.9 million ha) during 2016. Emerging from 42,000 ha under certified organic farming in 2003-04, the organic agriculture has grown many folds and by 2015-16, India has brought 5.71 m ha area under organic certification process. Out of this cultivated area accounts for 1.49 m ha (26.1 %) while remaining 4.22 m ha (73.9 %) is wild forest harvest collection area. Currently, India ranks 9th in terms of cultivable land under organic certification. In terms of wild collection, India ranks 3rd next to Finland and Zambia. Around 8.35 lakhs producers are engaged in the country in various forms. Sikkim state has been declared as organic state from January 2016 and has highest net sown area (100 %) under organic certification while Madhya Pradesh is having largest area under organic production system. The domestic market for organic products in the year 2014-15 was estimated at Rs. 875 crores. The total volume of export during 2017-18 was 4.58 lakh tonnes. The organic food export realization was around Rupees 3453.48 crores (515.44 million USD). Organic products are exported to USA, European Union, Canada, Switzerland, Australia, Israel, South Korea, Vietnam, New Zealand, Japan etc. In terms of export value realization, Oilseeds (47.6%) lead among the products followed by cereals and millets (10.4%), plantation crop products such as Tea and Coffee (8.96%), Dry fruits (8.88%), Spices and condiments (7.76%) and others.

India's first internationally certified organic products emerged in the mid 70's, supported by UK's Soil Association. Different parts of India have developed their own local or regional systems for ecological agriculture that are now gathered in one umbrella term '*Jaivic Krishi' or 'Jaivik Kheti'*.

In order to develop a package of practices for organic farming in a system mode, an All India Network Programme on Organic Farming (AI-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. Intitally, the project was operating with 13 centres covering 12 states. During XII plan, the number of centres of has been increased to 20. Presently the scheme covers 16 states. The results of one study on geo-referenced characterization of organic farmers, four on-station experiments and one farmer participatory experiment under TSP undertaken at various locations are presented in the report.

The policy of accelerated adoption of **"towards organic"** (integrated crop management) approach for intensive agricultural areas (food hubs) and **"certified organic farming"** with combination of tradition, innovation and science in the de-facto organic areas (hills) and rainfed/ dryland regions has been recommended during the year from the findings of the scheme which will contribute towards safe food security and climate resilience, besides increased income of farm households. This approach will also positively contribute to the cause of human, livestock and eco-system health, the basic objective of organic agriculture. Scientific organic farming needs to be promoted in the high intensive areas to keep the yield of crops at comparable level with chemical management. In rainfed/hilly areas, organic agriculture with scientific packages will result in significant improvement in productivity of crops.

Package of practices for organic production of crops and cropping systems developed through NPOF network

2. OBJECTIVES AND METHODOLOGY

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 2015-16, following twelve experiments/study were undertaken at different centers:

1. Geo-referenced charecterization of organic farmers
2. Evaluation of organic, inorganic and integrated production systems for crops and cropping systems
3. Evaluation of response of different varieties of major crops for organic farming
4. Evaluation of bio-intensive complimentary cropping systems under organic production systems
5. Development of integrated organic farming system models
6. Evaluation of Farm waste recycling techniques for organic farming
7. Documentation & validation of organic ITKs
8. Evaluation of organic management practices for insect pest in various crops
9. Evaluation of organic management practice for diseases in crops
10. Development of scientific organic package for large cardamom
11. Biochemical characterization & molecular identification of microbial population of different organic manures
12. Cluster based demonstration of organic farming package under TSP

The objectives, locations and treatment details of each experiment at various locations are presented in chapter 7 and at respective tables. General guidelines and standards for the production of organic

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

3. LOCATION

Multi-location experiments were conducted during 2015-16 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-175 125
2.	Bhopal	Madhya Pradesh	ICAR-Indian Institute of Soil Science, NabiBagh, 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 KrishiViswaVidyalaya, 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 and Technology, Pantnagar, Udham Singh Nagar – 263 145
11.	Raipur	Chhattisgarh	Indira Gandhi KrishiVishwavidyalaya, Raipur-492 012
12.	Ranchi	Jharkand	Birsa Agricultural University, Kanke, Ranchi – 834 006
13.	Umiam	Meghalaya	ICAR Research Complex for NEH Region, Umiam – 737 102
		New 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
17.	Narendrapur	West Bengal	School of Agriculture & Rural Development, Ramakrishna Mission Vivekananda University, PO Belur Math, Howrah-711 202,
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 and Technology, Udaipur

4. MANPOWER

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

5. SOIL AND CLIMATE

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

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

S. No.	Name of centre	Soil Type	Weather				Latitude (N)	Longi-tude (E)
			Rainfall (mm)	Tempera-ture (°C)		R.H (%)		
				Max.	Min.			
		Centres functioning from 2004-05						
1.	Bajura	Silty loam	843.0	23.8	10.85	78	31.8°	77°.0'
2.	Bhopal	Vertisols, Clayey Montmorillo-nite/smectite type	906.2	32.67	20.91	58.8	23°18'	77°24'
3.	Calicut	Clay loam, ustic Humitropept	4121	31.8	22.0	68	11°34'	75°48'
4.	Coimbatore	Udic, Rhodustalfs, fine loamy red and sandy soil	789	29.8	21.3	86	11°	77°.0'
5.	Dharwad	Vertic inceptisoles	755.6	30.9	18.8	63.8	15°26'	75°07'
6.	Jabalpur	Vertisoils, Chromusterts	1130.7	32.6	18.3	59.7	23°90'	79°90'
7.	Karjat	Haplustults udic-fluvents, red soil	3625	34 .0	21.0	69	18°33'	77°03'
8.	Ludhiana	Ustochrepts-Ustic pramments association, alluvial, sandy & sandy loam	620.2	30.0	17.4	65	30°56'	75°52'
9.	Modipuram	Alluvium soilsTypic ustochrept	517	29.9	16.3	71	29°4'	77°46'
10.	Pantnagar	Hapludolls, very deep alluvium coarse loomy soils	934	30.5	17.7	67	29°08'	79°05'
11.	Raipur	Ochraquals association, deep black soil	1004.43	32.97	21.38	59.8	21°16'	81°36'
12.	Ranchi	Ultic Palesustalfs, very deep soils	981.9	29.69	17.77	73.23	23°17'	85°19'
13.	Umiam	Clay loam	3085	20.6	4.6	75	25°41'	91°54'

S. No.	Name of centre	Soil Type	Weather				Latitude (N)	Longi-tude (E)
			Rainfall (mm)	Tempera-ture (°C)		R.H (%)		
				Max.	Min.			
			New Centres functioning from 2015-16					
14.	Ajmer		450				35°39'	22°31'
15.	Almora							
16.	Gangtok		240.90	23.78	14.63	71.36		
17.	Narendrapur		3597	31.6	23	72.05		
18.	Sardar Krushinagar			931.2	34.31	20.32	61.33'	
19.	Thiruvananthapuram			1289.70	32.27	23.79	92.62'	
20.	Udaipur	Clay loam	523.8	36.51	13.92	51.19	24º35'	74º42'

Initial nutrient status of soil (2003-04)

Centre	OC (%)	N (kg/ha)	P (kg/ha)	K (kg/ha)	S (ppm)	Fe (ppm)	Zn (ppm)	pH	EC (ds/m)
				Centres functioning from 2004-05					
Bajaura	0.45	146	43.3	121	22.4	30.0	1.20	-	-
Bhopal	0.53	154.2	12.8	530.2	4.92	5.52	0.74	7.85	0.50
Calicut	2.40	220	24.6	264	-	72	3.80	-	-
Coimbatore	0.60	269	17.9	690	-	66.0	10.0	-	-
Dharwad	0.41	250	23.0	330	20.0	7.5	0.80	-	-
Jabalpur	0.70	264	12.6	282	9.8	2.37	0.32	-	-
Karjat	1.10	234	30.0	350	-	-	1.72	-	-
Ludhiana	0.34	278	36.3	134	-	-	-	-	-
Modipuram	0.59	-	-	-	-	-	-	-	-
Pantnagar	0.65	238	16.7	156	65.0	30.24	0.84	-	-
Raipur	0.64	237	13.0	274	-	-	-	-	-
Ranchi	0.44	320	48.0	270	-	59.8	1.22	-	-
Umiam	1.32	186	10.4	165	-	-	-	-	-
				New Centres functioning from 2015-16					
Ajmer	0.28	124.6	11.91	336.2	-	-	-	7.13	0.13
Gangtok	0.93	320.7	17.9	417.8	23.78	-	2.18	5.57	-
Sardar Krushinagar		141	13.47	180	8.2			7.22	0.15
Thiruvananthapuram	-	-	-	-	-	-	-	4.54	0.053
Udaipur	0.67	280	36.2	243.3	7.9	2.2	.70	8.1	0.87

6. BUDGET

A total budget of Rs. 174.94 lakhs was released to 20 centres during 2015-16. The centre wise allocation of funds are given below.

(Rs. in lakhs)

Sl. No.	Name of Centre	T. A.	Other Cont.	Cont. Service	TSP general	Total
1.	HAREC, Bajaura	0.30	2.25	4.80	0.00	7.35
2.	ICAR-IISS, Bhopal	0.30	3.70	9.60	0.00	13.60
3.	ICAR-IISR, Calicut	0.39	1.96	4.00	0.00	6.35
4.	TNAU, Coimbatore	0.40	3.50	3.75	0.00	7.65
5.	UAS, Dharwad	0.35	3.00	4.00	0.00	7.35
6.	JNKVV, Jabalpur	0.20	2.25	4.00	0.00	6.45
7.	ARS, Karjat	0.15	1.50	2.85	0.00	4.50
8.	PAU, Ludhiana	0.20	1.50	3.61	0.00	5.31
9.	ICAR-IIFSR, Modipuram	0.11	4.70	2.39	0.00	7.20
10.	GBPUA&T, Pantnagar	0.40	4.66	5.50	0.00	10.56
11.	IGKV, Raipur	0.20	2.40	5.25	0.00	7.85
12.	BAU, Ranchi	0.10	1.25	3.50	0.00	4.85
13.	ICAR-RC-NEH, Umiam	0.50	6.75	7.12	0.00	14.37
14.	ICAR-NRCSS, Ajmer	0.30	3.50	5.75	0.00	9.55
15.	ICAR-VPKAS, Almora	0.40	5.32	4.88	0.00	10.60
16.	ICAR-NOFRI, Gangtok	0.50	4.75	5.38	0.00	10.63
17.	RMVU, Narendrapur (W.B.)	0.30	5.75	2.26	0.00	8.31
18.	SKDAU, Sardar Krushinagar	0.30	3.00	5.50	0.00	8.80
19.	ICAR-CTCRI, Thiruvananthapuram	0.34	4.72	6.43	0.00	11.49
20.	MPUA&T, Udaipur	0.40	5.80	6.00	0.00	12.20
	Total	6.14	72.26	96.57	0.00	174.97

7. RESEARCH RESULTS

7.1 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 farm households was fixed as target for collection of information. However some centres have collected information from less or more number of farmers depending on the resources. The objectives of the study was

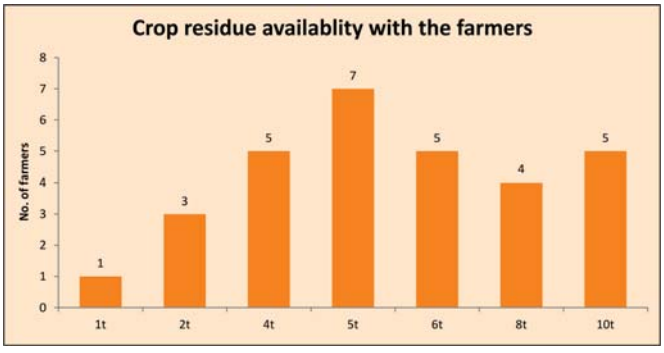
- To understand and characterize the practices and constraints of organic farmers
- To assess the technological gaps of organic farmers

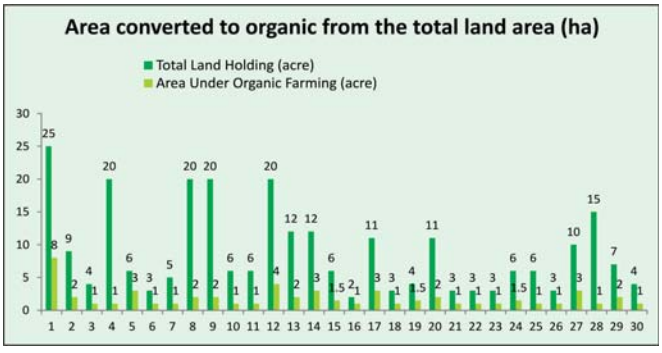
Ajmer: The total 43 farmers from Jhunjhunu district of Rajasthan were characterized during 2015-16.

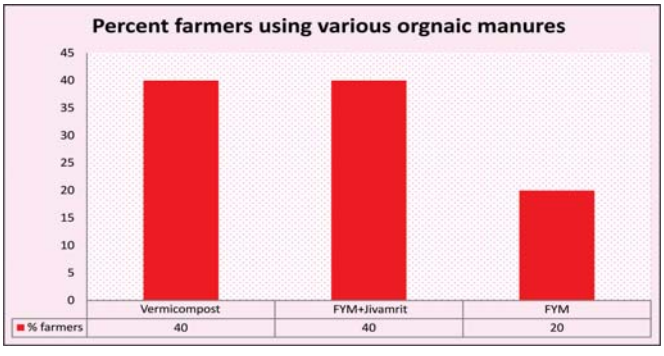
- 100 % farmers are having soil type of sandy nature and are using only FYM as nutrient source for crop production.
- 14% farmers having organically converted land holding between less than 2.5 ha, 65% are having between 2.51 -5.0 ha and 9% are having more than 5.0 ha.
- Major crops in *kharif* are Bajra and guar whereas in winter, wheat, fenugreek and chickpea occupy the major area of land holding.
- All the farmers are following hand weeding for controlling weeds and most of them are using neem oil as insecticide.
- Average yield in wheat is 1500 kg/ha, fenugreek is 1400 kg/ha and chickpea 1200 kg/ha.
- 100% of farmers are adopted organic farming is due to harmful effect of chemicals and said they are marketing their produce in local market and are not getting any premium price for their produce.
- 100% of the farmers said that low yield is main drawback in organic farming. Among them 10% of the farmers are not able to manage pest and disease outbreak.

Bhopal: Carried out a geo-referenced organic survey in an organic cluster at Chandpur village, District-Bhopal.

- Most of the organic farmers have their own irrigation facilities and integrated animal component in farming, and so organic manures are prepared on-farm.
- Among the respondents, the highest total land holding was found to be 25 hectare while minimum was 2 hectare. Out of which, the maximum area under organic farming was 8 hectare and minimum was 1 hectare.







Georeferenced survey

- Among the on-farm resources, farm yard manure is still the most predominant source of organic manure being used by the farmers followed by vermin-compost.
- A maximum crop residue availability varied between 1-10 t/ha
- Soybean is major crop of region.

- Neem based pesticides are the major organic pesticides for the management of pest and diseases in organic crops. Farmers make their own organic pesticides to make organic farming profitable.
- Most of the farmers under organic farming employed manual weeding whereas, summer ploughing and crop rotation were the other practices employed for the management of weeds.
- Only 10-20% of organic produces are reserved for house hold consumption and the rest sold out in either Krishi mandi or local market.
- Minimum requirement of off-farm market inputs and maintenance of soil health are the major reasons behind the adoption of organic farming besides, healthy product.
- However, slow response to organic inputs, non-availability of premium price, improper market mode was opined as the constraints of organic farming.
- Farmers also cultivate typical local variety of wheat cv. vanci for success in organic farming

Calicut

- Geo-referenced characterization of organic cluster at Irulam, district wayanad, kerala was carried out. Total 32 farmers of Irulam, in wayanad district were characterized in which 94.3% of land was found under organic farming.
- Major crops - pepper, coffee, coconut, arecanut, ginger, nutmug, banana.
- Land characterization of farmers-large-nil/ medium-2/small-30
- Farmers possessing farm animals - 19 and farm machineries - 17

Crops	Number of Farmers	Land under organic cultivation (ha)	Profit/ha (Rs)
Pepper	30	5.85	2,45,528
Coffee	32	12.44	56,492
Coconut	16	1.72	99,098
Areca nut	25	3.68	2,28,202
Cardamom	3	1	1,94,900
Ginger	6	0.42	1,11,510
Banana	8	0.72	64,583

- Crop residue availability within the farm for recycling - 1.1 t /ha/year
- Farmers having vermin-compost/biogas unit -11 and having mean production /vermin-compost unit-0.45 t/year
- Major mode of weed management-hand weeding
- Certification Agency-IMO, Bangalore
- Market mode-organic consortium-sulthan bathery
- Major reason for adoption of organic farming-For healthy and safe food.
- Major constraints-low price, lack of Govt. support and labour

Gangtok

- Demonstration on cluster based organic farming package under TSP has been initiated in Timpyem village of East Sikkim during 2015-16 and selected for geo-referenced characterization. Total 35. nos of farm families reside in the village. Base line survey has been completed in the village during December 2015 and mostly (91.4%) marginal farmers in the village. The cropping intensity of the village is hardly 130%. Crop production with low organic input was practiced by the farmers resulting in very low yield of the crops. During winter season no or very scanty rainfall was observed in the village since last few years.

- No – till vegetable pea technology demonstrated in the village around 0.4 ha area and compared it with the conventional sowing and found 24.4% increase in the yield in no-till planted over conventional planting.

- Maize-*Pahenlo dal* - buckwheat demonstrated in 1.0 ha area in the village was recorded higher B:C ratio of 2.59 over farmers practice 1.14 (Maize-fallow).

Modipuram

- Geo-referenced characterization of 28 organic farmers who had experienced the cultivation the organic forming was done

- All the farmers belonged to irrigated farming situation.

- 25% of the farmers were adopted organic farming on their entire land holding. Area under organic cultivation varied from 0.40 hectare to 40 hectare.

- Two farmers started organic farmers in nineteenth decade, whereas majority of the farmers (11 out of 28) initiated organic farming during 2010 and onward.

- Out of 28 farmers, 43 % farmers discontinued organic farming due to lower yields, lack of technical awareness, non-availability of vermi-compost and other organic manures in sufficient quantities and found major constraints responsible for discontinuation.

- Marketing was an important aspect in the adoption as well as in sustainability of organic farming however, there is no regular chain for sale of organic produce. Only few farmers of the cluster have opened their own sale counter. Organic produce of other farmers in going through personal efforts.

- While collecting information on reasons for adoption; health consciousness found to be at the top among successful organic farmers. Some of them, however reported, persuasion by the NGO or Govt. machinery.

- Apparently there was no direct relation with number of organic farmers & number of animals reared only few farmers were found to produce vermi-compost whereas majority of them depended on farm-yard manure.

- As far as yield is concerned, most of the farmers reported decline in yield. The yield of sugarcane reported by the farmers varied from 20 t to 96 t/ha.

- Rice was the major crop grown organically during kharif season. The other crops grown organically during kharif were black gram, green gram and turmeric.

- Out of 21 farmers growing rice organically, 10 farmers recorded rice yield <4000 kg/ha and two of them even beyond 6000 kg/ha whereas, nine farmers recorded rice yield between 3000 to 4000 kg/ha and two between 2000 to 3000kg/ha.

- During rabi, wheat was the major crop grown organically, where majority (74%) farmers recorded wheat yield >3000 kg/ha. Fifty per cent of these farmers recorded even more than 4000 kg/ha.

- Regarding plant protection, almost all the farmers controlled weed through hand weeding. The incident of insect-pest was very low. The bio-pesticides used were beejamirt, panchgaya, vermin-wash or some other herbal preparation/extract. Except one, all the farmers were found uncertified. The only one was reported to be certified by USOCA. Some of them were associated with 'Organic Farmer Association of India' (OFATC), Lokbharti, Utter Pradesh and one by RSS.

Pantnagar

Geo-referenced characterization of organic farms in the tarai region was conducted

- Average organic wheat yield at farmers field from 22 farmers was 3800 kg/ha however, average organic wheat yield from field trial using 14 different varieties was 3390 kg /ha i.e, 12.1% higher yield at farmer's field over field trial.

- Average coarse grain rice yield at farmers field from 20 farmers was 4054 kg/ha while average yield from field trial 7 coarse varieties was 5690 kg/ha i. e., 40.3 % higher yield at organic research field condition over at farmer's field.

- Average fine grain rice yield at farmers field from 2 farmers was 1950 kg/ha while 3800 kg/ha average of 7 varieties yield was obtain at field condition interpreting 94.9% increase in fine grain yield at organic research field over farmers field.

Sardarkrushinagar

Survey for characterization of organic cluster in SDAU jurisdiction was done in SDAU jurisdiction of Gujarat on organic cluster basis

- Total 39 farmers surveyed in Aravali, Banashkantha, Patan, Kutch, Sabarkantha, Mehsana and Gandhinagar District , in which land under organic farming is 75.4%, major crops are wheat, bajra, funnel, cumin, castor

- Farmers possessing farm animals -39

- Farmers possessing farm machineries - 32

- Crop residue availability within the farm for recycling - 4400 kg/ha/year

- Farmers having vermin-compost unit - 09

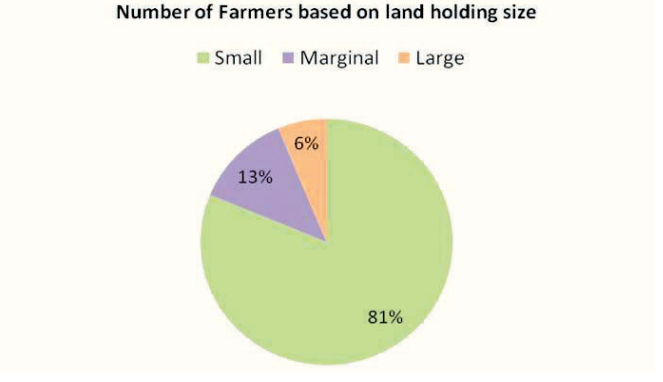
- Mean production /vermin-compost unit is 0.39 t/year

- Major mode of weed management-Hand Weeding, Inter culturing

Table. 5.4.1 Land pattern and economics of organic growers

Crops	Number of Farmers	Land under organic cultivation (ha)	Profit/ha (Rs.)
Castor	16	25	60,000-1,50,000
Pearl millet	14	10	45,000-60,000
Wheat	21	35	90,000-1,00,000
Green gram	17	09	60,000-65,000
Pome granate	04	20	1,00,000-2,00,000
Mustard	09	16	75,000-80,000
Funnel	14	22	1,00,000-1,50,000
Mango	20	65	90,000-1,00,000
Cumin	08	15	75,000-1,50,000
Ground nut	19	21	70,000-1,00,000

- Majority of the farmers belonged to small and marginal group (81% and 13% respectively) with a land holding size <2 ha. Average land holding size was 0.38 ha. The farming situation was mainly irrigated (90%). Under situations where land was limiting, terrace cultivation that could very well meet their requirements was practiced (10.53%).

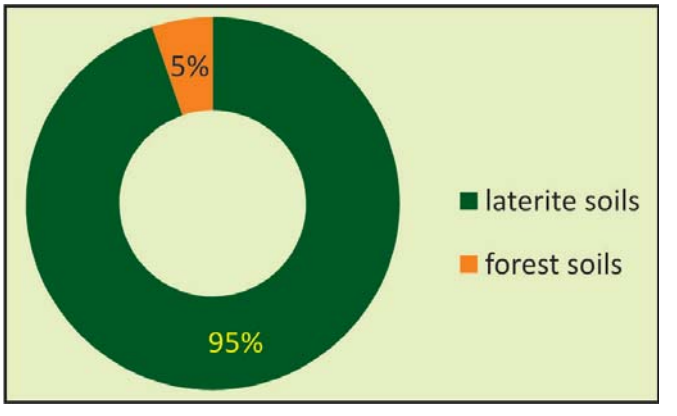


- Major crops grown organic were root and tuber crops (cassava, yams, taro, Chinese potato) including spices (ginger, turmeric); vegetables (okra, brinjal, bitter gourd, chillies, tomato, cabbage, cauliflower, amaranth, vegetable cowpea); fruit crops (banana, passion fruit, papaya), plantation crops (coconut & rubber); rice; ornamental crops (*Heliconia*, *Anthurium*, orchids) and medicinal plants. The relative share

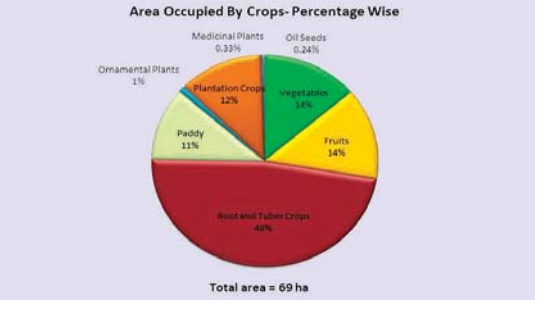
- Certification Agency-GOPCA, Jatan, ECOCERT
- Market Mode- Local and major reason for adoption of organic farming-For healthy and safe food, Premium price
- Major Constraints-lack of financial support from Govt, training, no weed control practices and marketing

Thiruvanthapuram

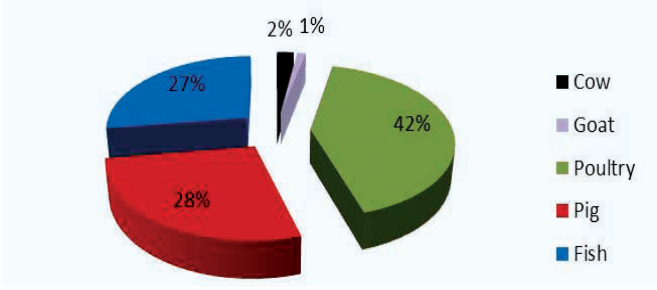
- Geo-referenced characterization survey of 19 farmers practising organic farming in Kazhakoottam, Neyyattinkara, Parassala, Vamanapuram and Pallichal blocks, in Thiruvananthapuram district, Kerala, was done.
- The major soil group is laterite (appox. 95% of the farmers) and forest soils were mainly confined to the hilly tracts only. The relative share of the soils is depicted by the doughnut chart below.



- Most of the farmers (79%) practiced organic farming mainly for sustenance to provide safe food to their family rather than marketing and making profit.



of each crop is depicted in the pie-diagram below.



- Farm animals were an integral part of organic farming including cow, goat, poultry component, fish and pig. Pictorial representation based on the number of farm animals under the organic farming situation is as follows:

- Majority of the farmers owned cow (85%). Piggery, ornamental fish cultivation and organic cut flowers were also important enterprises. For those practicing these enterprises, these were an assured source for income generation (B: C ratio: 6—7 & 5-6 respectively). Profit analysis showed that inclusion of an animal component will increase the net returns of the farmer.

- Organic recycling units: Animal wastes were converted to excellent manures using biogas (21% of farmers), coirpith (10.52% of farmers) and vermicompost units (10.52% of farmers) (with an average capacity to produce nearly 200 kg compost/annum). These units will help in effective waste management through the nutrient recycling within the farm.

- Cow dung slurry, biogas slurry (100% of respondents), bio-formulations like Hridayamrutha (sprayed after diluting it 10 times), Jeevamrutha, Ghanajeevamrutha (5.2% of farmers), fish amino acids (47.40%

Glimpses of geo-referenced survey at Thiruvanthapuram

of farmers), egg-lime mixture (10.52% of farmers), groundnut cake, ash (100% of farmers) constituted important nutrient sources.

- Insect pest management was by the following means: Neem cake application, cultural methods, intercropping, trap crops on field bunds, crop rotation to avoid pests overwintering in soil.
- Organic farms were uncertified.
- Constraints faced were labour shortage, land shortage, high input cost and availability, low price of the produce, yield fluctuations during initial years.

Udaipur

- Total 63 households randomly selected from two villages (Mayer & Kejad) in Sarada Tehsil of Udaipur district were surveyed for geo-referenced characterization. Average yield loss to the tune of 15% in maize and 20% in wheat was recorded in organic farming. Labour intensive and costly weed management, low productivity of crops, lack of availability of large quantity of organic inputs from small land holding and no assured market with premium price for organic product are major constraints faced by organic farmers.

7.2 Evaluation of organic, inorganic and integrated production systems 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 13 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 experiments were started at 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 from 2013-14 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 ***(Organic)***	1. Supply of 100% nutrients through organic sources and complete organic management
		2. Supply of only 75% nutrients through organic sources + innovative inputs (any two of cow urine @10%, Panchagavya, PGPR and vermiwash @10%) and complete organic management
	Inorganic management ***(Chemical)***	3. 100% inorganic nutrients and management
		4. Either state recommendation or farmers package (Choice to centres)
	Integrated management ***(Towards organic)***	5. 50% organic +50% inorganic source of nutrients and management
		6. 75% organic +25% inorganic source of nutrients and management
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 and Coimbatore) 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	Centre (State)
Arid	Ajmer (Rajasthan) Dharwad (Karnataka) SardarKrushinagar (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	1.0	0.20	0.75
	FYM	1.15	0.27	1.00
	Urea	46.0	-	-
	SSP	-	16.0	-
	MOP	-	-	60.0
	Rock phosphate	-	34.0	-
Bhopal	Vermi-compost	1.14	0.72	0.68
	Neem cake	4.17	0.92	1.04
	Sesbaniarostrata	2.90	0.7	1.54
Calicut	Farm Yard Manure	1.16	1.8	0.32
	Neem cake	1.52	0.36	1.45
	Ash	-	0.25	6.6
	Vermi-compost	0.59	0.93	0.54

Centre	Nutrient Sources	NPK contents on dry weight basis (%)		
		N (%)	P (%)	K (%)
	Green leaf manure	2.18	0.15	0.93
	Rajphos	-	18.5	-
	Urea	46	-	-
	MOP			58
Coimbatore	Vermi-compost	1.14	0.72	0.68
	Neem cake	4.17	0.92	1.04
	Sesbaniarostrata	2.90	0.7	1.54
Dharwad	Enriched compost	0.70	0.40	0.80
	Vermi-compost	1.00	0.86	0.98
	Farm yard manure	0.50	.035	0.50
	Glyricidia (Green leaf manure	0.50	0.35	1.15
Jabalpur	Green manure (Sunhemp)	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	0.30	0.60
	Cow dung manure	0.60	0.30	0.70
	NEOC–Non edible oil cake	3.0	0.70	1.70
	Rock phosphate		23	
Ranchi	FYM	0.50	0.30	0.50
	Vermi compost	1.2	0.45	1.4
	Karanj cake	4.0	1.0	1.0
	Urea	46.0		
	SSP		16.0	
	MOP			60.0
Umiam	F.Y.M.	0.72	0.29	0.61
	Vermicompost	1.50	0.62	1.00
	Rock phosphate	-	18.00	-
	Tephrosia *spp*	3.31	0.44	1.46

Centre	Nutrient Sources	NPK contents on dry weight basis (%)		
		N (%)	P (%)	K (%)
Narendrapur	Vermicompost	1.5	1.0	0.5
	Sashyagavya	1.0	0.015	0.125
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
	Green manure cowpea	2.80	0.52	2.02
	FYM	1.28	0.50	0.28
Udaipur	Vermicompost	1.83	0.43	2.09
	Neem Cake	5.22	1.08	1.48
	NADEP Compost	1.43	0.37	1.14
	Enriched Compost	1.34	0.49	0.92

Results

The parameter wise result of 2015-16 for each centre are presented and discussed below.

Influence of organic management package with reduced dose of organic manures, inorganic and integrated nutrient management packages on economic yield, straw yield and system equivalent yield of vegetable based cropping system (Table 1-3)

Bajaura: Among the crops evaluated under vegetable based cropping systems, all the nutrient management package in tomato-cauliflower-frenchbean system recorded almost similar tomato fruit yield during *Kharif* however, comparatively higher tomato fruit yield (2190 kg/ha) was observed with organic package (75% organic + innovative organic practices). In *summer*, tomato yield (10360 kg/ha) was also found to be higher with organic package (75% organic + innovative organic practices) and the yield difference over inorganic was observed to the tune of 110%.Response of cauliflower (11560 kg/ha), black gram (990 kg/

100% organic management in cauliflower and pea at Bajaura

Table 1. Influence of organic, inorganic and integrated package on grain yield (kg/ha) of crops in cropping systems at various locations

Locations /Treatments	Organic						Inorganic			Integrated (towards organic)								
	100% organic			75% organic + innovative organic practices			100% inorganic			State recommendation			50% organic + 50% inorganic			75% organic + 25% ilnorganic		
	Kharif	*Rabi*	*Summer*	*Kharif*	*Rabi*	*Summer*	*Kharif*	*Rabi*	*Summer*	*Kharif*	*Rabi*	*Summer*	*Kharif*	*Rabi*	*Summer*	*Kharif*	*Rabi*	*Summer*
Bajaura																		
Tomato-cauliflower-french bean	2070	9060	5740	2190	9520	6670	1970	5290	4530	2100	9640	6110	2150	11560	6820	2090	10850	7270
Fallow-cauliflower-tomato		6690	9780		6980	10360		5240	4930		7110	6770		6670	8440		5870	7420
Black gram-cauliflower-summer squash	900	8620	10230	880	9150	11560	710	5870	8970	880	9420	11630	990	11130	15090	940	10750	15310
Lady finger-pea	8600	6010		8850	6240		7670	4380		9030	5570		11840	7060		10760	6800	
Bhopal																		
Soybean-durum wheat	663	3181		617	2978		552	2644		561	2696		588	2870		621	3022	
Soybean- mustard	690	1196		632	1104		476	967		513	1067		523	1041		625	1115	
Soybean- chickpea	593	1515		635	1448		510	1296		538	1330		555	1411		636	1478	
Soybean- linseed	662			598			503			527			512			600		
Mean	652			621			510			535			545			621		
Calicut																		
Turmeric Prathibha	23100	27000					25300						28500	29200				
Alleppey Supreme	21100	27200					28700						26500	30100				
Varna	28300	29700					21600						27800	24700				
Sobha	22000	30900					29800						26500	27000				
Sona	24700	25300					25300						26000	25000				
Kanthi	28600	25900					21800						22200	23000				
Suvarna	29200	23600					25500						25600	28100				
Suguna	27500	28400					26100						34200	40300				
Sudarsana	36100	28200					27000						31500	34800				
Kedaram	21700	9100					21300						28800	26500				
Prabha	23200	20200					26800						23100	33300				
Mean	26000	25000					25400						27300	29300				
Coimbatore																		
Cotton - maize	1853	5145		1767	5304		1607	5417		1640	5671		1933	5772		1987	5968	
Chillies - sunflower	-	1484		-	1640		-	1512		-	1658		-	1570		-	1783	
Beetroot - maize	24450	5033		26250	4867		25030	5300		26410	5520		25120	5040		29010	5667	
Dharwad																		
Cowpea-safflower	140	1025		173	1018		23	1111		30	1266		67	1144		167	1071	
Pigeon pea (Sole)	1424			1230			1588			1523			1386			1394		
Green gram-sorghum	2150	2885		2431	2828		2443	2595		2440	2989		2214	2614		2411	2369	
Groundnut + hybrid cotton (2:1)	2414			2166			2443			2440			2346			2279		
	399			255			315			396			294			240		

Locations /Treatments	Organic						Inorganic			Integrated (towards organic)								
	100% organic			75% organic + innovative organic practices			100% inorganic			State recommendation			50% organic + 50% inorganic			75% organic + 25% ilnorganic		
	Kharif	*Rabi*	*Summer*	*Kharif*	*Rabi*	*Summer*	*Kharif*	*Rabi*	*Summer*	*Kharif*	*Rabi*	*Summer*	*Kharif*	*Rabi*	*Summer*	*Kharif*	*Rabi*	*Summer*
Maize-chickpea	6116	1251		5927	830		5904	523		7116	688		5528	757		4952	688	
Jabalpur																		
Basmati rice–wheat (durum)-green manure	3319	3908		3049	3554		3717	4880		3229	4360		3329	4660		3203	4450	
Basmati rice–chickpea - maize fodder	3319	541	35000	3078	333	22500	3598	654	40410	3435	477	31000	3399	600	36200	3173	490	29700
Basmati rice–berseem (fodder and seed)	3561	260 59500		3239	220 50800		3810	300 62500		3282	230 55400		3379	290 50800		3173	250 43100	
Basmati rice–vegetable pea-sorghum (fodder)	3495	3530	53120	3151	3060	48950	3770	4680	67200	3640	4040	60400	3224	4360	61400	3222	3910	60200
Mean	3424			3129			3724			3397			3333				3193	
Karjat																		
Rice-groundnut	4710	3092		4128	2872		4751	2882		4319	2491		4739	2903		4611	2973	
Rice-maize (sweet corn for cob)	4028	14595		3788	14434		4176	15675		4068	12266		4098	15459		3959	14666	
Rice-mustard	4380	749		4049	667		4490	667		4280	592		4489	614		4179	715	
Rice-*dolichos* bean (green pod for vegetable)	4525	5237		4169	5153		4608	5054		4376	5093		4716	5029		4509	5101	
Mean	4411			4034			4506			4261			4511			4315	4411	
Ludhiana																		
Basmati rice-chickpea-GM	4820	2610		4610	2880		4430	1690		4430	1610		4410	2770		4490	2720	
Basmati rice-wheat-GM	4410	3240		4410	2610		4200	4460		4290	4510		4100	4370		4230	3400	
Cluster bean-wheat-summer moong	-	5280	980	-	5340	960	-	5320	890	-	5360	840	-	5680	900	-	5660	980
Soybean -wheat	3180	4230		3070	4180		1990	4950		1960	4820		2180	5330		2100	5380	
Mean	4137			4030			3540			3560			3563			3607		
Modipuram																		
Basmati rice– wheat (*durum*) - *sesbania* green manure	5017	4167		4333	5000		3033	4167		3908	3667		4375	5583		4808	4583	
Rice– barley (*malt*) – green gram	3550	4333	925	3425	4833	932	2667	3750	740	3433	4000	860	3621	4583	1010	3582	4167	1035
Maize (*pop corn*) – potato– okra - *sesbania* green manure	1690	23740	7800	1725	23070	7250	1375	22990	5940	1425	22900	6950	1823	23570	7350	1850	22240	7100
Maize (*sweet corn*) – mustard - *Sesbania* green manure	5250	2166		6000	2083		6670	1499		8080	2124		8420	1833		8170	2207	

Locations /Treatments	Organic						Inorganic			Integrated (towards organic)								
	100% organic			75% organic + innovative organic practices			100% inorganic			State recommendation			50% organic + 50% inorganic			75% organic + 25% ilnorganic		
	Kharif	*Rabi*	*Summer*	*Kharif*	*Rabi*	*Summer*	*Kharif*	*Rabi*	*Summer*	*Kharif*	*Rabi*	*Summer*	*Kharif*	*Rabi*	*Summer*	*Kharif*	*Rabi*	*Summer*
Pantnagar																		
Basmati rice-wheat	6222	4849		6150	4467		5565	4735		5868	4768		5954	5096		5969	4927	
Basmati rice -chickpea	6222	1032		6150	1027		5565	864		5868	9181		5954	927		5969	968	
(4rows+2rows coriander)		1046			1273			1046			250			1068			1273	
Basmati rice -vegetable pea (4 rows vegetable pea +2 rows coriander)	6222	5064		6150	4916		5565	4840		5868	4786		5954	5136		5969	5152	
		1250			1182			932			977			1023			932	
Basmati rice -potato	6222	13961		6150	13331		5565	11335		5868	10884		5954	13073		5969	12365	
Raipur																		
Soybean-maize	1845	13474		1977	13794		1970	12121		2106	12979		1859	10733		1948	11500	
Soybean-pea	1970	6937		2052	7906		1975	6277		1949	6587		1896	6385		1784	6411	
Soybean-chilli	2056	8862		2143	9742		1911	7770		1956	7984		1723	6430		1838	6339	
Soybean-onion	2077	14407		2042	15371		1795	14179		1868	16857		1758	13975		1838	13422	
Mean	1987			2054			1913			1970			1809			1852		
Ranchi																		
Rice -wheat	3566	2412		3649	2271		2935	2838		2138	1942		3331	2729		3256	2669	
Rice -lentil	3334	336		3566	307		2524	393		2171	250		3324	428		2977	407	
Rice -potato	3570	19635		3659	17493		3142	12138		2128	10710		3570	13209		3331	14637	
Rice -linseed	3284	847		3534	814		3284	632		2817	624		3213	651		2963	716	
Mean	3439			3602			2971			2314			3360			3132		
Umiam																		
Vegetable-vegetable systems *on raised bed*																		
Broccoli -carrot	12640	14813		11320	12119		11570	12960					13440	15732				
Broccoli - potato	12430	15780		11130	13560		11020	13840					13110	16330				
Broccoli -french bean	15760	9870		14190	8350		13370	7930					14670	9570				
Broccoli -tomato	15030	17650		14150	15730		12340	15230					14860	16820				
Mean	13970			12700			12080						14020					
Rice- fallow system*on sunken bed*																		
Megha aromatic 2–fellow	4582			3971			4230						4628					
Shasharang –fellow	4757			4240			4628						4781					
Ngoba –fellow	4080			3754			3882						4216					
Lampnah –fellow	4413			4481			4239						4694					
Mean	4458			4112			4245						4580					

New centres started from 2015-16

Locations /Treatments	Organic						Inorganic			Integrated (towards organic)								
	100% organic			75% organic + innovative organic practices			100% inorganic			State recommendation			50% organic + 50% inorganic			75% organic + 25% ilnorganic		
	Kharif	*Rabi*	*Summer*	*Kharif*	*Rabi*	*Summer*	*Kharif*	*Rabi*	*Summer*	*Kharif*	*Rabi*	*Summer*	*Kharif*	*Rabi*	*Summer*	*Kharif*	*Rabi*	*Summer*
Ajmer																		
Coriander – cluster bean		794			797			917			1136			1087			1219	
Coriander - green gram																		
Fennel - cluster bean		1771			1850			1950			2183			2092			2285	
Fennel – green gram																		
Narendrapur																		
Paddy (sohini 2)– broccoli–*sesbania* green manure	5094	8620		5035	8996		5340	10008		5322	9003		5933	9566		5866	9304	
Paddy (satabdi)– mustard– green gram	5648	1147	1203	5483	1070	1291	5000	1230	1003	5333	1110	1018	5833	1170	1220	5583	1150	1154
Paddy (satabdi)– capsicum– green gram	5583	25156	1208	5350	23610	1282	5190	24760	987	5266	20994	1004	5542	19688	1216	5358	18207	1175
Paddy (satabdi) – french bean – sesame	5642	7000	1275	5217	6666	1142	5819	5771	1283	5890	4895	1083	6225	7167	1075	5983	6333	975
Sardar Krushinagar																		
Groundnut- potato-pearlmillet	1889	17917	4056	2028	24611	3750	2778	29917	4583	3056	22556	4861	2528	31750	4472	2611	29833	4833
Greengram- cumin-vegetable cowpea	544	-	4288	589	-	4050	636	372	5020	664	511	5688	594	436	4749	603	408	4969
Greengram-fennel-fallow	542	1083	-	582	944	-	632	1389	-	658	1556	-	586	1222	-	599	1472	-
Thiruvananthapuram																		
Cassava-veg. cowpea	-	30920	-	-	27530	-	-	33080	-	-	25190	-	-	24360	-	-	31300	-
Cassava-groundnut	-		-	-		-	-		-	-		-	-		-	-		-
Taro-black gram	-	11160	-	-	10650	-	-	8430	-	-	5390	-	-	15540	-	-	15580	-
Taro-greengram	-		-	-		-	-		-	-		-	-		-	-		-
Udaipur																		
Maize + blackgram (2:2)– durum wheat – *sesbania* (GM)	1167 93	3167		1167 83	3247		1083 83	4167		1050 83	3750		1333 83	3250		1000 93	4000	
Sweet corn + blackgram (2:2) – chickpea	2667 175			1417 100			1917 167			1583 92			2583 133			1833 83		
Blackgram – wheat	292	2250		417	2513		250	3000		292	2167		333	2500		188	2333	
Soybean - fenugreek	417			292			667			250			500			542		

Table 2. Influence of organic, inorganic and integrated packages on straw yield (kg ha^{-1}) of crops in cropping systems at various locations

Locations /Treatments	Organic						Inorganic			Integrated (towards organic)								
	100% organic			75% organic + innovative organic practices			100% inorganic			State recommendation			50% organic + 50% inorganic			75% organic + 25% ilnorganic		
	Kharif	*Rabi*	*Summer*	*Kharif*	*Rabi*	*Summer*	*Kharif*	*Rabi*	*Summer*	*Kharif*	*Rabi*	*Summer*	*Kharif*	*Rabi*	*Summer*	*Kharif*	*Rabi*	*Summer*
Bajaura																		
Tomato-Cauliflower-French bean	620	2970	1440	660	3120	1670	540	1840	1130	610	3150	2410	650	3720	1530	630	3510	1710
Fallow-Cauliflower-Tomato	2260	2750		2340	2630		1820	2470		2380	3050		2250	2800		2010	2920	
Black gram-Cauliflower – Summer squash	1880	2840		1660	3000		1570	2010		1720	3080		2060	3650		2000	3400	
Lady finger-Pea	680			7.0			640			7100			730			740		
Bhopal																		
Soybean-durum wheat	1660	3674		1690	3628		1630	3609		1694	3699		1454	3702		1478	3658	
Soybean- mustard	1880	3178		1711	2933		1607	2502		1639	2488		1353	2711		1450	3082	
Soybean- chickpea	1729	2633		1690	2637		1597	2197		1683	2340		1309	2485		1468	2649	
Soybean- linseed	1750	2374		1717	2304		1703	2097		1725	2083		1396	2348		1502	2370	
Mean	1755			1702			1634			1685			1378			1475		
Coimbatore																		
Cotton - maize	-	5481		-	5567		-	5535		-	5876		-	6082		-	6247	
Chillies - sunflower	-	3745		-	4061		-	3987		-	4350		-	3955		-	4269	
Beetroot - maize	-	6150		-	5820		-	6170		-	6500		-	6320		-	6760	
Dharwad																		
Cowpea-safflower																		
Pigeon pea (Sole)																		
Green gram-sorghum																		
Groundnut + hybrid cotton (2:1)	2702			2480			2735			2825			2601			2585		
Maize-chickpea	8039			8064			7322			8659			7297			5749		
Jabalpur																		
Basmati rice–durum wheat-green manure	4876	4260		4479	4000		5374	5650		4397	5310		4955	6920		4716	6500	
Basmati rice–chickpea - maize fodder	4616	2210		4432	2060		4972	2690		4307	2340		4758	2210		4435	2060	
Basmati rice–berseem (fodder and seed)	4561			4364			4767			4218			4565			4345		
Basmati rice–vegetable pea- sorghum (fodder)	4591			4212			4767			4316			4616			4337		
Karjat																		
Rice-groundnut	5640	4060		5085	3750		5644	3764		5301	3212		5710	3793		5394	3892	

Locations /Treatments	Organic						Inorganic			Integrated (towards organic)								
	100% organic			75% organic + innovative organic practices			100% inorganic			State recommendation			50% organic + 50% inorganic			75% organic + 25% ilnorganic		
	Kharif	*Rabi*	*Summer*	*Kharif*	*Rabi*	*Summer*	*Kharif*	*Rabi*	*Summer*	*Kharif*	*Rabi*	*Summer*	*Kharif*	*Rabi*	*Summer*	*Kharif*	*Rabi*	*Summer*
Rice-maize (sweet corn for cob)	4672	18252		4370	18043		4997	19907		4797	15176		4997	19633		4701	18479	
Rice-mustard	5091	1310		4632	1139		5160	1174		4863	1024		5174	1075		4901	1251	
Rice-*dolichos* bean (green pod for vegetable)	5468	2499		4951	2413		5446	2271		5266	2235		5532	2362		5366	2340	
Ludhiana																		
Basmati rice-chickpea-GM	8360	3810		8590	3390		8200	2260		8660	1920		8800	3410		8570	3500	
Basmati rice-wheat-GM	7940	5570		7770	4310		8500	6280		8500	7010		8400	6310		8070	5560	
Cluster bean-wheat-summer moong	2070	7880		2130	8140		1890	7960		1650	7640		1920	8300		1930	8510	
Soybean -wheat	6880	6110		6530	6080		3670	7160		3610	7220		3810	8090		4030	8050	
Modipuram																		
Basmati rice– wheat (*durum*) - *sesbania* green manure	9300	8500		7000	9900		5170	9250		8970	8000		7820	8500		8390	7000	
Rice– barley (*malt*) – green gram	7000	7625	2960	6900	8708	2990	5400	6667	2420	6900	7875	2990	7000	7958	3420	7300	7500	3510
Maize (*pop corn*) – potato– okra + *Sesbania* green manure	2675			2850			2412			2530			2925			3012		
Maize (*sweet corn*) – mustard - *Sesbania* green manure	12350	7580		13560	8020		10860	6890		10590	7950		14050	7650		14250	7580	
Pantnagar																		
Basmati rice-wheat	6931	5528		6806	5110		6170	5425		6538	5460		6601	5915		6627	5675	
Basmati rice -chickpea (4rows+2rows coriander)	6931	3032		6806	2915		6170	2820		6538	2880		6601	2910		6627	2932	
Basmati rice -vegetable pea (4 rows vegetable pea +2 rows coriander)	6931			6806			6170			6538			6601			6627		
Basmati rice -potato	6931			6806			6170			6538			6601			6627		
Raipur																		
Soybean-maize	3473			3338			3452			3589			3349			3413		
Soybean-pea	4025			3643			3221			3184			3254			3473		
Soybean-chilli	3420			3925			3495			3517			3286			3119		
Soybean-onion	3386			3798			3475			3605			3226			3333		
Mean soybean	3576			3676			3411			3474			3279			3335		

Locations /Treatments	Organic						Inorganic			Integrated (towards organic)								
	100% organic			75% organic + innovative organic practices			100% inorganic			State recommendation			50% organic + 50% inorganic			75% organic + 25% ilnorganic		
	Kharif	*Rabi*	*Summer*	*Kharif*	*Rabi*	*Summer*	*Kharif*	*Rabi*	*Summer*	*Kharif*	*Rabi*	*Summer*	*Kharif*	*Rabi*	*Summer*	*Kharif*	*Rabi*	*Summer*
Ranchi																		
Rice -wheat	5355	3392		5612	3213		5041	3927		3920	2820		5534	3784		5476	3713	
Rice -lentil	5355	1142		5430	1107		4330	1232		3998	964		5244	1285		4919	1250	
Rice -potato	5673	2794		5692	2695		5073	2181		3770	2051		5430	2449		5633	2338	
Rice -linseed	5587	2196		5748	2115		5766	1687		5159	1671		5081	1714		4962	1874	
Umiam																		
Rice- fallow system*on sunken bed*																		
Megha aromatic 2–fellow	6848			6164			6223						7000					
Shasharang –fellow	6902			6367			6309						7273					
Ngoba –fellow	6959			6564			6845						6929					
Lampnah –fellow	6919			6377			6443						6851					
Mean	6907			6368			6455						7013					
Udaipur																		
Maize + blackgram (2:2) – durum wheat – *sesbania* (GM)	5667 157			4833 125			4500 125			3833 208			3833 208			4917 233		
Sweet corn + blackgram (2:2) – chickpea	2042 575			1833 483			1042 500			1917 492			1667 533			1833 333		
Blackgram – wheat	1042			833			1208			1375			1000			1354		
Soybean - fenugreek	1167			1292			1667			1083			1583			1125		

New centres started from 2015-16

Locations /Treatments	Organic						Inorganic			Integrated (towards organic)								
	100% organic			75% organic + innovative organic practices			100% inorganic			State recommendation			50% organic + 50% inorganic			75% organic + 25% ilnorganic		
	Kharif	*Rabi*	*Summer*	*Kharif*	*Rabi*	*Summer*	*Kharif*	*Rabi*	*Summer*	*Kharif*	*Rabi*	*Summer*	*Kharif*	*Rabi*	*Summer*	*Kharif*	*Rabi*	*Summer*
Narendrapur																		
Basmati rice– broccoli – *sesbania* green manure																		
Paddy– mustard– green gram			230	198			151			103			91			113		
Paddy– capsicum– green gram			229	192			150			100			83			115		
Paddy –french bean – sesame			1404	1367			1083			1692			1992			1604		
Sardarkrushinagar																		
Groundnut-potato-6833 pearlmillet	2083	2417	6083	2194	2667	5597	3028	4222	6750	3306	4083	6944	2833	4500	6778	2944	4194	
Greengram- cumin-vegetable cowpea	1333	-	2125	1472	-	2306	1500	700	2292	1750	794	2528	1528	661	2306	1583	628	2403
Greengram-fennel-fallow	1292	3389	-	1472	3028	-	1458	3667	-	1694	4444	-	1472	3556	-	1569	4333	-

Table 3. Influence of organic, inorganic and integrated package on systems productivity (kg/ ha) at various locations

Cropping Systems/ Management practice	Organic		Inorganic		Integrated (towards organic)		Mean
	100% organic	75% organic+ innovative organic practices	100% inorganic	State recomm-endation	50% organic + 50% inorganic	75% organic+ 25% inorganic	
Bajaura							
Tomato-cauliflower-frenchbean	19740	21720	14060	20910	23940	23850	20700
Fallow-cauliflower-tomato	16470	17340	10170	13880	15110	13290	14380
Black gram-cauliflower-summer squash	21840	22850	16750	23160	18380	26870	**23170**
Lady finger-pea	15470	16000	12320	15130	19470	18270	16110
Mean	18380	19480	13320	18270	21530	20570	
Coimbatore							
Cotton-maize	3280	3238	3110	3213	3534	3643	3336
Chilli-sunflower	824	911	840	921	872	991	893
Beetroot-maize	6831	7185	7034	7402	6982	8021	7243
Mean	3645	3778	3661	3845	3796	4218	
Jabalpur							
Basmati rice – wheat (durum) – green manure	8597	7872	7587	6702	7200	6886	7474
Basmati rice – chickpea – maize fodder	7355	5974	7381	6359	6795	6007	6645
Basmati rice-berseem (fodder and seed)	10516	9225	10501	9033	9076	8045	9399
Basmati rice – vegetable pea–sorghum (fodder)	10389	9335	10801	9861	9709	9353	9908
Mean	9214	8102	9068	7989	8195	7573	
Karjat							
Rice-groundnut	26963	24696	20529	18015	20633	20818	21942
Rice-maize (sweet corn for cob)	26387	25798	22579	18532	22257	21152	22784
Rice-Mustard	11341	10229	8777	8133	8506	8664	9275
Rice-dolichos bean (for green pod vegetable)	21157	20370	16587	16399	16669	16583	17961
Mean	21462	20273	17118	15270	17016	16804	
Ludhiana							
Basmati rice-chickpea	14700	14900	11900	11800	14300	14300	13650
Basmati rice-wheat	11500	10800	12300	12500	12000	11300	11733
Moong-wheat	8300	8300	8100	8000	8500	8700	8317
Pigeon pea -wheat	9800	9600	8500	8300	9200	9100	9083
Mean	11075	10900	10200	10150	11000	10850	
Pantnagar							
Basmati rice-wheat	9734	9333	9071	9222	9268	9601	9371
Basmati rice -chickpea (4rows+2rows coriander)	13678	13544	12087	12817	12840	12909	12979
Basmati rice -vegetable pea (4 rows vegetable pea+ 2 rows coriander)	13297	13002	12485	12705	13508	12833	12972
Basmati rice -potato	9738	9427	8004	8561	9274	9121	9021
Mean	11612	11326	10412	10826	11223	11116	
Raipur							
Soybean-maize	12210	12588	11294	12089	10115	10794	11515
Soybean-pea	8640	9654	8010	8283	8035	7949	8429

Cropping Systems/ Management practice	Organic		Inorganic		Integrated (towards organic)		Mean
	100% organic	75% organic+ innovative organic practices	100% inorganic	State recomm-endation	50% organic + 50% inorganic	75% organic+ 25% inorganic	
Soybean-chilli	10577	11510	9382	9633	7906	7933	9490
Soybean-onion	12052	12684	11611	13539	11433	11130	12075
Mean	10870	11609	10074	10886	9372	9452	
Ranchi							
Rice(Birsamati) -wheat (K 9107)	5938	5882	5727	4048	6016	5881	5582
Rice (Birsamati) -lentil (PL 406)	4066	4235	3380	2716	4258	3864	3753
Rice(Birsamati) -potato (Kufri Ashoka)	13870	12836	9509	7746	10499	11009	10912
Rice (Birsamati) -linseed (Shekhar)	4394	4601	4113	3635	4067	3902	4119
Mean	7067	6889	5682	4536	6210	6164	
Umiam							
Vegetable-vegetable systems *on raised bed*							
Broccoli -carrot	36741	31525	32900		39034		35050
Broccoli - potato	34423	30256	30379		36005		32766
Broccoli -french bean	38445	33806	31949		36350		35138
Broccoli -tomato	40188	36957	33741		39115		37500
Mean	37449	33136	32242		37626		
Sardar Krushinagar							
Groundnut- potato- pearlmillet.	26957	32146	32613	29081	33002	32398	31033
Greengram- cumin- vegetable cowpea	13167	12869	15346	17865	15185	15435	14978
Greengram-fennel- fallow	5244	5132	5792	6319	5243	5889	5603
Mean	15123	16716	17917	17755	17810	17907	
Udaipur							
Maize + blackgram (2:2) – durum wheat – *sesbania* (GM)	3991	4192	4596	3430	4346	3899	4076
Sweet corn + blackgram (2:2) – chickpea	6410	3448	4858	3730	5987	179	4102
Blackgram – wheat	6127	6976	6788	6294	6633	6153	6495
Soybean - fenugreek	2186	1880	2714	1362	2557	2325	2171
Mean	4679	4124	4739	3704	4881	3139	

ha), okra (10510 kg/ha) and pea (7060 kg/ha) were found to be higher in integrated package consisting of 50% organic+50% inorganic management approach while, *summer* frenchbean recorded yield (7270 kg/ha) with 75% nutrient from organic + 25% nutrient from inorganic resulted in higher towards organic package. *Summer* squash also registered higher yield with integrated (50% each organic and inorganic and 75% organic+25% inorganic management) 15090 kg/ha and 15310 kg/ha respectively. It is also important to observed that *kharif* and *summer* tomato, *summer* frenchbean and squash, *rabi* cauliflower and pea recorded higher yield with integrated or towards organic crop management. However, yield is increase of 27.6 and 17.5, 10 and 37.7% was observed with 50% reduced application of nutrients in *rabi* cauliflower and pea, *kharif* and black gram and okra respectively, whereas, reverse was observed in *summer* frenchbean and squash where, yield was increased of 26.6 and 49.6% with 25% reduced application

of nutrients in the form of organic manures under integrated management. Straw yield of crops also followed the similar trend. In terms of system equivalent yield, blackgram-cauliflower-summer squash resulted in higher cauliflower equivalent yield (23170 kg/ha) among the cropping systems. Among the different management practices, integrated management with 50% organic+50% inorganic dose of nutrients resulted in higher equivalent yield (21530 kg/ha) across the cropping systems and it is on par with application of 75% nutrients only through organic manures (20570 kg/ha). The equivalent yield in term of cauliflower equivalent was increased to the tune of 17.1 and 61.6% with integrated nutrient management over organic.

Bhopal: Four soybean based cropping systems were evaluated. All the crops evaluated in the systems, recorded higher yield under organic management compared to integrated and inorganic management practices. Organic management practice with 75% nutrients only through organic manures +innovative practices recorded comparable yield with that of organic management with 100% nutrients through organic manures. Higher mean yield of soybean (652 kg/ha) was recorded under 100% organic management followed by management practices either with 75% nutrients application through organic manures

Linseed and mustard under organic management at Bhopal

Soybean under organic management at Bhopal

Integrated management in wheat at Bhopal

+innovative practices or under integrated (621 kg/ha). The yield of soybean was found to be higher by 27.8% and 21.8% compared to inorganic package respectively. The yield of *duram* wheat, mustard, chickpea and linseed was recorded maximum in 100% organic management of 3181, 1196, 1515 and 1526 kg/ha respectively. The yield difference between organic and inorganic management was 20.3, 23.7, 16.9, and 11.6 % for *durum* wheat, mustard, chickpea and linseed respectively. Straw yield of crops also recorded similar trend. In terms of system (soybean) equivalent yield, organic management registered higher yield (2306 kg/ha) with 100% nutrients through organic manures followed by integrated with75% nutrients application through organic manures + 25% inorganic (2202 kg/ha) than inorganic management packages. The soybean equivalent yield was increased with organic management of 20.3 and 12.3% over inorganic and integrated with 50% each organic and inorganic nutrient management practices, however, 75% nutrient supply through organic manure +innovative practices and 75% through organic manure+ 25% inorganic under integrated management recorded on par equivalent yield. Among the cropping systems, soybean-linseed recorded higher yield (2291 kg/ha) followed by soybean-wheat (2188 kg/ha).

Calicut: Spices crops such as ginger, turmeric and black pepper were evaluated under different management packages. 11 turmeric varieties were evaluated for effect of different management systems on yield of turmeric. Among the management systems, integrated package consisting of 50% organic+50% inorganic recorded higher yield of turmeric (29300 kg/ha) followed by reduced application of nutrients (75% through organic manures+25% inorganic) (27300 kg/ha) than organic management with 100% nutrients from organic sources (26000 kg/ha). Among varieties, sudarshana recorded highest yield (31500 kg/ha) followed by suguna (31300 kg/ha) under integrated management practice (50+50%). Among other varieties, kedaram and prabha recorded maximum yield under (100%) organic management practices. All the turmeric varieties performed better with integrated package of 75% organic+25% inorganic.

Ginger and turmeric under organic management at Calicut

Coimbatore: Among the management practice, all the crops registered higher yield towards organic with 75% nutrients only through organic manures with integrated management compared to 100% nutrients supply through organic sources and inorganic management. Cotton yield was increased to the tune of 23.6 and 7.23% with reduce dose of manure under 75% nutrient only through manure in integrated package

whereas the yield of maize (10.2 and 16%), sunflower (18 and 20.1%) and beetroot (15.9 and 18.6%) was increased compare to organic and inorganic package respectively. Residues/straw yield also exhibited the similar trend.

Beetroot and sunflower under organic management at Coimbatore

Dharwad: All the crops recorded higher yield under inorganic management and state recommendation except cowpea and chickpea. Pigeon pea (sole), green gram and groundnut recorded maximum yield (1588, 2443 and 2443 kg/ha respectively) with 100% inorganic management while, safflower, sorghum and maize recorded higher yield (1266, 2989 and 7116 kg/ha respectively) under state recommendation of nutrient supply. Cowpea and chickpea recorded maximum yield (173 and 1251 kg/ha) under organic with 100% nutrient source of organic and 75% organic +innovative practice. Among the nutrient management, crops cowpea and chickpea yield was increase with organic package more than 2.5 times over integrated and more than 7 times with inorganic. The yield reduction under 100% organic management were found to be in safflower, pigeon pea, green gram, sorghum, groundnut and maize were 7.7, 10.3, 12, 1.2and 14% respectively over inorganic nutrient packages. The straw yield also gave similar trend.

Groundnut and sorghum under organic management at Dharwad

Jabalpur: During *kharif* season, rice cv. pusa basmati-1 was grown in all 4 cropping system with crops such as wheat (*duram*), chickpea, maize (fodder), berseem, vegetable pea and sorghum. Mean grain yield of rice across cropping systems was not affected with the different nutrient management, however the maximum grain yield of rice (3810 kg/ha) was recorded under 100% inorganic management with overall mean (3724 kg/ha) which slightly decreased to the tune of 8.1 and 10.5% in compare to 100% organic and integrated (50% organic + 50% inorganic) nutrient management respectively. Yields of different crops behaved differently as compared to rice yields under different nutrient management during *rabi* and *summer* seasons. Yield of wheat (4880 kg/ha), chickpea (654 kg/ha), berseem seed and fodder (300 and 62500 kg/ha), vegetable pea (4680 kg/ha) during r*abi*and maize fodder (40410 kg/ha) and sorghum fodder (44690 kg/ha) during summer were recorded higher under inorganic nutrient package with 100% inorganic nutrient management. The reduction in the yield of wheat, chickpea, berseem fodder and seed, vegetable pea maize fodder, and sorghum fodder with organic management under 100% organic manure was found to be 19.9, 17.3, 13.3 & 4.8, 26.6, 13.4and 20.9% respectively over inorganic nutrients management. Straw yield also followed same trend. Total productivity of cropping system in terms of rice equivalent yields (REY) was recorded maximum with 100% organic nutrient management (9214 kg/ha/year) followed by inorganic (9068 kg/ha/year) and integrated (8165 kg/ha/year) nutrient management i.e. 50% organic+50% inorganic nutrient management. Among the crop-sequences, rice-vegetable pea- sorghum fodder led to record the highest rice equivalent yields (9908 kg/ha/year) followed by rice-berseem (fodder and seed), rice-wheat and rice-chickpea-maize fodder in descending order.

Maize and sorghum under integrated management at Jabalpur

Karjat: Under rice based cropping systems, crop groundnut, sweet corn, mustard and dolichos bean were evaluated. Among the different crops, across the cropping systems, higher mean yield of rice (4511 kg/ha) was recorded with integrated application of 50% organic +50% inorganic nutrient from organic and inorganic manures/fertilizer followed by 100% inorganic management (4506 kg/ha) and found to be on par to each other. The yield Influence by management package with 100% organic and reduced dose of organic manure was recorded only 2.3, 11.8 and 4.5% lower than the integrated management i.e. 50% each nutrient management. Other crops such as ground nut, mustard and dolichos bean recorded higher yield with organic nutrient package having 100% nutrient supply through organic sources and yield was found to be higher only 7.3 and 12.3 and 3.6% over inorganic nutrient management. Inorganic nutrient management practices were found to be better for maize with 100% nutrient supply through inorganic

sources (15675 kg/ha)found to be on par with integrated (15459 kg/ha) and reduction in yield was recorded to the tune of 6.9% over organic package. Straw yield also exhibited similar trend. System equivalent yield in term of rice equivalent, rice ground nut and rice-maize (sweet corn for cob) system grown with organic package of 100% nutrient by organic sources produced maximum rice equivalent yield (26963 and 26387 kg/ha)compared to other treatments followed by same system grown under 75% organic + innovative practices (34969 and 25798 kg/ha). Among the management package, organic management with 100% nutrient supply through organic sources recorded 25.4 and 18.4% higher over inorganic management practice respectively.

Dolichos bean and groundnut under organic management at Karjat

Ludhiana: In case of basmati rice, organic, inorganic and integrated management did not influence, however maximum basmati rice yield (4820 kg/ha) was recorded with organic management through application of 100% organic manure in basmati rice-chickpea-green manure system. Although basmati rice was grown with green manure in both the system, the slightly higher yield under organic management might be due to effect of organic manure in the treatments. During *kharif*, higher seed yield of soybean (3180 kg/ha) was also obtained under 100% organic package and it was 45.9 and 59.8% higher to integrated and inorganic packages. Crop clusterbean was failed due to heavy rains and diseases and data could not record. During *rabi,* chickpea (2880 kg/ha) performed better under organic with 75% organic + 25% innovative practice followed by integrated and produced significantly 70.4 and 78.9% more seed yield compared to 100% inorganic and state recommendation practices respectively. Wheat recorded higher yield (5680 kg/ha) in integrated package with 50% each organic and inorganic management. About 7.2% less yield was recorded with 100% organic management over towards organic management with 75%

Basmati rice and cowpea under organic management at Ludhiana

nutrient supply with organic sources+25% from inorganic sources. Residue yield of all the crops also resulted in similar trend. Although management practices did not influenced in terms of system equivalent yield, however, organic management with100% organic practices resulted in higher wheat equivalent yield (11075 kg/ha) followed by integrated management with 50% organic+50% inorganic source of nutrient as compared to other nutrient packages but it was on par with each other. Among the cropping systems, wheat equivalent yield was found to be higher (13650 kg/ha) in basmati rice-chickpea followed by basmati rice-wheat (11733 kg/ha).

Modipuram: Rice and maize based cropping systems with different crops such as wheat, greengram, barley, potato, mustard in *rabi* and okra in *summer* were evaluated. During *kharif*, basmati rice grain yield was increased by 65.4 and 28.4% with organic management along with highest grain yield (5017 kg/ha). Higher grain and straw yield of coarse rice was found to be higher under integrated nutrient management (3621 and 7300kg/ha respectively). As compared to 100% inorganic, 35.8% higher grain yield was recorded under integrated with50% each organic and inorganic nutrient management. Organic and towards organic management produced more or less similar yield of coarse rice. Among different management systems,

Basmati rice and okra under organic management at Modipuram

Green gram and mustard under organic management at Modipuram

integrated crop management system recorded higher grain and stover yield followed by organic as compared to inorganic production system. Highest grain (popcorn maize1850 kg/ha) was found to be higher towards organic(75% organic + 25% inorganic) which was 9.5 and 34.6% higher as compared to 100% organic and inorganic production system, respectively, however, maize cob yield (sweet corn) recorded also higher under integrated with 50% each nutrient sources (organic and inorganic) followed by towards organic. The reduction in yield with organic was found by 27% while towards organic it was increased by 22.5%as compared to inorganic management system. During *rabi and summer*, wheat, barley, mustard and greengram recorded higher yield (5583, 4583, 2207 and 1035 kg/ha respectively) under integrated management either with 50% each organic and inorganic nutrient or 75% organic + 25% inorganic nutrient (towards organic). The reduction in yield for wheat (34 & 21.8%) and barley (5.8 & 9.98%)were recorded with organic practices over integrated (with 50% each organic and inorganic nutrient and 75% organic + 25% inorganic nutrient) respectively however the yield of mustard and green gram was increased by 11.9 and 2% towards organic management. Potato and okra recorded higher yield (23740 and7800 kg/ha respectively) under organic management with 100% nutrient supply through organic sources and was on par with integrated. Straw yield also exhibited similar trend.

Pantnagar: Basmati rice based cropping system was evaluated under different management packages. Grain yield of basmati rice (6222 kg/ha) was higher with 100% organic package followed by 75% organic +innovative practices (6150 kg/ha)as compared to inorganic and integrated management. It was found to be higher by 11.8 and 4.5% over inorganic and integrated. In *rabi*, wheat yield (5096 kg/ha) was highest under integrated package (50%each organic and inorganic) followed by 75% organic+25%inorganic, that indicating better performance towards the organic production system and it was increased by 7.6 and 4% compare to inorganic. Other crops like chickpea, coriander and potato also recorded higher yield of 1032, 1273 and 13961 kg/ha under organic management respectively and increase in yield was found to be 19.4,21.7 and 23.2% respectively over inorganic management however, vegetable pea was recorded higher with integrated (5136 kg/ha).Straw yield also gave similar trend. The rice equivalent yield in term of

Vegetable pea and wheat under organic management at Pantnagar

system productivity was found to be higher (11612 kg/ha) with organic management having 100% nutrients through organic manures followed by 75% organic nutrients +innovative practices (11326 kg/ha). Among all the cropping systems, higher system productivity was recorded with rice-chickpea +coriander-*sesbania* system (12979 kg/ha) and was statistically on par with rice-vegetable pea +coriander-*sesbania* (12972 kg/ha) and least was observed in rice-potato system (9021 kg/ha).

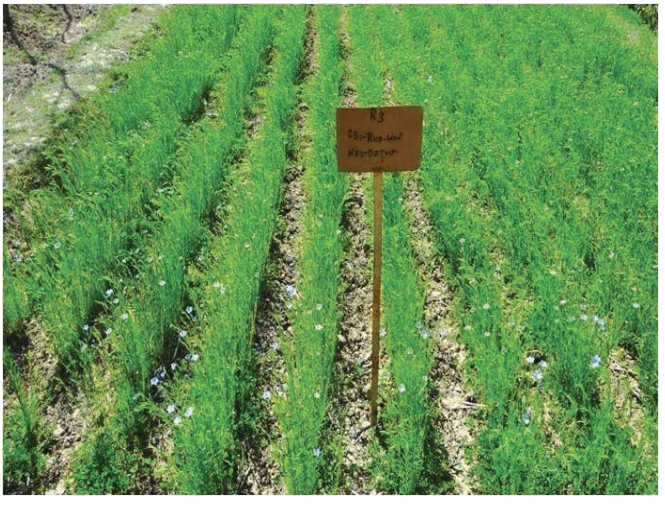
Raipur: Soybean based cropping systems were evaluated with maize, pea, chilli, and onion under organic, inorganic and integrated management packages. Soybean yield as influenced by management practice was recorded higher with reduced dose of organic manure 75% organic +innovative practices (2143 kg/ha) in soybean-chilli system. The enhancement in yield was found by 7.4and 13.5% over to 100% inorganic and integrated nutrient management. Other crops such as maize (green cob), pea, and chilli also recorded higher yield (13794, 7906and 9742 kg/ha respectively) under 75% organic manures+ innovative practices (foliar spray of vermiwash) while, onion bulb yield resulted in higher with state recommendation (16857 kg/ha). The yield differences under inorganic package (from 100% organic to inorganic) were found to be 13.8, 20 and 22% with maize, pea and chilli respectively. The straw yield of all crops was also found to be in same trend. Among the cropping systems, soybean-onion registered higher soybean equivalent yield (10178 kg/ha) compared to other cropping systems however, management systems was not influenced whereas highest SEY (9556 kg/ha) recorded under organic with 75% organic manures+ innovative practices (foliar spray of vermiwash) and was higher 7.1 and 26.3% to inorganic and state recommendation respectively.

Onion under organic management in soybean-wheat system at Raipur

Chickpea crop at Raipur

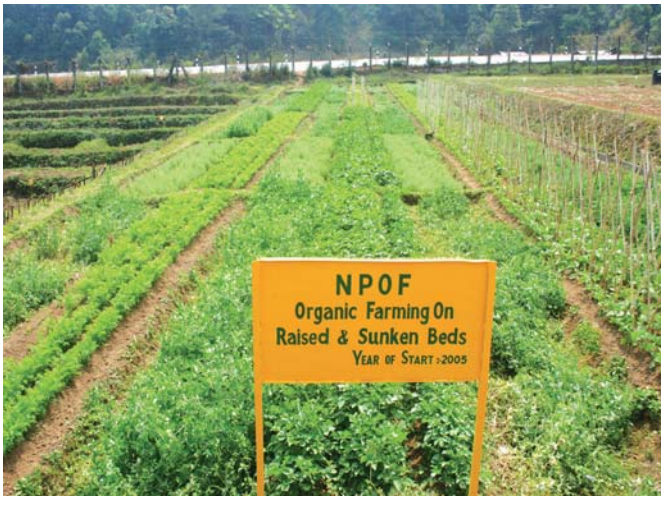
Ranchi: Different crops such as wheat, potato, linseed, & lentil were evaluated in basmati rice based cropping system. In rice, higher yield (3602 kg/ha) was found under organic management of nutrients with 75% organic nutrient sources+ innovative practices (*Azolla* in rice, *Rhizobium* in lentil and *Azotobactor* in wheat, potato & linseed along with vermiwash spray) across the system, the differences from 100% organic to towards organic (75% organic maures+25% inorganic source) was found to be 15.0 and 4.7% respectively among the nutrient management. Wheat recorded highest yield (2838 kg/ha) under inorganic package with 100% inorganic nutrients which was at par with integrated nutrient package. The yield was decrease with 100% organic and towards organic (75% organic+25% inorganic) by 15.0 and 6.0%

respectively. Potato and linseed recorded higher yield (19635 & 847 kg/ha) under organic package of nutrient with 100% nutrient supply through organic sources while, lentil recorded higher yield (428 kg/ha) under integrated package (50% organic+50% inorganic).The yield was found to be higher in potato and linseed to the tune of61.8& 48.6% and 34.0 & 30.1% respectively under organic management over inorganic and integrated nutrient package. The straw yield also gave similar trend. Systems equivalent yield was higher (7067 kg/ha) with organic nutrient package with 100% organic source of nutrients followed by 75% organic + innovative practices. State recommendation management practices produced minimum systems productivity yield (4536 kg/ha). Among the cropping systems, rice-potato recorded higher system equivalent yield (10178 kg/ha) while rice-lentil recorded lower equivalent yield (3753 kg/ha).



Lentil and linseed under integrated management at Ranchi

Umiam: Two different experiments of rice and vegetable based cropping system including different varieties of crops were evaluated with raised and sunken bed planting method. The experiment consists of four cropping system namely broccoli-carrot, broccoli-potato, broccoli-frenchbean, broccoli-tomato on raised beds and four cropping systems namely rice (var. Megha Aromatic 2)-fallow, rice (var. Shahsarang-1)-fallow, rice (Var. Ngoba)-fallow and rice (var. Lampnah)-fallow on sunken beds were evaluated. The higher



Crops under raised and sunken beds at Umiam

Tomato crop on raised bed under integrated management at Umiam

broccoli yield (15760 kg/ha) was recorded with broccoli-frenchbean cropping system. However, it remain statistically at par with broccoli yield under broccoli-tomato followed by broccoli - carrot and broccoli - potato cropping systems. Among the management practices, integrated treatment recorded maximum broccoli average yield (14020kg/ha) followed by 100% organic (13970 kg/ha). 75 % organic and inorganic management practice remains statistically at par with each other on broccoli average yield. The minimum broccoli average yield was recorded in inorganic management practice (12008 kg/ha).Carrot and potato recorded highest yield 15740 and 16330 kg/ha under integrated nutrient package towards organic with 75% nutrient supplied through organic manures however, frenchbean and tomato grown on raised bed recorded highest yield (9870 and 17650 kg/ha) under organic package with 100% organic manures. Straw yield of crops was also found to be in similar trend. The yield of frenchbean and tomato was increased with organic management to the tune of 24.5 and 15.8% over inorganic whereas, integrated management towards organic, carrot and potato produced 6.2 and 3.5% more yield compared to 100% organic. In sunken beds, the higher rice grain yield (4580 kg/ha) was recorded with integrated package having 50% organic+50% inorganic nutrients followed by 100% organic (4460 kg/ha).Among the rice varieties, Shahsharang-1 produced maximum grain yield (4600 kg/ha) followed by Lampnah (4460 kg/ha), Megha Aromatic 2 (4305 kg/ha) and Ngoba (3908 kg/ha).Rice equivalent yield of broccoli-vegetables cropping system were recorded maximum under integrated treatment (376003 kg/ha) followed by 100% organic (370045 kg/ha) and 75% organic (331400 kg/ha). Among cropping sequences, broccoli–tomato cropping system recorded maximum REY (37500 kg/ha) followed by broccoli- frenchbean, broccoli-carrot and broccoli -potato cropping system.

Ajmer: The experiment was started from *rabi* 2015-16 with coriander and fennel under seed spices based cropping system. Yield of coriander and fennel were influenced significantly by various nutrient management practices. Among them, seed yield of coriander and fennel was found to be higher in integrated approach towards organic with 75% organic + 25% inorganic (1219 and 2285 kg/ha respectively) followed by state recommendation (1136 and 2183 kg/ha) and 50% each organic and inorganic which were at par. Lowest was recorded in 100% organic management. The increase in yield of coriander and fennel was found to be 7.3 and 4.7% respectively from state recommendation to towards organic (75% organic +25% inorganic).The results with yield clearly indicate that integrated management for coriander and funnel towards organic performed better production than managing crop organically alone.

Seed spice crop coriander and fennel under integrated management at Ajmer

Narendrapur: The experiment consisting of four cropping system including two rice varieties sohini and shatabdi with different crops namely broccoli, mustard, greengram, capsicum, frenchbean and sesame was started during 2015-16 for evaluation under organic, inorganic and integrated nutrient management. Paddy variety sohini recorded maximum grain yield under integrated nutrient management having 50% each nutrient sources organic and inorganic followed by 75% nutrient through organic sources. Paddy variety shatabdi also recorded highest yield (6225 kg/ha) under integrated 50% each nutrient packages. The differences in yield of paddy were found to be 16.5 and 10.3% from integrated to organic and inorganic nutrient package. Other crops in the systems such as broccoli and mustard recorded higher yield (10008 and 1230 kg/ha respectively) under 100% inorganic management during *rabi*. Green gram, capsicum and sesame recorded maximum yield under 100% organic and reduced dose of organic manure and green gram was higher by 28.7% whereas capsicum and sesame was on par.

Sardarkrushinagar: Among the crops evaluated under different cropping systems and nutrient management package, all the crops recorded higher yield under state recommendation except potato which was higher with integrated management. Crops groundnut, pearl millet, green gram, vegetable cowpea and fennel resulted in higher yield (3056, 4861, 664, 5688 and 1556 kg/ha respectively) with state recommendation and reduction from state recommendation to 100% organic management were found to be 38.2, 16.6, 18.1 24.6 and 30.4 % respectively. Cumin crop grown under organic management was failed due to heavy infestation of blight disease while performance of crop under inorganic management showed better in seed yield (511 kg/ha) with State recommendation and reduction in yield with integrated package recorded to the tune of 20.2%. Response of potato (31750 kg/ha) was found to be higher in integrated package consisting of 50% organic + 50% inorganic management approach however, yield is increase with 50% reduced application of nutrients in the form of organic manures under integrated management by 77.2%. Straw yield of crops also followed the similar trend.

Pearlmillet and groundnut under organic management at Sardarkrushinagar

Thiruvananthapuram: Crops cowpea, groundnut, blackgram and greengram with two tuber crops such as cassava and taro were evaluated under four cropping systems. The tuber yield of cassava was highest in 100% inorganic package (33080 kg/ha) followed by towards organic with 75% organic + 25% inorganic (31300 kg/ha). However, taro was recorded higher under integrated 50% each nutrient from organic and inorganic sources (15580 kg/ha) but on par with 75% organic + 25% inorganic. The yield difference in

cassava with organic over inorganic was 6.5% and with integrated (75% organic +25% inorganic) was 5.4%. Taro yield difference from organic to integrated (towards organic) was recorded to the tune of 28.4%. The other crops, such as cowpea, groundnut, blackgram and greengram were not harvested so the data was not recorded.

Taro and cassava under organic management at Thiruvanthapuram

Udaipur: The experiment was started during 2015-16 consisting of four cropping systems for evaluation of effect of organic, inorganic and integrated production systems on yield of different crops in maize based cropping systems. Maize and inter crop blackgram resulted in higher yield (1333 and 93 kg/ha) under integrated packages whereas, wheat crop (*duram* 4167 kg/ha, *aestivum* 3000 kg/ha) and soybean (667 kg/ha) performed better with 100% inorganic management. Sweet corn and its intercrop black gram recorded higher yield with organic condition, while sole blackgram recorded maximum (417 kg/ha) with reduced dose of manure 75% organic+25% innovative practice. The yield difference between integrated to organic and inorganic management was 12.4 and 18.7% for maize. In wheat crop, reduction in yield for *duram* and *aestivum* with organic was found to be 24.0 and 25% respectively compared to inorganic. Sweet corn yield was increased with organic management of 39.1 and 3.2% over inorganic and integrated with 50% each organic and inorganic nutrient management practices, however, 75% nutrient supply was made through organic manure +innovative practices recorded higher yield for blackgram sole crop and produced 66.8 and 25.2% more yield compared to inorganic and integrated management packages. Out

Scientists of ICAR-IIFSR and PI's of different NPOF centres visiting the experiment field at Udaipur

of four cropping systems, blackgram-wheat (*aestivum*) cropping system gave maximum maize equivalent yield under organic with 75% organic+25% innovative practices (6976 kg/ha) followed by 100% inorganic management (6788 kg/ha). Among the management practices, integrated with 50% each organic and inorganic nutrient management practices recorded maximum maize equivalent yield (4881 kg/ha) but was at par with 100% organic and inorganic. The lowest equivalent yield was with 75% nutrient through organic manure+ 25% inorganic under integrated management.

Influence of organic management package with reduced dose of organic manures, integrated and inorganic nutrient management packages on Bulk density, electric conductivity, pH, organic carbon, available nitrogen, phosphorus and potassium (Table 4-7)

Bajaura: Chemical characteristics of soil in terms of pH, organic carbon, available N, P and K have been estimated and reported by the centres. The soil pH under different cropping systems as influenced by nutrient management was higher under integrated (75% organic+ 25% inorganic) and organic management package whereas lower value of soil pH was recorded in inorganic management.The soil pH indicated normal range of 6.2 -7.4 in all the treatments.Different cropping systems recorded maximum improvement in soil organic carbon ranging from 0.67 to 1.46%. Organic management with 100% nutrients through organic manures recorded higher organic carbon (1.26%) followed by organic management with 75% nutrients through organic manure +innovative practices (1.12%) which is 82.6 and 62.3% higher than 100% inorganic management. Among the cropping systems, cauliflower-tomato system recorded highest organic carbon content (1.46%) and found to be higher of 117.9%. Availability of residual N in soil was higher with integrated nutrient management practices at the end of cropping cycle than organic management in compare to inorganic. Around 12.6 and 12% higher soil available N was recorded under organic and integrated than inorganic management. Due to the presence of leguminous crop of pea in lady finger-pea system, higher soil available N (252.4 kg/ha) was noticed in this system. In term of soil available phosphorous, integrated management recorded higher available phosphorous (71.9 and 67.1 kg/ha) with 50% organic+50% inorganic or 75% nutrients through organic manure+25% inorganic as compared to inorganic packages. Not much variation was recorded among the cropping systems. Similarly, the higher content of soil available K_2O (256.5 kg/ha) was recorded in blackgram-cauliflower-summer squash system under integrated (50% organic+50% inorganic) nutrient management. The differences of K_2O with integrated over inorganic was found to be higher of 97%.

Bhopal: The soil electrical conductivity and pH did not change due to different nutrient management and varied from 0.13 to 0.25 dsm^{-1} and 7.54 to 7.90 respectively across the cropping system. Soil organic carbon was recorded higher in 100% organic management (0.93%) followed by 75 % organic + innovative practices (0.91%) and lowest was found in inorganic nutrient management and it was 63.1 and 59.6% higher than inorganic packages respectively. Among the copping systems, soybean-wheat recorded higher soil organic carbon followed by, soybean-mustard, soybean-linseed and soybean-chickpea. The soil available N varied from 199 kg ha^{-1}as lowest in state recommendation to 227 kg/ha as highest in integrated with75% organic+25% inorganic manure, similarly, the variation in P was observed18.0 to 43.0 kg/ha. Among the copping systems, soybean-wheat recorded higher available P followed by soybean-mustard, soybean-linseed and soybean-chickpea. K was not influenced by the management practice however; significantly, higher K was recorded in soybean-wheat followed by soybean-mustard which is on par.

Table 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

Treatments / Management practice	Bulk density (g/cc)							Soil EC (d/m)						
	Organic		Inorganic		Integrated (towards organic)		Mean	Organic		Inorganic		Integrated (towards organic)		Mean
	100% organic	75% organic + innovative organic practices	100% inorganic	State recomm-endation	50% organic + 50% inorganic	75% organic + 25% inorganic		100% organic	75% organic + innovative organic practices	100% inorganic	State recomm-endation	50% organic + 50% inorganic	75% organic + 25% inorganic	
Bhopal														
Soybean- wheat								0.17	0.25	0.22	0.17	0.16	0.19	0.19
Soybean- Mustard								0.19	0.20	0.17	0.16	0.19	0.14	0.18
Soybean- Chickpea								0.20	0.16	0.16	0.16	0.20	0.13	0.17
Soybean- Linseed								0.17	0.19	0.20	0.19	0.19	0.15	0.18
Mean								0.18	0.20	0.19	0.17	0.18	0.15	
Dharwad														
Cowpea-safflower	1.19	1.27	1.30	1.27	1.27	1.28	1.26	0.19	0.18	0.20	0.18	0.19	0.21	0.19
Pigeon pea (Sole)	1.19	1.27	1.31	1.30	1.28	1.27	1.27	0.20	0.19	0.17	0.20	0.20	0.20	0.19
Green gram-sorghum	1.20	1.27	1.31	1.31	1.27	1.29	1.28	0.22	0.21	0.20	0.20	0.19	0.21	0.20
Groundnut + hybrid cotton (2:1)	1.19	1.27	1.31	1.30	1.31	1.31	1.28	0.22	0.20	0.19	0.21	0.21	0.20	0.21
Maize-chickpea	1.20	1.27	1.30	1.26	1.28	1.29	1.27	0.21	0.20	0.21	0.21	0.20	0.20	0.20
Mean	1.19	1.27	1.31	1.29	1.28	1.29		0.21	0.20	0.19	0.20	0.20	0.20	
Jabalpur														
Basmati rice –wheat (duram)-green manure	1.23	1.24	1.36	1.36	1.32	1.33	1.31	0.39	0.40	0.53	0.52	0.47	0.45	0.46
Basmati rice – chickpea - maize fodder	1.26	1.26	1.40	1.38	1.33	1.32	1.33	0.38	0.38	0.48	0.46	0.41	0.40	0.42
Basmati rice – berseem (fodder and seed)	1.26	1.25	1.39	1.38	1.33	1.33	1.32	0.36	0.37	0.48	0.47	0.42	0.41	0.42
Basmati rice – vegetable pea-sorghum (fodder)	1.26	1.26	1.37	1.36	1.32	1.31	1.31	0.40	0.41	0.45	0.45	0.46	0.44	0.44
Mean	1.25	1.25	1.38	1.37	1.33	1.32		0.38	0.39	0.49	0.48	0.44	0.43	
Karjat														
Rice–groundnut								0.21	0.21	0.21	0.21	0.21	0.21	0.21
Rice – sweet corn								0.21	0.20	0.21	0.21	0.21	0.21	0.21
Rice – mustard								0.21	0.21	0.21	0.21	0.21	0.21	0.21
Rice – *dolichos* bean								0.21	0.21	0.21	0.21	0.21	0.21	0.21
Mean								0.21	0.21	0.21	0.21	0.21	0.21	0.21

Treatments / Management practice	Bulk density (g/cc)							Soil EC (d/m)						
	Organic		Inorganic		Integrated (towards organic)		Mean	Organic		Inorganic		Integrated (towards organic)		Mean
	100% organic	75% organic + innovative organic practices	100% inorganic	State recomm-endation	50% organic + 50% inorganic	75% organic + 25% inorganic		100% organic	75% organic + innovative organic practices	100% inorganic	State recomm-endation	50% organic + 50% inorganic	75% organic + 25% inorganic	
Ludhiana														
Basmati rice-chickpea-GM								0.21	0.22	0.20	0.21	0.19	0.19	0.20
Basmati rice-wheat-GM								0.18	0.22	0.19	0.19	0.19	0.21	0.20
Clusterbean-wheat-summer moong								0.23	0.20	0.22	0.25	0.22	0.22	0.22
Soybean -wheat								0.18	0.17	0.19	0.19	0.19	0.23	0.19
Mean								0.20	0.20	0.20	0.21	0.20	0.21	
Modipuram														
Basmati rice– wheat - *sesbania* green manure								0.12	0.12	0.12	0.12	0.12	0.13	0.12
Rice– barley (malt) – green gram								0.12	0.09	0.11	0.12	0.11	0.11	0.11
Maize (pop corn) – potato– okra + *sesbania* green manure								0.17	0.16	0.16	0.32	0.30	0.33	0.24
Maize (sweet corn) – mustard - *sesbania* green manure								0.25	0.31	0.16	0.26	0.29	0.26	0.26
Mean								0.17	0.17	0.14	0.21	0.21	0.21	
Pantnagar														
Basmati rice-wheat								0.33	0.25	0.48	0.38	0.39	0.31	0.36
Basmati rice -chickpea (4rows+2rows coriander)								0.36	0.23	0.45	0.42	0.30	0.37	0.36
Basmati rice -vegetable pea (4 rows vegetable pea +2 rows coriander)								0.45	0.27	0.43	0.39	0.38	0.42	0.39
Basmati rice -potato								0.28	0.31	0.41	0.47	0.34	0.29	0.35
Mean								0.36	0.27	0.44	0.42	0.35	0.35	
Umiam														
Vegetable-vegetable systems *on raised bed*														
Broccoli -carrot	1.09	1.12	1.16		1.06		1.11							
Broccoli - potato	1.09	1.14	1.16		1.11		1.12							
Broccoli -french bean	1.09	1.14	1.10		1.05		1.09							
Broccoli -tomato	1.09	1.15	1.14		1.12		1.12							
Mean	1.09	1.14	1.14		1.08									

New centres started from 2015-16

Treatments / Management practice	Bulk density (g/cc)							Soil EC (d/m)						
	Organic		Inorganic		Integrated (towards organic)		Mean	Organic		Inorganic		Integrated (towards organic)		Mean
	100% organic	75% organic + innovative organic practices	100% inorganic	State recomm-endation	50% organic + 50% inorganic	75% organic + 25% inorganic		100% organic	75% organic + innovative organic practices	100% inorganic	State recomm-endation	50% organic + 50% inorganic	75% organic + 25% inorganic	
Narendrapur														
Basmati rice–broccoli –*sesbania* green manure	1.89	1.81	1.88	1.60	1.79	1.83	1.80	0.30	0.22	0.35	0.23	0.41	0.22	0.38
Paddy– mustard – green gram	1.77	1.82	1.93	1.96	1.97	1.69	1.86	0.31	0.25	0.29	0.32	0.40	0.21	0.34
Paddy– capsicum – green gram	1.84	1.80	1.80	1.81	1.83	1.83	1.82	0.21	0.26	0.27	0.21	0.24	0.19	0.39
Paddy –french bean – sesame	1.94	1.984	1.86	1.92	1.88	1.81	1.90	0.29	0.27	0.23	0.42	0.32	0.23	0.44
Mean	1.86	1.85	1.87	1.82	1.87	1.79		0.27	0.25	0.28	0.29	0.34	0.21	
Sardarkrushinagar														
Groundnut-potato -pearlmillet	1.48	1.49	1.55	1.51	1.50	1.51	1.51	0.14	0.14	0.15	0.15	0.15	0.15	0.15
Greengram-cumin -veg. cowpea	1.49	1.50	1.55	1.53	1.51	1.52	1.51	0.14	0.15	0.15	0.15	0.14	0.14	0.15
Greengram-fennel	1.50	1.51	1.55	1.53	1.52	1.53	1.50	0.14	0.15	0.14	0.14	0.15	0.15	0.14
Mean	1.49	1.50	1.55	1.52	1.51	1.52		0.14	0.15	0.15	0.15	0.15	0.15	
Thiruvananthapuram														
Cassava-veg. cowpea	1.01	1.03	0.98	1.02	1.01	1.00	1.01	0.10	0.11	0.13	0.10	0.12	0.15	0.12
Cassava-groundnut Taro-black gram Taro-greengram	1.02	1.02	1.04	1.01	1.00	1.02	1.02	0.14	0.10	0.16	0.15	0.15	0.16	0.14
Udaipur														
Maize + blackgram (2:2) – durum wheat – *sesbania* (GM)	1.13	1.18	1.15	1.23	1.21	1.11	1.17	0.41	0.38	0.53	0.43	0.81	0.50	0.51
Sweet corn + blackgram (2:2) – chickpea	1.23	1.23	1.25	1.13	1.19	1.14	1.20	0.48	0.52	0.48	0.43	0.51	0.48	0.48
Blackgram – wheat	1.18	1.13	1.15	1.24	1.19	1.28	1.20	0.37	0.38	0.43	0.42	0.35	0.54	0.42
Soybean - fenugreek	1.37	1.41	1.40	1.21	1.33	1.24	1.33	0.42	0.40	0.51	0.44	0.48	0.43	0.45
Mean	1.23	1.24	1.24	1.20	1.23	1.19		0.42	0.42	0.49	0.43	0.54	0.49	

Table 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

Treatments / Management practice	pH							Organic carbon (%)						
	Organic		Inorganic		Integrated (towards organic)		Mean	Organic		Inorganic		Integrated (towards organic)		Mean
	100% organic	75% organic + innovative organic practices	100% inorganic	State recomm-endation	50% organic + 50% inorganic	75% organic + 25% inorganic		100% organic	75% organic + innovative organic practices	100% inorganic	State recomm-endation	50% organic + 50% inorganic	75% organic + 25% inorganic	
Bajaura														
Tomato-cauliflower -french bean	7.2	7.1	6.4	6.9	7.2	7.3	7.0	1.17	1.11	0.69	0.88	1.00	1.03	0.98
Fallow-cauliflower -tomato	7.2	7.2	6.5	7.2	7.2	7.4	7.1	1.46	1.10	0.67	0.96	0.95	1.06	1.03
Black gram-cauliflower - Summer squash	7.1	7.1	6.2	7.1	7.3	7.4	7.0	1.24	1.13	0.69	0.93	0.97	1.05	1.00
Lady finger-pea	7.2	7.4	6.3	7.2	7.3	7.4	7.1	1.15	1.14	0.71	0.76	1.00	0.98	0.96
Mean	7.2	7.2	6.4	7.1	7.3	7.4		1.26	1.12	0.69	0.88	0.98	1.03	
Bhopal														
Soybean-durum wheat	7.72	7.82	7.80	7.84	7.74	7.74	7.77	1.01	0.93	0.61	0.6	0.78	0.78	0.79
Soybean- mustard	7.70	7.76	7.62	7.64	7.59	7.77	7.68	0.97	0.89	0.51	0.55	0.9	0.85	0.78
Soybean- chickpea	7.69	7.65	7.74	7.77	7.54	7.68	7.68	0.79	0.91	0.57	0.54	0.75	0.74	0.72
Soybean- linseed	7.71	7.75	7.83	7.90	7.71	7.86	7.79	0.94	0.9	0.59	0.57	0.7	0.69	0.73
Mean	7.70	7.75	7.75	7.79	7.64	7.76		0.93	0.91	0.57	0.57	0.78	0.77	
Calicut														
Ginger -fallow	6.2	6.3	5.3		5.9	5.9		3.3	2.9	2.4		2.8	2.6	
Turmeric-fallow	5.7	5.5	4.7		5.5	5.0		2.9	2.4	1.7		2.2	2.0	
Dharwad										(g/kg)				
Cowpea-safflower	7.37	7.38	7.30	7.29	7.14	7.34	7.30	6.80	6.55	6.00	6.20	6.55	6.38	6.41
Pigeon pea (sole)	7.32	7.32	7.37	7.33	7.33	7.36	7.34	6.90	6.20	6.18	5.70	6.55	6.25	6.30
Green gram- sorghum	7.28	7.35	7.24	7.31	7.35	7.32	7.31	6.78	6.75	5.90	6.15	6.45	6.15	6.36
Groundnut + hybrid cotton (2:1)	7.33	7.33	7.25	7.26	7.38	7.28	7.30	6.60	6.43	6.08	6.33	6.50	6.25	6.36
Maize-chickpea	7.35	7.23	7.25	7.27	7.30	7.19	7.26	7.00	6.53	5.83	6.70	6.03	6.35	6.40
Mean	7.33	7.32	7.28	7.29	7.30	7.30		6.82	6.49	6.00	6.22	6.42	6.28	
Jabalpur														
Basmati rice –wheat -green manure	7.19	7.18	7.25	7.24	7.20	7.19	7.21	7.85	7.73	7.08	7.04	7.25	7.10	7.34
Basmati rice – chickpea - maize (fodder)	7.16	7.18	7.23	7.31	7.28	7.26	7.24	7.40	7.37	6.59	6.49	7.30	7.24	7.07
Basmati rice – berseem (fodder and seed)	7.20	7.21	7.25	7.23	7.28	7.24	7.24	7.51	7.37	6.99	6.83	7.24	7.18	7.19

Treatments / Management practice	pH							Organic carbon (%)						
	Organic		Inorganic		Integrated (towards organic)		Mean	Organic		Inorganic		Integrated (towards organic)		Mean
	100% organic	75% organic + innovative organic practices	100% inorganic	State recomm-endation	50% organic + 50% inorganic	75% organic + 25% inorganic		100% organic	75% organic + innovative organic practices	100% inorganic	State recomm-endation	50% organic + 50% inorganic	75% organic + 25% inorganic	
Basmati rice – vegetable pea- sorghum (fodder)	7.22	7.22	7.30	7.29	7.30	7.28	7.27	7.60	7.48	6.56	6.47	7.24	7.15	7.08
Mean	7.19	7.20	7.26	7.27	7.27	7.24		7.59	7.49	6.81	6.71	7.26	7.17	
Karjat														
Rice–groundnut	7.03	7.04	7.04	7.08	7.07	7.06	7.05	1.90	1.69	1.50	1.40	1.44	1.44	1.56
Rice – sweet corn	7.02	6.98	7.05	6.98	6.98	7.06	7.01	1.35	1.27	0.86	0.94	1.01	1.00	1.07
Rice – mustard	7.00	7.00	7.03	7.01	7.00	7.01	7.01	1.44	1.37	0.96	0.94	1.01	1.01	1.12
Rice – *dolichos* bean	7.01	7.01	7.04	7.05	7.04	7.02	7.03	1.86	1.86	1.30	1.18	1.34	1.27	1.47
Mean	7.02	7.01	7.04	7.03	7.02	7.04		1.64	1.55	1.16	1.12	1.20	1.18	
Ludhiana														
Basmati rice-chickpea-GM	7.45	7.45	7.50	7.50	7.45	7.43	7.46	0.59	0.57	0.45	0.45	0.51	0.57	0.52
Basmati rice-wheat-GM	7.53	7.52	7.55	7.52	7.57	7.55	7.54	0.64	0.63	0.45	0.4	0.54	0.56	0.54
Clusterbean-wheat -summer moong	7.45	7.45	7.45	7.44	7.48	7.46	7.46	0.59	0.57	0.42	0.42	0.54	0.57	0.52
Soybean -wheat	7.63	7.59	7.63	7.58	7.47	7.47	7.56	0.59	0.58	0.46	0.46	0.57	0.59	0.58
Mean	7.52	7.50	7.53	7.51	7.49	7.48		0.60	0.59	0.45	0.43	0.54	0.57	
Modipuram														
Basmati rice– wheat - *sesbania* green manure	8.20	8.20	8.40	8.30	8.30	8.30	8.28	0.77	0.74	0.62	0.73	0.73	0.70	0.72
Rice– barley (malt) – green gram	8.00	8.10	8.70	8.40	8.20	8.20	8.27	0.48	0.44	0.40	0.43	0.43	0.44	0.44
Maize (pop corn) – potato–okra + *sesbania* green manure	7.60	7.50	7.80	7.40	7.40	7.60	7.55	0.55	0.50	0.35	0.44	0.54	0.53	0.49
Maize (sweet corn) – mustard - *sesbania* green manure	7.80	7.40	7.90	7.30	7.50	7.50	7.57	0.62	0.56	0.40	0.44	0.52	0.59	0.52
Mean	7.90	7.80	8.20	7.85	7.85	7.90		0.61	0.56	0.44	0.51	0.55	0.57	

Treatments / Management practice	pH							Organic carbon (%)						
	Organic		Inorganic		Integrated (towards organic)		Mean	Organic		Inorganic		Integrated (towards organic)		Mean
	100% organic	75% organic + innovative organic practices	100% inorganic	State recomm-endation	50% organic + 50% inorganic	75% organic + 25% inorganic		100% organic	75% organic + innovative organic practices	100% inorganic	State recomm-endation	50% organic + 50% inorganic	75% organic + 25% inorganic	
Pantnagar														
Basmati rice-wheat	7.5	7.0	7.4	7.9	6.6	7.3	7.3	1.30	1.17	0.76	0.90	1.08	1.20	1.07
Basmati rice -chickpea (4rows+2rows coriander)	6.9	6.9	7.7	7.9	7.1	7.0	7.3	1.36	1.16	0.72	0.96	1.12	1.17	1.08
Basmati rice -vegetable pea (4 rows vegetable pea +2 rows coriander)	7.3	6.8	7.8	7.5	6.7	7.3	7.2	1.49	1.28	0.77	0.89	1.10	1.15	1.11
Basmati rice -potato	7.4	6.9	7.4	7.4	7.2	6.8	7.2	1.32	1.16	0.69	0.87	1.14	1.13	1.05
Mean	7.3	6.9	7.6	7.7	6.9	7.1		1.37	1.19	0.74	0.91	1.11	1.16	
Raipur														
Soybean-maize								0.67	0.69	0.67	0.67	0.70	0.68	0.68
Soybean-pea								0.67	0.66	0.68	0.68	0.70	0.67	0.68
Soybean-chilli								0.70	0.70	0.68	0.69	0.70	0.67	0.69
Soybean-onion								0.71	0.70	0.68	0.69	0.71	0.70	0.70
Mean								0.69	0.69	0.68	0.68	0.70	0.68	
Umiam														
Vegetable-vegetable systems *on raised bed*														
Broccoli -carrot	5.37	5.14	5.11		5.22		5.21	3.14	3.30	3.12		2.83		3.10
Broccoli - potato	5.20	5.14	4.92		5.21		5.12	3.27	3.23	3.21		2.77		3.12
Broccoli -french bean	5.41	5.21	5.16		5.36		5.29	3.15	3.32	3.23		2.93		3.16
Broccoli -tomato	5.37	5.12	5.13		5.32		5.23	3.20	3.33	3.26		2.68		3.12
Mean	5.34	5.15	5.08		5.28			3.19	3.29	3.20		2.80		
Rice- fallow system*on sunken bed*														
Megha aromatic 2–fellow							5.39							2.58
Shasharang–fellow							5.57							2.71
Ngoba –fellow							5.32							2.49
Lampnah –fellow							5.42							2.60
Mean	5.37	5.28	5.39		5.68			2.79	2.35	2.49		2.78		

New centres started from 2015-16

Treatments / Management practice	pH							Organic carbon (%)						
	Organic		Inorganic		Integrated (towards organic)		Mean	Organic		Inorganic		Integrated (towards organic)		Mean
	100% organic	75% organic + innovative organic practices	100% inorganic	State recomm-endation	50% organic + 50% inorganic	75% organic + 25% inorganic		100% organic	75% organic + innovative organic practices	100% inorganic	State recomm-endation	50% organic + 50% inorganic	75% organic + 25% inorganic	
Ajmer														
Coriander – cluster bean								0.29	0.29	0.28	0.28	0.27	0.28	0.28
Coriander - green gram														
Fennel - cluster bean								0.29	0.29	0.29	0.29	0.28	0.28	0.29
Fennel – green gram														
Mean														
Ajmer														
Basmati rice–broccoli – *sesbania* green manure	6.86	6.92	6.96	6.96	6.90	7.13	6.96	0.75	0.70	0.75	0.70	0.67	0.83	0.73
Paddy– mustard – green gram	6.87	6.75	6.97	6.95	6.92	6.94	6.90	0.90	0.65	0.65	0.52	0.65	0.78	0.69
Paddy– capsicum – green gram	7.08	7.01	6.97	7.05	6.99	6.99	7.02	0.60	0.67	0.85	0.80	0.58	0.60	0.68
Paddy –french bean – sesame	7.20	6.83	7.18	7.10	6.82	7.02	7.03	0.67	0.82	0.65	0.82	0.67	0.75	0.73
Mean	7.00	6.87	7.02	6.99	6.90	7.02		0.73	0.71	0.72	0.71	0.64	0.74	
Sardarkrushinagar														
Groundnut-potato-pearlmillet	7.21	7.25	7.30	7.27	7.32	7.25	7.27	0.36	0.34	0.25	0.32	0.34	0.33	0.32
Greengram-cumin -veg. cowpea	7.20	7.24	7.18	7.21	7.21	7.19	7.20	0.24	0.25	0.24	0.24	0.23	0.23	0.24
Greengram-fennel	7.16	7.16	7.23	7.19	7.2	7.22	7.19	0.25	0.23	0.22	0.22	0.24	0.24	0.23
Mean	7.19	7.22	7.24	7.22	7.24	7.22		0.28	0.27	0.24	0.26	0.27	0.27	
Thiruvananthapuram														
Cassava-veg. cowpea	4.70	4.50	4.20	4.20	4.60	4.40	4.43	1.32	1.31	1.02	0.62	1.02	1.11	1.07
Cassava-groundnut														
Taro-black gram	4.54	4.70	4.69	4.39	4.40	5.10	4.64	1.65	1.59	1.32	1.14	0.93	1.40	1.34
Taro-greengram														
Udaipur														
Maize + blackgram (2:2) – durum wheat – *sesbania* (GM)	8.16	8.36	8.23	8.18	8.10	8.23	8.21	0.93	1.10	0.70	0.69	0.81	0.90	0.86
Sweet corn + blackgram (2:2) – chickpea	8.08	8.13	8.17	8.17	8.10	7.94	8.10	0.99	0.87	0.84	1.01	0.92	1.33	0.99
Blackgram – wheat	8.43	8.37	8.29	8.34	8.33	8.32	8.35	1.30	0.86	0.93	0.87	0.70	0.78	0.91
Soybean - fenugreek	8.27	8.31	7.96	8.15	8.20	8.30	8.20	0.60	0.80	0.86	0.89	0.78	0.49	0.74
Mean	8.24	8.29	8.16	8.21	8.18	8.20		0.96	0.91	0.83	0.87	0.80	0.88	

Table 6. Influence of organic, inorganic and integrated package on soil available nitrogen and phosphorus at the end of cropping cycle at various locations

Treatments / Management practice	Available nitrogen (kg ha^{-1})							Available phosphorus (kg ha^{-1})						
	Organic		Inorganic		Integrated (towards organic)		Mean	Organic		Inorganic		Integrated (towards organic)		Mean
	100% organic	75% organic + innovative organic practices	100% inorganic	State recomm-endation	50% organic + 50% inorganic	75% organic + 25% inorganic		100% organic	75% organic + innovative organic practices	100% inorganic	State recomm-endation	50% organic + 50% inorganic	75% organic + 25% inorganic	
Bajaura														
Tomato-cauliflower-french bean	254.2	250.4	229.1	240.9	252.1	244.4	245.2	67.1	61	37.1	45.3	69	64.4	57.3
Fallow-cauliflower -tomato	247.2	249.6	241.4	245.8	232.8	233.8	241.8	69.4	65.5	38.4	43.3	74.9	65.2	59.5
Black gram-cauliflower - summer squash	243.7	237.4	205.5	219.5	260.1	258.0	237.4	68.2	67.7	36.8	42	73.7	68.6	59.5
Lady finger-pea	264.5	257.0	225.6	229.0	270.7	267.5	252.4	71.1	69	35.5	43.8	69.8	70	59.9
Mean	252.4	248.6	225.4	233.8	253.9	250.9		69.0	65.8	37.0	43.6	71.9	67.1	
Bhopal														
Soybean-durum wheat	224	222	194	224	209	220	215	52	48	38	43	17	20	36
Soybean- mustard	203	201	222	213	241	190	212	41	40	39	31	20	19	32
Soybean- chickpea	205	197	232	234	188	171	205	36	37	34	30	18	18	29
Soybean- linseed	216	190	239	238	220	213	219	42	37	36	34	23	14	31
Mean	212	202	222	227	214	199		43	40	37	34	20	18	
Calicut														
Ginger-fallow	732	633	525		649	605		23.4	15.6	5.8		15.0	11.0	
Turmeric-fallow	621.7	536.6	401.0		470.9	432.1		64.1	72.2	14.2		61.8	47.9	
Coimbatore														
Cotton - maize	255.0	262.0	245.0	243.0	261.0	274.0	256.7	11.0	11.5	12.6	13.0	12.0	11.8	12.0
Chillies - sunflower	256.5	261.5	236.0	245.0	240.0	250.5	248.3	11.2	10.2	13.4	12.6	9.4	10.0	11.1
Beetroot - maize	207.0	213.0	215.0	224.0	213.0	225.0	216.2	10.4	9.7	9.1	9.4	10.2	11.0	10.0
Mean	239.5	245.5	232.0	237.3	238.0	249.8	240.4	10.9	10.5	11.7	11.7	10.5	10.9	11.0
Dharwad														
Cowpea-safflower	315.3	278.2	249.0	273.8	284.6	282.4	280.6	42.1	39.7	38.5	39.5	39.9	37.1	39.5
Pigeon pea (sole)	291.9	285.9	264.7	282.7	289.0	275.0	281.5	40.9	38.8	38.3	38.3	38.6	40.1	39.2
green gram - sorghum	284.9	282.3	262.0	283.6	287.4	262.1	277.0	41.9	40.0	38.3	39.2	40.1	38.6	39.7
Groundnut + hybrid cotton (2:1)	297.0	292.6	263.5	270.1	271.9	283.9	279.8	40.5	39.6	38.5	39.8	40.0	39.7	39.7
Maize-Chickpea	303.9	279.2	268.2	277.9	266.3	266.3	277.0	41.8	40.3	38.8	37.8	39.7	39.5	39.6
Mean	298.6	283.6	261.5	277.6	279.8	273.9		41.4	39.7	38.5	38.9	39.7	39.0	
Jabalpur														
Basmati rice –wheat (duram)-green manure	277	273	262	260	266	264	267	15.8	15.5	14.9	13.7	15.2	14.8	14.9

Treatments / Management practice	Available nitrogen (kg ha^{-1})							Available phosphorus (kg ha^{-1})						
	Organic		Inorganic		Integrated (towards organic)		Mean	Organic		Inorganic		Integrated (towards organic)		Mean
	100% organic	75% organic + innovative organic practices	100% inorganic	State recomm-endation	50% organic + 50% inorganic	75% organic + 25% inorganic		100% organic	75% organic + innovative organic practices	100% inorganic	State recomm-endation	50% organic + 50% inorganic	75% organic + 25% inorganic	
Basmati rice – chickpea - maize fodder	268	268	245	243	265	267	259	15.6	15.2	14.1	12.6	14.3	13.9	14.3
Basmati rice – berseem (fodder and seed)	271	286	261	257	267	265	268	14.9	14.7	14.4	13.7	15.0	14.7	14.5
Basmati rice – vegetable pea- sorghum (fodder)	271	269	243	242	267	265	260	15.0	14.7	12.5	13.8	14.9	15.5	14.4
Mean	272	274	253	251	266	265		15.3	15.0	14.0	13.4	14.8	14.7	
Karjat														
Rice-groundnut	296.8	301.0	281.5	275.9	292.6	296.8	290.7	33.0	31.5	30.7	31.2	31.0	31.5	31.5
Rice-maize (sweet corn for cob)	271.7	267.5	257.8	242.4	271.7	271.7	263.8	28.4	28.4	28.8	28.1	29.2	29.4	28.7
Rice-mustard	288.4	284.2	256.4	242.4	280.1	284.2	272.6	31.0	30.7	29.0	28.4	29.4	30.5	29.8
Rice-*dolichos* bean (for green pod vegetable)	296.8	296.8	275.9	271.7	292.6	292.6	287.7	31.0	31.0	30.1	29.9	32.5	32.0	31.1
Mean	288.4	287.4	267.9	258.1	284.2	286.3		30.8	30.4	29.7	29.4	30.5	30.8	
CD (P=0.05)														
Production system	6.38							NS						
Cropping system	5.53							0.57						
Interaction	NS							NS						
Ludhiana														
Basmati rice-chickpea-GM	376.0	362.2	280.9	284.8	347.3	347.3	333.1	50.6	50.1	40.5	41.8	48.7	49.5	46.9
Basmati rice-wheat-GM	357.3	347.3	299.5	292.2	354.8	352.2	333.9	53.5	50.7	38.7	39.1	46.1	48.5	46.1
Clusterbean-wheat-summer moong	350.9	350.9	288.5	293.4	343.6	347.3	329.1	54.1	56.1	42.7	42.6	51.7	53.5	50.1
Soybean -wheat	372.2	373.6	397.2	303.6	397.3	365.2	368.2	51.7	48.5	40.0	41.4	47.0	49.6	46.4
Mean	364.1	358.5	291.5	293.5	350.8	328.0		52.5	51.4	40.5	41.2	48.4	50.3	
Modipuram														
Basmati rice– wheat (*durum*) - *sesbania* GM								40.8	42.2	26.2	28.2	28.9	27.7	32.3
Coarse rice– barley (*malt*) – green gram								49.1	45.2	28.4	31.7	42.2	43.4	40.0
Maize (*pop corn*) – potato– okra + *sesbania*								34.9	27.6	16.7	17.5	25.5	25.2	24.6
Maize (*sweet corn*) – mustard - *sesbania* GM								29.0	25.9	12.3	12.5	23.0	22.5	20.9
Mean								38.5	35.2	20.9	22.5	29.9	29.7	
Pantnagar														
Basmati rice-wheat	382	308	386	375	390	380	370	69.4	52.5	39.9	46.1	60.9	54	53.8

Treatments / Management practice	Available nitrogen (kg ha^{-1})							Available phosphorus (kg ha^{-1})						
	Organic		Inorganic		Integrated (towards organic)		Mean	Organic		Inorganic		Integrated (towards organic)		Mean
	100% organic	75% organic + innovative organic practices	100% inorganic	State recomm-endation	50% organic + 50% inorganic	75% organic + 25% inorganic		100% organic	75% organic + innovative organic practices	100% inorganic	State recomm-endation	50% organic + 50% inorganic	75% organic + 25% inorganic	
Basmati rice -chickpea (4rows+2rows coriander)	423	366	398	362	401	398	391	63.9	57.9	38.5	63.4	59.8	57.1	56.8
Basmati rice -vegetable pea (4 rows vegetable pea +2 rows coriander)	430	391	392	371	399	389	395	68.6	58.7	41.5	48.2	59.1	50.6	54.5
Basmati rice -potato	399	391	390	390	390	372	389	68.3	62.9	54.4	59	60.9	55.2	60.1
Mean	409	364	392	375	395	385		67.6	58	43.6	54.2	60.2	54.2	
Raipur														
Soybean-maize	217	213	225	238	251	213	226	19.3	21.6	21.7	21.6	20.3	19.5	20.7
Soybean-pea	225	238	213	221	225	213	223	21.9	24.0	19.2	20.6	20.7	20.6	21.2
Soybean-chilli	225	251	225	217	213	238	228	19.4	22.8	21.8	22.2	20.6	21.1	21.3
Soybean-onion	213	238	225	225	225	225	225	20.2	19.4	21.7	23.7	22.1	21.2	21.3
Mean	220	235	222	225	229	222		20.2	21.9	21.1	22.0	20.9	20.6	
Ranchi														
Rice -wheat	315.2	298.6	255.7	249.9	273.7	287.5	280.1	56.8	55.9	60.8	58.7	54.7	53.3	56.7
Rice-lentil	335.8	323.2	270.8	244.1	279.5	295.8	291.5	51.5	50.2	58.7	56.9	55.3	54.0	54.4
Rice-potato	312.5	309.8	289.7	256.6	300.4	304.3	295.5	58.5	58.0	61.8	60.0	56.8	55.9	58.5
Rice- linseed	310.6	293.6	257.0	230.3	257.8	283.7	272.1	57.6	55.3	58.5	56.8	53.9	53.7	55.9
Mean	318.5	306.3	268.3	245.2	277.8	292.8		56.1	54.9	59.9	58.1	55.2	54.2	
Umiam														
Vegetable-vegetable systems *on raised bed*														
Broccoli -carrot	250.9	251.3	232.3		247.6		245.5	22.1	20.9	15.4		20.4		19.7
Broccoli - potato	253.8	240.5	242.4		226.4		240.8	19.7	20.7	16.0		20.9		19.3
Broccoli -french bean	274.0	252.2	243.7		258.9		257.2	26.7	18.8	16.7		23.5		21.4
Broccoli -tomato	254.9	244.3	242.9		251.7		248.4	21.3	17.5	17.3		24.7		20.2
Mean	258.4	247.1	240.3		246.1			22.4	19.5	16.4		22.4		
					13.04									
Rice- fallow system*on sunken bed*														
Megha aromatic 2–fellow							225.8						18.1	
Shasharang–fellow							238.7						20.0	
Ngoba–fellow							229.5						17.2	
Lampnah–fellow							228.3						18.6	
Mean	241.8	219.5	221.5		239.7			20.7	17.3	14.3		22.2		

New centres started from 2015-16

Treatments / Management practice	Available nitrogen (kg ha^{-1})							Available phosphorus (kg ha^{-1})						
	Organic		Inorganic		Integrated (towards organic)		Mean	Organic		Inorganic		Integrated (towards organic)		Mean
	100% organic	75% organic + innovative organic practices	100% inorganic	State recomm-endation	50% organic + 50% inorganic	75% organic + 25% inorganic		100% organic	75% organic + innovative organic practices	100% inorganic	State recomm-endation	50% organic + 50% inorganic	75% organic + 25% inorganic	
Ajmer														
Coriander – cluster bean	135.5	133.4	129.6	126.3	130.0	127.1	130.3	17.0	16.1	13.9	13.2	14.2	13.7	14.7
Coriander - green gram														
Fennel - cluster bean	139.2	138.0	135.1	132.6	136.7	134.2	136.0	18.4	16.9	15.1	14.1	16.2	14.6	15.9
Fennel – green gram														
Narendrapur														
Paddy (sohini 2)– broccoli – *sesbania* green manure								73.0	44.0	56.6	54.1	42.8	79.3	58.3
Paddy (satabdi)– mustard– green gram								50.3	75.5	100.6	62.9	75.5	88.1	75.5
Paddy (satabdi)– capsicum– green gram								52.8	50.3	81.8	78.0	56.6	58.6	63.0
Paddy (satabdi)–french bean – sesame								56.6	62.9	75.5	73.0	57.7	73.0	66.4
Mean								58.2	58.2	78.6	67.0	58.2	74.7	
Sardarkrushinagar														
Groundnut-potato -pearlmillet	153.0	151.3	152.0	151.3	154.7	150.7	152.2	16.5	15.9	14.5	15.2	17.4	16.4	16.0
Greengram-cumin -veg. cowpea	151.7	149.7	149.3	152.0	152.7	152.7	151.3	12.3	12.5	13.7	14.4	13.0	13.7	13.3
Greengram-fennel	143.0	142.3	141.3	142.0	141.7	142.0	142.1	13.4	15.3	13.1	12.1	11.7	14.8	13.4
Mean	149.2	147.8	147.5	148.4	149.7	148.5		14.1	14.6	13.8	13.9	14.0	15.0	
Udaipur														
Maize + blackgram (2:2) – durum wheat – *sesbania* (GM)	363.8	363.8	313.6	363.8	326.1	382.6	352.3	47.9	44.1	46.6	48.1	38.1	43.6	44.7
Sweet corn + blackgram (2:2) – chickpea	283.5	276.0	257.2	263.4	350.6	351.2	297.0	41.1	39.4	39.1	40.6	36.1	35.1	38.6
Blackgram – wheat	376.3	326.1	250.9	263.4	364.4	276.6	309.6	37.4	33.1	62.9	63.6	26.6	46.6	45.0
Soybean - fenugreek	213.3	257.2	301.1	288.5	301.7	225.8	264.6	63.4	53.6	70.7	51.1	63.4	60.4	60.4
Mean	309.2	305.8	280.7	294.8	335.7	309.1		47.4	42.6	54.8	50.9	41.0	46.4	

Table 7. Influence of organic, inorganic and integrated package on soil available potassium at the end of cropping cycle at various locations

Cropping Systems/ Management practice	Available Potassium (kg ha^{-1})						Mean
	Organic		Inorganic		Integrated (towards organic)		
	100% organic	75% organic+ innovative organic practices	100% inorganic	State recomm-endation	50% organic + 50% inorganic	75% organic+ 25% inorganic	
Bajaura							
Tomato-Cauliflower - French bean	239.7	247.1	121.9	129.0	241.6	239.1	203.1
Fallow-Cauliflower-Tomato	241.3	251.3	137.5	143.2	249.4	255.2	213.0
Black gram-Cauliflower - Summer squash	244.3	222.9	118.1	125.3	256.5	243.2	201.7
Lady finger-Pea	226.1	217.2	122.4	127.9	237.1	232.0	193.8
Mean	237.9	234.6	125.0	131.4	246.2	242.4	
Bhopal							
Soybean-durum wheat	675.0	653.0	639.0	671.0	682.0	669.0	665.0
Soybean- mustard	657.0	662.0	671.0	588.0	627.0	603.0	635.0
Soybean- chickpea	629.0	606.0	637.0	595.0	532.0	626.0	604.0
Soybean- linseed	650.0	671.0	591.0	683.0	594.0	553.0	624.0
Mean	653.0	648.0	634.0	634.0	609.0	613.0	
Calicut							
Ginger- fellow	675.6	573.6	428.6		682.0	595.6	591.08
Turmeric-fallow	326.7	310.4	300.2		242.1	244.8	284.84
Coimbatore							
Cotton - maize	438.0	435.0	424.0	435.0	448.0	455.0	439.2
Chillies - sunflower	464.5	463.0	458.5	466.5	458.5	475.5	464.4
Beetroot - maize	452.0	465.0	471.0	476.0	483.0	489.0	472.7
Mean	451.5	454.3	451.2	459.2	463.2	473.2	
Dharwad							
Cowpea-safflower	351.3	331.9	319.2	351.1	336.7	325.4	335.9
Pigeon pea (sole)	353.5	331.6	268.6	352.1	354.0	310.0	328.3
Green gram - sorghum	372.6	360.4	320.9	332.5	333.7	319.6	340.0
Groundnut + hybrid cotton (2:1)	358.7	364.4	330.4	333.9	367.3	341.8	349.4
Maize-chickpea	348.8	350.0	338.8	310.3	322.6	332.9	333.9
Mean	357.0	347.7	315.6	336.0	342.9	325.9	
Jabalpur							
Basmati rice –wheat (durum)-green manure	268.0	265.0	255.0	254.0	263.0	262.0	261.0
Basmati rice – chickpea - maize fodder	266.0	270.0	251.0	248.0	257.0	256.0	258.0
Basmati rice – berseem (fodder and seed)	264.0	258.0	255.0	247.0	263.0	261.0	258.0
Basmati rice – vegetable pea - sorghum (fodder)	262.0	263.0	239.0	233.0	262.0	254.0	252.0
Mean	265.0	264.0	250.0	246.0	261.0	258.0	
Karjat							
Rice-groundnut	377.4	379.8	364.5	342.7	374.7	374.7	368.9
Rice-maize (sweet corn for cob)	390.0	390.0	364.5	358.9	384.9	384.9	378.8
Rice-mustard	396.5	390.9	355.2	336.6	385.3	390.9	375.9
Rice-*dolichos* bean (for green pod vegetable)	395.5	395.1	371.3	364.0	384.9	390.0	383.4
Mean	389.8	388.9	363.8	350.5	382.4	385.1	

Cropping Systems/ Management practice	Available Potassium (kg ha^{-1})						Mean
	Organic		Inorganic		Integrated (towards organic)		
	100% organic	75% organic+ innovative organic practices	100% inorganic	State recomm-endation	50% organic + 50% inorganic	75% organic+ 25% inorganic	
Ludhiana							
Basmati rice-chickpea-GM	158.8	143.4	144.4	134.4	143.4	147.8	145.4
Basmati rice-wheat-GM	163.4	155.6	141.0	140.0	151.2	156.8	151.3
Clusterbean-wheat -summer moong	166.8	162.4	146.8	145.2	163.4	166.8	158.6
Soybean -wheat	169.2	171.2	145.6	140.0	152.4	152.4	155.1
Mean	164.6	158.2	144.5	139.9	152.6	155.9	
Modipuram							
Basmati rice– wheat (durum) - *sesbania* green manure	317.0	310.2	182.6	197.1	241.9	302.5	258.6
Rice– barley (malt) – green gram	337.1	328.2	321.4	317.0	283.4	277.8	310.8
Maize (pop corn) – potato – okra + *sesbania* green manure	320.2	310.2	274.4	287.8	317.0	297.9	301.3
Maize (sweet corn) – mustard - *sesbania* green manure	336.0	350.6	256.5	379.7	292.3	376.3	331.9
Mean	327.6	324.8	258.7	295.4	283.7	313.6	
Pantnagar							
Basmati rice-wheat	223.0	239.0	228.0	227.0	249.0	253.0	237.0
Basmati rice -chickpea (4rows+2rows coriander)	240.0	239.0	239.0	287.0	231.0	254.0	248.0
Basmati rice -vegetable pea (4 rows vegetable pea +2 rows coriander)	249.0	231.0	224.0	289.0	275.0	289.0	260.0
Basmati rice -potato	251.0	244.0	239.0	262.0	252.0	245.0	249.0
Mean	241.0	238.0	233.0	266.0	252.0	260.0	
Raipur							
Soybean-Maize	358.0	359.0	377.0	371.0	377.0	346.0	365.0
Soybean-Pea	359.0	368.0	375.0	362.0	337.0	345.0	358.0
Soybean-Chilli	347.0	366.0	375.0	366.0	342.0	336.0	355.0
Soybean-Onion	338.0	378.0	380.0	368.0	347.0	361.0	362.0
Mean	351.0	368.0	377.0	367.0	351.0	347.0	
Ranchi							
Rice -wheat	224.3	221.6	152.3	149.0	184.8	189.5	186.9
Rice - linseed	231.7	226.5	153.9	148.4	166.6	170.8	183.0
Rice - potato	201.7	194.7	154.7	146.1	169.6	174.4	173.5
Rice - lentil	230.9	223.9	163.4	155.8	183.5	196.6	192.4
Mean	222.2	216.7	156.1	149.8	176.1	182.8	
Umiam							
Vegetable-vegetable systems *on raised bed*							
Broccoli -carrot	290.1	278.8	246.8		281.4		274.3
Broccoli - potato	281.4	272.7	266.5		273.8		273.6
Broccoli -french bean	261.2	276.9	292.6		306.6		284.3
Broccoli -tomato	284.8	257.4	256.8		303.9		275.7
Mean	279.4	271.4	265.7		291.4		

Cropping Systems/ Management practice	Available Potassium (kg ha^{-1})						Mean
	Organic		Inorganic		Integrated (towards organic)		
	100% organic	75% organic+ innovative organic practices	100% inorganic	State recomm-endation	50% organic + 50% inorganic	75% organic+ 25% inorganic	
Rice- fallow system*on sunken bed*							
Megha aromatic 2–fellow							276.8
Shasharang–fellow							284.1
Ngoba–fellow							274.9
Lampnah–fellow							278.9
Mean	287.9	272.8	270.1		284.3		

New centress started from 2015-16

Cropping Systems/ Management practice	Available Potassium (kg ha^{-1})						Mean
	Organic		Inorganic		Integrated (towards organic)		
	100% organic	75% organic+ innovative organic practices	100% inorganic	State recomm-endation	50% organic + 50% inorganic	75% organic+ 25% inorganic	
Ajmer							
Coriander – cluster bean	369.3	377.0	370.7	367.0	372.8	371.5	371.4
Coriander - green gram							
Fennel - cluster bean	367.8	369.0	374.4	377.9	373.2	365.6	371.3
Fennel – green gram							
Narendrapur							
Paddy (sohini 2)–broccoli – *sesbania* green manure	220.0	286.0	290.0	290.0	214.0	221.0	253.5
Paddy (satabdi)– mustard – green gram	364.0	211.0	266.5	325.0	336.0	258.0	293.4
Paddy (satabdi)– capsicum – green gram	244.0	205.0	258.0	259.0	250.0	247.0	243.8
Paddy (satabdi)–french bean – sesame	222.0	256.0	204.0	231.0	272.0	212.0	232.8
Mean	262.5	239.5	254.6	276.3	268.0	234.5	
Sardarkrushinagar							
Groundnut-potato-pearlmillet	202.7	194.3	204.7	203.3	207.7	200.3	202.2
Greengram-cumin-veg. cowpea	184.0	186.3	185.3	191.3	188.3	184.0	186.6
Greengram-fennel	184.7	181.3	181.3	188.0	184.7	180.3	183.4
Mean	190.5	187.3	190.4	194.2	193.6	188.2	
Udaipur							
Maize + blackgram (2:2) – durum wheat – *sesbania* (GM)	501.5	465.6	523.5	490.6	548.3	518.0	507.9
Sweet corn + blackgram (2:2) – chickpea	548.3	491.8	392.6	394.0	395.4	381.6	433.9
Blackgram – wheat	387.1	403.6	501.5	552.4	518.0	450.5	468.8
Soybean - fenugreek	491.8	498.7	398.1	406.4	374.7	531.8	450.2
Mean	482.2	464.9	453.9	460.8	459.1	470.5	

Calicut: The pH range in ginger crop was recorded from 4.7 as lowest in 100% inorganic to 6.4 as highest in organic management with 75% organic +innovative practices. Higher organic carbon (3.3%) was recorded under organic package and it was found to be 37.5 and 17.8% higher than inorganic and integrated packages. Residual availability of N, P and K in the soil was also found to be higher with organic management package. Similarly, in turmeric crop variation in soil pH was in the range of 5.0 (100% inorganic) to 5.6(organic) whereas organic carbon was in range of 1.9 in inorganic to 3.4% in 100% organic. Available N, P and K were also significantly higher under organic management system. Among the varieties, maximum soil organic carbon (2.29) and nitrogen availability (508.40 kg/ha) was noticed in Prathibha that was on par with Alleppy supreme, Suvarna, kedarm while, phosphorus and potassium content was significantly higher in Prabha.

Coimbatore: Higher available N was recorded under integrated management with 75% organic through manure and 25% inorganic sources (274 kg/ha). The reduction in availability of nitrogen in soil was found to be 6.9 and 10.6% compared to organic and inorganic respectively. Cotton-maize recorded higher available N in the soil at the end of cropping cycle (256.7 kg/ha) among the system. Among the management practices, higher available P (11.7 kg/ha) was recorded under inorganic management with 100% inorganic as well as state recommendation, however chili crop leave the maximum residual P in the (13.4 kg/ha). Out of three systems, cotton-maize recorded highest available P in the soil. Higher available K was recorded (489 kg/ha) under integrated management package with 75% organic+25%inorganic in beetroot system and it was at par with inorganic management package. The reduction in availability of potassium in soil was found to be 7.6 and 3.7% compared to organic and inorganic respectively.

Dharwad: At the end of cropping cycle, the physical property like bulk density decreased significantly from 1.31 g/cm^3 with 100 % inorganic to 1.19 g/cm3 with 100 % organic management. The chemical properties like soil pH and EC didn't differ significantly either due to nutrient management or due to cropping systems. The organic carbon increased significantly from 6.00 g/kg with 100% inorganic to 6.82 g/kg with 100% organic and it was increased by 13.7%. The nutrients *viz*., available N and P increased significantly from 261.5 and 38.48 kg/ha with 100% inorganic to 298.6 and 41.44 kg/ha, respectively with 100% organic and this was followed by integrated systems and was found to be higher by 14.2 and 6.9% respectively. Potassium also didn't vary significantly due to nutrient management or cropping system, however, among the nutrient management beetroot-maize system resulted higher K under integrated towards organic application through application of 75% organic manure + 25% inorganic source.

Jabalpur: Bulk density showed significant variation from 1.25 with organic management either 100% organic or 75% organic +innovative practices as lower to 1.38 in 100% inorganic nutrient management. The soil electrical conductivity also changed due to different nutrient management and varied from 0.38 as lowest in organic management to 0.49 dsm^{-1} as maximum in inorganic. Cropping systems did not influence to each other for electrical conductivity and bulk density. The pH range varied from 7.19 with organic to 7.27 in integrated and state recommendation was neutral in reaction. The treatments receiving organic nutrient management either fully (100% organic) or integrated exhibited improvement in OC content of the soil and the effect of 100% organic nutrient management was more pronounced in this regard. Soil organic carbon in basmati rice-wheat system varied from 6.47 g/kg under state recommendation to 7.85 g/kg with 100% organic package. Organic management recorded 11.4 and 4.5% higher organic carbon in the soil compared to inorganic and integrated management respectively. Available nitrogen and potassium were not influenced due to the cropping system and the variation in N (242-286 kg/ha) and K (233-270 kg/

ha) were recorded with lower under state recommendation to higher under organic package of nutrient with 100% nutrient through manure whereas, the available phosphorous was ranged from 12.5 -15.8 kg/ha as higher under organic management with 75% organic +innovative practice to as lower in state recommendation.

Karjat: There was no any significant effect among different production systems on soil pH, EC and available P_2O_5 at the end of cropping cycle and varied from 0.205 to 0.210 dsm^{-1}, 6.98 to 7.08 and 28.1 to 33.0 kg/ha respectively across the cropping system. Significantly higher organic carbon (1.64 %), available N (288.4 kg/ha) and K_2O (389.8 kg/ha) were observed under 100% organic production system as compared to rest of the production systems following 75% organic maure+ Innovative organic practices and these were 41.4, 7.6 and 7.1% higher than inorganic packages respectively. Among the copping systems, Organic carbon, available N and P_2O_5 were significantly higher in rice-groundnut system as compared to other systems except rice- *dolichos* bean system which was at par.

Ludhiana: Electrical conductivity, pH, soil organic carbon, available N, P and K were estimated at the end of cropping cycle. Among the management practices, soil organic carbon, soil available nitrogen, phosphorus and potassium were higher in organic package with100% nutrient application through manure. Soil organic carbon was higher by 33.3% over inorganic and 11.1% than integrated management. EC and pH were not varying significantly due to management practice as well as cropping systems. Available N, P and K were higher under organic management and found to be (N 24.9 and 3.8%), (P 29.6 and 8.5 %) and (K 13.9 and 7.9%) than inorganic and integrated package respectively. Among the cropping systems, soybean-wheat system recoded higher available nitrogen in the soil (368.2 kg/ha) whereas, available P (50.1 kg/ha) and K (158.6 kg/ha) was higher in clusterbean-wheat-summer moong systems.

Modipuram: Soil pH, EC, organic carbon, available phosphorus and potassium were estimated. Higher pH was recorded with inorganic crop management (8.2) whereas it was reduced by towards organic management. Electrical conductivity varied from 0.14 (inorganic condition) to 0.21 in integrated nutrient condition. In term of cropping systems, significantly lower EC was recorded in rice-barley-green gram system (0.11). Among the different production systems after end of crop cycle, higher soil organic carbon, available P and K was found under organic production system followed by integrated crop management. Organic carbon content was recorded significantly higher (0.77%) in rice-wheat–*sesbani*a (green manure) system with 100% organic management. Organic production system recorded .38.6% higher organic carbon content in the soil compared to inorganic. Available phosphorus and potassium was also higher with organic production system (38.5 and 327.6 kg/ha). In term of cropping systems, highest available P was noted in rice-barley-green gram (40.0 kg/ha) while, K was recorded under maize-mustard-*sesbania* system (331.9 kg/ha).

Pantnagar: Electric conductivity, pH, organic carbon, available N, P and K were estimated after completion of crop cycle. Lower EC (0.27 dsm^{-1}) was recorded under organic package with 75% nutrient application through organic manure+25% innovative practice as compared with other packages. Basmati rice-potato system recorded lowest EC (0.35 dsm^{-1}) while, pH varied from 6.9 to 7.7 among management options. At the end of cropping cycle, soil organic carbon was influenced by different mode of production management and the maximum value (1.37%) was recorded under 100% organic practice followed by 75% organic +Innovative technology (1.19%) and it was increased by 85 and 60.8% over inorganic respectively. Among the cropping system, maximum organic carbon was recorded under basmati rice–vegetable pea (1.11%)

followed by basmati rice–chickpea +coriander-*sesbania* (1.08%). The maximum available N and P (409.0 and 67.6 kg/ha) was recorded under organic management with 100% organic while K was higher under inorganic condition. Among the cropping systems, maximum availability of N and K was recorded in basmati rice -vegetable pea (395 and 260 kg/ha) whereas P was higher in rice-potato system (60.1 kg/ha).

Raipur: Soil organic carbon, available nitrogen, phosphorus and potassium were estimated at the end of crop cycle. Soil organic carbon content varied from 0.68 to 0.70% after the harvest of soybean and succeeding *rabi* crops and variation was not significant. However, soil organic carbon content was slightly higher under integrated nutrient management of 50% inorganic + 50% organic package. As regards to cropping system significantly higher organic carbon content in soil was observed under soybean-onion cropping system. The available N content in soil after harvest of the *rabi* crops were found significantly higher under organic with 75% organic+ innovative practice (235 kg/ha). Soybean-chilli system recorded significantly higher N in soil after succeeding *rabi* crops. The available P and K content of soil were not significantly influenced due to various management packages however; both were higher with inorganic condition. Soybean-maize resulted in significantly higher K in the soil (365 kg/ha).

Ranchi: Higher pH, organic carbon, available N, P & K was recorded with 100% organic package followed by 75% organic + innovative practices, 75% organic + 25% inorganic (towards organic). Among cropping system, pH, organic carbon was found to be higher in rice-lentil, available N and P in rice-potato and K was higher with rice-linseed system.

Umiam: Bulk density in raised was slightly decreased with organic management compared to inorganic (1.14 to1.09 g/cm^3). Among the different management practices, 100% organic (5.34) and integrated (5.28) management exhibited maximum pH over inorganic treatment under in raised bed which indicated the improvement of soil health due to application of organic management practices. Soil organic carbon increased over the other management options. Organic carbon in raised beds method was higher under organic management (3.29%) with 75% nutrient application by organic sources+ innovative practices followed by integrated (3.20%) and it was increased up to 3.1% over organic and 17.5% over integrated. Among the cropping systems, broccoli-frenchbean recorded higher organic carbon (3.16%) under raised bed method. Maximum available N and P was found under 100% organic (258.4kg/ha and 22.4 kg/ha, respectively) whereas, maximum K were found under integrated management (291.4 kg/ha). In case of sunken beds, available N and K were also found higher under 100% organic (241.8 kg/ha and 287.9 kg/ha, respectively) while available P was higher under integrated (22.2 kg/ha).

Ajmer: Soil nutrient status after completion of coriander crop was influenced by different modes of management and, the maximum value of organic carbon (0.29%), N (135.48 kg/ha) and P (16.98 kg/ha) was recorded under 100% organic followed by 75 % Organic + innovative practices whereas, maximum K is found (376.95 kg/ha) under 75% organic + innovative practices followed by integrated (50% organic & 50% inorganic nutrient sources). In case of fennel crop, soil nutrient status was also varied by different management systems and the maximum organic carbon (0.29 %), N (139.24 kg/ha) and P (18.36 kg/ha) was recorded under 100% organic followed by 75% organic + innovative practices while, K is found to be higher (377.93 kg/ha) under inorganic with state recommendation.

Narendrapur: Soil physio-chemical properties were not influenced due to the different production management and cropping systems. Bulk density and pH varied from 1.60 to1.98 (g/cc) and 6.75 to 7.20 respectively across the cropping system. However, soil electrical conductivity and organic carbon did change due to different nutrient management and varied from 0.19 to 0.41 dsm^{-1} and 0.58 to 0.90% respectively across the cropping system. Soil organic carbon was recorded higher in 100% organic management (0.90%) followed by 75% organic + 25% inorganic under integrated (0.83%). Among the copping systems, basmati rice-broccoli-*sesbania* green manure system recorded higher soil organic carbon but was on par with rice-frenchbean-sesame. The soil available phosphorus was higher in inorganic management followed by integrated towards organic with 75% organic +25% inorganic recommendation (78.6 kg/ha) while, K was higher in integrated with 50% each nutrient through organic and inorganic (272.0 kg/ha). Among the copping systems, paddy-mustard-greengram recorded higher available K.

Influence of organic management package with reduced dose of organic manures, integrated and inorganic management packages on available micronutrient iron, manganese, zinc and copper in soil (Table 8-9)

Bajaura: Soil available micronutrients such as iron, manganese, zinc and copper were estimated. Higher available iron and zinc (14.2 and 3.62 ppm) were recorded under organic package with 100% organic management while manganese and copper recorded higher under integrated package (50% each organic and inorganic) of 11.6 and 2.89 ppm. Available Fe and Zn was found to be higher (105.8&97.8 %) compared to inorganic whereas, Mn and Cu (93.3&207.4%) was higher than inorganic management respectively. In terms of cropping system, all cropping systems performed well under different management practices but there was not much variation recorded with micronutrients. Among the cropping systems, black gram-cauliflower-summer squash recorded higher available Fe and Zn (12.1 and 2.84 ppm respectively) in the soil. Cauliflower tomato recorded higher available Mn(9.7 ppm) while ladyfinger-pea recorded higher copper (2.38 ppm) availability in the soil.

Calicut: In ginger crop**,** higher available iron (41.5 ppm) was recorded under organic management whereas; manganese was recorded higher (3.5 ppm) under integrated with 50% each organic and inorganic nutrient. Higher zinc (7.5 ppm) was found maximum with 75% organic+25% inorganic nutrient and copper (4.1 ppm) recorded under inorganic management package. In case of turmeric, higher available iron, manganese and zinc (50.0, 5.3&3.5 ppm) were higher under organic management system whereas copper was higher under integrated management system with 75% organic+25% inorganic nutrient. Among the turmeric varieties, the range ofironfrom 33.00-38.87ppm,Mn ranged from 11.72 -14.67 ppm, Zn in soil ranged from 1.37-1.70ppm and copper was recorded in range from 1.77-2.20 ppm. Alleppy supreme recorded maximum iron and copper whereas manganese was higher with suguna, and soba recorded higher zinc.

Dharwad: The micronutrients availability in the soil at the end of cropping cycle *viz*., Fe, Mn, Zn and Cu increased significantly with 100% inorganic from 9.25, 11.13, 0.92 and 3.32, mg/kg to 10.65, 12.80, 1.05 and 3.76 mg/kg, respectively with 100% organic management practice. Whereas, cropping systems and interactions did not differ significantly.

Pantnagar: Availability of Zn (1.5 ppm) and Mn (14.7 ppm) in the soil was found higher in 100% Organic followed by 75% Organic+ Innovative practice. However, the availability of Cu (5.09 ppm) and Fe (72.0 ppm) was maximum under 75%Organic+Innovative practices followed by 100% Organic packages. Among

Table 8. Influence of methods of organic, inorganic and integrated package on soil available micronutrients at the end of cropping cycle at different locations

Cropping systems/ Management practice	Soil available Iron (ppm)							Soil available Manganese (ppm)						
	Organic		Inorganic		Integrated (towards organic)		Mean	Organic		Inorganic		Integrated (towards organic)		Mean
	100% organic	75% organic + innovative practices	100% inorganic	State recomm-endation	50% organic + 50% inorganic	75% organic + 25% inorganic		100% organic	75% organic + innovative practices	100% inorganic	State recomm-endation	50% organic + 50% inorganic	75% organic + 25% inorganic	
Bajaura														
Tomato-cauliflower - french bean	13.1	10.8	6.1	8.3	12.6	10.7	10.3	10.3	8.5	6.3	7.1	12.0	9.6	9.0
Fallow-cauliflower -tomato	14.3	11.1	7.6	9.4	12.3	11.2	11.0	11.2	9.9	6.1	8.4	12.8	9.9	**9.7**
Black gram-cauliflower - summer squash	16.4	12.4	6.9	9.1	15.0	12.7	**12.1**	10.8	7.7	5.5	7.1	10.6	9.4	8.5
Lady finger-pea	12.9	12.0	6.9	8.4	15.0	12.7	11.3	11.5	9.6	6.2	8.4	10.9	9.3	9.3
Mean	**14.2**	**11.6**	6.9	8.8	13.7	11.8		10.9	9.0	6.0	7.7	**11.6**	**9.6**	
Calicut														
Ginger - fallow	41.5	39.2	40.5		39.7	38.7		2.3	2.7	3.8		3.4	3.5	
Turmeric-fallow	51.8	34.8	26.8		34.5	30.3		17.4	11.5	9.9		10.5	15.7	
Dharwad														
Cowpea-safflower	10.51	9.87	9.27	9.64	10.29	10.11	9.95	13.15	12.56	11.90	11.65	12.01	11.41	12.11
Pigeon pea (sole)	11.25	10.01	9.65	10.33	9.71	9.79	10.12	12.69	12.35	11.46	12.12	11.89	11.47	12.00
green gram - sorghum	11.12	10.32	9.03	9.81	9.83	10.25	10.06	13.15	12.22	10.54	12.3	12.14	11.49	11.97
Groundnut + hybrid cotton (2:1)	10.05	10.13	8.94	9.49	10.1	9.88	9.77	12.79	12.23	10.48	11.77	12.35	12.87	12.08
Maize-chickpea	10.32	10.08	9.37	9.67	9.94	9.7	9.85	12.23	11.78	11.29	12.22	12.14	12.69	12.06
Mean	10.65	10.08	9.25	9.79	9.97	9.95		12.80	12.23	11.13	12.01	12.10	11.99	
Pantnagar														
Basmati rice-wheat	66.9	71.6	48.5	36.4	44.0	55.9	53.9	12.3	11.6	9.4	10.9	12.0	11.8	11.3
Basmati rice -chickpea (4rows+2rows coriander)	68.0	72.5	48.0	39.2	45.0	52.6	54.2	13.9	11.9	9.2	9.8	12.8	11.6	11.5
Basmati rice -vegetable pea (4 rows vegetable pea +2 rows coriander)	61.5	71.4	46.9	37.1	47.2	58.8	53.8	17.6	12.0	10.8	8.6	12.4	12.0	12.2
Basmati rice -potato	60.9	72.3	46.2	38.6	44.8	60.0	53.8	14.8	13.1	10.2	10.5	13.8	12.4	12.5
Mean	64.3	72.0	47.4	37.8	45.3	56.8		14.7	12.2	9.9	10.0	12.8	12.0	
Umiam														
Vegetable-vegetable systems on *raised bed*														
Broccoli -carrot							76.3						6.86	
Broccoli - potato							71.8						7.33	
Broccoli -french bean							87.8						9.57	
Broccoli -tomato							85.9						7.95	
Mean	85.2	76.2	75.8		84.5			9.48	7.53	6.10		8.59		

New centress started from 2015-16

Cropping systems/ Management practice	Soil available Iron (ppm)							Soil available Manganese (ppm)						
	Organic		Inorganic		Integrated (towards organic)		Mean	Organic		Inorganic		Integrated (towards organic)		Mean
	100% organic	75% organic + innovative practices	100% inorganic	State recomm-endation	50% organic + 50% inorganic	75% organic + 25% inorganic		100% organic	75% organic + innovative practices	100% inorganic	State recomm-endation	50% organic + 50% inorganic	75% organic + 25% inorganic	
Sardarkrushinagar														
Groundnut-potato -pearlmillet	3.67	3.59	3.47	3.50	3.64	3.56	3.57	5.57	5.41	5.04	5.28	5.41	5.38	5.35
Greengram-cumin-veg. cowpea	3.59	3.66	3.40	3.39	3.57	3.52	3.52	6.31	6.20	5.81	6.00	6.10	6.08	6.08
Greengram-fennel	3.77	3.51	3.51	3.48	3.6	3.56	3.57	6.08	5.91	5.68	5.84	5.9	5.89	5.88
Mean	3.68	3.59	3.46	3.46	3.60	3.55		5.99	5.84	5.51	5.71	5.80	5.78	
Thiruvananthapuram														
Cassava-veg. cowpea	14.54	18.54	15.48	7.63	19.16	15.46	15.14	10.22	10.88	12.43	5.13	9.90	10.29	9.81
Cassava-groundnut Taro-black gram Taro-greengram	31.74	22.46	15.77	15.21	17.83	22.70	20.95	13.89	15.50	12.47	10.64	15.59	18.66	14.46
Udaipur														
Maize + blackgram (2:2) – durum wheat – *sesbania* (GM)	2.75	2.17	2.49	2.83	2.25	2.08	2.43	1.39	1.49	1.39	2.51	3.32	3.11	2.20
Sweet corn + blackgram (2:2) – chickpea	2.58	3.24	3.49	3.74	3.24	3.08	3.23	3.08	4.34	4.52	5.99	3.88	3.95	4.29
Blackgram – wheat	3.49	3.41	1.01	1.51	0.93	1.09	1.91	1.84	1.88	2.90	2.51	1.88	1.91	2.15
Soybean - fenugreek	3.24	1.75	1.84	2.17	1.75	2.08	2.14	6.84	3.67	2.83	4.66	7.57	4.13	4.95
Mean	3.02	2.64	2.21	2.56	2.04	2.08		3.29	2.85	2.91	3.92	4.16	3.28	

Table 9. Influence of methods of organic, inorganic and integrated package on soil available micronutrients at the end of cropping cycle

Management practice	Zinc (ppm)							Copper (ppm)						
	Organic		Inorganic		Integrated (towards organic)		Mean	Organic		Inorganic		Integrated (towards organic)		Mean
	100% organic	75% organic + innovative practices	100% inorganic	State recomm-endation	50% organic + 50% inorganic	75% organic + 25% inorganic		100% organic	75% organic + innovative practices	100% inorganic	State recomm-endation	50% organic + 50% inorganic	75% organic + 25% inorganic	
Bajaura														
Tomato-Cauliflower - French bean	3.91	2.80	1.89	1.85	3.06	2.82	2.72	2.13	1.70	0.94	1.42	2.35	1.74	1.71
Fallow-Cauliflower -Tomato	3.32	2.85	1.70	2.06	3.05	2.85	2.64	3.10	1.83	1.02	1.63	3.71	2.39	2.28
Black gram-Cauliflower - Summer squash	3.71	3.10	1.82	2.82	2.89	2.71	**2.84**	1.32	0.95	0.88	0.95	1.63	1.43	1.19
Lady finger-Pea	3.53	2.56	1.86	2.35	3.00	2.72	2.67	3.52	2.11	0.93	1.42	3.85	2.44	**2.38**
Mean	**3.62**	**2.83**	1.82	2.27	3.00	2.78		2.52	1.65	0.94	1.36	**2.89**	**2.00**	
Calicut														
Ginger -fallow	6.7	4.5	2.6		7.5	2.7		3.4	3.7	4.1		3.2	3.4	
Turmeric-fallow	2.6	1.6	0.4		1.7	1.2		1.1	3.0	1.5		2.6	1.9	
Dharwad														
Cowpea-safflower	1.01	1.02	0.90	0.95	0.96	0.95	0.97	3.81	3.56	3.25	3.49	3.49	3.31	3.48
Pigeon pea (sole)	1.07	0.94	0.87	0.88	0.95	0.97	0.95	3.62	3.40	3.32	3.46	3.36	3.49	3.44
Green gram - sorghum-	1.04	0.97	0.94	0.98	0.99	0.97	0.98	3.77	3.56	3.27	3.38	3.41	3.42	3.47
Groundnut + hybrid cotton (2:1)	1.05	1.01	0.94	0.97	1.00	0.98	0.99	3.84	3.48	3.23	3.54	3.45	3.40	3.49
Maize-chickpea	1.06	1.01	0.96	0.93	1.01	0.99	0.99	3.74	3.49	3.53	3.31	3.64	3.37	3.51
Mean	1.05	0.99	0.92	0.94	0.98	0.97		3.76	3.50	3.32	3.44	3.47	3.40	
Pantnagar														
Basmati rice-wheat	1.40	1.52	0.88	0.90	1.31	0.92	1.16	4.96	5.10	3.80	3.80	4.80	5.01	4.58
Basmati rice - chickpea (4rows+ 2rows coriander)	1.44	1.60	0.86	0.94	1.35	1.10	1.22	5.08	5.22	3.82	3.95	4.85	4.90	4.64
Basmati rice - vegetable pea (4 rows vegetable pea +2 rows coriander)	1.64	1.53	0.95	0.98	1.22	1.18	1.25	4.88	4.98	3.75	3.82	4.78	4.82	4.51
Mean	1.50	1.48	0.89	0.93	1.24	1.08		4.95	5.09	3.77	3.87	4.83	4.87	
Umiam														
Vegetable-vegetable systems on *raised bed*														
Broccoli -carrot							0.46						1.21	
Broccoli - potato							0.42						1.40	
Broccoli -french bean							0.53						1.23	
Broccoli -tomato							0.43						1.20	
Mean	0.54	0.42	0.38		0.50			1.37	1.24	1.13		1.30		

New centress started from 2015-16

Management practice	Zinc (ppm)							Copper (ppm)						
	Organic		Inorganic		Integrated (towards organic)		Mean	Organic		Inorganic		Integrated (towards organic)		Mean
	100% organic	75% organic + innovative practices	100% inorganic	State recomm-endation	50% organic + 50% inorganic	75% organic + 25% inorganic		100% organic	75% organic + innovative practices	100% inorganic	State recomm-endation	50% organic + 50% inorganic	75% organic + 25% inorganic	
Sardarkrushinagar														
Groundnut-potato -pearlmillet	0.46	0.44	0.27	0.37	0.40	0.43	0.39	0.69	0.59	0.39	0.49	0.59	0.57	0.55
Greengram-cumin -veg. cowpea	0.44	0.42	0.32	0.38	0.43	0.40	0.40	0.56	0.52	0.36	0.43	0.51	0.47	0.48
Greengram-fennel	0.38	0.35	0.26	0.3	0.34	0.34	0.33	0.53	0.52	0.39	0.44	0.52	0.45	0.47
Mean	0.43	0.40	0.28	0.35	0.39	0.39		0.59	0.54	0.38	0.45	0.54	0.50	
Thiruvananthapuram														
Cassava-veg. cowpea	2.61	2.41	2.56	1.81	2.87	3.09	2.56	2.10	2.21	1.85	1.71	2.08	2.18	2.02
Cassava-groundnut Taro-black gram Taro-greengram	3.09	3.14	3.93	5.25	2.67	4.94	3.84	2.82	2.56	2.13	1.89	2.20	3.27	2.48
Udaipur														
Maize + blackgram (2:2) – durum wheat – *sesbania* (GM)	4.91	8.65	5.39	6.97	6.13	6.28	6.39	13.98	24.70	16.12	20.18	14.59	14.51	17.35
Sweetcorn + blackgram (2:2) – chickpea	7.33	4.92	4.72	4.71	5.17	8.16	5.84	19.11	13.82	13.36	13.82	15.05	22.94	16.35
Blackgram – wheat	5.45	6.83	4.31	7.59	5.12	4.84	5.69	14.14	17.63	10.74	18.99	12.87	11.97	14.39
Soybean - fenugreek	4.85	3.79	3.12	3.48	5.32	4.71	4.21	12.34	10.41	18.93	10.33	14.23	12.26	13.08
Mean	5.64	6.05	4.39	5.69	5.44	6.00		14.89	16.64	14.79	15.83	14.19	15.42	

the cropping systems, the availability of Zn was higher in basmati rice- vegetable pea system (1.25 ppm) that of Cu (4.64 ppm) and Fe (54.20 ppm) was higher in basmati rice –chickpea system. Although, availability of Mn (12.5 ppm) was recorded higher in basmati rice-potato system.

Umiam: Maximum micronutrient content (Fe, Mn, Zn, Cu) of soil under different management practices was increased up to 20.9, 35.6, 29.6 and 17.5% respectively in 100% organic management followed by 20.2, 28.9, 24 and 13.1% in integrated management practice in raised bed planting technology compared to inorganic management, respectively.

Influence of organic management package with reduced dose of organic manures, integrated and inorganic management packages on N, P and K uptake (Table 10-12)

Bajaura: Uptake of N, P and K by the different vegetable crops in cropping systems was estimated. Tomato and cauliflower recorded higher N uptake (2.23 and 3.0%) with 50% each nutrient supplied through organic and inorganic sources under integrated management. French bean and black gram recorded higher N uptake (2.41 and 2.43%) with 100% organic management. Summer squash recorded higher N uptake (1.83%) under integrated management with 50% each organic and inorganic sources of nutrients. Cauliflower and pea removed higher phosphorus from the soil of 0.39 and 0.36% respectively under integrated nutrient management approach while, tomato, frenchbean, black gram, summer squash, and lady finger removed higher phosphorus (0.28, 0.20, 0.28, 0.28 and 0.29%) respectively with state recommendation. Tomato, frenchbean, black gram and vegetable pea recorded higher K uptake (2.35, 2.05, 2.13& 0.96% respectively) under integrated management practices with 50% each nutrient source through organic and inorganic. Lady finger and cauliflower was at par with organic and integrated management and no variation was found. However summer squash recorded higher K uptake (2.16 %) under inorganic management with state recommendation and was at par with integrated management practices.

Calicut: Leaf nutrient status in ginger at 120 DAP revealed significantly higher nitrogen and phosphorus in organic management system while potassium were on par among different treatments but higher with. In case of turmeric, nutrient status in turmeric rhizome as influenced by different management system (nitrogen and phosphorus) was found to be higher in organic management practice whereas uptake of potassium were significantly higher in integrated nutrient management practice either with 50% each organic and inorganic or with 25% more organic manure. Among turmeric varieties, Sudarshana and. Suguna showed maximum uptake of N, P and K.

Pantnagar: During *kharif* in basmati rice, highest uptake of macronutrients i.e. N (109.7 kg/ha) was observed with 100% organic package followed by 75% organic+ innovative technology. However, uptake of P (32.1 kg/ha) and K (66.7 kg/ha) by basmati rice was higher in 75% organic+ innovative technology under organic followed by towards organic 75% organic + 25% inorganic 31.4 kg/ha and 66.5 kg/ha, respectively. Nitrogen (127.1 kg/ha) and potassium uptake (108.0 kg/ha) in wheat crop was recorded maximum in 50% organic + 50% chemical under integrated followed by other treatments whereas phosphorus uptake (52.2 kg/ha) were recorded maximum in state recommendation. by In case of chickpea crop, nitrogen uptake (70.6 kg/ha) was found to be higher in 75% organic + Innovative Technology (organic), however phosphorus (17.6 kg/ha) and potassium uptake (34.9 kg/ha) was maximum under 100 % organic management.

Table 10. Influence of organic, inorganic and integrated package on N uptake of crops and cropping systems

Cropping systems/ management package	Organic						Inorganic						Integrated management (towrsd organic)					
	100% organic			75% organic + innovative organic practices			100% in organic			State recommendation			50% organic + 50% inorganic			75% organic + 25% inorganic		
	Kharif	*Rabi*	*Summer*	*Kharif*	*Rabi*	*Summer*	*Kharif*	*Rabi*	*Summer*	*Kharif*	*Rabi*	*Summer*	*Kharif*	*Rabi*	*Summer*	*Kharif*	*Rabi*	*Summer*
Bajaura									(%)									
Tomato-cauliflower-french bean	2.04	2.82	2.41	1.99	2.76	2.39	2.13	2.92	2.26	2.22	2.96	2.27	2.19	2.94	2.33	2.03	2.90	
Fallow-cauliflower -tomato		2.85	2.06		2.76	2.02		2.89	2.13		2.88	2.20		3.00	2.23		2.98	
Black gram-cauliflower - summer squash	2.43	2.81	1.80	2.35	2.78	1.76	2.24	2.92	1.79	2.30	2.95	1.81	2.38	2.97	1.83	2.28	2.95	
Lady finger-pea	1.89	3.44		1.82	3.43		1.92	3.34		1.96	3.38		1.98	3.43		1.95	3.41	
Calicut																		
Ginger-fallow **(%)**	2.9			2.5			2.4						2.4			2.4		
Turmeric-fallow (kg/ha)	110.95			96.12			81.47						93.77			95.09		
Pantnagar																		
Basmati rice - wheat	109.7	117.8		107.3	110.4		99.8	116.3		103.4	118.5		103.8	127.1		104.6	127.0	
Basmati rice–chickpea (4 rows chickpea + 2 rows coriander)	109.7	68.5		107.3	70.6		99.8	58.6		103.4	61.9		103.8	63.2		104.6	64.7	
Basmati rice–vegetable pea (4 rows vegetable pea + 2 rows coriander)	109.7			107.3			99.8			103.4			103.8			104.6		
Basmati rice – potato	109.7			107.3			99.8			103.4			103.8			104.6		
Raipur																		
Soybean-maize	134.8			142.3			143.1		151.9				134.0			140.4		
Soybean-pea	145.3			147.6			142.1		139.8				137.7			131.0		
Soybean-chilli	146.8			154.7			140.5		141.9				127.6			132.0		
Soybean-onion	149.0			148.2			132.0		137.3				129.2			133.8		
Mean	144.0			148.2			139.4		142.7				132.1			134.3		
Ranchi																		
Rice- wheat	78.1	60.5		82.5	56.5		46.6	74.2		63.9	48.6		74.2	70.1		71.7	67.9	
Rice - lentil	73.1	21.4		76.4	19.8		47.8	24.6		56.8	16.6		73.6	27.3		65.5	25.4	
Rice- potato	82.6	65.8		84.7	60.0		46.7	46.5		69.1	40.2		80.4	52.4		76.4	49.4	
Rice - linseed	72.1	57.6		77.7	56.3		54.0	43.8		64.5	37.4		69.7	43.6		63.5	50.2	
Mean	76.5			80.3			48.8			63.6			74.5			69.3		

New centres included from 2015-16

Cropping systems/ management package	Organic						Inorganic						Integrated management (towrsd organic)					
	100% organic			75% organic + innovative organic practices			100% in organic			State recommendation			50% organic + 50% inorganic			75% organic + 25% inorganic		
	Kharif	*Rabi*	*Summer*	*Kharif*	*Rabi*	*Summer*	*Kharif*	*Rabi*	*Summer*	*Kharif*	*Rabi*	*Summer*	*Kharif*	*Rabi*	*Summer*	*Kharif*	*Rabi*	*Summer*
Ajmer																		
Coriander– clusterbean	19.7			17.53			23.14			29.7			25.63			31.99		
Coriander - greengram																		
Fennel - cluster bean	49.5			52.2			50.2			62.3			57.0			66.4		
Fennel – green gram																		
Sardarkrushinagar																		
Groundnut-potato -pearlmillet	3576			398.4			498.5			476.6			500.5			501.5		
Greengram-cumin-veg. cowpea	47.5			52.8			80.0			85.2			76.0			76.3		
Greengram-fennel	119.5			116.1			134.9			146.0			134.1			138.9		
Udaipur																		
Maize + blackgram (2:2) – durum wheat – *sesbania* (GM)	46.89			41.33			43.63			32.64			48.34			47.66		
Sweet corn + blackgram (2:2) – chickpea	71.68			44.95			57.06			42.43			57.26			79.56		
Blackgram – wheat	25.43			25.89			28.21			23.69			31.01			31.56		
Soybean - fenugreek	44.49			38.09			70.11			30.46			54.79			61.08		

Table 11. Influence of inorganic, inorganic and integrated on P uptake of crops at different locations

Cropping systems/ management package	Organic						Inorganic						Integrated management (towrsd organic)					
	100% organic			75% organic + innovative organic practices			100% in organic			State recommendation			50% organic + 50% inorganic			75% organic + 25% inorganic		
	Kharif	*Rabi*	*Summer*	*Kharif*	*Rabi*	*Summer*	*Kharif*	*Rabi*	*Summer*	*Kharif*	*Rabi*	*Summer*	*Kharif*	*Rabi*	*Summer*	*Kharif*	*Rabi*	*Summer*
Bajaura																		
Tomato-cauliflower - french bean	0.21	0.38	0.19	0.23	0.35	0.20	0.25	0.33	0.19	0.28	0.35	0.20	0.26	0.39	0.20	0.23	0.38	0.18
Fallow-cauliflower -tomato		0.36	0.24		0.37	0.25		0.33	0.27		0.35	0.28		0.37	0.27		0.36	0.25
Black gram-cauli-flower - summer squash	0.26	0.35	0.26	0.26	0.32	0.28	0.26	0.32	0.26	0.28	0. 35	0.28	0.25	0.36	0.28	0.28	0.35	0.24
Lady finger-pea	0.18	0.30		0.16	0.33		0.26	0.34		0.29	0.35		0.26	0.36		0.24	0.34	
Calicut																		
Ginger-fallow **(%)**	0.35			0.34			0.13						0.26			0.25		
Turmeric-fallow (kg/ha)	55.32			43.24			15.46						46.52			42.25		
Pantnagar																		
Basmati rice - wheat	27.9	46.5		32.1	47.1		27.1	49.0		27.6	52.2		29.2	50.7		31.4	48.5	
Basmati rice–chickpea (4 rows chickpea + 2 rows coriander)	27.9	17.6		32.1	16.4		27.1	13.7		27.6	14.9		29.2	15.8		31.4	14.6	
Basmati rice–vegetable pea (4 rows vegetable pea + 2 rows coriander)	27.9			32.1			27.1			27.6			29.2			31.4		
Basmati rice – potato	27.9			32.1			27.1			27.6			29.2			31.4		
Raipur																		
Soybean-maize	14.9			14.5			15.9			16.4			14.5			14.8		
Soybean-pea	16.4			16.1			15.5			15.2			15.0			13.8		
Soybean-chilli	16.1			16.9			15.3			16.3			14.2			14.0		
Soybean-onion	15.8			15.9			14.6			15.3			13.6			14.2		
Mean	15.8			15.8			15.3			15.8			14.3			14.2		
Ranchi																		
Rice- wheat	19.4	11.4		19.8	10.6		15.6	14.4		11.0	8.9		18.0	12.9		17.3	13.5	
Rice - lentil	19.2	5.5		19.6	5.1		14.3	6.3		12.1	4.3		18.0	7.0		16.0	6.5	
Rice- potato	21.1	45.8		21.2	42.7		17.0	31.7		11.3	27.7		19.9	37.6		18.8	34.0	
Rice - linseed	19.2	6.5		20.3	6.3		16.8	4.8		14.0	4.7		17.6	5.1		16.3	5.5	
Mean	19.7			20.2			15.9			12.1			18.4			17.1		

New centre included from 2015-16

Cropping systems/ management package	Organic						Inorganic						Integrated management (towrsd organic)					
	100% organic			75% organic + innovative organic practices			100% in organic			State recommendation			50% organic + 50% inorganic			75% organic + 25% inorganic		
	Kharif	*Rabi*	*Summer*	*Kharif*	*Rabi*	*Summer*	*Kharif*	*Rabi*	*Summer*	*Kharif*	*Rabi*	*Summer*	*Kharif*	*Rabi*	*Summer*	*Kharif*	*Rabi*	*Summer*
Ajmer																		
Coriander – cluster bean	3.78			4.82			5.50			6.88			6.52			7.62		
Coriander - green gram																		
Fennel - cluster bean	11.0			11.5			11.2			13.9			11.9			14.6		
Fennel – green gram																		
Sardarkrushinagar																		
Groundnut-potato-pearlmillet	57.5			66.5			90.2			78.7			87.7			88.2		
Greengram-cumin-veg. cowpea	6.8			7.1			12.5			11.9			11.1			10.4		
Greengram-fennel	33.7			33.9			38.2			38.7			37.1			40.1		
Udaipur																		
Maize + blackgram (2:2) – durum wheat – *sesbania* (GM)	9.73			8.46			8.43			5.60			9.11			9.49		
Sweetcorn+ blackgrm (2:2)– chickpea	12.01			7.33			9.48			6.71			9.83			13.51		
Blackgram – wheat	3.77			3.60			4.27			3.81			4.68			4.42		
Soybean - fenugreek	4.86			4.32			7.65			3.48			5.87			6.76		

Table 12. Influence of inorganic, inorganic and integrated on K uptake of crops at different locations

Cropping systems/ management package	Organic						Inorganic						Integrated management (towrsd organic)					
	100% organic			75% organic + innovative organic practices			100% in organic			State recommendation			50% organic + 50% inorganic			75% organic + 25% inorganic		
	Kharif	*Rabi*	*Summer*	*Kharif*	*Rabi*	*Summer*	*Kharif*	*Rabi*	*Summer*	*Kharif*	*Rabi*	*Summer*	*Kharif*	*Rabi*	*Summer*	*Kharif*	*Rabi*	*Summer*
Bajaura									(%)									
Tomato-cauliflower-french bean	2.22	2.55	1.96	2.19	2.50	1.96	2.30	2.54	1.97	2.32	2.55	1.99	2.35	2.56	2.05	2.30	2.50	2.00
Fallow-cauliflower -Tomato		2.53	2.26		2.55	2.27		2.50	2.25		2.55	2.29		2.57	2.33		2.54	2.30
Black gram-cauliflower- summer squash	2.06	2.53	2.13	2. 08	2.54	2.14	2.10	2.56	2.15	2.12	2.58	2.16	2.13	2.55	2.16	2.10	2.53	2.12
Lady finger-pea	2.12	0.83		2.13	0.86		2.09	0.94		2.12	0.96		2.12	0.96		2.09	0.93	
Calicut																		
Ginger-fallow (%)	2.41			2.13			2.15						1.54			1.84		
Turmeric-fallow (kg/ha)	84.36			74.06			84.57						81.23			85.54		
Pantnagar																		
Basmati rice - wheat	65.4	96.0		66.7	93.2		59.7	99.1		63.6	105.1		65.8	108.0		66.5	103.7	
Basmati rice– chickpea (4 rows chickpea + 2 rows coriander)	65.4	34.9		66.7	31.8		59.7	29.6		63.6	30.4		65.8	31.4		66.5	30.4	
Basmati rice– vegetable pea (4 rows vegetable pea + 2 rows coriander)	65.4			66.7			59.7			63.6			65.8			66.5		
Basmati rice – potato	65.4			66.7			59.7			63.6			65.8			66.5		
Raipur																		
Soybean-maize	65.6			64.3			65.2			68.3			63.9			65.4		
Soybean-pea	75.0			68.4			63.1			62.7			63.1			65.4		
Soybean-chilli	66.6			74.3			66.9			67.6			62.5			60.4		
Soybean-onion	66.0			71.3			66.0			68.7			60.7			64.2		
Mean	68.3			69.6			65.3			66.8			62.6			63.8		
Ranchi																		
Rice- wheat	67.5	33.7		69.7	31.7		57.9	42.0		41.2	26.1		66.8	38.0		63.7	39.4	
Rice - lentil	64.2	13.2		62.7	12.4		49.4	14.5		41.6	10.6		61.4	15.5		55.7	15.0	
Rice- potato	71.9	139.6		72.8	130.0		58.9	98.0		40.3	88.5		63.9	113.6		66.4	105.9	
Rice - linseed	66.7	29.3		70.6	28.0		61.2	21.3		47.5	20.3		59.3	21.9		55.6	24.4	
Mean	67.6			69.0			56.9			42.7			62.9			60.4		

New centres included from 2015-16

Cropping systems/ management package	Organic						Inorganic						Integrated management (towrsd organic)					
	100% organic			75% organic + innovative organic practices			100% in organic			State recommendation			50% organic + 50% inorganic			75% organic + 25% inorganic		
	Kharif	*Rabi*	*Summer*	*Kharif*	*Rabi*	*Summer*	*Kharif*	*Rabi*	*Summer*	*Kharif*	*Rabi*	*Summer*	*Kharif*	*Rabi*	*Summer*	*Kharif*	*Rabi*	*Summer*
Ajmer																		
Coriander – cluster bean	15.14			15.31			17.33			22.77			20.34			24.98		
Coriander - green gram																		
Fennel - cluster bean	37.8			37.2			42.1			49.1			42.4			52.3		
Fennel – green gram																		
Sardarkrushinagar																		
Groundnut-potato-pearlmillet	253.7			281.1			364.5			358.1			362.9			366.4		
Greengram-cumin -veg. cowpea	31.0			37.0			55.9			59.2			54.5			54.1		
Greengram-fennel	94.7			95.4			103.5			117.6			102.7			111.3		
Udaipur																		
Maize + blackgram (2:2) – durum wheat – *sesbania* (GM)	73.69			62.32			63.98			48.35			75.29			74.17		
Sweet corn + blackgram (2:2) – chickpea	43.39			32.67			27.66			30.29			35.89			42.43		
Blackgram – wheat	13.43			11.24			16.12			16.16			18.33			15.45		
Soybean - fenugreek	23.33			23.59			34.60			18.42			24.61			31.80		

Raipur: Difference in N, P and K uptake in soybean due to various management packages was observed. The uptake was higher in soybean with application of 75% organic + innovative practices (foliar spray of vermiwash 10%) of 154.7, 16.9 and 74.3 kg/ha respectively) in rice-chilli system and found to be higher (N 10.1 and 21.2%), (P 10.5 and 19.1%) and (K 11.1 and 18.9%) compared to organic and integrated management.

Ranchi: Total nitrogen uptake by rice crop was maximum (80.3 kg/ha) in the 75% organic + innovative practices with organic management followed by 100% organic sources (76.5 kg/ha), likewise, similar trend was observed with P & K uptake in rice crop during *kharif*. In *rabi* season, N, P and K uptake was maximum under 100% organic followed by 75% organic + innovative practices among the different production system. Among different crops during *rabi,* maximum N, was removed by wheat (63.4 kg/ha) while, minimum N was uptake by lentil crop (22.5 kg/ha). Phosphorus and potassium was removed from soil by potato crop of 36.6, 112.6 kg/ha respectively.

Ajmer: Uptake of nutrient by coriander revealed that highest uptake of N (31.99 kg/ha), P (7.62 kg/ha) and K (24.98 kg/ha) were observed in integrated with 75% organic + 25% inorganic practices followed by state recommendation. Uptake of nutrient by fennel showed similar trend that highest uptake of nutrients i.e. N (66.41 kg/ha), P (14.64 kg/ha) and K (52.28 kg/ha) were observed in integrated with 75% organic + 25% inorganic followed by state recommendation and 50% organic + 50% inorganic management practices..

Influence of organic, inorganic and integrated management on micronutrient (iron, manganese, zinc and copper) uptake (Table 13-14)

Bajaura: Cauliflower, lady finger and pea recorded higher iron uptake (57.0, 42.0 and 42.0 mg/ha respectively) under 100% organic supply through organic sources while Tomato, frenchbean, black gram and summer squash were recorded higher iron uptake (57.0, 112.0, 116.0 and 55.0 mg/ha respectively) under integrated management either 50% each nutrient supply through organic and inorganic or with 75% organic + 25% nutrient. Tomato, frenchbean, blackgram, cauliflower, summer squash, lady finger and pea recorded higher manganese uptake (26.0, 22.0, 22.0, 26.0, 24.0, 20.0 and 24.0 mg/ha respectively) with organic nutrient management either 100% nutrient supply through organic or with 75% organic + innovative organic practice. Uptake of zinc in tomato, cauliflower, black gram, lady finger and peawas higher(22.0, 25.0, 33.0, 16.0 and 11.0 mg/ha) respectively with organic management but at par with integrated nutrient management (75% organic+ 25% inorganic) whereas frenchbean and summer squash (30.0 &20.0 mg/ha) recorded higher with 75% organic+25% innovative practices. Similar trend was observed in case of copper, crops such as, tomato, cauliflower, frenchbean, black gram, summer squash, lady finger and pea recorded higher copper uptake (9.7, 13.0, 12.3, 12.7, 8.4, 8.2, and 18.0 mg/ha) respectively under 100% organic management practice.

Calicut: Leaf nutrient status in ginger at 120 DAP revealed significantly higher copper content in organic management system. Potassium calcium and magnesium concentration were on par among different treatments whereas significantly higher manganese was noticed in inorganic system. In case of turmeric, nutrient status in turmeric rhizome as influenced by different management system for calcium, iron, zinc and copper were significantly higher in integrated nutrient management practice either with 50% each organic and inorganic or with 25% more organic manure. Uptake of manganese was recorded maximum

Table 13. Influence of organic, inorganic and integrated nutrient management on micronutrients (Fe, Mn, Zn and Cu) uptake by different crops at Bajura

Cropping systems/ management package	Organic						Inorganic						Integrated management (towrsd organic)					
	100% organic			75% organic + innovative organic practices			100% in organic			State recommendation			50% organic + 50% inorganic			75% organic + 25% inorganic		
	Kharif	*Rabi*	*Summer*	*Kharif*	*Rabi*	*Summer*	*Kharif*	*Rabi*	*Summer*	*Kharif*	*Rabi*	*Summer*	*Kharif*	*Rabi*	*Summer*	*Kharif*	*Rabi*	*Summer*
Iron (mg/kg)																		
Tomato-cauliflower-french bean	56	57	111	54	55	109	46	45	98	49	54	104	55	56	110	53	55	112
Fallow-cauliflower-tomato		56	55		53	53		44	44		49	48		54	57		53	54
Black gram-cauliflower - summer squash	110	56	50	112	54	46	96	44	42	104	50	44	116	53	55	115	52	51
Lady finger-pea	42	42		40	40		35	32		38	35		40	40		42	39	
Manganese (mg/kg)																		
Tomato-cauliflower - french bean	25	24	20	26	25	22	20	16	15	23	20	16	24	22	17	25	20	16
Fallow-cauliflower -tomato		21	25		20	26		15	19		20	24		20	24		19	23
Black gram -cauliflower-summer squash	22	26	24	21	24	22	15	16	16	18	19	18	22	23	23	20	22	22
Lady finger-pea	20	24		17	22		13	17		16	18		20	22		19	20	
Zinc (mg/kg)																		
Tomato-cauliflower - french bean	22	25	28	18	22	30	12	13	20	14	15	23	19	20	26	18	19	25
Fallow-cauliflower -tomato		20	20		18	17		12	13		16	15		20	19		18	15
Black gram-cauliflower - summer squash	33	22	18	32	19	20	21	12	12	25	14	15	29	17	17	25	15	16
Lady finger-pea	16	11		15	10		10	7		12	9		14	9		13	8	
Copper (mg/kg)																		
Tomato-cauliflower - french bean	9.7	13.0	12.3	8.5	12.5	10.8	5.1	6.9	6.9	6.4	8.2	8.1	8.8	11.3	10.8	8.3	9.8	8.0
Fallow-cauliflower -tomato		12.8	9.5		11.5	7.0		7.7	6.2		9.5	7.3		11.4	8.5		10.0	8.6
Black gram-cauliflower-summer squash	12.7	12.3	8.4	12.2	11.8	7.8	7.2	8.6	4.6	8.4	9.2	5.6	11.2	12.2	7.6	11.6	12.5	7.8
Lady finger-pea	8.2	18.0		6.8	18.0		4.5	11.0		5.9	14.0		7.2	17.0		7.4	19.0	

Table 14. Effect of different management systems on nutrient uptake in turmeric rhizomes at Calicut

	Treatments	Mg	Fe	Mn	Zn	Cu	Mg	Fe	Mn	Zn	Cu
Organic	100% Organic	0.43	148.8	127.8	26.25	20.5	10.88	3.90	1.12	0.31	0.14
	75% Organic + innovative organic practices	0.45	133.8	106.5	26.5	22.8	12.56	3.81	1.05	0.39	0.15
Inorganic	100% Inorganic	0.45	124.5	337.5	23.0	12.8	12.86	4.44	1.03	0.38	0.18
Integrated	50% Organic+50% inorganic	0.43	132.0	211.3	25.75	11.0	12.39	4.59	1.09	0.42	0.18
	75% Organic+25% Inorganic	0.47	148.8	218.3	23.75	12.0	7.78	3.91	1.40	0.35	0.18
	CD (*P=0.05*)	NS	9.74	2.92	2.92	3.36	0.83	0.14	0.06	0.02	0.01

in inorganic management practice. Among turmeric varieties, Sudarshana and. Suguna showed maximum uptake of nutrients.

Microbial population in soil as influenced by the different management practices including cropping systems (Table 15-16)

Bajaura: In general, the organic management practice improved soil microbial properties in all the cropping systems compare to inorganic and integrated practice. Under organic management, soil bacteria ranged from 12.6 to 18.1 log cfu/g, soil fungi from 11.5 to 14.0 log cfu/g, soil actinomycetes from 9.7 to 14.5 log cfu/g and phosphate solubilizing bacteria from 11.6 to 16.4 log cfu/g across the four cropping systems. Higher population of bacteria was recorded under 100% organic management of (16.8 x10^6cfu/g)followed by 25% reduced dose of organic manure (13.9 x10^6cfu/g) was found to be higher by35.5 and 12.1% over inorganic package respectively. Among the cropping systems, lady finger-pea recorded higher bacterial population (13.7x10^6cfu/g) but was on par with tomato-cauliflower-frenchbean (13.6x10^6cfu/g). Soil Fungi, actinomycetes and phosphate solubilizing bacteria population (13.7, 13.4 and 15.4 logcfu/g respectively) also recorded higher under organic followed by integrated with 75% organic+25% organic (13.5, 12.6 and 13.2logcfu/g respectively) management package.With100%organic management, fungi, actinomycetes and PSB was increased by 48.9, 70.3 and 57.1% compared to inorganic management. Among the cropping systems, fungi, actinomycetes and phosphate solubilizing bacteria were not influenced by cropping system.

Bhopal: Microbial count in soil (bacteria, fungi and actinomycetes) was found to be highest under 100% organic which was closely followed to 75% organic+25% innovative/inorganic as compared to inorganic or state recommendation. Under organic management, Bacteria was increased by 31.2 and 23.5%, fungi 21.4 and 13.3%, 26.7 and 18.7% compared to inorganic and integrated (50% each organic and inorganic nutrient) package.Soil enzymes fluorescein diacetate activity was recorded highest in 100 % organic followed by 75% organic + 25% innovative practice and 75% organic + 25% inorganic treatment indicating beneficial effect of addition of organics on soil microorganisms.âGlucosidase activity recorded highest in 100% organic followed by 75% organic + innovative practice and 75%organic + 25% inorganic treatment indicating beneficial effect of addition of organics on soil microorganisms.

Coimbatore: Higher bacteria population was recorded under organic nutrient management of 10.0 and 9.7 x10^6cfu/g and it was 42.8 and 25% higher with 100% organic compared to inorganic and integrated. However fungi (7.3. x10^6cfu/g) and recorded higher with inorganic under state recommendation and reduction was found to be with organic up to 8.2% compared to inorganic. Actiniomycetes (7.7 and 8.0x10^4cfu/g) was recorded in integrated with 75% organic+25% inorganic nutrient management. Among the cropping systems, cotton-maize system recorded higher fungi and actinomycetes population (9.0, 9.7 x10^6cfu/g) while bacteria was maximum in chilli-sunflower (8.7x10^4cfu/g).

Dharwad: No significant differences in populations of microorganisms in the rhizosphere either due to nutrient management or to cropping system was observed. Bacterial population increased from 7.67x10^6cfu/g under inorganic to 7.82 x10^6cfu/g in organic management. Slightly reduction was observed with organic in population of fungi 4.73 x10^6cfu/g compared to 4.87 x10^6cfu/g in inorganic with state recommendation. Higher actinomycetes (4.60x10^4cfu/g) recorded under organic management through 100% organic package and it was found to be higher by 14.4 % compared to inorganic. However, phosphate solubilizing bacteria increased up to the 5% over organic and 6.1% than integrated with 75% organic nutrients application.

Table 15. Rhizosphre microbial (Bacteria and Fungi micro-organisms) population in soil as influenced by the different nutrient practices and cropping systems

Cropping systems / Management practice	Bacteria (x10^6 cfu/g)							Fungi (x10^6 cfu/g)						
	Organic		Inorganic		Integrated (towards organic)		Mean	Organic		Inorganic		Integrated (towards organic)		Mean
	100% organic	75% organic + innovative organic practices	100% inorganic	State recomm-endation	50% organic + 50% inorganic	75% organic + 25% inorganic		100% organic	75% organic + innovative organic practices	100% inorganic	State recomm-endation	50% organic + 50% inorganic	75% organic + 25% inorganic	
Bajaura														
Tomato-Cauliflower - French bean	17.4	14.5	9.3	12.4	13.2	14.6	13.6	13.9	12.4	9.2	12.8	12.2	13.0	12.3
Fallow-Cauliflower -Tomato	16.3	14.0	9.3	12.4	14.5	12.8	13.2	14.0	12.5	9.3	12.5	12.0	13.2	12.3
Black gram-Cauliflower-Summer squash	15.2	12.6	9.0	12.3	12.6	13.2	12.5	13.3	11.5	9.2	12.7	12.3	14.0	12.2
Lady finger-Pea	18.1	14.6	9.5	12.6	13.0	14.2	13.7	13.5	11.8	9.2	11.3	12.9	13.7	12.1
Mean	16.8	13.9	9.3	12.4	13.3	13.7		13.7	12.1	9.2	12.3	12.4	13.5	
Bhopal														
Soybean- wheat														
Soybean- mustard														
Soybean- chickpea														
Soybean- linseed														
Mean	42.0	38.0	32.0	32.0	34.0	38.0		34.0	31.0	28.0	29.0	30.0	33.0	
Coimbatore														
Cotton - maize	11.0	11.0	7.0	7.0	8.0	9.0	8.8	8.0	9.0	8.0	10.0	9.0	10.0	9.0
Chillies - sunflower	10.0	10.0	11.0	8.0	8.0	9.0	9.3	7.0	8.0	7.0	7.0	7.0	7.0	7.2
Beetroot - maize	9.0	8.0	7.0	6.0	8.0	7.0	7.5	5.0	3.0	6.0	5.0	4.0	4.0	4.5
Mean	10.0	9.7	8.3	7.0	8.0	8.3		6.7	6.7	7.0	7.3	6.7	7.0	
Dharwad														
Cowpea-safflower	7.91	7.88	7.83	7.81	7.69	7.65	7.79	4.78	4.81	5.04	4.90	4.35	4.50	4.73
Pigeon pea (sole)	7.93	7.89	7.69	7.71	7.83	7.76	7.80	4.89	5.03	4.68	5.15	4.54	4.68	4.83
Green gram - sorghum	7.81	7.80	7.65	7.79	7.90	7.93	7.81	4.86	4.55	4.95	4.93	4.78	4.70	4.79
Groundnut + (2:1) hybrid cotton	7.77	7.82	7.59	7.58	7.82	7.66	7.71	4.39	4.52	4.73	4.73	4.58	4.88	4.64
Maize-chickpea	7.66	7.83	7.58	7.70	7.59	7.77	7.69	4.73	4.79	4.84	4.63	4.97	4.84	4.80
Mean	7.82	7.85	7.67	7.72	7.76	7.76		4.73	4.74	4.85	4.87	4.64	4.72	

Cropping systems / Management practice	Bacteria (x10^6 cfu/g)							Fungi (x10^6 cfu/g)						
	Organic		Inorganic		Integrated (towards organic)		Mean	Organic		Inorganic		Integrated (towards organic)		Mean
	100% organic	75% organic + innovative organic practices	100% inorganic	State recomm-endation	50% organic + 50% inorganic	75% organic + 25% inorganic		100% organic	75% organic + innovative organic practices	100% inorganic	State recomm-endation	50% organic + 50% inorganic	75% organic + 25% inorganic	
Jabalpur														
Basmati rice – wheat (durum) – green manure	56.58	56.36	39.41	38.82	45.18	45.44	47.0	48.9	48.6	32.9	30.7	42.8	43.5	41.2
Basmati rice – chickpea – maize fodder	52.98	51.82	36.20	37.32	40.24	40.52	43.2	46.8	46.4	30.9	29.7	35.9	36.7	37.7
Basmati rice – berseem (fodder and seed)	52.84	52.49	36.38	36.12	43.12	43.47	44.1	48.1	47.6	30.7	30.6	40.3	40.6	39.6
Basmati rice – vegetable pea– sorghum (fodder)	55.35	54.32	39.70	39.42	44.21	44.82	46.3	47.6	47.6	31.9	31.7	38.0	38.1	39.1
Mean	54.44	53.75	37.92	37.92	43.19	43.56		47.8	47.5	31.6	30.7	39.2	39.7	
Ludhiana														
Basmati rice-chickpea-GM	28.0	28.0	13.0	12.0	24.0	26.0	21.8	19.0	16.0	11.0	10.0	11.5	12.0	13.3
Basmati rice-wheat-GM	31.0	28.0	14.0	13.0	22.0	23.0	21.8	23.0	18.0	8.0	7.0	9.0	11.0	12.7
Cluster bean-wheat -summer moong	25.0	23.0	18.0	16.0	22.0	22.0	21.0	13.0	12.0	8.5	8.0	9.0	10.0	10.1
Soybean -wheat	29.0	27.0	17.0	15.0	25.0	25.0	23.0	18.0	17.0	9.0	9.0	10.0	18.0	13.5
Mean	28.3	26.5	15.5	14.0	23.3	24.0		18.3	15.8	9.1	8.5	9.9	12.8	

New centres started from 2015-16

Cropping systems / Management practice	Bacteria (x10^6 cfu/g)							Fungi (x10^6 cfu/g)						
	Organic		Inorganic		Integrated (towards organic)		Mean	Organic		Inorganic		Integrated (towards organic)		Mean
	100% organic	75% organic + innovative organic practices	100% inorganic	State recomm-endation	50% organic + 50% inorganic	75% organic + 25% inorganic		100% organic	75% organic + innovative organic practices	100% inorganic	State recomm-endation	50% organic + 50% inorganic	75% organic + 25% inorganic	
Narendrapur														
Basmati rice– broccoli – *sesbania* green manure	13.33	16.66	12.66	13.00	14.66	14.00	14.05	10.00	11.00	4.66	5.00	6.66	5.66	7.16
Paddy– mustard – green gram	14.33	16.66	14.33	14.00	14.66	14.00	14.66	9.66	10.66	5.33	6.66	7.33	6.33	7.66
Paddy– capsicum – green gram	15.00	16.33	12.33	12.00	14.33	14.33	14.05	10.33	9.33	6.33	6.33	7.00	5.66	7.50
Paddy –french bean – sesame	15.00	15.00	12.66	12.66	15.00	14.00	14.05	10.66	9.66	4.33	6.66	7.33	5.66	7.38
Mean	14.42	16.16	13.00	12.92	14.66	14.08		10.16	10.16	5.16	6.16	7.08	5.83	
Thiruvananthapuram														
Cassava-veg. 13.00 cowpea	13.83	5.17	4.67	11.67	10.84	9.86	9.50	9.83	12.34	8.50	13.00	9.17	10.39	
Cassava-groundnut Taro-black gram Taro-greengram	29.8	10.3	29.7	6.7	126.2	33.3	39.3	11.8	9.5	12.2	10.2	9.3	11.3	10.7

Table 16. Rhizosphre microbial (Actinomycetes and phosphate solubilizing micro-organisms) population in soil as influenced by the different nutrient practices and cropping systems

Cropping systems / Management practice	Soil Actinomycetes (x10⁴ cfu/g)							Phosphate solubilizing bacteria (x10⁴ cfu/g)						
	Organic		Inorganic		Integrated (towards organic)		Mean	Organic		Inorganic		Integrated (towards organic)		Mean
	100% organic	75% organic + innovative organic practices	100% inorganic	State recomm-endation	50% organic + 50% inorganic	75% organic + 25% inorganic		100% organic	75% organic + innovative organic practices	100% inorganic	State recomm-endation	50% organic + 50% inorganic	75% organic + 25% inorganic	
Bajaura														
Tomato-Cauliflower - French bean	13.2	10.7	8.1	10.6	10.8	12.3	11.0	14.9	12.3	9.2	12.0	12.4	13.2	12.3
Fallow-Cauliflower -Tomato	13.5	11.5	8.0	10.0	11.2	12.1	11.1	14.2	11.6	9.6	12.6	12.7	13.0	12.3
Black gram-Cauliflower-Summer squash	14.5	12.7	8.0	11.6	11.4	13.0	11.9	16.4	12.0	9.9	12.0	12.8	13.4	12.8
Lady finger-Pea	12.2	9.7	8.2	11.4	12.0	12.8	11.1	16.0	12.5	10.3	11.9	12.2	13.3	12.7
Mean	13.4	11.2	8.1	10.9	11.4	12.6		15.4	12.1	9.8	12.1	12.5	13.2	
Coimbatore														
Cotton - maize	10.0	9.0	8.0	9.0	10.0	12.0	9.7							
Chillies - sunflower	9.0	8.0	7.0	8.0	8.0	9.0	8.2							
Beetroot - maize	4.0	2.0	4.0	4.0	5.0	3.0	3.7							
Mean	7.7	6.3	6.3	7.0	7.7	8.0								
Dharwad														
Cowpea-safflower	4.73	4.70	3.95	3.97	4.47	4.46	4.38	6.47	6.25	6.28	6.57	6.27	6.59	6.41
Pigeon pea (sole)	4.59	4.37	4.26	4.60	4.59	4.46	4.48	6.29	5.84	5.73	6.47	6.53	6.44	6.22
green gram - sorghum	4.69	4.72	4.16	4.70	4.64	4.31	4.54	6.39	6.16	5.78	6.16	6.26	6.60	6.23
Groundnut + hybrid cotton (2:1)	4.51	4.46	3.93	4.44	4.56	4.10	4.33	6.53	6.36	6.44	6.26	5.91	6.30	6.30
Maize-Chickpea	4.50	4.46	3.81	4.55	4.01	4.52	4.31	6.14	6.59	6.07	6.15	6.12	6.22	6.22
Mean	4.60	4.54	4.02	4.45	4.45	4.37		6.36	6.24	6.06	6.32	6.22	6.43	
Jabalpur														
Basmati rice – wheat (durum) – green manure	17.52	17.18	6.44	6.19	12.27	13.02	12.10	17.11	16.69	13.62	12.69	15.70	14.32	15.02
Basmati rice – chickpea – maize fodder	14.30	14.02	5.83	5.30	10.72	11.18	10.23	16.86	16.18	11.34	11.19	12.08	12.75	13.40
Basmati rice – berseem (fodder and seed)	14.53	14.06	5.82	5.06	10.77	11.56	10.30	16.61	14.29	9.57	9.31	11.90	12.44	12.35
Basmati rice – vegetable pea– sorghum (fodder)	12.38	12.17	5.87	5.56	11.57	11.97	9.92	16.01	15.19	10.47	9.69	13.90	16.42	13.61
Mean	14.68	14.36	5.99	5.53	11.33	11.93		16.65	15.59	11.25	10.72	13.40	13.98	

Cropping systems / Management practice	Soil Actinomycetes (x10⁴ cfu/g)							Phosphate solubilizing bacteria (x10⁴ cfu/g)						
	Organic		Inorganic		Integrated (towards organic)		Mean	Organic		Inorganic		Integrated (towards organic)		Mean
	100% organic	75% organic + innovative organic practices	100% inorganic	State recomm-endation	50% organic + 50% inorganic	75% organic + 25% inorganic		100% organic	75% organic + innovative organic practices	100% inorganic	State recomm-endation	50% organic + 50% inorganic	75% organic + 25% inorganic	
Ludhiana														
Basmati rice-chickpea-GM	23.0	21.0	35.0	31.0	12.0	11.0	22.2	18.0	15.0	10.0	8.0	12.0	12.5	12.6
Basmati rice-wheat-GM	29.3	25.0	39.0	40.0	18.0	20.0	28.6	10.5	10.2	6.0	4.0	9.0	9.5	8.2
Cluster bean-wheat-summer moong	13.0	15.9	32.0	39.0	11.0	10.0	20.2	15.0	13.2	9.0	8.5	11.0	10.0	11.1
Soybean -wheat	18.0	17.0	29.0	36.0	16.0	13.0	21.5	11.9	10.0	7.0	6.0	9.8	9.0	9.0
Mean	20.8	19.7	33.8	36.5	14.3	13.5		13.9	12.1	8.0	6.6	10.5	10.3	

New centres from 2015-16

Cropping systems / Management practice	Soil Actinomycetes (x10⁴ cfu/g)							Phosphate solubilizing bacteria (x10⁴ cfu/g)						
	Organic		Inorganic		Integrated (towards organic)		Mean	Organic		Inorganic		Integrated (towards organic)		Mean
	100% organic	75% organic + innovative organic practices	100% inorganic	State recomm-endation	50% organic + 50% inorganic	75% organic + 25% inorganic		100% organic	75% organic + innovative organic practices	100% inorganic	State recomm-endation	50% organic + 50% inorganic	75% organic + 25% inorganic	
Narendrapur														
Basmati rice–broccoli –*sesbania* green manure	19.33	25.33	15.66	16.00	17.00	17.66	18.50							
Paddy– mustard – green gram	21.00	23.33	15.00	14.66	18.00	16.66	18.11							
Paddy– capsicum – green gram	20.66	27.33	16.33	14.33	16.33	17.00	18.66							
Paddy –french bean – sesame	23.66	24.33	16.33	15.33	17.33	16.33	18.89							
Mean	21.16	25.08	15.83	15.08	17.17	16.91								
Thiruvananthapuram														
Cassava-veg. cowpea	1.34	2.00	1.50	1.33	1.33	1.50	1.50							
Cassava-groundnut														
Taro-black gram	3.34	2.84	2.00	2.00	2.67	2.34	2.53							
Taro-greengram														

Jabalpur: It was observed that application of organic nutrient through manure either fully (100% organic) or reduced dose (75% organic) exhibited improvement in microbial population in the soil viz. fungi, bacteria, actinomycetes and phosphate solubilizing bacteria (PSB) and the effect of 100% organic nutrient management was more pronounced in this respect. Population of bacteria (54.4, 53.7 x106cfu/g), fungi (47.8, 47.5 x106cfu/g), actinomycetes (14.7, 14.4 x104cfu/g) and PSB (16.6, 15.6 x106cfu/g) with organic management was increased from inorganic management for bacteria (37.9, 37.9 x106cfu/g), fungi (31.6, 30.7 x106cfu/g), actinomycetes (6.0, 5.5 x104cfu/g) and PSB (11.2, 10.7 x106cfu/g) respectively. Among the cropping systems, basmati-rice-duram wheat-green manure system registered highest population of microbial population.

Ludhiana: The microbial studies done after harvest of *rabi* crops and population of bacteria was recorded in the ranged from 15 cfux10^3 as lowest in state recommendation to 31 cfux10^3 as highest in organic management. Population of fungi and PSB was also significantly higher under organic condition of all the management system with ranged from (fungi 7.0 to 23 cfux10^3) and (PSB 4-18 cfux10^3) however, actinomycetes population recorded higher with 100% inorganic condition. Bacteria, fungi and P-solubilize bacteria population were increased with organic management by 82.6, 101.9 and 73.7% over inorganic while in compare to integrated it was increased to the tune of 21.4, 84.8 and 32.3% respectively. Reduction in actinomycetes was found to be 38.5% with organic over inorganic. Among the cropping systems, population of bacteria and fungi were found to be higher inn soybean-wheat system, whereas, actinomycetes was recorded maximum in basmati rice-wheat-GM (28.6 cfux10^4) while P-solubilize bacteria population was higher in basmati rice-chickpea-GM system.

Narendrapur: It was observed that application of organic nutrient through manure either fully (100% organic) or reduced dose (75% organic) exhibited improvement in microbial population in the soil viz. fungi, bacteria and actinomycetes. Population of bacteria (14.42, 16.16 x106cfu/g), fungi (10.16, 10.16 x106cfu/g) and actinomycetes (21.16, 25.084 x104cfu/g) with organic management was increased compared to inorganic management (bacteria 13.0, 12.92 x106cfu/g), (fungi 5.16, 6.16 x106cfu/g) and (actinomycetes 15.83, 15.08 x104cfu/g) respectively. Among the cropping systems, paddy-mustard-greengram system registered highest bacteria and fungi population.

Effect of different management systems on quality aspects of organic produce (Table 17)

Bajaura: Quality parameters protein, TSS (^{0}brix) and vitamin C in different vegetable crops namely frenchbean, black gram, tomato, pea and cauliflower were tested under different management practice. Organic management with 100% nutrient through manure showed higher value of protein, TSS (^{0}brix) and vitamin C andit was found on par with integrated management. Protein in frenchbean, black gram and pea was increased by 8.6, 7.9 and 3.4% respectively under organic management. TSS in tomato was also increased by 24.4% with organic package while in pea it was higher (28.6%) with integrated (50% each nutrient source through organic and inorganic) but was on par with state recommendation practice. Vitamin C in cauliflower recorded higher by108% compare to inorganic.

Bhopal: Nutritional quality constituents such as protein, oil and methionine were determined in soybean seeds. Although, protein, oil and methionine content in soybean seed did not influence significantly due to different nutrient management practices, however, the higher values of protein, oil and methionine content were recorded in 100% organic management as compared to other nutrient management practices.

Table 17. Influence of organic, inorganic and integrated package on quality of crops at different locations

Locations	Crops/variety	Quality parameter	Organic		Inorganic		Integrated	
			100% organic	75% organic + innovative organic practices	100% inorganic	State recomm-endation	50% organic + 50% inorganic	75% organic+ 25% inorganic
Bajaura	French bean		**15.2**	**14.8**	14.0	14.2	14.4	14.6
	Black gram	Protein %	**15.0**	14.4	13.9	14.4	14.8	14.2
	Pea		**21.5**	21.3	20.8	21.2	**21.5**	21.4
	Tomato (*Kharif*)		**5.4**	4.6	4.2	4.4	5.0	4.8
	Tomato (*Summer*)	TSS (^{0} Brix)	**5.6**	5.2	4.5	5.0	4.8	4 .6
	Pea		17.0	16.0	14.0	**18.0**	**18.0**	16.0
	Tomato	Vitamin C (mg/100g)	35.5	34.8	31.0	32.2	**35.8**	36.0
	Cauliflower		**48.0**	46.7	43.3	44.4	45.7	45.0
Bhopal		Protein %	37.83	37.49	36.61	36.59	36.97	37.54
	Soybean	Oil (%)	19.36	19.01	18.83	18.73	18.96	19.18
		Methionine (g/16gN)	1.79	1.77	1.67	1.68	1.73	1.74
Calicut	Prathibha	Oil content (%)	2.22	2.22	1.9		2.1	1.9
	Alleppey supreme		2.00	2.10	2.1		1.9	1.9
	Varna		1.89	1.89	2.0		2.0	1.8
	Sobha		2.00	1.66	1.9		2.3	1.9
	Sona		2.00	2.00	1.9		2.1	2.2
	Kanthi		1.87	2.40	2.0		2.2	1.8
	Suvarna		1.77	2.00	1.9		2.0	2.0
	Suguna		3.11	2.44	2.0		2.2	2.1
	Sudarsana		2.77	2.66	1.8		2.0	2.1
	Kedaram		3.00	2.32	1.9		2.3	2.1
	Prabha		2.77	2.10	1.8		2.1	2.3
	CD(0.05) T		0.07					
	CD(0.05) V		0.10					
	Prathibha	**Oleoresin (%)**	10.0	10.2	10.2		10.1	10.0
	Alleppey supreme		10.9	9.8	10.2		10.4	9.1
	Varna		7.6	7.8	6.9		7.7	6.8
	Sobha		6.6	7.4	7.0		7.1	7.2
	Sona		8.0	9.0	7.5		7.5	7.6
	Kanthi		6.7	6.6	5.9		6.4	6.6
	Suvarna		6.8	11.0	6.5		8.0	6.8
	Suguna		10.6	9.3	8.5		12.2	9.9
	Sudarsana		8.9	10.7	8.5		12.5	10.6
	Kedaram		11.1	9.1	10.3		10.6	9.8
	Prabha		9.5	9.6	10.6		10.1	9.3
	Prathibha	**Curcumin (%)**	4.70	4.53	4.5		4.9	4.8
	Alleppey supreme		4.30	4.17	4.0		4.0	4.0
	Varna		2.20	2.30	1.6		1.9	2.1
	Sobha		2.40	2.23	2.0		2.3	2.3
	Sona		2.90	2.47	1.9		1.9	2.2
	Kanthi		2.70	2.60	1.8		2.1	1.8
	Suvarna		2.03	3.87	1.5		1.9	1.9
	Suguna		4.00	3.73	3.3		3.8	3.5
	Sudarsana		3.43	3.47	3.5		3.8	3.7
	Kedaram		4.30	3.80	3.9		4.1	3.9
	Prabha		4.13	3.97	3.6		3.5	3.6
Coimbatore	Cotton	Ginning (%)	35.5	34.5	33.4	35.8	34.6	35.8
		Fibre length (mm)	32.1	31.8	32.5	32.8	32.5	32.5
Ranchi	Rice	Protein (%)	7.01	7.05	6.72	6.55	6.97	6.86
		Moisture (%)	14.04	13.98	13.90	13.88	13.91	13.98
	Wheat	Protein (%)	9.88	9.76	10.15	9.96	9.99	9.92
		Moisture (%)	10.18	10.24	10.37	10.33	10.31	10.27

Locations	Crops/variety	Quality parameter	Organic		Inorganic		Integrated	
			100% organic	75% organic + innovative organic practices	100% inorganic	State recomm-endation	50% organic + 50% inorganic	75% organic+ 25% inorganic
Umiam	Tomato	Specific gravity(g/ml)	1.24	1.17	1.12		1.19	
		Average fruit diameter (mm)	52.05	47.79	42.56		51.35	
		TSS (%)	4.77	4.59	4.13		4.42	
		Acidity (%)	0.63	0.68	0.75		0.71	
		Ascorbic acid	29.23	25.28	24.25		27.03	
		Total sugar (%)	4.77	4.84	5.03		4.98	
		Lycopene	18.18	16.22	15.39		17.21	
	Carrot	Root diameter (mm)	28.9	26.4	26.6		31.2	
		TSS (%)	8.6	8.3	6.8		7.9	
		Ascorbic acid (mg/100g)	41.3	38.9	33.2		40.6	
		Acidity (%)	0.3	0.2	0.3		0.3	
		Beta carotene (mg/100g)	9.1	8.9	6.3		8.8	
		Total carotenoids (mg/g)	74.0	65.2	61.6		68.3	
		Total sugar (%)	5.2	5.2	5.8		5.7	

New centre

Locations	Crops	Quality parameter	Organic		Inorganic		Integrated		Mean
			100% organic	75% organic + innovative organic practices	100% inorganic	State recomm-endation	50% organic + 50% inorganic	75% organic+ 25% inorganic	
Ajmer	Coriander	N (%)	2.46	2.20	2.52	2.57	2.35	2.59	2.45
		P (%)	0.48	0.61	0.60	0.61	0.60	0.62	0.59
		K (%)	1.91	1.92	1.89	2.00	1.87	2.05	1.94
		Protein (%)	15.35	13.77	15.74	16.05	14.66	16.20	15.30
		Fe (ppm)	122.25	129.73	140.54	165.58	151.35	162.16	145.27
		Cu (ppm)	17.27	20.12	20.12	22.64	17.86	22.89	20.15
		Essential oil (%)	0.22	0.23	0.24	0.24	0.24	0.24	0.24
	Fennel	N (%)	2.75	2.8	2.63	2.84	2.7	2.89	2.77
		P (%)	0.62	0.62	0.57	0.63	0.57	0.64	0.61
		K (%)	2.13	2.01	2.16	2.25	2.03	2.29	2.15
		Protein (%)	17.18	17.51	16.47	17.72	16.89	18.09	17.31
		Fe (ppm)	148.62	151.35	151.35	153.51	149.19	155.67	151.62
		Cu (ppm)	21.12	23.9	25.15	27.67	25.4	30.18	25.57
		Essential oil (%)	1.13	1.28	1.31	1.32	1.31	1.32	1.28
	Cassava	Cyanogenic glucoside (µg g^{-1}) FW	57.32	36.96	36.45	23.77	64.81	25.88	40.87
		Dry matter (%)	25.85	30.75	29.65	27.80	29.25	31.70	29.17
		Starch (%) FW	19.45	21.55	20.40	19.15	19.70	21.45	20.28
		Crude protein (%) FW	1.24	1.45	1.10	1.18	1.29	1.35	1.27
		Total sugars (%) FW	1.19	1.50	1.18	1.02	1.38	1.34	1.27
	Taro	Dry matter (%)	26.35	29.15	30.10	23.40	29.35	29.55	27.98
		Starch (%) FW	13.35	16.85	19.45	12.05	15.10	18.00	15.80
		Crude protein (%) FW	3.59	3.68	3.91	2.66	2.34	2.38	3.09
		Total sugars (%) FW	2.40	2.33	3.24	1.56	1.73	2.37	2.27

Calicut: Influence of different management system among treatment and between the varieties on quality of turmeric varieties was observed. Oil, oleoresin and curcumin (%) for turmeric varieties were estimated. Among turmeric varieties, oil and curcumin content was significantly higher in organic management (2.31 and 3.38%) however, oleoresin content was significantly higher in integrated management practice. Among the varieties maximum oil content was noticed in suguna (3.11 %.) followed by sudarshana (2.66%). Oleoresin content was significantly higher under integrated management. In integrated management maximum oleoresin content was recorded by the variety sudarshana and suguna (12.5%). Kedaram recorded maximum oleoresin content (11.1%) under organic management practice. Maximum curcumin content was recorded under organic management (3.38%) followed integrated management (3.11%) and yellow colouring component i.e. curcumin was found to be more to the tune of 17.8 with organic package. Among different varieties, Prathibha recorded maximum curcumin content (4.7 %) followed by Aleppey supreme (4.3%).

Coimbatore: Quality of ginning and fibre length did not influenced by the different production management however, ginning and fibre length in cotton recorded higher under integrated management with 75% organic+25% inorganic supply through organic sources (35.8% and 32.5 mm respectively).

Ranchi: Quality of protein in rice was increased with organic production management from 6.72 and 6.55 under inorganic and state recommendation to 7.01 and 7.05 respectively. In case of wheat, it was decreased to the tune of 1.7% .

Umiam: Specific gravity (1.24 g/ml), average fruit diameter (52.05 mm), TSS (4.77%), acidity (0.63%), ascorbic acid (29.23 mg/100g), reducing sugar (2.68%), lycopene (18.18 mg/100g) and total sugar (4.77%) of tomato were recorded maximum in 100% organic management followed by integrated. Quality of carrot such as root diameter (mm), specific gravity (g/ml), TSS (%), ascorbic acid (mg/100g), acidity, beta carotene, total carotenoids, total sugar and reducing sugar were estimated. The maximum root diameter (mm) was recorded under integrated (31.23 mm) treatment, whereas, TSS (%), ascorbic acid (mg/100g), beta carotene (mg/100g), total carotenoids, and reducing sugar were recorded under 100% organic treatment (8.57 %, 41.32 mg/100g, 9.11 mg/100g, 74.03 mg/g and 4.58% respectively) followed by integrated management practices.

Ajmer: Quality parameters such as protein% and essential oil (%) in coriander and fennel crops were influenced by various nutrient management practices and among them, both are observed significant and found to be higher in integrated with 75% organic + 25% Inorganic followed by inorganic with state recommendation that was on par with organic management package.

Influence of organic, inorganic and integrated management packages on chlorophyll content of different crops (Table 18)

The effect of different nutrient management practices on total chlorophyll content in crops was estimated at Bhopal during *rabi*. There were no significant differences in total chlorophyll in all crops. Highest total chlorophyll content in wheat, mustard, chickpea and linseed was observed in 100% organic followed by 75% organic +25% innovative practice and lowest in state recommendation. The nitrate reductase activity measured at 45 DAS in different crops as influenced by the application of different management practices showed significant difference. The 100 % organic treatment recorded the highest activity of the enzyme in

Table 18: Physiological parameters (total chlorophyll and Nitrate reductase activity at 45 DAS) in diffèrent crops at Bhopal

Crops	Total chlorophyll content (mg/g FW)							Nitrate reductase activity (µM NO, / g fresh weight / hours)						
	Organic		Inorganic		Integrated (towards organic)		Mean	Organic		Inorganic		Inegrated (towards organic)		Mean
	100% organic	75% organic+ innovative organic practices	100% Inorganic	State recommendation	50% organic + 50% inorganic	75% organic + 25% inorganic		100% organic innovative	75% organic	100% organic +	State recommendation	50% organic + 50% inorganic	75% organic + 25% inorganic	
Wheat	2.45	2.39	2.15	2.10	2.26	2.31	2.28	117.3	109.0	95.9	91.4	98.3	110.9	103.8
Mustard	2.12	2.00	1.90	1.87	1.96	2.05	1.98	139.9	122.3	106.4	101.6	107.5	117.6	115.9
Chickpea	3.06	2.94	2.71	2.58	2.76	2.84	2.82	111.2	103.7	75.4	72.8	99.1	105.1	94.6
Linseed	3.17	3.12	2.72	2.74	3.01	3.01	2.96	81.2	71.5	65.5	65.9	67.0	72.4	70.6

Table 18.1: Effect of different management systems on soil enzymes of ginger at Calicut

	Treatments	Ginger				Turmeric			
		Acid phosphatase (nmol TPF/g/hr)	Alkaline phosphatase	Phosophodiesterase	Dehydrogenase (nmol TPF/g/hr)	Acid phosphatase (nmol TPF/g/hr)	Alkaline phosphatase	Phosphodiesterase	Dehydrogenase (nmol TPF/g/hr)
Organic	100% Organic	31.1	11.4	36.0	4398	28.7	11.7	33.6	4557
	75% organic + innovative organic practices	20.5	10.1	29.1	4156	22.2	8.9	28.0	4644
Inorganic	100% inorganic	18.3	8.7	25.8	3891	15.3	8.4	20.9	3822
Intergrated	50% organic + 50% inorganic	16.8	8.6	25.2	3832	19.0	8.4	2.2	3059
	75% organic + 25% Inorganic	17.5	7.4	23.3	3585	14.0	4.7	16.4	1923
	CD (P=0.05)	3.42	1.06	2.73	346.82				

all the crops of wheat, mustard, chickpea and linseed. Among the different crops, mustard recorded the highest NRA followed by wheat, chickpea and linseed.

Influence of organic, inorganic and integrated management packages on economics of different crops and cropping systems Table (19-20)

Bajaura: Maximum gross return of Rs. 5,71,250/ha was recorded in black gram-cauliflower-summer squash cropping system under organic management practice with 75% nutrient through manure + innovative organic practice followed by integrated (50% each organic and inorganic) of Rs.5,51,700/ha. It was 70.6 and 3.5% higher than inorganic and integrated management respectively. Among the cropping systems, it was found to be increased by 31.8, and 42.8 % higher than tomato-cauliflower and lady finger-pea respectively. In different management packages, lower cost of cultivation (Rs.2,13,390/ha) was recorded with 100% inorganic nutrient management while, higher cost of cultivation was recorded under state recommendation of Rs.3,10,260/ha. Among the cropping systems, tomato-frenchbean-cauliflower recorded higher cost of cultivation (Rs.3,10,043/ha) and lady finger-pea recorded lower cost of cultivation (Rs.1,90,353/ha). Black gram-black gram- cauliflower-summer squash recorded maximum net return (Rs.2,92,165/ha) under organic practice with 75% organic manure+ innovative organic practice followed by integrated (Rs.2,71,822/ha) and it was found to be higher more than two times than inorganic and 147% higher than state recommendation. However, the net returns per rupee invested (1.23) was higher in lady finger-pea system due to practice of organic management following of 75% organic + innovative organic practice.

Bhopal: Among the different nutrient management systems, 100% organic management with organic nutrient input supply through manure recorded higher gross returns (Rs. 66860/ha), net returns (Rs.48801) and benefit cost ratio in term of return per rupee investment (2.40) as compared to inorganic managementand it was 20.3 and 12.3% (gross return), 65.2 and 69.5 (net return) and23.7 and 12.7% (B:C ratio) higher than the inorganic and integrated management respectively. Among the cropping systems, soybean-linseed recorded higher gross return, net return and B:C ratio (Rs.65713, Rs.41051/ha and 2.33 respectively) as compared to other systems with cost of cultivation of Rs.30917/ha similar to (Rs.30614 /ha) in soybean-mustard.

Calicut: Under turmeric-fallow system,higher gross return (Rs.5,27,400/ha), net return (Rs.3,95,765/ha) and BC ratio(3.01) were found to be higher with towards organic approach having consisting either 50% each nutrient through organic and inorganic or 75% organic nutrient through manure+25% inorganic under integrated management. The reduction in 100% organic was found to be 11.3&8.2 and 18.5% higher than 100% inorganic practices. Higher cost of cultivation was observed under organic (100%), organic (75%), inorganic and integrated of Rs. 158996, 148346, 120401, 149045,131635, respectively.

Coimbatore: Higher gross return (Rs.1,94,925/ha) was recorded towards organic under integrated management with 75% organic+25% inorganic and It is 15.1 & 16.3% higher than organic and inorganic management. Among the cropping systems, beetroot-maize recorded higher gross return (Rs.3,31,022/ha) and it is higher 107.7 and 53.3% than cotton-maize r. Lower cost of cultivation (Rs.42,230 /ha) was recorded under inorganic management with state recommendation and higher cost of cultivation (Rs.60,040 /ha) with organic management. Among the cropping systems, chilli-sunflower was found more profitable with lower cost of cultivation (Rs.16,403/ha) whereas beetroot-maize was found higher cost (Rs.91,579/

Table 19. Influence of methods of organic, inorganic and integrated package on economics of different crops and cropping system

Management practice	Grossreturns (Rs./ha)							Cost of cultivation (Rs/ha)						
	Organic		Inorganic		Integrated (towards organic)		Mean	Organic		Inorganic		Integrated (towards organic)		Mean
	100% organic	75% organic + innovative organic practices	100% inorganic	State recomm-endation	50% organic + 50% inorganic	75% organic + 25% inorganic		100% organic	75% organic + innovative organic practices	100% inorganic	State recomm-endation	50% organic + 50% inorganic	75% organic + 25% inorganic	
Bajaura														
Tomato-Cauliflower-French bean	493666	542687	281100	418133	478860	476810	448542	308310	298310	266806	396906	289411	300514	310043
Fallow-Cauliflower -Tomato	411722	433444	254444	347000	377778	332222	359435	208790	200040	172465	262656	191294	199529	205871
Black gram-Cauliflower- Summer squash	545875	**571250**	334900	463100	551700	537300	500687	285935	279085	245663	245263	279878	288712	287423
Lady finger-Pea	386625	399937	246400	302475	389430	365333	348366	183277	179265	168627	236307	184882	189757	190353
Mean	459472	486829	279211	382677	449442	427916		246577	239175	213390	310260	236366	244628	
Bhopal														
Soybean- wheat							63446							33130
Soybean- Mustard							52556							30614
Soybean- Chickpea							58993							29666
Soybean- Linseed							65713							30917
Mean	66860	63268	55593	57780	59535	63851		34774	36744	26071	27015	30744	31143	
Calicut														
Turmeric-Fallow	743996	710846	659035		577601	640445	555321	158996	148346	131635		120401	149045	141685
Coimbatore														
Cotton - maize	157131	154782	148122	152990	168955	174090	159345	100452	89372	57963	74086	77306	88758	81323
Chillies - sunflower	37100	41000	37800	41450	39250	44575	40196	19628	15021	13295	14374	16401	19698	16403
Beetroot - maize	313605	323844	317015	343640	321920	366110	331022	107985	102524	91579	115249	107923	108593	91579
Mean	169279	173209	167646	179360	176708	194925		60040	52197	54279	44230	46854	54228	
Dharwad														
Cowpea-safflower	51537	53352	41527	43983	44174	47774	47058	81915	74195	37436	47086	64858	72699	63032
Pigeon pea (sole)	129456	112931	126330	121272	110575	111360	118654	44938	41218	20462	26287	36387	41942	35206
Sorghum-green gram	141814	140574	125097	129233	117564	109986	127378	75491	67651	32015	41665	58315	68876	57336
Groundnut +hybrid cotton (2:1)	129115	120455	109516	124969	105768	111776	116933	85785	76505	34937	48262	59811	70505	62634
Maize-Chickpea	171877	146339	112908	141818	111888	106025	131809	98847	87272	33949	46099	70373	78290	69138
Mean	124760	114730	103076	112255	97994	97384		77395	69368	31760	41880	57949	66462	
Jabalpur														
Basmati rice – wheat (durum) – green manure	214926	196799	189669	167542	180005	172154	186849	101800	90600	128825	109159	81322	90061	100295

Management practice	Grossreturns (Rs./ha)							Cost of cultivation (Rs/ha)						
	Organic		Inorganic		Integrated (towards organic)		Mean	Organic		Inorganic		Integrated (towards organic)		Mean
	100% organic	75% organic + innovative organic practices	100% inorganic	State recomm-endation	50% organic + 50% inorganic	75% organic + 25% inorganic		100% organic	75% organic + innovative organic practices	100% inorganic	State recomm-endation	50% organic + 50% inorganic	75% organic + 25% inorganic	
Basmati rice – chickpea – maize fodder	183874	149356	184535	158966	169863	150170	166127	92120	87920	118387	96855	82354	88957	94432
Basmati rice – berseem (fodder and seed)	262891	230634	262517	225818	226890	201120	234978	83760	77320	204724	169723	71277	79415	114370
Basmati rice – vegetable pea– sorghum (fodder)	259721	233367	270017	246516	242716	233837	247696	98560	87920	203869	188442	81354	87957	124684
Mean	230353	202539	226685	199711	204869	189320		94060	85940	163951	141045	79077	86598	
Karjat														
Rice–groundnut	380173	348214	289463	254017	290931	293537	309389	158272	149825	129793	126647	144470	151812	143470
Rice – sweet corn	372057	363758	318368	261302	313826	298237	321258	205970	188436	145371	142445	176111	191478	174969
Rice – mustard	159906	144226	123757	114674	119937	122161	130777	133552	118290	81051	78923	107927	121368	106852
Rice – *dolichos* bean	298308	287218	233873	231230	235033	233824	253248	224274	212433	185648	182302	205401	215280	204223
Mean	302611	285854	241365	215306	239932	236940		180517	167246	135466	132579	158477	169985	
Ludhiana														
Basmati rice-chickpea-GM	213219	205127	164786	164397	164604	165868	179667	82835	82300	77569	77554	77627	75906	78965
Basmati rice-wheat-GM	197342	185215	199726	202218	195725	183131	193893	71915	7035	69553	69488	66653	64435	58180
Cluster bean-wheat-summer moong	158160	158417	140230	137609	146736	150926	148680	59598	58038	59083	59137	53549	51742	56858
Soybean -wheat	180166	176643	143129	142133	154811	153866	158458	57215	55130	54946	54996	50271	48963	53587
Mean	187222	181351	161968	161589	165469	163448		67891	50626	65288	65294	62025	60262	
Modipuram														
Basmati rice– wheat - *sesbania* green manure	204098	202725	124207	134082	172641	166051	167301	93600	80950	57569	77869	74722	82112	77804
Rice– barley (*malt*) – green gram	181272	187031	117583	136965	153658	149162	154279	107340	95250	74338	104638	89692	95116	94396
Maize(popcorn)-potato–okra + *sesbania* green manure	543909	525327	375128	397638	431297	416895	448366	187995	171320	146410	176309	167336	175531	170817
Maize(sweet corn)-mustard- *sesbania* green manure	177652	186596	138595	178214	172971	182188	172703	89195	78420	57550	77150	73711	78693	75786
Mean	276733	275420	188878	211725	232642	228574		119533	106485	83967	108992	101365	107863	

Management practice	Grossreturns (Rs./ha)							Cost of cultivation (Rs/ha)						
	Organic		Inorganic		Integrated (towards organic)		Mean	Organic		Inorganic		Integrated (towards organic)		Mean
	100% organic	75% organic + innovative organic practices	100% inorganic	State recomm-endation	50% organic + 50% inorganic	75% organic + 25% inorganic		100% organic	75% organic + innovative organic practices	100% inorganic	State recomm-endation	50% organic + 50% inorganic	75% organic + 25% inorganic	
Pantnagar														
Basmati rice-wheat	255421	245170	208709	212387	212264	221237	225865	72355	62770	60532	61632	73227	77337	67976
Basmati rice - chickpea (4rows+ 2rows coriander)	354787	351338	270725	286835	287265	288490	306573	57725	51682	56185	57195	66808	67045	59440
Basmati rice - vegetable pea (4 rows vegetable pea +2 rows coriander)	344817	364467	278835	283800	301810	286365	310016	67045	61452	67575	68725	76568	76805	69695
Basmati rice -potato	255952	247857	185925	200420	215515	212575	219707	80239	76069	73941	75071	91396	96605	82220
Mean	302744	302208	236048	245861	254214	252167		69341	62993	64558	65656	77000	79448	
Raipur														
Soybean-Maize	317452	327287	293639	314316	262978	280639	299385	63984	63241	72281	72265	66765	66137	67446
Soybean-Pea	224645	251005	208270	215364	208910	206665	219143	48522	48250	58735	59720	50955	50282	52744
Soybean-Chilli	275005	299270	243922	250468	205563	206271	246750	55522	53906	63900	64885	57347	58559	59020
Soybean-Onion	313342	329774	301876	352003	297257	289385	313940	54502	52058	62667	63653	55744	56707	57555
Mean	282611	301834	261927	283038	243677	245740		55633	54364	64396	65131	57703	57921	
Ranchi														
Rice–wheat	136139	134906	110101	112564	108191	76391	113049	70309	62396	64878	59460	46646	43094	57797
Rice – lentil	91399	94281	70052	76405	61981	50550	74111	46859	42749	44770	42718	36554	33994	41274
Rice – potato	273007	253198	174994	166512	151232	123008	190325	97959	89103	92630	87329	74683	71104	85468
Rice– linseed	93157	97098	66202	68596	70578	62650	76380	47300	42237	44198	41135	32955	31068	39816
Mean	148426	144871	105337	106019	97996	78150		65607	59121	61619	57661	47710	44815	
Umiam **Vegetable-vegetable systems *on raised bed***														
Broccoli -carrot	466172	400941	328995		390339		396612	192602	191277	151531		165396		175202
Broccoli - potato	431269	363230	301347		360050		363974	232190	219049	187678		207107		211506
Broccoli -french bean	512598	450749	319494		363499		411585	182532	167718	137378		157378		161252
Broccoli -tomato	512306	471789	337409		391155		428165	211788	193715	165205		182409		188279
Mean	480586	421677	321811		376261			204778	192940	160448		178073		

New centres started from 2015-16

Management practice	Grossreturns (Rs./ha)							Cost of cultivation (Rs/ha)						
	Organic		Inorganic		Integrated (towards organic)		Mean	Organic		Inorganic		Integrated (towards organic)		Mean
	100% organic	75% organic + innovative organic practices	100% inorganic	State recomm-endation	50% organic + 50% inorganic	75% organic + 25% inorganic		100% organic	75% organic + innovative organic practices	100% inorganic	State recomm-endation	50% organic + 50% inorganic	75% organic + 25% inorganic	
Ajmer														
Coriander–cluster bean	167,875	173,784	189,566	252,008	200,125	197,150	196,751	74298	64462	41676	51676	57619	65550	59213.5
Coriander - green gram	94,892	86,699	98,497	133,715	115,262	141,835	111,817	60,866	54,644	41,038	51,038	50,604	55,312	52,250
Fennel - cluster bean	186,375	196,225	228,800	204,875	189,867	239,542	207,614	74298	64462	41676	51676	57619	65550	59213.5
Fennel – green gram	82,979	88,532	103,162	116,280	123,970	126,362	106,881	60,866	54,644	41,038	51,038	50,604	55,312	52,250
Mean	133,030	136,310	155,006	176,720	157,306	176,222		67,582	59,553	41,357	51,357	54,112	60,431	
Narendrapur														
Basmati rice–broccoli – *sesbania* green manure	963876	1000300	880740	799990	854198	832310	888569	406207	374450	312352	302696	351394	332700	346633
Paddy– mustard–green gram	249766	249736	159368	162837	178339	171095	195190	180199	167830	119403	112637	141159	129850	141846
Paddy– capsicum–green gram	431865	418910	309140	280792	310201	269679	336765	236378	221950	166763	155306	194795	179595	192465
Paddy –french bean – sesame	886625	836130	596792	515508	700030	624973	693343	438685	448450	339163	329714	394922	370942	386979
Mean	633033	626269	486510	439782	510692	474514		315367	303170	234420	225088	270568	253272	
Sardar Krushinagar														
Groundnut- potato -pearlmillet.	415083	499333	521805	465292	528028	518376	491320	224626	316665	404685	346672	401601	373905	344692
Greengram- cumin - vegetable cowpea	210671	205903	245529	285846	242965	246961	239646	120591	120885	179394	218212	164859	162868	161135
Greengram-fennel- fallow	83902	82104	92666	101111	83889	94223	89649	1610	24249	36917	43862	14868	32009	25586
Mean	236552	262447	286667	284083	284961	286520		115609	153933	206999	202915	193776	189594	
Thiruvananthapuram														
Cassava-veg. cowpea	618310	550530	496155	377888	365400	469545	479638	159213	168088	120011	126851	178298	195330	157965
Cassava-groundnut														
Taro-black gram	558000	532325	337060	215640	621740	623240	481334	292920	296926	205087	211927	272031	301893	263464
Taro-greengram														

Table 20. Influence of methods of organic, inorganic and integrated package on economics of different crops and cropping system

Management practice	Net returns (Rs./ha)							B:C ratio						
	Organic		Inorganic		Integrated (towards organic)		Mean	Organic		Inorganic		Integrated (towards organic)		Mean
	100% organic	75% organic + innovative organic practices	100% inorganic	State recomm-endation	50% organic + 50% inorganic	75% organic + 25% inorganic		100% organic	75% organic + innovative organic practices	100% inorganic	State recomm-endation	50% organic + 50% inorganic	75% organic + 25% inorganic	
Bajaura														
Tomato-Cauliflower-French bean	185356	244377	14294	21227	189449	176296	138500	060	0.82	0.05	0.05	0.65	0.59	0.46
Fallow-Cauliflower -Tomato	202932	233404	81979	84435	186484	132693	153655	0.97	1.17	0.48	0.32	0.97	0.67	0.76
Black gram-Cauliflower- Summer squash	259940	**292165**	89237	117837	271822	248588	**213265**	0.91	1.05	0.36	0.34	0.97	0.86	0.75
Lady finger-Pea	203348	220672	77773	66168	204548	175576	158014	1.11	**1.23**	0.46	0.28	1.11	0.93	**0.85**
Mean	212894	**247655**	65821	72417	213076	183288		0.90	**1.07**	0.34	0.25	0.93	0.76	
Bhopal														
Soybean- wheat							36387							2.10
Soybean- Mustard							29978							1.88
Soybean- Chickpea							35026							2.18
Soybean- Linseed							41051							2.33
Mean	48801	42641	29522	30764	28791	32708		2.40	2.15	2.13	2.14	1.94	2.05	
Calicut														
Turmeric-Fallow	585000	562500	527400		457200	491400	524700	3.68	3.79	4.01		3.79	3.3	3.71
Coimbatore														
Cotton - maize	56679	65410	90159	78904	91649	85331	78022	1.56	1.73	2.56	2.07	2.19	1.96	2.01
Chillies - sunflower	17472	25979	24505	27076	22849	24877	23793	1.89	2.73	2.84	2.88	2.39	2.26	2.50
Beetroot - maize	205620	221320	225436	228391	213997	257517	225380	2.90	3.16	3.46	2.98	2.98	3.37	3.14
Mean	93257	104236	113367	111457	109498	122575		2.12	2.54	2.95	2.64	2.52	2.53	
Dharwad														
Cowpea-safflower	-30378	-20843	4,091	-3,102	-20684	-24925	-15,974	0.63	0.72	1.11	0.93	0.68	0.66	0.79
Pigeon pea (sole)	84,519	71,713	1,05,868	94,985	74,188	69,418	83,449	2.88	2.74	6.17	4.61	3.04	2.66	3.68
Sorghum-green gram	66,323	72,923	93,083	87,568	59,249	41,111	70,043	1.88	2.08	3.91	3.1	2.02	1.6	2.43
Groundnut + hybrid cotton (2:1)	43,331	43,950	74,579	76,708	45,958	41,270	54,299	1.51	1.57	3.13	2.59	1.77	1.59	2.03
Maize-Chickpea	73,030	58,612	78,960	95,720	41,515	27,735	62,595	1.74	1.67	3.33	3.08	1.59	1.35	2.13
Mean	47365	45271	71316	70376	40045	30922		1.73	1.76	3.53	2.86	1.82	1.57	
Jabalpur														
Basmati rice – wheat (durum) – green manure	113126	106199	128825	109159	98683	82093	106348	1.11	1.17	2.12	1.87	1.21	0.91	1.40

Management practice	Net returns (Rs./ha)							B:C ratio						
	Organic		Inorganic		Integrated (towards organic)		Mean	Organic		Inorganic		Integrated (towards organic)		Mean
	100% organic	75% organic + innovative organic practices	100% inorganic	State recomm-endation	50% organic + 50% inorganic	75% organic + 25% inorganic		100% organic	75% organic + innovative organic practices	100% inorganic	State recomm-endation	50% organic + 50% inorganic	75% organic + 25% inorganic	
Basmati rice – chickpea – maize fodder	91754	61436	118387	96855	87509	61213	86192	1.00	0.70	1.79	1.56	1.06	0.69	1.13
Basmati rice – berseem (fodder and seed)	179131	153314	204724	169723	155614	121705	164035	2.14	1.98	3.54	3.03	2.18	1.53	2.40
Basmati rice – vegetable pea– sorghum (fodder)	161161	145447	203869	188442	161362	145880	167694	1.64	1.65	3.08	3.24	1.98	1.66	2.21
Mean	136293	116599	163951	141045	125792	102723		1.47	1.38	2.63	2.43	1.61	1.20	
Karjat														
Rice-groundnut	221901	198389	159670	127370	146461	141725	165919	2.40	2.32	2.23	2.01	2.01	1.93	2.15
Rice – sweet corn	166087	175322	172997	118857	137715	106759	146290	1.81	1.93	2.19	1.83	1.78	1.56	1.85
Rice – mustard	26354	25936	42706	35751	12010	793	23925	1.20	1.22	1.53	1.45	1.11	1.01	1.25
Rice – *dolichos* bean	74034	74785	48225	48928	29632	18544	49025	1.33	1.35	1.26	1.27	1.14	1.09	1.24
Mean	122094	118608	105900	82727	81455	66955		1.69	1.71	1.80	1.64	1.51	1.40	
Ludhiana														
Basmati rice-chickpea-GM	130384	122827	87217	86843	86977	89962	100702	2.57	2.49	2.12	2.12	2.12	2.19	2.27
Basmati rice-wheat-GM	12542	114860	130173	132731	129072	118696	106346	2.47	2.63	2.87	2.91	2.94	2.84	2.78
Cluster bean-wheat -summer moong	98562	100379	81147	78476	93187	99184	91823	2.65	2.73	2.37	2.33	2.74	2.92	2.62
Soybean -wheat	123651	121513	88183	87137	104540	104903	104988	3.16	3.20	2.60	2.58	3.08	3.14	2.96
Mean	91285	114895	96680	96297	103444	103186		2.71	2.76	2.49	2.49	2.72	2.77	
Modipuram														
Basmati rice– wheat (*durum*) – *sesbania* green manure	110498	121775	66638	56213	97919	83941	89497	2.36	3.00	2.44	1.42	2.64	2.02	2.31
Rice– barley (*malt*) – green gram	73932	91781	43245	32327	63967	54047	59883	2.27	3.14	2.00	1.00	2.38	1.96	2.13
Maize (*pop corn*) – potato– okra + *sesbania* green manure	355914	354007	228718	221329	263961	241366	277549	6.11	6.77	5.51	4.33	5.38	4.66	5.46
Maize (*sweet corn*) – mustard - *sesbania* green manure	88457	108176	81045	101064	99260	103496	96916	2.11	2.90	2.87	2.65	2.63	2.64	2.63
Mean	157200	168935	104912	102733	131277	120712		3.21	3.95	3.21	2.35	3.26	2.82	

Management practice	Net returns (Rs./ha)							B:C ratio						
	Organic		Inorganic		Integrated (towards organic)		Mean	Organic		Inorganic		Integrated (towards organic)		Mean
	100% organic	75% organic + innovative organic practices	100% inorganic	State recomm-endation	50% organic + 50% inorganic	75% organic + 25% inorganic		100% organic	75% organic + innovative organic practices	100% inorganic	State recomm-endation	50% organic + 50% inorganic	75% organic + 25% inorganic	
Pantnagar														
Basmati rice-wheat	183066	182400	148177	150755	139037	143900	157889	2.53	2.91	2.45	2.45	1.90	1.86	2.35
Basmati rice -chickpea (4rows+2rows coriander)	297062	299656	214540	229640	220457	221445	247133	5.15	5.80	3.82	4.02	3.30	3.30	4.23
Basmati rice -vegetable pea (4 rows vegetable pea +2 rows coriander)	277772	303015	211260	215075	225242	209560	240321	4.14	4.93	3.13	3.13	2.94	2.73	3.50
Basmati rice -potato	175713	171788	111984	125349	124119	115970	137487	2.19	2.26	1.51	1.67	1.36	1.20	1.70
Mean	233403	239215	171490	180205	177214	172719		3.50	3.98	2.73	2.82	2.38	2.27	
Raipur														
Soybean-maize	253469	264045	224358	242051	196213	214502	232440	4.96	5.18	4.24	4.35	3.94	4.24	4.49
Soybean-pea	176122	202755	152535	155644	157955	156383	166899	4.63	5.20	3.74	3.61	4.10	4.11	4.23
Soybean-chilli	219483	245364	183022	185583	148215	147711	188230	4.95	5.55	4.01	3.86	3.58	3.52	4.25
Soybean-onion	258840	277717	242208	288350	241513	232679	256885	5.75	6.33	5.06	5.53	5.33	5.10	5.52
Mean	226979	247470	200531	217907	185974	187819		5.07	5.57	4.26	4.34	4.24	4.24	
Ranchi														
Rice -wheat	65830	72509	61545	33296	53104	45222	55251	1.98	2.45	2.64	1.55	1.82	1.44	1.98
Rice -lentil	44540	51532	25426	16555	33687	25282	32837	1.56	1.96	1.24	0.78	1.34	0.95	1.31
Rice -potato	175048	164095	76549	51903	79183	82364	104857	3.40	3.66	2.34	1.53	1.99	1.83	2.46
Rice -linseed	45857	54860	37622	31581	27461	22004	36564	1.64	2.19	1.82	1.65	0.99	0.75	1.51
Mean	82819	85749	50286	33334	48359	43718		2.15	2.57	2.01	1.38	1.54	1.24	
Umiam														
Vegetable-vegetable systems *on raised bed*														
Broccoli -carrot	273570	209664	177464		224943		221410	1.42	1.10	1.17		1.36		1.26
Broccoli - potato	199079	144181	113669		152943		152468	0.86	0.66	0.61		0.74		0.72
Broccoli -french bean	330066	283031	182116		206121		250334	1.81	1.69	1.33		1.31		1.54
Broccoli -tomato	300518	278074	172204		208746		239886	1.42	1.44	1.04		1.14		1.26
Mean	275808	228738	161363		198188			1.38	1.22	1.04		1.14		

New centres started from 2015-16

Management practice	Grossreturns (Rs./ha)							Cost of cultivation (Rs/ha)						
	Organic		Inorganic		Integrated (towards organic)		Mean	Organic		Inorganic		Integrated (towards organic)		Mean
	100% organic	75% organic + innovative organic practices	100% inorganic	State recomm-endation	50% organic + 50% inorganic	75% organic + 25% inorganic		100% organic	75% organic + innovative organic practices	100% inorganic	State recomm-endation	50% organic + 50% inorganic	75% organic + 25% inorganic	
Ajmer														
Coriander–cluster bean	93,577	109322	147890	200332	142506	131600	137,538	1.30	1.70	3.50	3.90	2.50	2.00	2.48
Coriander - green gram	34,026	32,055	57,459	82,677	64,658	86,523	59,566	0.60	0.60	1.40	1.60	1.30	1.60	1.18
Fennel - cluster bean	112077	131763	187124	153199	132248	173992	148,401	1.50	2.00	4.50	3.00	2.30	2.70	2.67
Fennel – green gram	22,113	33,888	62,124	65,242	73,366	71,050	54,631	0.40	0.60	1.50	1.30	1.40	1.30	1.08
Mean	65,448	76,757	113,649	125,363	103,195	115,791		0.95	1.23	2.73	2.45	1.88	1.90	
Narendrapur														
Basmati rice–broccoli – *sesbania* green manure	557669	625850	568388	497294	502804	499610	541936	2.29	2.76	2.88	2.73	2.50	2.65	2.64
Paddy– mustard– green gram	69567	81906	39965	50200	37180	41245	53344	1.28	1.54	1.04	1.38	0.80	0.94	1.16
Paddy– capsicum– green gram	195487	196960	142377	125486	115406	90084	144300	1.28	1.54	1.04	1.38	0.80	0.94	1.16
Paddy –french bean – sesame	447940	387680	257629	185794	305108	254031	306364	2.10	1.85	2.00	1.66	1.52	1.43	1.76
Mean	317666	323099	252090	214693	240125	221243		1.74	1.92	1.74	1.78	1.40	1.49	
Sardar Krushinagar														
Groundnut- potato-pearlmillet.	190457	182668	117120	118620	126427	144471	146627	1.18	1.73	3.46	2.92	3.18	2.59	2.51
Greengram- cumin-vegetable cowpea	90080	85018	66135	67634	78106	84093	78511	1.34	1.42	2.71	3.23	2.11	1.94	2.12
Greengram-fennel-fallow	82292	57855	55749	57249	69021	62214	64063	0.02	0.42	0.66	0.77	0.22	0.51	0.43
Mean	120943	108514	79668	81168	91185	96926		0.85	1.19	2.28	2.31	1.83	1.68	
Thiruvananthapuram														
Cassava-veg. cowpea	459098	382443	376144	251037	187103	274216	321674	3.88	3.28	4.13	2.98	2.05	2.4	3.12
Cassava-groundnut														
Taro-black gram	265080	235399	131973	3713	349709	321347	217870	1.90	1.79	1.64	1.02	2.29	2.06	1.78
Taro-greengram														
Udaipur														
Maize + blackgram (2:2) – durum wheat – *sesbania* (GM)	15835	32543	32935	54169	104304	65936	50954							
Sweet corn + blackgram (2:2) – chickpea	49643	55807	47447	37465	43638	38687	45448							
Blackgram – wheat	105536	81921	120105	137201	179220	151618	129267							
Soybean - fenugreek	32760	25073	33010	33889	43442	15481	30609							
Mean	50944	48836	58374	65681	92651	67931								

ha). Among the different production system, higher net return (Rs.1,22,575/ha) was recorded under integrated management towards organic by 75% nutrient application through organic sources but it was at par with inorganic management with 100% inorganic and state recommendation of Rs.1,13,367 and 1,14,557/ha respectively. The reduction with organic over inorganic was 17.7%. Cropping systems beetroot-maize was found to more profitable with B:C ratio of 3.46 under inorganic across the nutrient management.

Dharwad: Higher gross return (Rs.1,24,760/ha) was recorded under organic management with 100% organic manure followed by inorganic with state recommendation (Rs.1,12,255/ha) and was found to be 21.0 and 27.3% higher than inorganic and integrated management respectively. Among the cropping systems, Maize-chickpea recorded higher gross return Rs. 1,31,809/ha irrespective of management. Lower cost of cultivation of Rs.31,760 /ha were found under inorganic condition while higher was under organic followed by integrated. In terms of cropping systems, maize-chickpea was recorded higher cost of cultivation (Rs.69,138/ha) whereas, pigeon pea sole recorded lowest cost (Rs.20,246/ha) with inorganic package. Production practices involving application recommended rates of inorganic fertilizers only and state recommendation produced higher net monetary returns and higher B:C ratio (Rs. 71,316 and 70,376/ha and 3.53 and 2.86, respectively) as compared to organic production system only (Rs. 45,271 to 47,365/ha and 1.76 to 1.73, respectively); and integrated production system involving application of 50 % organic + 50 % inorganic and 75 % organics + 25 % inorganic (Rs. 40,045 and 30,922/ha and 1.82 to 1.57, respectively). In terms of cropping system, sole pigeon pea cropping system found more remunerative (Rs.83,449/ha and 3.68 net monetary returns and B:C ratio, respectively) as compared to greengram-sorghum cropping system (Rs.70,043/ha and 2.43 net monetary returns and B:C ratio, respectively).

Jabalpur: The higher gross return and cost of cultivation under organic management with 100% organic through manure of Rs. 2,30,353 and Rs.94,060/ha was recorded. However, net return (Rs.1,63,951 /ha) and benefit cost ratio (2.63) was higher in inorganic management followed by state recommendation. The reduction in net return and net return invested per rupee with organic found to be by 16.9 and 44.1% and 23.3 and 38.8% in comparison of inorganic and integrated respectively. Among the cropping systems, basmati rice-vegetable pea-sorghum (fodder) recorded maximum gross return and production cost of Rs.2,47,696 and Rs. 1,24,684/ha respectively compared to other systems. Basmati rice-berseem (fodder and seed) gave significantly more benefit in term of net return invested per rupee (2.49). Rice-chickpea recorded significantly lower net return and B:C ratio.

Karjat: Application of 100% organic package resulted in significantly higher gross returns (Rs. 302611/ha) and net returns (Rs. 122094/ha) as compared to other production systems followed by adoption of 75 per cent organic + Innovative organic practices with net returns (Rs. 118608/ha). Though the gross and net returns were higher under 100% organic package, the B:C ratio were significantly higher under 100% inorganic package (1.80) and adoption of 75% organic + Innovative organic practices (1.71). This is mainly due to higher cost of organic inputs. The maximum and significantly higher gross returns (Rs. 321258/ha) and net returns (Rs. 165920/ha) were observed under rice-sweet corn and rice- groundnut system, respectively as compared to other cropping systems. However, significantly the highest B:C ratio (2.15) was observed with rice–groundnut system followed by rice–sweet corn system (1.85).

Modipuram: Organic management package with 100% organic through manure recorded higher gross return (Rs.2,76,733/ha) and cost of cultivation (Rs.1,19,533/ha) while inorganic recorded lower gross return and cost of cultivation of Rs. 1,88,878 and 83,967/ha and It was 46.5 & 42.3% higher than inorganic

management respectively. Higher net return of Rs.1,68,935 and B:C ratio (3.95) were recorded under organic management with 75% organic +innovative practices followed by 100% organic management. 23.0 and 21.2% befit was observed in term of net return per rupee invested. In term of cropping system, maize-potato-okra+*sesbania* performed well with higher B:C ratio(5.46). Maize-potato–okra+green manure registered higher net return of Rs.2,77,549/ha and was found to 210.1, 363.5 and 186.4% higher than basmati rice-wheat-*sesbania*, rice-barley-green gram and maize-mustard-*sesbania* respectively.

Pantnagar: Organic management with 100% nutrient through manure recorded higher gross return (Rs.3,02,744/ha). It was found to be 28.2 & 19.1% higher than inorganic and integrated management. Cost of cultivation (Rs. 96605/ha) was higher under integrated management with 75% nutrient through manure in rice-potato-*sesbania*. Net return and befit cost ratio was higher under organic with 75% nutrient through manure+ innovative practices (Rs. 239215/ha and 3.98). Rice-chickpea + coriander + *sesbania* recorded significantly higher net return (Rs. 2,47,133 /ha) and it was 2.8, 79.5 and 56.5% higher than rice-vegetable pea+coriander-*sesbania*, rice-potato-*sesbania* and rice-wheat-*sesbania* respectively. Benefit cost ratio was found to be 45.8 and 67.2% higher under organic with 75% nutrient through manure+ innovative practices than inorganic and integrated management respectively.

Raipur: Higher gross return, net return and B:C ratio was recorded under organic management with 75% organic+ innovative practices (Rs 3,01,834, Rs. 2,47,47 /ha and 5.57 respectively) and were at par with 100% organic through manure which found to be 15.2, 23.4 and 30.7% higher compared to inorganic (100%) and 23.7, 33.1 and 31.4% higher over integrated (50% each) management respectively. In terms of cropping systems, soybean-onion performed well with higher gross return (Rs.3,139,40/ha) net return (Rs. 2,56,885/ha) and BC ratio (5.52) compared with other cropping system. Net return found to be higher by 36.5, 53.9 and 10.53% than soybean-chilli, soybean-pea and soybean-maize respectively.

Ranchi: Among the different management systems, economics of rice based cropping systems in term of gross return, net return and benefit cost ratio was recorded under organic management either with 100% nutrient through manure or 75% organic manure +innovative practices . It was found to be 40.9 and 86.2% higher than inorganic respectively compared to other management practices. Lower cost of cultivation (Rs 47,710/ha) was recorded under inorganic nutrient management and higher cost (Rs 65607/ha) under organic management whereas, rice- lentil recorded lower cost of cultivation (Rs. 41274/ha) and rice (Birsamati)-potato (Kufriashoka) recorded higher (Rs. 85468/ha) cost of cultivation. Rice (Birsamati)-potato (Kufriashoka) performed well with higher gross return (Rs. 1,92,325/ha), net return (Rs. 1,04,857/ha) and B:C ratio (2.48) compared to other cropping systems. Among the cropping systems, rice-potato found to be higher by 186.7, 219.3 and 89.8% than rice-linseed, rice-lentil and rice-wheat systems in case of net monetary return.

Umiam: The economics of broccoli-vegetable based cropping systems under different management practices was also calculated with considering of premium price for 100% organic & 75% organic management. Maximum gross return was recorded in broccoli- tomato cropping system of Rs. 4,28,165/ha followed by broccoli - frenchbean of Rs. 4,11,1585/ha. Among the different production systems, organic production systems resulted higher gross return, cost of cultivation net return and B:C ratio. Net return per rupee invested was maximum in broccoli - frenchbean (1.81) cropping system followed by broccoli-tomato (1.44) under organic and 75% organic+ innovative management practices. 70.9% more return was observed with organic over inorganic however, 32.7% more net return per rupee invested was obtained with organic as compared to inorganic.

Ajmer: Economics showed that the highest net returns (Rs 86523/ha) in coriander was obtained from 75% organic + 25% inorganic package followed by state recommendation practice (Rs. 82677/ha) and lowest net was in returns from 100% organic management (Rs. 22113/ha). Higher net returns (Rs 200332/ha) in fennel was recorded with state recommendation package and lowest net returns from 100% organic management. However, highest B:C ratios (1.6) was observed in 75% organic package + 25 % inorganic package followed by or equal to 100 % inorganic package (No organic manures) and State recommendations. In fennel B: C ratios is higher (3.5 and 4.5) was found in the production of 100% inorganic package (No organic manures) followed by State recommendations or farmers package in fennel. Among both the crops fennel realized higher net returns as compared to coriander. Since the seed yield of coriander is lower than the seed yield of fennel crop.

Narendrapur: Organic management with 100% nutrient through manure recorded higher gross return (Rs.6,33,033/ha) and cost of cultivation (Rs. 315367/ha). It was found to be 28.2 & 19.1% higher than inorganic and integrated management however, lower cost of cultivation (Rs. 2,25,088/ha) was recorded under inorganic management with state recommendation. Net return and befit cost ratio was higher under organic with 75% nutrient through manure+ innovative practices (Rs. 3,23,099/ha and 1.92). It was 28.2 and 34.5% higher than inorganic and integrated respectively. Net return per rupee invested was found to be more by 10.3 and 37.1% with organic package over inorganic and integrated. Rice-broccoli-*sesbania* recorded significantly higher net return and benefit cost ratio (Rs. 5,41,936 /ha and 2.64) and it was 275.6 and 76.9% higher in term of net return than paddy-capsicum-greengram and paddy-frenchbean-sesame respectively. Benefit cost ratio was also found to be higher by 127.6 and 50% compared to other systems namely, paddy-capsicum-greengram and paddy-frenchbean-sesame respectively.

Sardarkrushinagar: Highest gross return (Rs. 5,28,028/ha) recorded under integrated (50% each organic and inorganic) which was statistically on par with inorganic (100%) package (Rs. 521805/ha) while reverse was found in case of cost of cultivation which recorded lowest under inorganic condition. Maximum Net return (Rs.1,20,945 and 1,08,514/ha) was obtained under 100% organic package whereas minimum was received under inorganic cultivation. Benefit cost ratio was higher under inorganic management followed by integrated. Among the cropping systems, groundnut-potato-pearlmillet system produced significantly higher Net return (Rs. 1,46,627/ha) and B:C ratio (2.51). Greengram-cumin-vegetable cowpea was the next succeeding system. Greengram-fennel-fallow recorded lowest net return and B:C ratio.

Thiruvananthapuram: With premium price, cassava under 100% organic resulted in higher returns followed by 75% organic+ innovative practices. It was 22.1 and 145.4% higher than inorganic and integrated management. In term of befit cost ratio, cassava was recorded higher (4.13) with inorganic management and 6.05% lower return per rupee invested was noticed with organic than inorganic. In the case of taro, 50% organic + 50% inorganic followed by 75% organic + 25% inorganic under integrated management resulted in higher net returns and benefit cost ratio (Rs. 349709 and Rs. 321347/ha and 2.29 and 2.06 respectively). Under organic management, 24.2 and 17% less return and return per rupees invested was received than integrated management.

Udaipur: Among four cropping systems evaluated under different management practices, blackgram-wheat (*Aestivum*) cropping system recorded maximum net return (Rs 1,61,376 ha^{1}) under 100% inorganic management system followed by state recommendations (Rs 149095 ha^{1}). It is observed more than double than the other cropping systems. Among production systems, reduction in organic in comparison of inorganic and integrated was found to be up to the 45 and 37% respectively.

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 centres have taken up this experiment as it is very important to identify the varieties which form the core of organic farming package.

Year of start: 2013-14

Locations: All the 20 centres in different ecosystem as mentioned in section 7.1 have conducted the experiments including 7 new centres started experimentation from 2015-16.

Results

Bajaura

Response of varieties/hybrids of important crops in tomato-pea-tomato and okra-cauliflower system under organic management

Tomato: Twelve varieties/hybrids of tomato in *kharif* and *summer* were evaluated in the tomato-pea-tomato system for their performance and suitability under organic conditions. Significant differences among the varieties/hybrids for measured variables were observed except days taken to harvest. The variety RK 123 attained maximum plant height (92.9 cm) in *kharif* and Yash (99.5 cm) in *summer* whereas Sioux recorded minimum plant height (77.8 cm) during *kharif* and Palam pink (62.0 cm) in *summer* season. The maximum fruit yield was recorded with variety Heem Sohna (1948 kg/ha) in *kharif* and RK-123 (15830 kg/ ha) with higher number of fruits/plant (24) in *summer*. Significantly higher fruit size was recorded with RK-123 (23.6 cm^2) and Marglobe (32.9 cm^2) during *kharif* and *summer* respectively. TSS (^{0}Brix) in term of quality varied ranging from 3.2-4.1 during *kharif* and 3.6-4.5 during *summer* (Table 21.1).

Pea: Eight varieties of pea were evaluated for their performance under organic conditions during *rabi*. Number of days taken to flowering was higher of Ten Plus (114 days) followed by Nirali and Plam Priya (112.7 days), however, they were statistically on par with each other. The minimum days taken to flowering was recorded in Arkel (91.0). Variety Ten Plus attained significantly higher plant height (56.1 cm) followed by nirali (55.5 cm) whereas significantly lower height was observed in GC-477. Maximum pod yield (6119 kg/ha) was recorded with variety Ten Plus, which was statistically at par with Nirali (5627 kg/ha) but

Table 21.1. Yield attributes and yield of tomato in tomato-pea-tomato system under organic management at Bajaura

Varieties/ hybrids	Plant height (cm)		Numbers of fruits/plant		Fruit size (cm^2)		Days taken to harvest		Yield (kg/ha)		TSS (^{0}Brix)	
	Kharif	*Summer*	*Kharif*	*Summer*	*Kharif*	*Summer*	*Kharif*	*Summer*	*Kharif*	*Summer*	*Kharif*	*Summer*
Yash	87.6	99.5	5	19	18.2	26.7	36	38	1613	11680	4.1	4.5
Naveen 2000	90.5	99.0	6	14	15.2	23.0	34	34	1639	6680	3.6	4.0
Manisha	91.2	86.0	5	16	20.1	25.2	42	44	1634	9310	4.1	4.5
Red Gold	90.9	88.0	6	22	20.6	28.1	36	36	1657	15260	3.9	4.3
Hybrid7730	90.4	96.0	6	16	19.1	22.3	33	35	1604	10440	3.3	3.7
Roma	85.1	66.0	4	10	20.2	20.5	44	46	1123	4310	3.2	3.6
Sioux	77.8	83.5	3	8	19.0	20.2	34	35	970	2410	3.3	3.7
Best of All	92.3	77.0	4	9	19.7	13.4	36	36	1278	3800	3.9	4.3
Palam Pink	90.0	62.0	5	9	19.5	26.2	34	36	1197	4600	3.4	3.8
Mar Globe	86.3	90.5	2	10	18.5	32.9	35	36	1534	2450	3.2	3.6
RK-123	92.9	92.0	5	24	23.6	26.8	36	37	1700	15830	3.9	4.3
Heem Sohna	91.0	91.5	6	21	15.0	20.0	33	35	1948	14090	4.1	4.5
CD (P=0.05)	5.0		0.8		0.62		NS		231		0.40	

Table 21.2. Yield attributes and yield of vegetable pea (rabi) in tomato-cauliflower-pea system under organic mangaement of Bajaura

Entry hybrids	Plant height (cm)	Pod length (cm)	No. of pods/plant	No. of seeds/pod	Days taken to flowering	Pod yield (kg/ha)	TSS (^{0}Brix)
Pb-89	52.8	8.8	19	6	92.7	5267	16
Azad-P1	54.4	8.7	16	5	92.7	4778	15
PalamPpriya	55.1	8.7	13	5	112.3	4515	16
GC-477	39.6	7.8	9	5	109.3	4027	15
Nirali	55.5	8.8	20	7	112.7	5627	16
Ten Plus	56.1	8.9	21	7	114.0	6119	16
Arkel	53.6	9.0	17	6	91.0	4618	15
Palam Triloki	54.3	8.7	18	6	92.7	4996	15
CD (P=0.05)	4.35	0.35	2.64	0.91	8.67	650	NS

Table 21.3. Yield attributes and yield of okra-cauliflower system under organic management at Bajaura

Variety	Plant height (cm)	Days taken to Harvest	No. of fruits/ plant	Fruit length (cm)	Fruit yield (q/ha)
Perkins Long Green	213.0	62.0	16.2	8.1	10247
Pusa Makhmali	219.6	59.7	20.5	8.6	10216
Palam Komal	205.3	55.0	21.3	8.5	9784
P-8 (check)	209.7	55.0	17.2	8.2	10926
Indranil	192.6	55.0	17.7	9.0	12099
Chameli-015	224.0	55.0	13.0	9.1	12608
CD (P=0.05)	2.58	3.0	2.98	4.01	351.0

Table 21.4. Yield attributes and yield of cauliflower (rabi) in okra-cauliflower system under organic management at Bajaura

Variety/hybrid	Marketable curds (%)	Curd size (cm^2)	Curd weight (g)	Curd yield (km/ha)	Biomass (kg/ha)
PSBK-1	76.5	180.77	383	9420	12306
PSB-1	27.3	92.48	98.0	340	641
Palam uphar	64.3	144.75	381	8362	10889
Maharani	76.4	191.21	471	9810	13802
US-178	80.9	188.40	581	11279	14293
Chandra mukhi	78.4	194.87	570	10600	14078
71 No.	77.0	182.92	465	8568	10996
CD (P=0.05)	0.43	2.06	13.34	398	1008

significantly higher than the all other varieties owing to higher number of pods/plant (21), number of seeds/pod (7) and pod length (8.9 cm) (Table 21.2).

Okra: Six varieties of okra were evaluated in okra-cauliflower system for their suitability under organic conditions during *kharif*. Significant differences were observed for all the parameters such as plant height, days taken to harvest, no. of fruits/plant, fruit length and fruit yield. The results revealed that variety Chameli-015 recorded significantly higher fruit yield (12608 kg/ha) owing to higher fruit length (9.1 cm) and height (224 cm) followed by and Indranil of yield and fruit length (12099 kg/ha and 9.0cm) compared to others, however both the varieties/hybrids were statistically at par with each other (Table 21.3).

Cauliflower: Seven varieties/hybrids of cauliflower were evaluated during *rabi*. Though higher curds size was obtained in Chandramukhi (194.87 cm^2) but higher percentage of marketable curd was obtained in US-178 (80.9%) along with highest curd weight (581 g) resulted in significantly higher curd yield per hectare (11279 kg) as compared to all other varieties. Chandramukhi also recorded significantly higher curd yield (10600 kg/ha) than other entries tested. Variety PSB-1 severely affected by the prevailing conditions as it performed poorly as compared to other varieties evaluated. In this variety black rot disease was reported as well rottening of the curds (64.3% rotten curds) resulting in very poor number of marketable curd, yield, curd size and curd weight (Table 21.4).

Cauliflower, vegetable pea and tomato under organic management at Bajaura

Bhopal

Response of different varieties/hybrids of crops in soybean-wheat and maize-chickpea system: Twelve varieties of each soybean, wheat, maize and chickpea including two major varieties grown by the farmers in the region were evaluated in soybean-wheat and maize-chickpea cropping systems.

Soybean: Among the soybean varieties grown under similar nutrient source and doses, variety NRC 37 attained maximum plant height (36 cm) and statistically at par with RVS 2002-4, RVS 2002-7 and JS 335 whereas variety JS 20-34 recorded minimum plant height (20 cm). Soybean variety, RVS-2002-4 resulted in significantly higher seed yield (814 kg/ha) owing to higher pods/plant (36.3) and biomass (2936 kg/ha) than others while, JS 20-34 recorded lowest soybean yield (631 kg/ha). Seeds/pod of different soybean varieties varies from 2.6 in JS 93-05 as lower to 3.5 in JS 20-41 as higher (Table 22.1).

Quality of soybean: A significant variation was observed for oil and protein content among the soybean varieties evaluated. The percentage of protein and oil content from different varieties of soybean seeds was found to be in the range of 36.19 – 37.89% and 18.23–20.17% respectively. The oil content (20.17%) was significantly higher in RVS 2002-7 followed by RVS 2002-6 (19.94%) and lower (18.23%) in the variety JS 20-34. Significantly higher protein (37.89%) was recorded with JS-93-05 followed by JS 20-29 (37.87%) (Table 22.1).

Wheat: Among the wheat varieties grown under organic condition, GW-366 recorded significantly higher yield and total biomass (3221 and 6767 kg/ha), owing to higher seeds/spike (75), number of spikes/meter row length (96) and harvest index (47.6) followed by HI-3102 and Malwashakti in term of yield and was on par to each other, while C-306 produced poor yield (1983 kg/ha) with total biomass (4687 kg/ha) (Table 22.2).

Maize: Plant height varied from 110 cm to 167 cm among the maize varieties. Sona 222 recorded higher plant height of 167 cm while, sweet corn attained minimum height 110 cm. The range of grain yield for different varieties of maize recorded 585-2308 kg/ha having maximum with Kanchan of 2308 and 5234 kg/ha yield and total biomass respectively and minimum was recorded with sweet corn (585 kg/ha) biomass yield (1275 kg/ha). The variation was observed in cobs/plant, grain rows/cob and seeds/row from 1.0 -1.3, 9.4- 12,2 and 11.0 -16 respectively (Table 22.3).

Quality of maize: Among all the quality parameters assessed, Pro agro-4412 was superior over all the varieties/hybrids evaluated. It recorded more protein (10.11%), ash% (1.54) and tryptophan (0.90 g/16gN). Other maize varieties resulted in protein ranging from 9.29 (sweet corn) to 9.89% (CBPG 4202), ash range from 1.39-1.56 and tryptophan ranging from 0.69-0.90 g/16gN (Table 22.3).

Chick pea: The chickpea varieties exhibited significance differences among themselves in yield attributes and yield. In all the yield components, JG 130 was recorded higher seed yield (1839 kg/ha), correspondingly higher biomass yield of 4758 kg/ha and harvest index 39% followed by RVG 203 (1759 kg/ha) and JG 16 (1678 kg/ha) which is at statistically on par. Rest of varieties were varied from 1001 to 1425 kg/ha on grain yield basis (Table 22.4).

Table 22.1. Response of soybean varieties for yield attributes and yields and quality in soybean-wheat system under organic management at Bhopal

Variety	Plant height (cm)	Pods/ Plant	Seeds/ Pod	Seed yield (kg/ha)	Total Biomass (kg/ha)	HI%	Protein (%)	Oil (%)
JS-335	35	27.7	3.3	631	2261	27.9	36.76	19.38
JS-93-05	26	25.5	2.6	517	2005	25.8	37.89	19.17
JS-95-60	31	25.9	3.1	556	2159	25.8	36.68	18.94
JS-20-41	27	33.7	3.5	808	2715	29.8	36.54	19.35
NRC-7	27	30.2	3.3	604	2367	25.5	36.45	18.66
NRC-37	36	25.5	2.7	501	1974	25.4	37.24	18.65
JS-20-29	25	24.5	3.2	521	1722	30.2	37.87	19.70
RVS-2002-4	36	36.3	3.4	814	2936	27.7	36.25	19.69
RVS-2002-6	25	25.7	2.7	517	2004	25.8	36.19	19.94
RVS-2002-7	35	26.4	2.7	658	2228	29.5	36.45	20.17
JS-97-52	35	34.5	3.4	795	2681	29.7	36.33	18.70
JS-20-34	20	27.7	2.9	563	1893	29.7	36.24	18.23
CD (P= 0.05)		4.8	0.5	126	386		0.41	0.13

Table 22.2. Response of wheat varieties for yield attributes and yields in soybean-wheat system under organic management at Bhopal

Variety	Spikes/meter length	Seeds/spike	Grain Yield (kg/ha)	Total biomass (kg/ha)	HI%
C-306	71	62	1983	4687	42.3
HI-8663	83	68	2578	5793	44.5
HI-1544	92	70	2820	6367	44.3
Malwashakti	86	73	3023	6483	46.6
GW-322	82	72	2742	6627	41.4
GW-366	96	75	3221	6767	47.6
HI-1531	77	66	2458	6067	40.5
HI-8498	88	74	3102	6650	46.6
HI-1500	70	63	2278	5300	43.0
1202	80	61	2630	6295	41.8
HD-932	82	62	2443	5683	43.0
LOK-1	69	59	2245	5512	40.7
CD (P= 0.05)	9	5	170	517	

Table 22.3. Yield indices, yield and quality of different maize varieties/hybrids in maize-chickpea system under organic management at Bhopal

Variety	Plant height (cm)	Cobs/ Plant	Rows/ Cob	Seeds/ Row	Seed yield (kg/ha)	Total biomass (kg/ha)	Harvest Index (HI) %	Protein (%)	Ash (%)	Tryptophan (g/16 g N)
Kanchan	155	1.2	12.2	16.5	2308	5234	44.1	9.68	1.56	0.86
Pratap 5	130	1.1	11.4	13.8	1573	3429	45.9	9.58	1.46	0.83
Arawali	146	1.2	11.3	14.2	1418	3230	43.9	9.78	1.42	0.76
Sona 222	167	1.3	11.5	11.1	1371	3210	42.7	9.60	1.47	0.82
Pratap 6	165	1.2	11.5	14.9	1642	3995	41.1	9.54	1.48	0.78
JM 216	136	1.1	11.3	11.9	1238	2809	44.1	9.78	1.45	0.74
Popcorn 1	131	1.3	9.9	12.9	673	1489	45.2	9.14	1.43	0.69
JM 8	148	1.2	10.6	12.7	1824	3937	46.3	9.65	1.46	0.85
JM 12	147	1.1	10.3	11.3	1500	3298	45.5	9.39	1.47	0.80
Proagro 4412	138	1.2	11.6	14.6	2181	5048	43.2	10.11	1.54	0.90
Sweet Corn	110	1.2	9.4	11.0	585	1275	45.9	9.29	1.39	0.70
CPBG 4202	144	1.0	10.9	12.1	1010	2245	45.0	9.89	1.51	0.84
CD (P= 0.05)	NS	NS	1.5	NS	708	1094	64.7	NS	NS	NS

Table 22.4. Yield indices and yield of different chickpea varieties/hybrids in maize-chickpea system under organic management at Bhopal

Treatment	Pods/ plant	Seed/ pod	Grain yield (Kg/ha)	Biological yield (Kg/ha)	HI %
RVG-202	92	1.5	1435	3975	36
JG-16	96	1.7	1678	4305	39
JGK-3	101	1.7	1137	3025	38
RVG-203	98	1.4	1759	4555	39
JG-11	82	1.4	1349	3645	37
JG-6	82	1.5	1210	3360	36
JG-130	99	1.6	1839	4758	39
JG-315	78	1.6	1309	3367	39
JG-63	68	1.3	1198	3587	33
JG-74	75	1.6	1321	3528	37
VIRAT	98	1.6	1224	3450	35
UJJWALA	96	1.3	1001	2765	36
CD (P=0.05)	9	0.3	148	447	

Changes in soil chemical properties

The soil physical and chemical properties were analyzed at the end of cropping cycles from each variety of soybean- wheat and maize-chick pea reveal that the changes in soil pH and EC did not change. The soil organic carbon content varied between 0.80 - 0.94% in maize - chick pea cropping cycle and 0.76 - 0.89% in soybean - wheat cropping system at the end of cropping cycle. The soil available N content varied between 100 -118 mg kg^{1} after maize - chick pea and 90 -105 mg kg^{1}after soybean - wheat system. Similarly soil P content varied between 33 - 41 mg kg^{1} in maize chickpea and 26 - 36mg kg^{1} in soybean - wheat system after end of cropping cycle. Soil K content was recorded very high that ranged between 235 - 251mg kg^{1} in maize - chick pea and 226 - 265 mg kg^{1}in soybean - wheat system in the end of cropping cycle (Table 22.5).

Table 22.5: Soil properties after end of cropping cycle

Crop varieties		Soil Parameters					
Soybean	Wheat	pH	EC	WBC (%)	Available N (mg kg^{-1})	Available P (mg kg^{-1})	Available K (mg kg^{-1})
JS-95-60	C-306	7.76	0.25	0.82	104	34	254
JS-20-41	HI-8663	7.73	0.22	0.86	104	32	260
NRC-7	HI-1544	7.78	0.22	0.81	93	27	246
NRC-37	Malwashakti	7.74	0.23	0.76	95	27	263
JS-20-29	GW-322	7.77	0.25	0.80	90	30	243
RVS-2002-4	GW-366	7.73	0.30	0.85	105	27	259
RVS-2002-6	HI-1531	7.67	0.26	0.84	103	35	259
RVS-2002-7	HI-8498	7.72	0.27	0.82	97	26	252
JS-97-52	HI-1500	7.73	0.25	0.83	102	31	226
JS-2034	JW-1202	7.75	0.24	0.78	95	36	239
JS-95-60	HD-932	7.73	0.24	0.89	102	33	265
JS-20-41	LOK-1	7.55	0.26	0.82	102	30	232
Maize	**Chick pea**						
Kanchan	RVG-202	7.57	0.24	0.86	105	33	251
Pratap 5	JG-16	7.57	0.23	0.86	118	41	240
Arawali	JGK-3	7.53	0.26	0.93	103	37	246
Sona 222	RVG-203	7.52	0.32	0.92	115	38	246
Pratap 6	JG-11	7.41	0.28	0.89	113	38	235
JM 216	JG-6	7.59	0.22	0.92	106	38	248
Popcorn 1	JG-130	7.55	0.23	0.8	100	40	242
JM 8	JG-315	7.56	0.23	0.91	110	36	250
JM 12	JG-63	7.60	0.22	0.94	100	41	243
Proagro 4412	JG-74	7.69	0.22	0.80	109	35	241
Sweet Corn	VIRAT	7.62	0.25	0.87	116	41	249
CPBG 4202	UJJWALA	7.60	0.23	0.81	114	37	249

Calicut

Evaluation of response of different varieties of turmeric for organic farming in turmeric–fallow systems

Among the 11 varieties of turmeric evaluated under organic and inorganic situation, maximum yield was recorded by Sudarshana (36100 kg/ha), followed by Suvarna and Kanthi (29200 and 28600 kg/ha respectively). Variation in other turmeric varieties was recorded in range from 21100 kg/ha (Alleppey

Table 23. Effect of different management systems on yield and quality of turmeric under organic conditions at Calicut

Varieties	Yield (kg/ha)		Mean	Oil content (%)		Mean	Oleoresin content (%)		Mean	Curcumin (%)		Mean
	Organic	Inorganic 100%		Organic 100%	Inorganic		Organic 100%	Inorganic		Organic 100%	Inorganic	
Prathibha	23100	25300	24200	2.22	1.90	2.06	10.00	10.20	10.10	4.70	4.50	4.60
Alleppey Supreme	21100	28700	24900	2.00	2.10	2.05	10.90	10.20	10.55	4.30	4.00	4.15
Varna	28300	21600	24950	1.89	2.00	1.95	7.60	6.90	7.25	2.20	1.60	1.90
Sobha	22000	29800	25900	2.00	1.90	1.95	6.60	7.00	6.80	2.40	2.00	2.20
Sona	24700	25300	25000	2.00	1.90	1.95	8.00	7.50	7.75	2.90	1.90	2.40
Kanthi	28600	21800	25200	1.87	2.00	1.94	6.70	5.90	6.30	2.70	1.80	2.25
Suvarna	29200	25500	27350	1.77	1.90	1.84	6.80	6.50	6.65	2.03	1.50	1.77
Suguna	27500	26100	26800	3.11	2.00	2.56	10.60	8.50	9.55	4.00	3.30	3.65
Sudarsana	36100	27000	31550	2.77	1.80	2.29	8.90	8.50	8.70	3.43	3.50	3.47
Kedaram	21700	21300	21500	3.00	1.90	2.45	11.10	10.30	10.70	4.30	3.90	4.10
Prabha	23200	26800	25000	2.77	1.80	2.29	9.50	10.60	10.05	4.13	3.60	3.87
Mean	26000	25400	25700	2.31	1.93	2.12	8.80	8.40	8.60	3.37	2.87	3.12
(CD=0.05) T	570			0.07			0.16			0.05		
(CD =0.05)V	840			0.10			0.23			0.08		

supreme) to 28300 kg/ha (Varna) while, under inorganic condition, Alleppey Supreme was performed superior (29800 kg/ha). There was a significant difference between the varieties of the turmeric cultivars for yield, oil, oleoresin and curcumin content. Oil content, was maximum in the varieties Suguna (3.11%) followed by Kedaram and was least in Suvarna (1.77 %). The oleoresin content varied from 6.6 to 11.1%. Among the varieties, Kedaram showed maximum oleoresin content% followed by AlleppeySupreme, and Suguna. Least oleoresin content was noticed in the variety Sobha. In regard to curcumin content, variety Prathibha recorded maximum (4.7%) followed by Aleppey supreme and Kedaram. Least curcumin content was noticed in Suvarna (2.03%). Under inorganic condition, Pratibha recorded higher oleoresin and curcumin content (Table 23).

Performance of turmeric varieties under organic management at Calicut

Coimbatore

Evaluation of rice varieties suitable for organic farming

Variety white ponni recorded highest numbers of productive tillers hill^{-1} (11.8) followed by CO(R)-51(11.2) and CO 43 these were statistically on par to each other but significantly higher to the other varieties, while, least productive tillers recorded in KDML-105 (6.6). Among the cultivars, significant variation in number of filled grains/panicle was observed from 93.9 with CO 43 to 149.3 with CB05022. Mappillai samba showed significantly higher 1000 grains weight (26.5g) followed by the Red kavuni (23.8g) and

KDML 105 Mappillai samba CO (R) 48

Performance of different rice varieties under organic management at Coimbatore

Table 24.1. Response of rice varieties/hybrids under organic management at Coimbatore

Treatments	Productive tillers hill^{-1}	No. of filled grains panicle^{-1}	1000 grains weight (g)	Grain yield (kg/ha)	Straw yield (kg/ha)	Harvest index
Bhavani	7.6	121.7	21.7	3.21	3.84	0.46
White Ponni	11.8	135.4	16.4	4.2	5.01	0.46
Mappillai samba	9	122.3	26.5	4.67	8.65	0.35
Kitchili samba	8.6	110.2	16.5	2.5	3.27	0.43
IR 20	10.2	103.7	18.6	3.15	3.99	0.44
CO 43	10.8	93.9	20.1	3.27	4.02	0.45
CO(R) 48	9.4	147.1	19.4	4.29	5.02	0.46
CO(R) 51	11.2	97.6	18.1	3.16	3.96	0.44
CB 05022	10.2	149.3	19.5	4.76	6.62	0.42
KDML 105	6.6	129.7	15.0	2.06	3.35	0.38
Red kavuni	6.8	109.2	23.8	2.83	4.76	0.37
Jeeraga samba	9.8	122.9	15.5	2.99	5.28	0.36
	0.39	8.39		0.18	0.2	-
CD (P=0.05)	0.81	17.4		0.37	0.42	-

Table 24.2. Physical parameters of rice varieties under organic farming

Treatments	Hulling%	Milling (%)	Before cooking		After cooking	
			Length of kernel (mm)	Breadth of kernel (mm)	Length of kernel (mm)	Breadth of kernel (mm)
Bhavani	86.0	79.5	5.7	2.0	10.7	2.7
IW Ponni	71.3	65.0	5.4	1.9	10.2	2.9
Mappillai samba	86.3	72.3	5.8	2.3	9.1	3.4
Kitchili samba	72.3	a	5.3	2.0	9.5	2.6
IR 20	88.6	83.0	5.2	1.8	9.1	2.5
CO 43	78.6	72.3	5.4	1.9	9.3	2.5
CO(R) 48	78.2	67.3	5.9	1.8	9.4	3.0
CO 51	85.9	79.0	4.9	1.7	9.5	2.8
CB 05022	73.2	64.5	5.5	2.1	9.4	2.6
KDML	81.4	75.3	7.0	1.8	10.3	2.5
Red kavuni	79.3	65..0	5.4	2.1	9.4	3.6
Jeeraga samba	69.6	61.0	5.3	2.2	9.6	3.8

bhavani (21.7g) then the others cultivars while, KGML 105 recorded least test weight (15.0g). In all the varieties assessed, CB 05022 outperformed and superior over all the cultivars evaluated. It produced more grains/panicle with more filled grains and correspondingly recorded higher yield (4760 kg/ha). Mappillai samba, CO(R)48 and white ponni also performed well in yield and recorded 4670, 4290 and 4200 kg/ha respectively whereas, straw yield recorded in range from minimum 3270 kg in Kitchili samba to 8650 kg/ha maximum in Mappillai samba (Table 24.1).

Table 24.3. Cooking parameters of rice varieties under organic farming

Treatments	Gelatinization temperature (GT)	Gel Consistency (GC)	Linear elongation ratio (LER)	Volume expansion ratio	Breadth wise expansion ratio
Bhavani	3	Medium	1.88	4	1.35
IW Ponni	2	Medium	1.96	3.80	1.52
Mappillai samba	3	Medium	1.56	3.40	1.47
Kitchili samba	2	Medium	1.79	3.60	1.30
IR 20	3	Medium	1.75	4.00	1.38
CO 43	2	Medium	1.72	3.60	1.31
CO(R) 48	2	Soft	1.59	4.00	1.66
CO 51	1	Medium	1.93	3.80	1.64
CB 05022	3	Medium	1.70	3.40	1.23
KDML	7	Soft	1.47	3.40	1.39
Red kavuni	3	Medium	1.74	3.40	1.71
Jeeragasamba	3	Soft	1.81	3.80	1.72

Table 24.4. Economics of rice under organic cultivation (2015-16)

Treatments	Cost of Cultivation (Rs/ha)	Gross return (Rs/ha)	Net return	B:C Ratio
Bhavani	37430	60265	22835	1.61
White Ponni	37430	78949	41519	2.11
Mappillai samba	37430	92436	55006	2.47
Kitchili samba	37430	47353	9923	1.27
IR 20	37430	59579	22149	1.59
CO 43	37430	61555	24125	1.64
CO(R) 48	37430	80487	43057	2.15
CO(R) 51	37430	59619	22189	1.59
CB 05022	37430	90849	53419	2.43
KDML 105	37430	39957	2527	1.07
Red kavuni	37430	55277	17847	1.48
Jeeraga samba	37430	58801	21371	1.57

Physical quality parameter of rice such as hulling, milling, length and breadth of kernel (before after cooking) were estimated at post-harvest stage and given in Table 24.2. Maximum hulling and milling% in rice varieties was recorded with IR-20 (88.6 and 83.0% respectively) and minimum was in Jeeraga samba (69.6 and 61.0% respectively). KDML 105 recorded remarkably higher kernel length of 7.0 mm under long category while, variety CO51 recorded 4.90 mm kernel length under short category. The other varieties, Bhavani, White ponni ,Mappillai samba, Kitchili samba, IR-20, CO-43, CO(R) 48, CO(R) 51, CB 05022 and Red kavuni recorded kernel length ranged from 5.2-5.9 mm and they were classified as medium size category. The variety Mappillai samba recorded higher kernel breadth of 2.3 mm before cooking. After cooking, maximum kernel length was recorded with Bhavani (10.7 mm) followed by KMDL-10 (10.3 mm),

while, IR20 and Mappillai samba recorded 9.1 mm as lowest. The maximum Kernel breadth after cooking registered in Jeeraga samba and Red kavuni (3.8 and 3.6 respectively), while lowest value 2.5 recorded in IR 20, CO-43 and KDML. Maximum linear elongation ratio and breadth wise elongation ratio were recorded in the variety white ponni (1.96) followed by CO-51 (1.93), while minimum elongation ratio was in KDML (1.47). CO(R) 48, Bhavani and IR 20 recorded higher volume expansion ratio of 4.00 followed by Jeeraga samba, CO-51 and IW Ponni of 3.8. The lesser volume expansion was noticed in Mappillai samba of 3.40. Breadth wise expansion ration was found in range from 1.23 to 1.72 of CB05022 as minimum and Jeeraga samba as maximum (Table 24.2 & 24.3).

Economics in term of gross return, cost of cultivation, net return and befit cost ratio were calculated and presented in table 24.4. Mappillai samba gave Maximum gross return (Rs. 92436/ha), net return (Rs. 55006/ha) and net returns per rupee invested (2.47) followed by CB05022, CO(R) 48 and IW Ponni, while, KDML105 gave minimum net return (Rs.2527/ha) and net return rupee per invested (1.07). Other rice varieties CO-43, Bhavani, CO(R) 51, IR 20, Jeeraga samba, Red kavun and Kitchili samba were in ranging from Rs. 24125 – Rs. 9923/ha for net return and net return rupee per invested (Table 24.4).

Dharwad

Evaluation of response of different varieties of chickpea and wheat for organic farming under rainfed farming situation during rabi season

Chickpea: Five varieties of Chickpea, namely A1, MABC 27, MABC 37, BGD 103 and Jaki 9218 were evaluated. The effect of cultivars on organic and inorganic management was significant for plant height and 1000 grains weight. The production management did not differ significantly for all the traits. Variety A1 recorded taller plants (45.9 cm), while BGD gave higher number of pods/plant (84) and seed weight/plant (22.1g) whereas higher 1000

Table 25.1: Yield attributes of chicken cultivars as influenced by different production systems under rainfed situation at Dharwas

Sorghum cultivars	Plant height (cm)			No. of pods/plant			Seed weight (g/plant)			1000 grains weight (g)		
	Organic	Inorganic	Mean	Organic	Inorganic	Mean	Organic	Inorganic	Mean	Organic	Inorganic	Mean
A1	45.9	44.9	45.4	78.8	82.0	80.4	20.7	20.7	20.7	236.5	245.3	240.9
MABC 27	44.8	41.0	42.9	71.5	76.4	73.9	19.2	20.7	20.0	342.9	328.2	335.5
MABC 37	42.1	42.4	42.2	73.3	76.7	75.0	20.0	20.5	20.3	276.1	255.9	266.0
BGD 103	41.1	44.4	42.8	84.0	72.6	78.3	22.1	20.2	21.2	284.2	253.8	269.0
JAKI 9218	43.4	44.3	43.8	78.9	77.1	78.0	21.0	20.6	20.8	250.0	280.3	265.1
Mean	43.5	43.4		77.3	77.0		20.6	20.5		277.9	272.7	
CD (P=0.05)												
Production System (PS)		NS			NS			NS			NS	
chickpea Cultivars (cv.)		2.0			NS			NS			1.94	
cv at same PS		2.9			NS			NS			NS	

* Organic farming, *Inorganic:Conventional farming with the use of farm yard manure and inorganic fertilizers

Table 25.2: Yield straw yield and harvest index of chickpea cultivars as influenced by different production systems under rainfed farming situation at Dharwad

Sorghum cultivars	Grain yield (kg/ha)			Stover yield (kg/ha)			Harvest Index		
	Organic	Inorganic	Mean	Organic	Inorganic	Mean	Organic	Inorganic	Mean
A1	2075	2219	2147	3419	3472	3446	0.38	0.39	0.38
MABC 27	1992	2183	2088	3457	3337	3397	0.37	0.40	0.38
MABC 37	2210	2557	2384	3623	3768	3695	0.38	0.40	0.39
BGD 103	2267	2454	2361	3698	3667	3683	0.38	0.40	0.39
JAKI 9218	2439	2531	2485	3739	3719	3729	0.40	0.41	0.40
Mean	2197	2389		3587	3593		0.38	0.40	
CD (P=0.05)									
Production System (PS)		NS			NS			NS	
Chickpea Cultivars (cv.)		NS			NS			NS	
cv at same PS		NS			NS			NS	

Table 25.3: Yield attributes and yield of wheat cultivars as influenced by different production systems under rainfed farming situation at Dharwad

Sorghum cultivars	Plant height (cm)			1000 Grain weight (g)			Grain yield (kg/ha)			Stover yield (kg/ha)			Harvest Index		
	Organic	Inorganic	Mean	Organic	Inorganic	Mean	Organic	Inorganic	Mean	Organic	Inorganic	Mean	Organic	Inorganic	Mean
BIJAGA YELLOW	79.1	70.4	74.8	45.1	45.0	45.0	1159	1161	1160	3002	2951	2976	0.28	0.29	
UAS 446	64.2	68.9	66.5	39.5	41.6	40.5	1208	1149	1179	2936	3148	3042	0.29	0.26	
DWR 2006	65.0	64.5	64.8	45.2	46.2	45.7	1214	1157	1186	2620	2762	2691	0.32	0.30	
UAS 347	57.4	59.6	58.5	41.4	42.2	41.8	1245	1172	1208	2411	2959	2685	0.34	0.29	
NIAW 1415	46.0	45.8	45.9	37.1	37.8	37.4	1339	1143	1241	2573	2978	2776	0.34	0.28	
Mean	62.3	61.8		41.6	42.5		1233	1156		2708	2960		0.32	0.28	
CD (P=0.05)															
Production System (PS)		NS			NS			NS			NS			o.097	
Wheat Cultivars (cv.)		NS			2.539			NS			546			0.039	
cv at same PS		7.32			NS			NS			NS			NS	

* Organic farming, *Inorganic:Conventional farming with the use of farm yard manure and inorganic fertilizers

grains weight (342.9 g) recorded in MABC 27 under organically grown chickpea varieties, and a non-significant difference was observed in management practices. Application of recommended rates of fertilizers along with farmyard manure (inorganically grown condition) produced higher seed yield of chickpea (2389 kg/ha) as compared to the production practices involving the application of organics (2197 kg/ha). Cultivar JAKI 9218 produced 4.24%, 5.25%, 15.74% and 19.03% higher seed yield over cultivars MABC 37 (2384 kg/ha), BGD 103 (2361 kg/ha), A1 (2147 kg/ha) and MABC 27 (2088 kg/ha), respectively. Reduction in seed yield of chickpea was found to be 8% under organic production management compare to inorganic situation (Table 25.1 & 2).

Wheat: Production practices involving the application of organic, produced higher grain yield of wheat (1233 kg/ha) as compared to the application of recommended rates of fertilizers along with farmyard (1156 kg/ha). Cultivar NIAW (Bread wheat) produced 2.73%, 4.64%, 5.26% and 6.98% higher seed yield over cultivars UAS 347 (Bread wheat) (1208 kg/ha), DWR 2006 (Durum wheat) (1186 kg/ha), UAS 446 (Durum wheat) (1179 kg/ha) and Bijaga yellow (Durum wheat) (1160 kg/ha), respectively (Table 25.3).

Performance of chickpea and wheat at Dharwad

Jabalpur

Evaluation of response of different varieties of rice and wheat crop for organic farming

Rice: Twelve varieties of rice were tested for their suitability under organic nutrient management. Significant difference among the varieties for yield and yield attributing parameters were recorded. Among the cultivars, the maximum grain yield was recorded with PS-3 (3525 kg/ha) followed by PS-5 (3450 kg/ha) because of higher number of effective tillers/m^2 13.0 and 12.7, panicle length 23.6 and 23.5 cm, grains/panicle 63.3 & 63.2 and plant height 81.2 and 76.7 cm respectively. Other varieties of rice recorded in range of effective tillers/m^2 8.6-11.5, panicle length 18.2-22.4 cm, grains/panicle 55.8-62.1 and plant height 68.3 and 75.0 cm. The lowest yield was recorded in BVD-109 (2563 kg/ha) owing to lower effective tillers/m^2 (8.2), grains/panicle (55.4) and harvest index 32.9% (Table 26.1).

Wheat: Twelve varieties of wheat were tested under organic nutrient management condition. Spike length, grains/spike and test weight recorded significantly superior in HW 2004 (11.8 cm, 49.4 and 46 g respectively) followed by HI-1500 (11.7 cm, 48.1 and 45.1g respectively) among the wheat varieties. Variation for other

Table26.1. Yield attributes and yield of rice varieties under organic farming at Jabalpur

Rice varieties	Plant height (cm)	Effective tillers / m²	Panicle length (cm)	Grains/ panicle	Test weight (g)	Sterility (%)	Grain yield (kg/ha)	Straw yield (kg/ha)	Harvest index
PS 5	76.7	12.7	23.5	63.2	21.5	12.3	3450	5310	39.4
Shehdri	71.5	8.8	19.4	56.3	25.0	17.3	2740	5090	35.0
PS 4	69.1	11.5	21.8	58.8	21.3	15.7	3010	4726	38.9
BVD 109	72.2	8.2	19.2	55.4	23.3	17.8	2563	5239	32.9
JR-201	74.7	11.5	22.4	56.6	24.5	17.4	2793	5216	34.9
Dhanteshwari	71.6	11.3	22.1	62.1	24.6	12.4	3418	4936	40.9
Madhuri	68.3	10.0	18.5	61.1	22.2	12.9	3325	4843	40.7
IR 36	64.6	8.6	18.1	60.8	24.5	13.7	3231	4676	40.9
MTU 1010	70.2	9.0	18.2	59.5	24.0	14.6	3120	4727	39.8
IR 64	75.0	8.7	18.2	58.5	24.1	16.2	2850	5150	35.6
Pusa basmati 1	68.5	10.4	19.7	55.8	22.1	17.7	2620	4784	35.4
PS 3	81.2	13.0	23.6	63.3	22.6	12.2	3525	5336	39.8
CD (P=0.5 %)	4.3	3.1	2.0	1.9	1.0	-	351	697	

Table 26.2. Yield attributes and yield of wheat varieties under organic farming at Jabalpur

Wheatvarieties	Plant height (cm)	Effective tillers / m²	Spike length (cm)	Grains/ spike	Test weight (g)	Grain yield (kg/ha)	Straw yield (kg/ha)	Harvest index
JW 17	72.8	529.5	11.2	45.3	45.1	3409	5006	40.5
JW 3020	74.9	525.4	10.7	43.7	45.0	3345	4359	43.4
JW 3173	74.2	586.9	8.7	39.1	42.4	3908	5181	43.0
JW 3269	73.9	506.3	9.8	38.8	43.7	3569	5399	39.8
JW 3288	73.5	529.2	10.8	41.1	44.8	3551	5294	40.2
HI 1531	74.1	525.7	10.3	41.8	42.5	3500	4948	41.4
HI 1500	74.6	467.5	11.7	48.1	44.8	3921	5115	43.4
C 306	73.3	528.6	11.1	45.2	43.1	3392	4470	43.1
HW 2004	74.6	531.8	11.8	49.4	46.0	3610	4855	42.7
HI 2987	74.1	386.9	10.4	41.8	42.3	3648	5020	42.1
HD 4672	73.4	553.3	10.0	42.6	44.9	3497	5337	39.6
HI 1418	75.5	429.0	10.7	41.7	44.0	3913	4945	44.2
CD (P=0.5 %)	1.2	9.9	0.6	2.8	0.7	213	136	

varieties of wheat was found to be in the range of spike length 8.7–11.1 cm, grains/spike 38.8-45.2 and test weight of wheat grains were in the range of 42.3–44.9. HI 1418 prod educed taller plant (75.5 cm while, JW 17 recorded smallest plant height (72.8cm) Significantly higher wheat yield was recorded with HI 1500 (3921 kg/ha) and found to be on par to HI 1418 (3913kg) and JW-3173 (3908 kg). These varieties are significantly superior over HI 2987 (3648 kg/ha), HW 2004 (3610 kg/ha), JW 3269 (3569 kg), JW 3288

(3551 kg), HI 1531 (3500 kg/ha), HD-4672 (3497 kg/ha), JW 17 (3409). JW 3020 recorded minimum grain and straw yield of wheat (3345 and 4359 kg/ha) (Table 26.2).

Rice equivalent yield, production efficiency, consumptive use of water, water productivity and economics of different varieties of rice and wheat: The total productivity of rice-wheat cropping systems under organic management in term of rice equivalent yield (REY) recorded maximum with Mdhuri (rice)-HI 1500(wheat) of 6367 kg/ha followed by JR 201 (rice)-JW 3288 (wheat) of 6258 kg/ha and PS(rice) -JW 3173(wheat) of 6136 kg/ha. Pusa 1-HD 4672 recorded minimum equivalent yield of 5124 kg/ha. Production efficiency refers to the total productivity per hectare per day under a particular variety in the system recorded with variety JR 201(rice) and JW 3288(wheat) of 27.57 and significant superior to all the varieties combinations except Madhuri & HI 1500, Dhanteshwari& HI 1531, and PS 3 & HI 1418. Other varieties of rice and wheat combinations were recorded for production efficiency in between 21.35 to 23.60 kg/ha/day and being on par to each other. Lowest 21.35 kg/ha/day was observed with PS 1 and HD 4672 of rice and wheat system. The varieties PS-5 and JW-17 of rice and wheat in system recorded highest consumptive use of water (244.4 cm/ha) and found significantly superior over to all other varieties in rice-wheat cropping system except, Madhumati-HI-1500, PS-4-JW-3173 with the production efficiency of 234.5 and 234.2 cm/ha, respectively. The lowest consumptive use of water was recorded with Danteshwari and HD 1531 of 204.1 cm/ha. Water productivity in term of water-use-efficiency (WUE) for the different varieties of rice-wheat cropping system was calculated. Significantly higher water productivity (30.1 kg/ha/cm) was recorded with the varieties Dhanteswari and HI 1531 closely followed by JR 201 and JW 3288 (29.9 kg/ha/cm) and Madhavi and HI 1500 (27.2 kg/ha/cm). Other varieties of rice and wheat in system mode recorded water productivity from 25.5 to 27.1 kg/ha/cm. The lowest water productivity recorded by the variety Pusa Basmati 1 and HD 4672 (22.6 kg/ha/cm) in the system (Table 26.3).

Table 26.3. Rice equivalent yield, production efficiency, consumptive use of water and water productivity under different varieties of rice and wheat under organic farming at Jabalpur

Rice (*Kharif*)	Wheat (*Rabi*)	Rice equivalent yield (kg/ha)	Production efficiency (kg/ha/day)	Consumptive use of water (cm/ha)	Water productivity (kg/ha/cm)
PS 5	JW 17	5722	22.0	244.4	23.4
Shehdri	JW 3020	5417	21.8	206.6	26.2
PS 4	JW 3173	6136	23.6	234.2	26.2
BVD 109	JW 3269	5418	24.9	209.8	25.8
JR – 201	JW 3288	6258	27.6	209.6	29.9
Dhanteshwari	HI 1531	6125	26.0	204.1	30.0
Madhuri	HI 1500	6367	26.2	234.5	27.2
IR 36	C 306	5833	23.2	229.0	25.5
MTU 1010	HW 2004	5738	22.8	221.9	25.9
IR 64	HI 2987	5538	22.7	210.8	26.3
Pusa 1	HD 4672	5124	21.4	227.2	22.6
PS 3	HI 1418	6133	25.5	226.2	27.1
CD (P=0.5 %)		452	2.2	12.6	3.4

Table 26.4. Economics of various different varieties of rice and wheat in cropping systems under organic farming at Jabalpur

Rice (*Kharif*)	Wheat (*Rabi*)	Gross return (Rs/ha/annum)	Cost of cultivation (Rs/ha)	Net return (Rs/ha/annum)	B:C ratio
PS 5	JW 17	171680	66000	105680	1.60
Shehdri	JW 3020	135400	66000	69400	1.05
PS 4	JW 3173	153410	66000	102460	1.55
BVD 109	JW 3269	135455	66000	69455	1.06
JR – 201	JW 3288	156470	66000	90470	1.37
Dhanteshwari	HI 1531	153125	66000	87125	1.45
Madhuri	HI 1500	159195	66000	93195	1.41
IR 36	C 306	145840	66000	79840	1.20
MTU 1010	HW 2004	143450	66000	77450	1.17
IR 64	HI 2987	138460	66000	72460	1.10
Pusa 1	HD 4672	153730	66000	87730	1.32
PS 3	HI 1418	184010	66000	118010	1.78

The maximum gross return of Rs. 1,81,010/ha/year, net return of Rs. 1,18,010/ha/year and B:C ratio of 1.78 were recorded with the variety PS-3 and HI-1418 followed by Madhuri and HI 1500 (GR 1,71,680, NR 1,05,680 and B:C ratio 1.6) in the system. The lowest gross return, net return and B:C ratio was recorded by the variety Shehdri and JW 3020 with Rs.1,35,400, Rs. 69,400 and 1.05 respectively (Table 26.4).

Effect of different varieties of rice and wheat on soil microbial properties: Changes the soil properties was observed over their initial status under all the treatment in rice-wheat system. The difference among

Table 26.5. Effect of different varieties of rice and wheat on soil properties at the end of cropping cycle in Jabalpur

Rice (*Kharif*)	Wheat (*Rabi*)	pH	EC (dS/m)	OC (g/kg)	Available nutrients (kg/ha)		
					N	P	K
PS 5	JW 17	7.25	0.36	7.1	266	12.3	298
Shehdri	JW 3020	7.24	0.35	7.2	266	13.1	299
PS 4	JW 3173	7.29	0.37	7.5	270	13.6	302
BVD 109	JW 3269	7.29	0.35	7.4	268	13.0	301
JR – 201	JW 3288	7.27	0.35	7.5	270	13.2	302
Dhanteshwari	HI 1531	7.31	0.36	7.4	269	13.0	302
Madhuri	HI 1500	7.25	0.36	7.2	266	12.7	300
IR 36	C 306	7.37	0.37	7.3	267	12.8	300
MTU 1010	HW 2004	7.28	0.35	7.3	267	12.6	300
IR 64	HI 2987	7.27	0.37	7.3	267	12.9	302
Pusa 1	HD 4672	7.28	0.37	7.4	268	13.0	301
PS 3	HI 1418	7.25	0.37	7.5	270	13.3	302
CD (P=0.5 %)		0.03	0.01	0.09	1.21	0.97	2.01

the varieties in respect of physical and chemical properties found to be significant. Maximum organic carbon content (7.5%) in the soil was found to be with rice (JR-201)-wheat (JW-3288), PS4-JW 3173 and PS 3 – HI 1418 in the system and lowest was with PS5 – JW 17 of 7.1 g/kg in the system. Available N, P and K follow the same trend as organic carbon.

Table 26.6. Effect of microbial changes in soil under different varieties of rice and wheat at Jabalpur

Rice (*Kharif*)	Wheat (*Rabi*)	Fungi (10^4/gcfu)	Bacteria (10^6/gcfu)	AZB (10^6/gcfu)	PSB (10^6/gcfu)	ACT (10^4/gcfu)
PS 5	JW 17	35.5	48.0	24.8	16.4	15.3
Shehdri	JW 3020	33.3	45.2	26.3	15.6	14.3
PS 4	JW 3173	32.5	47.0	26.5	16.3	15.0
BVD 109	JW 3269	34.6	47.9	24.3	15.6	16.0
JR – 201	JW 3288	36.2	46.3	27.0	16.2	15.3
Dhanteshwari	HI 1531	33.7	45.4	25.2	15.9	14.8
Madhuri	HI 1500	34.5	46.8	25.9	15.1	14.8
IR 36	C 306	35.7	46.4	25.7	15.7	15.0
MTU 1010	HW 2004	34.3	46.1	26.1	14.8	20.6
IR 64	HI 2987	36.7	46.8	27.5	15.8	15.2
Pusa 1	HD 4672	32.9	44.3	25.7	15.8	15.0
PS 3	HI 1418	33.1	46.3	25.4	15.2	14.7
CD (P=0.5 %)		1.1	0.9	0.9	0.1	2.3

Among the varieties grown in *kharif* and *rabi* in rice-wheat system, significantly higher fungi (36.7 x10^4/g cfu) and azatobacter (27.5 x10^6/g cfu) was recorded in rice (IR 64)-wheat (HI 2987). Bacteria and PSB was found to be higher in rice (PS-5)-wheat (JW 17) of 48.0 and 16.4 x10^6/g cfu). Cropping system rice (MTU-1010)-wheat (HW-2004) retained significantly higher Actinomycets 20.6 10^6/g cfu while lower was with rice (Shehdri)-wheat (JW 3020) system (14.15x10^6/g cfu) (Table 26.5 & 26.6).

Karjat

Evaluation of response of different varieties of rice and groundnut under rice-groundnut system: 15 varieties of rice including 4 early, 4 mid late, 4 late and 3 popularly varieties grown by the farmers were evaluated during *kharif* season and 15 varieties of groundnut also evaluated during *rabi* season in the system mode under organic management.

Rice: Significantly higher plant height (106.3 cm), number of tillers hill^{-1} (20.2), effective tillers hill^{-1}(18.7), grain yield (6390 kg/ha) and straw yield (6924 kg/ha) was recorded by Sahyadri-4 under early sown conditions. Sahyadri-3 outperformed better under mid-late sown condition with the yield of 6573 kg/ha owing to the higher number of tillers hill^{-1} (23.5), effective tillers hill^{-1}(21.6), and panicle length (23.3 cm). Variety sahyadri-5 (6665 and 7076 kg/ha) recorded maximum grain and straw yield among rice varieties. Sahyadri-3 and 5 produced 11 and 12.6% more grain yield than variety Jaya grown by the farmers. Karjat-4 (3897 kg/ha) produced significantly Lower grain yield among the rice varieties (Table 27.1).

Table 27.1. Evaluation of response of different varieties of rice on yield attributes and yields in rice-groundnut system under organic management at Karjat

Duration	Rice varieties / hybrids	Plant Height (cm)	No. of tillers hill^{-1}	Effective tillers hill^{-1}	Panicle Length (cm)	Grain Yield (kg ha^{-1})	Straw Yield (kg ha^{-1})
Early	Karjat – 4	79.0	15.0	12.7	16.9	3897	4599
	Karjat-7	95.4	17.8	16.1	22.0	5140	5535
	Ratnagiri-1	104.1	16.1	14.3	18.2	4889	4683
	Sahyadri-4	106.3	20.0	18.7	19.8	6390	6924
Mid-late	Karjat-5	115.3	15.2	14.2	20.7	5952	7413
	Karjat-6	96.3	15.1	13.6	17.9	4468	5686
	Palghar-1	85.2	15.9	14.3	21.6	4606	6773
	Sahyadri-3	117.9	23.5	21.6	23.3	6573	7024
Late	Ratnagiri-2	111.4	15.2	13.4	25.4	5527	5770
	Ratnagiri-3	103.4	17.1	16.0	23.2	5385	6522
	Karjat-8	114.7	18.9	17.9	21.5	4819	6404
	Sahyadri-5	102.1	24.4	22.9	21.3	6665	7076
Grown by	Karjat-3	96.9	17.8	16.3	22.3	5740	6355
farmers	Jaya	109.1	17.7	15.9	21.8	5919	7111
	Karjat-2	101.6	16.3	15.0	21.9	5173	6104
	CD(*P=0.05*)	5.40	1.34	1.80	1.41	581	711

Table 27.2. Evaluation of response of different varieties of groundnut on yield attributes and yields in rice-groundnut system under organic management at Karjat

Groundnut varieties/hybrids	Plant Height(cm)	Yield dry pods (kg/ ha)	Haulm weight (kg/ ha)
Phule-6021	40.1	2592	3552
SB XI	38.7	2141	3897
Western-44	37.3	2331	3301
Western-66	41.9	2912	3713
TAG-24	35.8	2892	3628
TKG-Bold	42.6	2752	3957
Kopergaon-1	36.8	2201	3211
Phule Pragati (JL-24)	29.1	2171	3986
JL-220	47.5	2098	3376
JL-776	47.1	3042	3350
JL-501	38.1	2418	3275
TG-37 A	43.3	2151	3229
TG-26	40.7	2622	3912
Konkan Gaurav	36.5	3172	3972
RHRG-6083	44.6	2505	3278
CD(*P=0.05*)	4.85	286	527

Table 27.3. Response of different varieties of rice and groundnut in rice-groundnut system on system equivalent yield and economics under organic management at Karjat

Rice	Groundnut	System equivalent yield (kg ha^{-1})	Gross returns (Rs. ha^{-1})	Cost of cultivation (Rs. ha^{-1})	Net returns (Rs. ha^{-1})	B:C ratio
Karjat - 4	Phule-6021	22538	317783	158272	159511	2.01
Karjat-7	SB XI	21567	304095	158272	145823	1.92
Ratnagiri-1	Western-44	21996	310140	158272	151868	1.96
Sahyadri-4	Western-66	28171	397205	158272	238933	2.51
Karjat-5	TAG-24	27344	385545	158272	227273	2.44
Karjat-6	TKG-Bold	24530	345875	158272	187603	2.19
Palghar-1	Kopergaon-1	21352	301066	158272	142794	1.9
Sahyadri-3	Phule Pragati (JL-24)	23876	336658	158272	178386	2.13
Ratnagiri-2	JL-220	21550	303849	158272	145577	1.92
Ratnagiri-3	JL-776	27360	385772	158272	227500	2.44
Karjat-8	JL-501	22917	323126	158272	164854	2.04
Sahyadri-5	TG-37 A	23744	334786	158272	176514	2.12
Karjat-3	TG-26	25264	356228	158272	197956	2.25
Jaya	Konkan Gaurav	29049	409585	158272	251313	2.59
Karjat-2	RHRG-6083	23858	336392	158272	178120	2.13
CD (*P=0.05*)		2030	28616		28616	0.18

Table 27.4. Response of different varieties of rice and groundnut in rice-groundnut system on physical and chemical properties of soil after end of cropping cycle under organic management at Karjat

Rice	Groundnut	Soil pH	Soil EC (dSM^{-1})	Organic carbon (%)	Available Nitrogen (kg ha^{-1})	Available P_2O_5 (kg ha^{-1})	Available K_2O (kg ha^{-1})
Karjat - 4	Phule-6021	6.77	0.292	1.28	259.16	21.97	381.25
Karjat-7	SB XI	6.82	0.294	1.30	250.80	22.22	369.60
Ratnagiri-1	Western-44	7.09	0.305	1.38	250.80	23.99	369.60
Sahyadri-4	Western-66	7.26	0.312	1.43	250.80	25.29	369.60
Karjat-5	TAG-24	7.24	0.311	1.41	259.16	25.00	381.25
Karjat-6	TKG-Bold	6.88	0.297	1.31	259.16	22.47	380.80
Palghar-1	Kopergaon-1	6.98	0.301	1.33	250.80	23.23	369.60
Sahyadri-3	Phule Pragati (JL-24)	7.29	0.314	1.44	263.34	25.55	387.07
Ratnagiri-2	JL-220	7.05	0.304	1.36	259.16	23.49	381.25
Ratnagiri-3	JL-776	7.06	0.304	1.36	267.52	23.49	392.45
Karjat-8	JL-501	6.88	0.297	1.31	250.80	22.47	369.60
Sahyadri-5	TG-37 A	7.31	0.315	1.45	263.34	26.07	387.07
Karjat-3	TG-26	7.17	0.309	1.39	284.24	24.24	414.40
Jaya	Konkan Gaurav	7.19	0.310	1.40	288.42	24.50	420.67
Karjat-2	RHRG-6083	6.91	0.298	1.32	280.06	23.23	409.02
CD (*P=0.05*)			0.39	NS	0.09	22.09	2.12
29.59							

Ground nut: Groundnut variety, JL220 attained significantly maximum plant height (47.5 cm) followed by JL 776 (47.2 cm), RHRG6083 (44.6 cm) and TG 37A (43.3 cm) and they were on par to each other whereas Phule Pragati was recorded the shortest variety (29.1 cm). Significantly higher pods yield (3172 kg/ha) recorded in Konkan Gaurav followed by JL 776, TG 26, Western 66 and TAG 24 which is statistically at par to each other. The range other varieties of groundnut recorded from 2098 tyo 2752 kg/ha. JL 220 produced lower yield (2098 kg/ha) among the varieties. Haulm weight (3986 kg/ha) was recorded higher in Phule Pragati over rest of the varieties (Table 27.2).

System equivalent yield and economics: Cropping system variety Jaya (rice) in *kharif* and Konkan Gaurav (groundnut) in *rabi* recorded significantly higher system equivalent yield (REY 29049 kg/ha), net return (Rs. 2,51,313/ha) and net return per rupees invested (2.59) compared to other varieties evaluated in the system and were statistically on par with Jaya-Konkan gaurav, Sahyadri 4-western-66, Ratnagiri 3-JL-776 and Karjat 5- TAG 24. Lowest system equivalent yield and net return was recorded in rice (palghar-1) - groundnut (kopergaon-1) of 21352 kg/ha and Rs. 1,42,794/ha respectively. The variation of systems equivalent yield in other varieties of rice and groundnut in systems ranged from 21550-25264 kg/ha similarly, in net return (Rs./ha) was from Rs. 1,45,577 to 1,97,956/ha (Table 27.3 & 27.4).

Ludhiana

Evaluation of response of different varieties of rice and wheat under rice-wheat system: Ten varieties of rice and twelve of wheat were evaluated in rice-wheat system for their suitability under organic management. All the varieties of rice and wheat were grown under similar nutrient source and doses.

Basmati rice: Basmati rice variety AVT 1 BT 2502 attained maximum plant height (193.7 cm) and 1000 grain weight (38.2 g). Punjab basmati 2 recorded 129.3 cm plant height among the other varieties. Lowest plant height was recorded by 6001 (90.0 cm) while grains weight was lowest in RYT 3404 (29.6 g). Number of effective tillers was observed in range from 270 to 359 as lowest in AVT1BT2507 to as highest in Ent-6001. The variation in panicle length is ranging from 17 cm to 25.3 cm was recorded among the rice

Table 28.1. Performance of basmati rice varieties/hybrids under organic management in rice-wheat system 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 (kg/ha)	Harvest index
RYT 3382	95.7	303	21.4	60.8	31.3	4720	7603	0.38
Punjab Basmati 2	129.3	280	25.3	58.2	30.9	3607	6300	0.36
Punjab Basmati 3	108.6	314	24.7	58.2	30.1	4717	8292	0.36
RYT 3390	90.7	333	21.0	48.1	32.0	4547	6533	0.41
6001	90.0	359	20.4	51.9	31.7	5063	7113	0.42
Punjab Basmati 1121	98.3	333	24.0	52.9	32.1	4833	6977	0.41
PPB 1509	106.1	287	22.8	67.1	31.8	4837	8270	0.37
RYT 3404	110.1	344	22.1	51.2	29.6	4554	7664	0.37
AVT 1 BT 2502	193.7	280	22.2	59.3	38.2	4020	6370	0.39
AVT 1 BT 2507	116.3	270	17.0	66.5	36.9	5653	8838	0.39
CD (P=0.05)								

Table 28.2. Performance of wheat varieties/hybrids under organic management in rice-wheat system at Ludhiana

Wheat varieties/ hybrids	Plant height (cm)	Effective tillers / m^2	Spike length (cm)	Grains/ spike	1000 grain weight (g)	Grain yield (kg/ha)	Straw yield (kg/ha)	Harvest index
PBW 702	85.0	270	7.8	30.7	42.1	3472	4163	0.45
PBW 706	81.8	177	8.9	39.0	44.9	3000	3748	0.44
PBW 621	74.1	288	7.3	32.3	38.4	3597	4453	0.45
PBW 644	88.9	205	8.6	39.7	44.1	3430	4540	0.43
PBW 175	77.1	212	8.5	42.5	39.8	3528	4430	0.44
BWL-4440	87.6	193	8.4	39.1	44.8	3472	4363	0.44
BWL -0134	87.5	180	8.3	45.8	42.1	3469	4587	0.43
BWL-1940	92.4	262	8.8	28.8	44.3	3384	4138	0.45
PBW658	70.3	237	8.4	31.8	39.6	2993	4196	0.42
BWL- 720	89.1	277	8.0	34.6	39.2	3750	4707	0.44
C-306	107.4	197	7.9	36.1	45.0	3097	4458	0.41
PBW 660	85.3	190	7.8	38.3	40.5	2847	4117	0.41
CD (P=0.05)								

varieties. The highest number of grains/panicle (67.1) recorded with variety Punjab Pusa basmati-1592 and it was significantly higher than all other varieties except AVT1BT2507 and RYT 23382. The lowest number of grains/panicle was in RYT 3390 (48.1) and it was statistically on par with RYT 3304. Grain yield of basmati rice varied from 3607-5653 kg/ha with a maximum variation of 56.7%. Basmati rice variety AVT 1 BT 2507 outperformed significantly higher grain yield of 5653 kg/ha followed by Ent-6001 (5063 kg/ha) while, Pusa Basmati-2 recorded lowest grain yield (3607 kg/ha). Straw yield followed the similar trend among all the varieties (Table 28.1).

Wheat: Among the varieties, maximum height was found to be for C-306 (107.4 cm) and minimum in PBW-658 (70.3 cm). The highest number of effective tillers (288) was observed in PBW followed by BWL-720 and PBW 702 which were statistically at par. The lowest number of effective tillers/m^2 was in PBW-706 (177). Spike length recorded significantly higher (8.9 cm) in PBW 7.6 than other varieties followed by BWL 1940 (8.8 cm), PBW 644 (8.6 cm) BWL-0134 (8.5 cm).and found significant. Variation in thousand-grain weight per spike was recorded in range from 38.4 (g) in PBW 621 to 45.0 g in C306 and did not differ significantly. Significant higher grain yield of wheat (3750 kg/ha) was observed in BWL -720 was significantly higher than the other varieties of wheat which were statistically at par among themselves. The lowest grain yield was recorded with PBW 660 (2847 kg/ha). Highest straw yield recorded in BWL720 (4707 kg/ha) whereas harvest index (0.45%) was found to be higher in PBW 621 PBW 702 and BWL1940, while lower straw yield was produced by PBW 706 (3748 kg/ha) however, C306 and PBW-660 recoded lowest harvest index of 0.41% (Table 28.2).

Performance of different wheat varieties under organic management at Ludhiana

Modipuram

Evaluation of response of different varieties of maize and mustard crops for organic farming during *kharif* and *rabi*

Twelve promising varieties of maize and mustard in maize-mustard system were evaluated under similar nutrient source and doses under organic condition.

Maize: Significant variation among the varieties for all the traits was observed. The variety PMH-1 recorded the tallest plant (240.7 cm) and it was statistically on par with Bio-9637, HQPM-1 and HQPM-5 (236.5, 232.7 and 232 cm respectively). Shorter plant were observed Vivek QPM-9 (187.7 cm) however, dry matter plant^{-1} was recorded significantly higher in PMH-4 (178.7g) followed by PMH-1 and HQPM-1 while lowest was recorded in Vivek QPM-9 (82g). Number of cobs/plants was recorded significantly higher with PMH-3 (1.43) followed by HQPM-5 whereas lowest plant height was recorded in PMH-1 (0.97). Maximum cob length was observed in Seed tech-2324 (24.4 cm) followed by HQPM-1 and Prakash. Cob girth and grains/row was observed in range from 17.1 cm -13.8 cm and 41.6 – 32.4. Among the varieties, maximum 1000-grains weight was recorded in Seed tech-2324 followed by PMH-4 whereas Prakash registered lower 1000-grans weight of 233.3g. Grain and stover yield was significantly varied among the different varieties of maize and higher grain and stover yield was found to be in PMH-3 (8600 kg/ha respectively) followed by PMH-4 (8083 kg/ha) and seed tech-2324 (7517 kg/ha) while lowest yield and stover yield recorded in Vivek QPM-9 (5116 kg/ha). Gross return, net returns and net return per rupee invested was recorded higher with PMH-3 of Rs. 1,42,442, Rs.90,467 ha^{-1} and 1.74 respectively followed by PMH-4 and seed tech-2324 (Table 29.1 & 29.2).

Mustard: The differences for all measured variable among the varieties was observed to be significant for mustard crop. Among the varieties, maximum plant height was recorded with NRCDR-02 (183 cm) but statistically at par with RGN- 229, DRMRIJ-31 and Pusa mustard-25 and minimum was with Pusa bold (155.0 cm) however, Pusa bold recorded significantly higher dry matter /plant (66.8g) followed by RGN-229, Urvashi, NRCHB- 506 which were on par to each other, minimum dry matter/plant observed in Pusa mustard-25 (51.1g). Main branches/plant were found higher in 'RGN 48' (6.33) variety and the lowest was in 'Pusa Mustard 26. The number of secondary branches was higher with Pusa Mustard-25 (21.3) and lowest was with DRMRIJ-31 (10.7). Number of siliqua/plant was found to be significantly higher with NRCHB-506 (410.6) followed by RGN-48 and Pusa Tarak. while, grains/siliqua was found to be higher in RH-0406 (15.1) followed by pusa mustard-25 and DRMRIJ- 31 which was statistically at par. DRMRIJ- 31 produced maximum 1000-granis weight of 7.0g and Pusa Mustard-25 produced minimum grains weight for 1000-grains. Among the mustard varieties, significantly higher grain yield was recorded with RGN-229 (1975 kg/ha) and it was statistically at par with Pusa Bold. Variety Pusa Tarak gave minimum yield of 1567 kg/ha. The yield of RGN-229 was found to be 26.4% higher than lowest yielded variety. Maximum gross, net return and net return per rupee invested was recorded with RGN-229 (Rs. 82,504, 45,284/ha and 1.22 followed by RH-0406 with Rs 44,446 as net return and 1.19 of BC ratio. Varieties Urvashi, NRCHB-506 and Pusa Bold also gave good returns and net return per rupee invested than the rest of other varieties. DRMRIJ- 31 recorded lowest gross, net return and B:C ratio of Rs. 64076, Rs.26856 and 0.72 respectively (Table 29.3 & 29.4).

Table 29.1. Growth parameter, yield attributes, yield and harvest index of maize cultivars in maize –mustard systems under organic management at Modipuram

Maize varieties/ hybrids	Plant height (cm)	Dry matter/ plant (g)	Cobs/ plant	Cob length (cm)	Cob girth (cm)	Grain rows/ cob	Grains/ row	1000 grain wt. (g)	Grain yield (kg/ha)	Straw yield (kg/ha)	Harvest Index (%)
Prakash	199.0	111.1	1.20	21.0	15.3	13.4	39.5	233.3	7150	8973	0.44
Seed tech- 2324	227.2	145.4	1.30	24.4	16.2	13.7	37.2	334.0	7517	9277	0.45
PMH -1	240.7	161.1	0.97	20.7	16.1	14.3	37.2	262.0	6783	8533	0.44
PMH -3	226.3	101.1	1.43	19.9	13.8	15.3	41.6	244.0	8600	10290	0.46
PMH -4	197.9	178.7	1.03	20.5	15.4	13.5	39.4	295.7	8083	8570	0.49
PMH -5	204.3	153.1	1.13	17.4	14.7	15.5	32.4	258.0	7096	8657	0.45
HQPM-5	232.7	127.0	1.40	20.3	15.1	13.8	33.7	270.7	5848	8590	0.41
HQPM-1	232.0	161.4	1.27	21.5	17.1	15.4	38.8	241.3	5621	7187	0.44
Bio- 9681	225.7	118.5	1.23	20.3	15.8	15.4	36.3	263.3	6380	6967	0.48
Bio- 9637	236.5	141.9	1.03	20.8	16.4	14.2	34.9	293.0	6724	8920	0.43
Vivek hybrid- 9	192.0	95.7	1.20	20.8	16.3	15.6	38.1	238.0	5534	6600	0.46
Vivek QPM- 9	187.7	82.0	1.07	19.2	15.9	14.2	32.5	240.0	5116	6000	0.46
CD (p=0.05)	8.09	13.28	0.24	2.86	1.55	1.39	3.72	5.12	203	579	

Table 29.2. Economics of different of maize cultivars under organic management at Modipuram

Maize varieties/ hybrids	Gross return (Rs/ha/annum)	Cost of cultivation (Rs/ha/annum)	Net returns (Rs/ha/annum)	B:C ratio
Prakash	51975	118426	66451	1.28
Seed tech- 2324	51975	124504	72529	1.40
PMH -1	51975	112347	60372	1.16
PMH -3	51975	142442	90467	1.74
PMH -4	51975	133879	81904	1.58
PMH -5	51975	117531	65556	1.26
HQPM-5	51975	96860	44885	0.86
HQPM-1	51975	93101	41126	0.79
Bio- 9681	51975	105672	53697	1.03
Bio- 9637	51975	111370	59395	1.14
Vivek hybrid- 9	51975	91660	39685	0.76
Vivek QPM- 9	51975	84736	32761	0.63

Evaluation of qualities of grain and popcorn maize varieties under organic farming

Twelve maize varieties for grain and six popcorn maize varieties were grown under organic farming system for evaluation of different qualities viz., reducing sugar, non-reducing sugar, total sugar, starch and oil content. In case of different qualities among the varieties, each quality was found highly significant ($P \leq 0.001$). Among the different varieties of maize grown, the maximum reducing sugar (1.73 mg/g) was recorded in maize variety, PMH-3 whereas, the minimum reducing sugar (0.14 mg/g) was recorded in popcorn maize variety (P4). In case of non-reducing sugar, the maximum (51.4mg/g) and minimum (16.9mg/

Table 29.3. Growth parameter, yield attributes, yield and harvest index of mustard cultivars in maize –mustard systems under organic farming at Modipuram

Mustard varieties/ hybrids	Plant height (cm)	Dry matter/ plant (g)	Primary Branches/ plant	Secondary Branches/ plant	No. of siliqua/ plant	Grains/ siliqua	1000 grain wt. (g)	Seed yield (kg/ha)	Stover yield (kg/ha)	Harvest Index
DRMRIJ- 31	180.3	57.3	5.7	10.7	251.1	14.1	7.0	1725	6560	0.21
NRCDR- 02	183.0	55.0	5.4	15.2	313.8	13.5	6.0	1683	6009	0.22
NRCHB- 101	174.2	51.6	5.7	14.1	326.9	12.8	5.4	1608	5545	0.22
NRCHB- 506	178.2	63.0	6.2	18.5	410.6	11.9	5.2	1733	7184	0.19
Pusa Mustard-25 (NPJ-112)	180.3	51.1	5.7	21.3	330.4	12.5	4.2	1575	5472	0.22
Pusa Mustard-26 (NPJ-113)	168.2	52.0	5.1	16.6	240.9	14.5	4.9	1717	5528	0.24
Pusa Tarak	164.6	53.3	6.1	20.6	353.8	12.5	5.9	1567	5855	0.21
RH- 0406	173.8	61.3	5.6	14.6	325.4	15.1	5.7	1675	6808	0.20
RGN- 229	182.2	64.8	5.4	20.4	282.8	11.7	5.3	1975	7382	0.21
RGN- 48	163.9	60.8	6.3	18.0	396.0	13.3	6.1	1767	6848	0.21
Urvashi	169.6	64.4	5.2	17.0	235.0	13.5	5.6	1625	7355	0.18
Pusa Bold	155.3	66.8	5.8	18.0	326.8	12.4	6.5	1917	7813	0.20
CD (P=0.05)	4.09	1.42	0.18	0.96	45.46	1.85	0.34	203	547	

Table 29.4. Economics of different of mustard cultivars under organic management at Modipuram

Mustard varieties/hybrids	Gross return (Rs/ha)	Cost of cultivation(Rs/ha)	Net returns (Rs/ha)	B:C ratio
DRMRIJ- 31	37220	64076	26856	0.72
NRCDR- 02	37220	73290	36070	0.97
NRCHB- 101	37220	69102	31882	0.86
NRCHB- 506	37220	79991	42771	1.15
Pusa Mustard-25 (NPJ-112)	37220	69102	31882	0.86
Pusa Mustard-26 (NPJ-113)	37220	69940	32720	0.88
Pusa Tarak	37220	65752	28532	0.77
RH- 0406	37220	81666	44446	1.19
RGN- 229	37220	82504	45284	1.22
RGN- 48	37220	76640	39420	1.06
Urvashi	37220	79991	42771	1.15
Pusa Bold	37220	78316	41096	1.10

g) were recorded in popcorn variety P5 and P6 respectively. Similarly, in case of total sugar content, the maximum (53.0mg/g) and minimum (17.1mg/g) were recorded in popcorn maize variety P5 and P6 respectively. However, the maximum starch content (79.8mg/100g) was recorded in maize variety, Vivek QPM-9 while, the minimum (57.2mg/100g) was recorded in popcorn maize variety P5. Among different maize variety evaluated, the maximum oil content (5.32%) was recorded in MH-1 while, the minimum (2.65%) was recorded in popcorn maize variety P6 (Table 29.5).

Table 29.5. Sugar, starch and oil content of different maize varieties and popcorn grown under organic system

Variety	Reducing Sugar (mg/g) ±SE	Non reducing Sugar (mg/g)±SE	Total Sugar (mg/g)±SE	Starch (g/100g)±SE	Oil (%) ±SE
Parkash	0.56±0.01	41.7±0.11	42.3±0.16	71.6±0.18	3.76±0.01
Seed Tech-2324	0.58±0.02	20.6±0.56	21.1±0.87	74.6±0.47	3.04±0.01
PMH-1	0.89±0.03	49.3±0.19	50.2±0.28	74.3±0.09	5.32±0.02
PMH-3	1.73±0.05	42.5±0.09	44.2±0.10	73.6±0.09	3.07±0.00
PMH-4	0.49±0.02	46.9±0.29	47.4±0.48	63.5±0.25	3.19±0.00
PMH-5	0.67±0.02	50.6±0.11	51.3±0.16	74.5±0.38	4.23±0.02
HQPM-5	1.23±0.03	39.4±0.12	40.7±0.17	75.5±0.43	4.17±0.00
HQPM-1	0.74±0.02	42.5±0.11	43.2±0.19	68.3±0.31	3.33±0.00
BIO-9681	1.08±0.04	35.0±0.09	36.1±0.14	75.2±0.29	4.51±0.00
BIO-9637	0.76±0.03	41.8±0.41	42.6±0.63	73.3±0.18	3.95±0.00
Vivek Hybrid-9	0.76±0.01	24.7±0.39	25.4±0.62	71.2±0.25	3.93±0.02
Vivek QPM-9	0.95±0.02	17.3±0.72	18.2±1.15	79.8±0.06	5.18±0.01
		Popcorn			
P1	0.72±0.01	27.6±0.21	28.3±0.34	76.5±0.41	3.41±0.23
P2	0.72±0.01	29.3±0.09	30.1±0.14	60.9±0.12	3.18±0.00
P3	0.61±0.01	22.7±0.23	23.3±0.37	59.9±0.12	2.92±0.00
P4	0.14±0.01	32.9±0.17	33.1±0.28	74.7±0.77	2.95±0.00
P5	1.58±0.01	51.4±0.09	53.0±0.14	57.2±0.72	3.54±0.00
P6	0.25±0.01	16.9±0.23	17.1±0.38	62.5±0.12	2.65±0.00
P (0.05)	0.000	0.000	0.000	0.000	0.000

P1 100 kg N (50kg FYM + 50 kg Vermy Compost)
P2 75 kg N (37.5 kg FYM+ 37.5 kg Azotobactor PSB, Trchoderma, Neemcake & Panchgavya
P3 100 kg N (25 kg FYM + 25 VC + 50 kg Ferti + Azotobactor PSB, trichoderma, Neemcake
P4 100 kg N (37.5 kg FYM + 37.5 kg VC + 25 kf Ferti Azotobactor PSB, trichoderma, Neemcake
P5 100:60:40 kg NPK through Ferti
P6 100:60:40 kg NPK through Feri + 10 t FYM

Table 29.6. Protein, methionine, phenol, lysine and tryptophan content of different maize varieties and popcorn grown under organic system

Variety	Protein (%)±SE	Methionine (%)±SE	Phenol (%)±SE	Lysine (%)±SE	Tryptophan (%)±SE
Parkash	11.62±1.76	0.18±0.00	0.18±0.01	25.87±0.08	0.17±0.01
Seed Tech-2324	9.06±1.11	0.21±0.03	0.12±0.03	32.63±0.07	0.60±0.13
PMH-1	11.73±0.65	0.19±0.00	0.16±0.02	29.42±0.05	0.36±0.06
PMH-3	10.50±0.22	0.16±0.02	0.17±0.03	21.45±0.10	0.55±0.03
PMH-4	11.93±0.48	0.21±0.02	0.16±0.02	26.07±0.16	0.77±0.04
PMH-5	11.73±0.70	0.16±0.01	0.17±0.02	6.86±0.16	0.45±0.05
HQPM-5	9.81±0.29	0.15±0.01	0.14±0.03	7.43±0.15	0.34±0.03
HQPM-1	13.98±1.93	0.20±0.02	0.12±0.01	23.76±0.22	0.47±0.06
BIO-9681	10.14±1.62	0.21±0.01	0.07±0.02	17.71±0.07	0.62±0.01
BIO-9637	12.54±0.05	0.21±0.01	0.11±0.01	24.77±0.24	0.60±0.02
Vivek Hybrid-9	11.16±0.62	0.17±0.01	0.08±0.01	22.43±0.16	0.72±0.01
Vivek QPM-9	7.28±0.34	0.17±0.01	0.11±0.03	22.52±0.13	0.58±0.03
		Popcorn			
P1	12.87±1.25	0.35±0.00	0.13±0.01	5.07±0.08	0.48±0.03
P2	12.18±0.73	0.27±0.01	0.12±0.01	18.22±0.05	0.25±0.02
P3	11.95±0.29	0.29±0.03	0.11±0.00	25.10±0.16	0.39±0.02
P4	10.16±0.32	0.25±0.02	0.21±0.03	19.57±0.05	0.41±0.01
P5	13.48±0.06	0.25±0.01	0.14±0.01	10.13±0.12	0.32±0.02
P6	12.08±0.41	0.20±0.03	0.06±0.02	7.11±0.11	0.40±0.01
P (0.05)	0.002	0.000	0.028	0.000	0.000

P1 100 kg N (50kg FYM + 50 kg Vermy Compost)
P2 75 kg N (37.5 kg FYM+ 37.5 kg Azotobactor PSB, Trchoderma, Neemcake & Panchgavya
P3 100 kg N (25 kg FYM + 25 VC + 50 kg Ferti + Azotobactor PSB, trichoderma, Neemcake
P4 100 kg N (37.5 kg FYM + 37.5 kg VC + 25 kf Ferti Azotobactor PSB, trichoderma, Neemcake
P5 100:60:40 kg NPK through Ferti
P6 100:60:40 kg NPK through Feri + 10 t FYM

Protein, methionine, phenol, lysine and tryptophan content were also evaluated and presented in Table 29.6. In case of different qualities among the varieties, methionine, lysine and tryptophan were found highly significant (P≤0.001), however, protein and phenol was found significant (Pd"0.05). Among the different varieties of maize grown, the maximum protein (13.98%) was recorded in maize variety, HQPM-1 whereas; the minimum protein (7.28%) was recorded in Vivek QPM-9. In case of methionine, the maximum (0.35%) and minimum (0.15%) were recorded in popcorn maize variety P1 and maize variety, HQPM-5 respectively. In case of phenol content, the maximum (0.21%) and minimum (0.06%) were recorded in popcorn maize variety P4 and P6 respectively (Table 2). However, the maximum lysine content (32.63%) was recorded in maize variety, Seed Tech-2324 while, the minimum (5.07%) was recorded in popcorn maize variety P1. Among different maize variety evaluated, the maximum tryptophan content (0.77%) was recorded in maize variety PMH-4 while, the minimum (0.17%) was recorded in maize variety Parkash (Table 29.5).

Performance of maize and mustard crop under organic management at Modipuram

Pantnagar

Evaluation of rice (fine and coarse grain) and wheat varieties under organic cultivation: 14 varieties of rice including seven coarse grain and seven fine grain basmati rice varieties during kharif and fourteen varieties of wheat in rabi were evaluated under similar organic nutrient inputs and doses.

Rice: Plant height at harvest and grain weight per panicle (g) of rice showed significant variation among different rice varieties. Plant height of different coarse grain varieties ranged from 103 to 110 cm and fine grain basmati rice varieties ranged from 99 to 132 cm. Maximum plat height of rice recorded among coarse grain & fine grain were PD-18 & Taraori, respectively. Among coarse grain varieties, significantly higher number of effective tillers/m^2 was in PD-19 and UPR-3425-11-1-10 (265), whereas among fine grain rice varieties, highest number of effective tillers/m^2 was 260 in Pant Basmati-1. Grain weight/panicle ranges among the different course and fine grain varieties were 2.52-2.66g and 2.07-2.16g respectively. Significantly higher grain weight/panicle among coarse grain rice varieties were observed in NDR-359 (2.66g) being at par with PD-18 (2.63g), however, significantly higher grain weight/panicle of fine grain rice varieties was observed in Pant Basmati-1(2.16g) and at par with UPR-3488621 (Table 30.1).

1000-grains weight, grain yield, straw yield & harvest index showed significant variation among different rice varieties. 1000-grain weight of different coarse grain rice varieties ranged from 24.4 to 30.7g and of fine grain varieties ranged from 20.4 to 22.2 g. Significantly higher test weight of coarse grain rice varieties

Table 30.1. Response for yield attributes, yield, harvest index and N, P, K & S uptake of rice varieties/hybrids in rice-wheat system under organic management at Pantnagar

Rice varieties/ hybrids	Plant height (cm)	Effective tillers/ m^2	Grain weight / panicle (g)	1000 grain weight (g)	Grain yield (kg/ha)	Straw yield (kg/ha)	Harvest Index	Total N uptake (kg/ha)	Total P uptake (kg/ha)	Total K uptake (kg/ha)	Total S uptake (kg/ha)
Coarse grain											
Pant dhan-4	103	264	2.55	30.0	5486	6614	45.3	108.8	32.8	103.3	21.1
IR-64/36	106	259	2.54	27.4	5340	6478	45.2	106.9	30.6	104.0	21.1
Pusa-44	104	257	2.56	24.4	5292	6397	45.3	105.0	30.1	102.4	20.9
Pant dhan-18	110	263	2.63	29.2	5913	7135	45.3	107.7	33.9	110.3	26.1
Pant dhan-19	104	265	2.52	29.6	5923	7109	45.4	106.2	34.1	111.2	24.3
NDR-359	103	263	2.66	29.6	5934	7082	45.6	107.8	34.4	111.7	24.7
UPR-3425-11-1	105	265	2.60	30.7	5905	7075	45.5	104.7	32.9	113.0	23.2
Fine grain											
Taraori	132	254	2.10	21.6	3016	5397	35.9	71.8	21.9	69.5	15.4
Pusa-1509	103	253	2.07	20.6	3544	4394	44.7	78.1	20.9	69.1	15.1
Pusa Basmati-1	108	260	2.06	21.1	3452	3887	47.0	67.2	18.2	63.4	14.1
Pusa-1121	110	256	2.10	22.0	4127	4650	47.0	82.0	24.2	76.2	16.6
Pant Basmati-1	112	259	2.16	20.4	4742	5359	47.0	96.6	28.5	86.2	18.6
UPR-3488621	99	256	2.15	22.2	3857	4952	43.8	61.8	17.5	56.5	12.0
UPR-3506-7-1-1	128	259	2.10	20.4	3873	5073	43.3	61.2	16.5	53.8	11.3
CD (*P=0.05*)	3.52	5.35	0.05	1.18	346	427	8.06	6.68	2.48	7.04	2.97

was found in UPR-3425-11-1-1 (30.7g) which was at par with PD-4 (30.0 g), PD-19 (29.6g) and NDR-359 (29.6g) however, fine grain rice varieties viz. Pusa-1121 (22.0g), Taraori (21.6g) and Pusa-Basmati-1 (21.1g) were at par with each other but significantly higher test weight was observed in UPR-3488621 (22.2g). Grain yield of coarse grain rice varieties ranged from 5292 to 5934 kg/ha and that of fine grain rice varieties ranged from 3016 to 4742 kg/ha. Among coarse grain rice varieties, significantly higher grain yield was observed in NDR-359 (5934 kg/ha) which was found to be at par with PD-19 (5923Kg/ha), PD-18 (5913 kg/ha) and UPR-3425-11-1-1 (5905 kg/ha). Fine grain rice varieties produced the grain yield in ranged from 3016 to 4742 kg/ha. Significantly higher grain yield among fine grain rice varieties was observed in Pant Basmati-1(4742 kg/ha) over all other fine grain rice varieties. Straw yield of coarse grain rice ranged from 6397 to 7135 kg/ha and significantly higher straw recorded in PD-18 (7135 kg/ha) being at par with PD-19 (7109 kg/ha), NDR-359 (7082 kg/ha) & UPR-3525-11-1-1-1(7075 kg/ha). While, fine grain rice varieties ranged from 3887 to 5397 kg/ha and significantly higher being recorded in Taraori (5397 kg/ha) and at par with varieties Pant Bsamati-1 and UPR-3506-7-1-1-1. Non-significant differences in harvest index were observed among different coarse grain rice varieties and recorded in ranged from 45.2 to 45.6. However, among fine grain rice varieties, harvest index was significantly higher in Pant Basmati-1 (47.0) and was at par with all other varieties except Taraori (Table 30.1).

Nutrient Uptake by Paddy: Significant differences in N, P, K and S uptake were observed among different rice varieties (Table 30.1). Nitrogen uptake in coarse grain rice varieties was found to be higher in PD-4 (108.8 kg/ha) but at par with all other coarse grain rice varieties, while, N-uptake by fine grain rice varieties was significantly higher in Pant Basmati-1 (96.6 kg/ha) over all other rice varieties. P uptake by coarse grain rice varieties was found significantly higher in NDR-359 (34.4 kg/ha) and at par with all other variety expected IR-64 and Pusa-44. On the other hand, phosphorus uptake by fine grain rice varieties was significantly higher in Pant Basmati-1 (28.5 kg/ha) over all other rice variety. Potassium uptake by coarse grain rice varieties was found significantly higher in UPR-3425-11-1-1 (113 kg/ha) and at par with NDR-359, PD-19 and PD-18 rice varieties, while K uptake by fine grain rice varieties was found to be significantly higher in Pant Basmati-1 (86.2 kg/ha) over all other fine grain rice varieties. Sulphur uptake by coarse grain rice varieties was found to be significantly higher in PD-18 (26.1 kg/ha) which was at par with PD-19, NDR-359 and UPR-3425-11-1-1-1, while S-uptake by fine grain rice varieties was found higher in Pant Basmati-1 (18.6 kg/ha) and at par with Pusa-1121 fine grain rice variety (Table 30.1).

Wheat: Plant height at harvest, spikes/m^2, number or grains/spike and grain wt./spike of wheat showed significant variation among different wheat varieties. Plant height at harvest of different wheat varieties ranged from 90 to 109 cm and tallest variety recorded of UP-2784 (109 cm) followed by HD-2967 (108 cm). Significant differences in spikes/m^2 of wheat varieties were observed and it ranged from 274 to 292. Similar and significantly higher spikes/m^2 of wheat was found in HD-2967 and WH-1105 (292) which was found to be *at par* with UP-2565 (289). Likewise, number of grains/spike ranged between 50.3 to 59.5 among the different varieties of wheat and significantly higher number were observed in HD-2967 (59.5) but being at par with PBW-550 (57.6), UP-2565 (57.5) and UP-2684 (57.5). Grain weight per spike of wheat was significant among different wheat varieties and ranged from 2.24 to 2.38 (g) and significantly higher grain wt. /spike (2.38 g) being observed under UP-2572, which was at par with PBW-550, UP-2425 and HD-2967 varieties (Table 30.2).

Table 30.2. Response for yield attributes, yield, harvest index and N, P, K & S uptake of wheat varieties/hybrids in rice-wheat system under organic management at Pantnagar

Wheat varieties/ hybrids	Plant height (cm)	Spikes m^2	No. of grains/ spike (g)	Grain wt./ spike (g)	1000-grain wt. (g)	Grain yield (kg/ha)	Straw yield (kg/ha)	Harvest Index	N uptake (kg/ha)	P uptake (kg/ha)	K uptake (kg/ha)	S uptake (kg/ha)
WH-1105	102	292	55.6	2.30	41.67	3340	3610	48.1	62.3	16.4	52.0	21.2
PBW-550	96	287	57.6	2.37	41.16	3508	3638	49.1	63.1	16.2	52.0	20.4
UP-2628	93	282	52.8	2.33	42.26	3377	3628	48.2	61.3	14.3	49.9	16.9
UP-1109	103	285	51.8	2.32	41.54	3340	3713	47.4	61.3	14.7	49.5	20.2
UP-2425	102	274	52.4	2.36	43.13	3392	3676	48.0	61.9	14.1	52.7	19.2
UP-2843	103	279	54.4	2.29	41.14	3279	3640	47.4	60.0	16.2	52.0	20.9
UP-2841	90	278	52.9	2.24	40.78	3281	3633	47.5	60.8	15.5	50.8	22.0
UP-2572	98	281	53.2	2.38	45.04	3404	3776	47.4	63.6	16.7	51.5	23.1
DPW-62150	98	281	56.3	2.31	42.33	3374	3831	46.8	63.0	15.2	54.2	23.9
UP-2565	104	289	57.5	2.31	44.18	3539	3943	47.3	65.5	15.1	54.9	21.4
HD-2967	108	292	59.5	2.35	41.49	3580	3940	47.6	67.1	15.4	55.7	24.5
UP-2684	103	282	57.5	2.33	41.12	3348	3668	47.7	62.4	15.1	51.5	22.5
DBW-17	105	278	51.1	2.31	40.10	3347	3791	46.9	61.5	15.0	51.4	24.0
UP-2784	109	277	50.3	2.24	42.10	3316	3681	47.4	61.9	15.3	52.5	21.8
CD (*P=0.05*)	3.23	4.20	2.85	0.04	NS	133.0	148.4	0.79	3.30	1.55	3.21	2.05

Test weight, grain yield, straw yield and harvest index of wheat varieties also showed significant variation. Test weight of different wheat varieties ranged from 40.10 to 45.04 g. and recorded significantly higher in UP–2472 (45.04) over all other wheat varieties. Grain yield of different wheat varieties ranged from 3279 to 3580 kg/ha. and significantly higher grain yield being recorded in HD-2967 (3580 kg/ha) and was at par with UP-2565 (3539 kg/ha) and PBW-550 (3508 kg/ha) as compared to other wheat varieties. Straw yield among different wheat varieties were observed ranged from 3610 to 3943 kg/ha, and higher being observed in UP-2565 (3943 kg/ha) which is at par with DPW-62150 and HD-2967. Significant differences in harvest index were observed among different wheat varieties and ranged from 47.3 to 49.1. However, harvest index was higher in PBW-550 (49.1) over all other wheat varieties (Table 30.2).

Total nutrient uptake by wheat: Significant differences in N, P, K and S uptake were observed among different wheat varieties. N was removed by the plant from soil in from 60-67.1 kg/ha and HD 2967 removed maximum N from the soil of 67.1 kg/ha followed by UP 2565, both the varieties found statistically on par. P uptake in wheat recorded in ranged from 14.3-16.7 kg/ha being higher with UP 2572. Potassium and sulpher uptake was also found to be higher in HD 2967 (55.7 and 24.5 kg/ha respectively) being at par with DPW-62150 (Table 30.2).

Raipur

Response of different traditional and improved scented rice and chickpea varieties under organic farming in rice-chickpea cropping system

Fifteen ttraditional/improved scented rice varieties and 15 popular chickpea varieties in the region were assessed for their response under organic management in rice-chickpea cropping system.

Rice: Among the different varieties of rice the range of plant height was recorded from 104 to 182 cm and Karigilas recorded as a tall variety followed by Shymjeera (177.02 cm) and Vishnuhog (164.04) while Lalu 14 observed smallest. No. of tillers hill^{-1} were observed significantly higher in scented rice variety Badshahbhog (8.94) over other varieties except Kubri Mohar, Gangabaru, Sugandhmati and Dujai these are statistically on par to each other, whereas the number of filled grain penicle^{-1} was obtained in range of 69-277, variety bisni(277) which was significantly superior over rest of the rice varieties, however variety, Dujai and Dubraj was next in order and produced 186 and 181 filled grain panicle^{-1}. Other yield attributing characters like panicle length recorded between ranged from 18.3 – 30.1 cm and was higher in Gangabaru (30.1 cm) which was comparable with Gopalbhog and Lohandi (29.9 and 27.8 cm respectively) whereas, the lowest panicle length was recorded in Lalu 14 (18.3 cm). As regards to test weight of the rice varieties, the highest test weight was achieved by Karigilias (37.5 g) while the lowest test weight in Badshahbhog (12.18 g). Grain characters like grain length and grain width, the higher grain length was recorded in Sugandhmati (11.4 mm), while grain width was higher in Dujai and karigilas (3.0 mm). In case of grain length 2 varieties recorded <10 cmm (10.6-11.4mm) as traditional long, 6 varieties recorded <7 cmm (7.6-9.0 mm) as traditional medium and 7 varieties recorded <5 cmm (5.2-6.8 mm) as short grain length. The highest grain yield of rice was recorded in Dujai(3722 kg/ha) which was significantly superior over rest of the varieties except Shyamajeera, Karigilas, Dubraj and CR Sugandha Dhan 907 which produced 3602, 3579, 3506, and 3423 kg/ha respectively. The lowest grain yield of scented rice was observed in Lalu 14 (1408 kg/ha). However, the harvest index was higher in CR Sugandha Dhan-907 (42.13%) while the lowest harvest index was obtained in Gopalbhog (25.05%) (Table 31.1).

Table 31.1. Response of different traditional and improved scented varieties of rice under organic production system at Raipur

Variety	Plant height at harvest (cm)	Tillers hill^{-1} at harvest (g)	No. of filled grains/ panicle	Panicle length (cm)	Test weight	Grain length (mm)	Grain width (mm)	Grain yield (kg/ha)	Straw yield (kg/ha)	Harvest Index
Badshahbhog	159.6	8.9	181.0	22.7	12.2	6.2	2.4	3219	8643	27.3
Gopalbhog	159.4	7.3	142.0	29.9	20.9	8.2	2.4	3012	8988	25.1
Vishnubhog	164.0	7.7	175.0	22.1	12.6	6.8	2.4	3027	8127	27.1
Bisni	155.6	7.9	141.0	25.6	13.9	6.6	2.4	3199	6976	31.5
Shyamajeera	177.0	7.3	174.0	25.6	13.9	6.4	2.6	3423	8973	27.7
Karigilas	182.4	7.5	107.0	25.5	37.5	10.6	3.0	3506	8466	29.7
Kubri Mohar	153.3	8.2	123.0	24.5	14.7	7.6	2.2	2558	7005	26.9
Dubraj	146.7	6.9	118.0	22.0	19.1	8.2	2.4	3579	7960	31.1
Indira Sugandhi Dhan	112.4	7.8	135.0	25.6	22.5	9.0	2.4	3207	5068	38.7
Gangabaru	161.1	8.6	277.0	30.1	18.7	5.2	2.6	3046	8847	25.6
Sugandhmati	130.9	8.1	85.0	24.8	23.9	11.4	2.0	2955	5842	35.2
Lalu 14	104.0	7.0	69.0	18.3	16.5	8.0	2.4	1408	3507	28.8
Dujai	137.0	8.2	186.0	23.6	13.1	6.2	3.0	3722	9470	28.3
Lohandi	135.1	7.1	138.0	27.8	26.0	6.4	2.4	3242	8827	27.0
CR Sugandha 907 Dhan	151.7	7.8	134.0	22.7	19.3	8.2	2.4	3602	4952	42.1
CD (P=0.05)	16.2	0.9	19.2	4.9	0.0	0.0	0.0	301	1454	3.1

Table 31.2. Available Nutrient status after harvest of different traditional and improved scented varieties of rice under organic production system at Raipur

Variety	Organic Carbon (%)	Available N (Kg/ha^{-1})	Available P (Kg/ha^{-1})	Available K (Kg/ha^{-1})
Badshahbhog	0.68	248	20.18	315
Gopalbhog	0.66	251	19.54	322
Vishnubhog	0.68	244	20.43	317
Bisni	0.68	247	21.21	311
Shyamajeera	0.68	244	20.57	316
Jeeraphool	0.68	243	21.38	313
Kubri Mohar	0.67	251	21.77	313
Tulsi Manjari	0.67	246	20.24	312
Jaygundi	0.68	242	21.24	324
Gagabaru	0.68	247	21.58	317
Sugandhmati	0.69	247	20.20	323
Lalu 14	0.68	245	20.14	315
Dujai	0.68	241	19.76	313
Dubraj	0.69	241	21.19	314
CR Sugandha Dhan 907	0.67	247	21.26	311
CD (P=0.05)	NS	NS	2.26	14.50

Table: 31.3. Response of different improved varieties of chickpea under organic production system at Raipur

Variety	Plant height at harvest (cm)	No. of branches at harvest	No. of pods/plant at harvest	No. of nodules/plant at 60DAS	Test weight	Seed yield (kg/ha)	Stover yield (kg/ha)	Harvest Index	Net return (Rs/ha)	B:C ratio
Jaki	44.23	3.89	30.77	22.04	26.43	1207	1437	45.65	32194	2.46
RG2009-01	44.59	3.22	51.22	30.46	15.03	1692	1872	47.48	53858	3.44
Vaibhav	36.85	2.66	34.55	26.58	25.20	1553	1770	46.78	47661	3.16
RG2009-16	48.37	3.55	35.44	26.77	23.27	1477	1595	47.98	44169	3.00
JG-130	41.67	3.44	26.55	20.05	24.40	1071	1413	43.12	26219	2.19
Vishal	42.90	3.99	36.66	25.67	23.23	1388	1559	47.08	40248	2.83
JG-226	42.87	2.77	34.33	25.57	28.93	1675	1820	47.89	53056	3.41
Vijay	41.23	4.00	30.78	20.58	28.37	1116	1717	40.04	28507	2.29
Daftari-21	41.29	3.77	50.89	26.69	17.83	1685	2286	42.45	53949	3.45
BGD-128 Kabuli	40.67	3.22	35.11	24.22	26.77	1466	1573	48.21	43651	2.98
JG-11	41.04	3.66	41.00	25.92	26.97	1505	1602	48.53	45415	3.06
JG-14	45.52	4.55	40.22	23.22	29.17	1335	1508	47.13	37843	2.72
PKV Kabuli	41.58	2.89	51.42	32.85	23.57	1719	1889	47.62	55040	3.50
RG.2003-28	44.11	4.66	25.89	18.97	31.57	990	1303	43.16	22556	2.02
JG-16	45.24	3.55	41.55	26.99	27.33	1587	1670	48.63	49037	3.22
CD (P=0.05)	5.01	0.94	15.08	7.45	3.45	219	288	5.01	-	-

Soil Nutrient Status

Soil organic carbon, available soil nitrogen, phosphorus and potash were analyzed after harvesting of the rice crop revealed that soil organic carbon and available nitrogen after the harvest of rice did not differ significantly due to varieties. and all varieties behaved almost similar with ranged from organic carbon 0.66-0.69% available N ranged from 241-251 kg/ha. However, available phosphorus and potassium showed significant variation due to variety. Available phosphorus was recorded higher in the variety Kubri Mohar 21.77 kg ha^{-1} and lowest was in variety Gopalbhog 19.54 kg/ha. In case of available potassium the higher K was recorded in Jaygundi (324 kg/ha) (Table 31.2).

Chickpea: 15 varieties of chickpea were evaluated during *rabi* season. All the growth and yield parameters were influenced significantly due to the response of different chickpea varieties to organic farming. Plant height of chickpea was significantly higher in RG 2009-16 (48.4cm) compared to all other except Jaki and RG-2009-1, JG 14, RG-2003-28 and JG -16 which were statistically on par to each other. Significantly lower plant height was recorded in vaibhav. Number of branches $plant^{-1}$ at harvest was recorded higher in RG 2003-28 (4.66) which was comparable with Vishal, Vijay, Daftari – 21 and JG-14. Number of pods $plant^{-1}$ was higher under PKV kabuli followed by RG 2009-01 and Daftari – 21. As regards the number of nodules $plant^{-1}$ at 60 DAS, higher number of nodules $plant^{-1}$ was maximum in PKV kabuli (32.85) followed by RG 2009-01 (30.46). Similarly 100 seed weight was higher in RG 2003-28 (31.57 g) followed by JG-14 (29.17 g).Test weight of chickpea was observed in ranged from 18.97 to 32.85 as highest in PKV kabuli (Table 31.3).

Table: 31.4. Available Nutrient status after harvest of different improved varieties of chickpea under organic production system.

Variety	Organic Carbon (%)	Available N (Kg ha^{-1})	Available P (Kg ha^{-1})	Available K (Kg ha^{-1})
Jaki	0.66	253.00	22.29	318
RG2009-01	0.66	252.83	22.53	318
Vaibhav	0.63	245.83	22.48	315
RG2009-16	0.65	252.00	22.60	316
JG-130	0.67	247.50	22.68	326
Vishal	0.67	245.88	22.03	319
JG-226	0.66	251.58	21.69	314
Vijay	0.66	249.75	22.53	324
Daftari-21	0.65	249.29	22.37	318
BGD-128 Kabuli	0.66	248.75	21.99	324
JG-11	0.66	249.63	21.17	320
JG-14	0.66	249.46	21.86	318
PKV Kabuli	0.67	248.17	21.60	323
RG.2003-28	0.66	252.50	22.83	313
JG-16	0.66	250.25	21.15	320
CD (P=0.05)	0.02	6.49	NS	NS

Seed yield of chickpea was also influenced due to different chickpea varieties under organic farming. Significantly higher seed yield was obtained from variety PKV kabuli (1719 kg ha^{-1}) which was significantly higher over other varieties except RG 2009-01 (1692 kg ha^{-1}), JG-226 (1675 kg ha^{-1}), Daftari-21 (1685 kg ha^{-1}), JG-16 (1587 kg ha^{-1}) and JG-11 (1505 kg ha^{-1}) whereas lowest seed yield was with RG-2003-28 of 990 kg/ha. Stover yield in Daftari-21 recorded higher significantly over rest of the varieties (2286 kg ha^{-1}). The harvest index was maximum in JG-16 (48.63) followed by JG-11 (48.53). Net return was maximum in PKV kabuli (Rs 55040 ha^{-1}) followed by Daftari–21(Rs 53949 ha^{-1}) and RG 2009-01 (Rs 53858 ha^{-1}). The B:C ratio was higher in PKV kabuli (3.50) followed by Daftari – 21(3.45) and RG 2009-01 (3.44) (Table 31.3).

Soil Nutrient Status: Organic carbon content in soil was not influenced significantly due to different chickpea varieties under organic production system. However, available nitrogen (kg ha^{-1}) was affected significantly due to performance of different chickpea varieties. Available nitrogen content in soil after harvest of chickpea was statistically on par in majority of varieties except Vishal and Vaibhav were the lower in soil. Soil nutrient status of available P and K was not influenced significantly with adoption of different chickpea varieties (Table 31.4).

Ranchi

Twelve varieties of rice and wheat were assessed for their performance under organic management conditions in the system mode with same level and sources of nutrients.

Yields attributes and yield of Rice: Maximum tillers (330 m^{-2}) was noticed in variety Birsamati, followed by Naveen, Lalat, Birsa vikas dhan 203 and MTU 10 (322, 307, 302 and 297 tillers m^{-2}, respectively). The lowest number of tillers (215 m^{-2}) was noted in variety BVD-110. Among rice varieties, plant height was maximum (117.3 cm) in BVD-110 followed by 114.9 cm and 114.3 cm in Anjali and Birsa vikas sugandha

Table 32.1. Yield and yield attributing characters of rice varieties under organic management practices at Ranchi

Cropping System	Effective tillers/m^2	Plant height (cm)	Panicle length (cm)	Grain/panicle	1000 grain weight (g)	Grain yield (q/ha)	Straw yield (q/ha)
Birsa Vikas Dhan 203	302	89.4	21.76	96	22.01	3617	5900
Birsa Dhan 201	285	90.6	21.84	91	23.28	3522	6260
Birsa Vikas Sugandha 1	243	114.3	20.07	114	21.11	3400	5849
B.V.D110	215	117.3	21.59	92	22.28	2787	5304
Sahbhagi	245	100.6	21.95	93	22.29	3293	5927
Birsamati	330	111.8	22.91	105	21.34	3907	5999
Anjli	235	114.9	24.09	96	22.58	2956	5247
Lalat	307	91.3	22.77	103	22.80	4099	6211
M.T.U 10	297	90.8	22.43	102	24.22	4259	6442
Akhchhai	240	104.5	24.47	100	22.97	3090	4706
Pusa Sugandha	268	101.2	23.15	112	22.02	3668	6478
Naveen	322	98.9	22.53	102	21.92	3724	6393
CD (P=0.05)	24.3	9.99	2.54	16.77	1.33	367	427

Table 32.2. Yields and yield attributing characters of wheat varieties under organic management practices at Ranchi

Varieties	Number of spikes/m²	Plant height (cm)	Spike length (cm)	No. of grains/ spike	1000 grain weight (g)	Grain yield (kg/ha)	Straw Yield (kg/ha)
Raj 4250	90.2	298	7.7	27	41.56	2217	3477
GW 366	88.1	352	8.4	32	39.53	2959	4276
NW 2036	88.9	345	8.1	29	39.89	2664	3929
K0307	91.6	372	9.5	32	40.40	3206	4500
K9107	96.5	320	8.6	31	40.38	2669	4089
HI 1563	93.3	295	7.8	27	43.97	2343	3544
Raj 4229	84.1	355	9.0	31	41.61	3100	4409
DBW 14	82.1	323	8.0	29	41.00	2584	3911
WR 544	92.2	307	8.0	26	47.85	2536	3724
BG 3	88.3	322	8.6	28	46.67	2803	4173
HD 2733	81.6	305	7.2	26	41.97	2216	3467
DBW 39)	84.7	330	8.8	31	42.92	2926	4263
CD (P=0.05)	6.15	41.7	0.73	3.09	3.65	456	478

1, respectively. The panicle length and was higher (24.5 cm) in variety Akhchhai,and statistically at par with Anjali and Pusa sugandha, however, grains/panicle was in ranged from 91-114 whereas Birsa Vikas Sugandha 1 produced higher grains/panicle (114). 1000-grains weight, grain yield and straw yield showed significant variation among the rice varieties evaluated (Table 32.1).

Table 33.3. Soil nutrient status of different varieties of rice and wheat under organic management practices at Ranchi

Cropping system	pH	OC%	Available nutrient (kg/ha)			Uptake (kg/ha)		
			N	P	K	N	P	K
Rice (Birsa Vikas Dhan 203) - Wheat (Raj 4250)	6.01	0.66	254.61	37.10	203.92	140.8	33.2	100.9
Rice (Birsa Dhan 201) – Wheat (GW 366)	6.11	0.65	255.66	38.82	142.40	152.0	35.7	115.0
Rice (Birsa Vikas Sugandha 1) -Wheat (NW 2036)	6.05	0.69	264.87	44.22	224.19	144.1	32.7	106.9
Rice (B.V.D110) – Wheat (K0307)	6.19	0.67	261.95	42.46	219.26	138.4	33.4	105.7
Rice (Sahbhagi) – Wheat (K9107)	6.08	0.67	258.27	40.75	207.88	137.9	32.6	106.2
Rice (Birsamati) – Wheat (HI 1563)	6.04	0.67	258.46	42.72	214.84	146.9	34.2	111.3
Rice (Anjli) – Wheat (Raj 4229)	6.16	0.68	265.41	41.66	218.93	136.6	33.2	106.1
Rice (Lalat) – Wheat (DBW 14)	6.05	0.66	253.01	34.28	203.32	150.5	35.7	107.4
Rice (M.T.U 10) – Wheat (WR 544)	6.04	0.66	257.19	39.99	207.36	148.5	35.9	110.6
Rice (Akhchhai) – Wheat (BG 3)	6.12	0.67	263.12	41.40	218.70	135.7	31.7	105.5
Rice (Pusa Sugandha) –Wheat (HD 2733)	5.90	0.66	259.40	41.05	216.14	142.5	33.1	102.1
Rice (Naveen) – Wheat (DBW 39)	6.10	0.66	258.23	40.20	207.33	153.9	37.0	118.8
CD (P=0.05)	0.39	0.04	15.17	5.43	58.47	13.5	2.9	14.1
Initial	5.5	0.42	230	32.25	162			

Table 32.4. Systems productivity and economics of different varieties of rice and wheat crop under organic management at Ranchi

Treatment	REY of *rabi* crop (kg/ha)	System productivity (kg/ha)	Gross return (Rs/ha)			Cost of cultivation (Rs/ha)			Net Returns (Rs/ha)			Benefit : cost ratio		
			Rice	Wheat	System	Rice	Wheat	System	Rice	Wheat	System	Rice	Wheat	System
Rice (Birsa vikas dhan 203) - wheat (Raj 4250)	5870	73973	45975	119948	30986	39323	70309	42987	6652	49639	1.39	0.17	0.71	
Rice (Birsa dhan 201) – wheat (GW 366)	6530	73326	60088	133414	30986	39323	70309	42340	20765	63106	1.37	0.53	0.90	
Rice (Birsa vikas sugandha 1) – wheat (NW 2036)	6109	74122	54384	128506	30986	39323	70309	43136	15061	58197	1.39	0.38	0.83	
Rice (B.V.D110) – wheat (K0307)	6046	58893	64635	123528	30986	39323	70309	27907	25312	53219	0.90	0.64	0.76	
Rice (Sahbhagi) – wheat (K9107)	6007	68745	55012	123757	30986	39323	70309	37759	15689	53448	1.22	0.40	0.76	
Rice (Birsa mati) – wheat (HI 1563)	6289	83364	48141	131505	30986	39323	70309	52378	8818	61196	1.69	0.22	0.87	
Rice (Anjli) – wheat (Raj 4229)	6107	61514	62706	124220	30986	39323	70309	30528	23383	53911	0.99	0.59	0.77	
Rice (Lalat) – wheat (DBW 14)	6726	82647	53102	135749	30986	39323	70309	51661	13779	65441	1.67	0.35	0.93	
Rice (M.T.U 10) – wheat (WR 544)	6837	85845	51703	137548	30986	39323	70309	54859	12380	67239	1.77	0.31	0.96	
Rice (Akhchhai) – wheat (BG 3)	5940	62363	57358	119721	30986	39323	70309	31377	18035	49411	1.01	0.46	0.70	
Rice (Pusa sugandha) – wheat (HD 2733)	5920	80381	45921	126302	30986	39323	70309	49395	6598	55993	1.59	0.17	0.80	
Rice (Navin) – wheat (DBW 39)	6699	76971	59536	136507	30986	39323	70309	45985	20213	66198	1.48	0.51	0.94	
CD (p=0.05)	568							6872	8241	10071	0.22	0.21	0.14	

The maximum 1000-grains weight and grain yield of rice (24.22g and 4259 kg/ha) was obtained with rice variety MTU-10 which was significantly superior over all the rice varieties except Birsa dhan-2001 for test wt. and Lalat (4099 kg/ha), Birsamati (3907 kg/ha), Naveen (3889 kg/ha), Pusa Sugandha (3668 kg/ha) and Birsa Vikash Dhan-203 (3617 kg/ha). In case of straw yield Pusa sugandha produced higher straw yield while akhchhai was the lowest straw yield producer (Table 32.1).

Yields attributes and yield of wheat: The varietal effect on the yield attributes and yield was found to be significant and the results indicated that the range of plant height was noted from 81,6 to 96.5 as tallest plant of K9107. Number of tiller m^{-2} was in ranged of 295 to372 however, K0307 recorded maximum number of tillers spike length (9.5 cm) and number of grains $spike^{-1}$ (32.0). Among the cultivars, the variation in 1000-grains weight of the wheat ranged from 39.5g (GW-366) to 47.8g (WR-544). K-0307 recorded the significantly higher wheat yield (3206 kg/ha) which was statistically at par with Raj 4229 (3100 kg/ha), GW 366 (2959 kg/ha), DBW 39 (2926 kg/ha) and BG-3 (2803kg/ha). However, 1000-grains weight was higher in WR-544 (Table 32.2).

Soil nutrient status at the end of cropping cycle: There was significant improvement in soil pH, organic carbon, available N, P and K in different varieties under rice-wheat cropping system from their initial values. Soil pH was significantly improved in rice (B.V.D110)–wheat (K0307) system (6.19) of their initial value of 5.5. After completion of cropping cycle, higher organic carbon (0.69%) was found in rice (Birsa Vikas Sugandha 1) - wheat (NW 2036) system and it was increased by 64% to their initial value of 0.42. Significantly higher available N in the soil was found in rice (Anjli) – wheat (Raj 4229) of 265.4 kg/ha, however, residual P & K was recorded highest in Rice (Birsa Vikas Sugandha 1) - wheat (NW 2036) in the soil at the end of cropping cycle. Among cropping system, rice (Naveen) – wheat (DBW 39) removed highest N (153.9 Kg/ha), P (37.0 kg/ha) and K (118.8 kg/ha) and found to be on par to all other varieties except rice (B.V.D110) – wheat (K0307), rice (Sahbhagi) – wheat (K9107), rice (Anjli) – wheat (Raj 4229) and rice (Akhchhai) – wheat (BG 3) (Table 32.3).

Systems productivity and economics of system: In terms of system productivity of rice-wheat, rice (MTU-10) - wheat (WR 544) system gave significantly higher system productivity (6837 kg/ha), net return (Rs. 67,239/ha) and B:C ratio 1.97 over other varieties but it remains statistically on par with rice (Naveen) – wheat (DBW 39), rice (Lalat) – wheat (DBW 14), rice (Birsamati) – wheat (HI 1563) and rice (Birsa Dhan 201) – wheat (GW 366). While, the lowest system net return (Rs. 49411/ha) and B:C ratio (0.70) was obtained in Akhchhai – BG-3 cropping sequence (Table 32.4).

Umiam

The experiment consisted of three major crops viz., maize, frenchbean and tomato. In Maize, Among 11 varieties, eight were composites, one hybrid and two local varieties. French bean consisted of 10 varieties where 8 were improved and 2 local varieties and for tomato crop, 20 varieties/lines were evaluated under the experiment.

Tomato: Plant height, chlorophyll index, primary and secondary branches pod borer incidence and fruit yield of tomato showed significant variation among different varieties. Plant of different tomato varieties ranged from 34.7 to 112.2 cm at 60 DAS. Tallest variety was observed MCTR 5 (43.27 cm) and O-17 (112.3cm) while smallest was recorded Arka vikas (21.5 and 34.7 cm). In case of chlorophyll index, highest

chlorophyll were found in cultivar MT 2 (46.10 30 DAS) and H 86 (46.68 60 DAS) and varied significantly over rest of varieties except SET 9A and MT1 at 30 DAS while at 60 DAS, MT 2, 0-17, MT 3 and Rocky being on par with H 86. Primary branches, secondary branches and fruit yield also showed significant variation. Primary branches and secondary branches of different tomato varieties ranged from 6.1 – 7.4 and 3.44 – 6.14 was observed at 60 DAS. The range of fruit yield of tomato were from 6060 to 22590 kg/ha among the different varieties. Tomato cultivars MT-2 produce higher fruit yield (22590 kg/ha) compared to other cultivars due to the less pod borer incidence and being at par with 0-17, Pant T 10, MT 11, MT 3, TMC 9, DMT 1, RCT 3, DMT5 and MCTR 4**.** The lowest yield of tomato was recorded in the cultivar H 86 (6060 kg/ha) due to the less secondary branches and heavy pod borer incidence. Less fruit borer infection (9.97%) was observed in MT-2 compared to the other cultivars. Other less infested cultivars were 0-17 (10%), Pant T-10 (11.07%) and MT 11 (11.67%). Among the cultivars most infested cultivars are H 86 (2017%) which are statistically at par with SET 9A (16.77%) and Rocky (16.67%) (Table 33.1).

Table 33.1. Growth parameters, pod borer incidence and yield of different tomato cultivars at Umiam

Cultivars	Plant height (cm)		Chlorophyll Index		Primary branches		Secondary branches		Pod borer incidence (%)	Yield (kg/ha)
	30 DAT	60 DAT	30 DAT	60 DAT	30 DAT	60 DAT	30 DAT	60 DAT		
TMC 2	25.3	43.3	42.0	39.3	4.4	5.8	0.00	5.14	13.17	9650
MCTR 4	30.6	49.2	43.3	38.7	6.1	6.4	0.81	5.14	13.37	14160
DMT5	28.1	43.1	41.6	38.0	5.1	6.1	1.11	5.14	12.37	14340
Sel 2	29.2	47.7	40.6	30.1	5.4	5.8	0.41	5.14	12.87	8960
RCT 3	28.9	44.3	40.7	32.0	4.8	6.1	2.81	5.44	13.47	14780
MT 3	31.2	55.5	41.4	43.1	4.8	5.4	2.11	4.84	12.77	17410
RCM T8	29.9	49.9	40.1	35.1	6.4	4.8	0.00	4.14	14.77	12350
SET 9A	29.2	37.0	38.8	31.3	5.1	5.4	0.41	3.84	16.77	13080
MT 11	33.6	49.8	43.1	35.5	4.1	6.1	0.05	5.14	11.67	18740
MT 2	34.7	66.3	46.3	43.8	6.4	7.4	1.41	6.14	9.97	22590
Arka Vikash	21.5	34.7	41.6	38.4	4.4	6.4	0.05	4.84	14.87	11260
H 86	24.3	38.2	42.3	46.7	5.4	6.1	0.05	3.44	20.17	6060
Sel 1	30.3	38.7	42.2	36.0	6.1	6.1	1.11	4.44	14.47	13070
MCTR 5	43.4	112.1	41.1	39.8	6.4	6.8	1.31	5.84	12.77	13120
Pant T 10	28.5	47.5	44.0	37.0	4.8	6.1	0.41	4.84	11.07	19130
Rocky	30.1	59.1	43.7	42.9	3.1	4.4	0.81	3.84	16.67	8810
TMC 9	21.5	42.1	39.8	36.5	4.4	6.4	0.05	4.84	12.57	15020
DMT 1	27.9	48.8	43.1	36.8	2.8	3.4	1.41	1.44	12.57	14940
MT 1	26.1	47.3	37.5	34.0	5.4	5.1	0.41	4.14	14.07	10600
0-17	43.2	112.2	44.4	43.1	6.4	7.4	1.41	6.09	10.00	22280
CD(P=0.05)	6.29	20.33	4.30	5.05	1.71	1.82	0.98	1.88	4.32	8970

French bean: Maximum plant height recorded in Naga Local (238.5cm) followed by RCM-FB-18 (223.5 cm) and RCM-FB-80 (223.3 cm) while, shortest plant recorded in Maram (47.5 cm). Naga local recorded the highest pod length (16.2 cm) and average pod weight (11.3g) followed by RCM-FB-18 (15.9 and 10.2 cm respectively) while lowest pod length and average pod weight was recorded in Maram (13.0cm and 3.9g). Significantly higher green pod yield was recorded in Naga local (8770 kg/ha) followed by RCM-FB-

18 (7880 kg/ha) and RCM-FB-19 (5570 kg/ha). Lowest green pod yield was recorded in Maram (1050 kg/ha) followed by Nagaland local 1 (2160 kg/ha). Seed yield also shown the similar trend and observed in range from 690-4230 kg/ha. Stover yield was also higher in Naga local (7530 kg/ha) followed by Nagaland local 3 (6300 kg/ha) and RCM-FB-18 (6260 kg/ha). Lowest stover yield was recorded in Maram (1350 kg/ha) (Table 33.2).

Table 33.2: Evaluation of different varieties of frenchbean under organic farming at Umiam

Variety	Plant height(cm)	Pod length(cm)	Average pod weight(g/pod)	Green pod yield(kg/ha)	Seed yield (kg/ha)	Stover yield (kg/ha)
RCM FB 18	223.5	15.9	10.2	7880	3690	6260
RCM FB-19	188.6	15.1	7.4	5570	3120	5440
RCM FB-37	220.0	14.7	7.2	5380	2350	5140
RCM FB 61	157.2	14.0	6.4	3570	2340	4860
RCM FB-62	216.4	13.5	6.5	5540	2430	5220
RCM FB-80	223.3	15.1	7.0	5710	2870	4870
Nagaland local 1	197.9	13.3	4.4	2160	1500	3280
Nagaland local 3	148.0	14.7	5.9	5000	2930	6300
Maram	47.5	13.0	3.9	1050	690	1350
Naga local	238.5	16.2	11.3	8770	4230	7530
CD (P=0.05)	13.3	1.6	0.6	1070	750	770

Maize: Significant variation was found among the maize varieties for all the traits. Plant height at harvest was significant. Among the varieties of maize, plant height was maximum in RCM 75 (252.3 cm) followed by RCM 1-3 (2488 cm) and Hemant (246.8 cm) whereas, Hybrid (JKMH) recorded the shortest plant (210.5 cm). Remarkable variation in chlorophyll content across the growth stages were also noticed

Table 33.3: Plant height, chlorophyll index, yield attributes and yields of different varieties of maize under organic production system at Umiam

Varieties	Plant height (cm)	Chlorophyll index (CI)		Cob Length(cm)	Cob weight(g)	Green cob yield (Kg/ha)	Seed yield(kg/ha)	Stover yield (kg/ha)
		30 DAS	60 DAS					
RCM-1-1	246.5	36.0	43.27	13.4	210.9	5360	3250	7320
RCM-1-2	233.7	37.0	45.47	12.9	201.7	4940	3120	7050
RCM-1-3	248.8	41.7	47.27	13.4	212.9	5540	3450	8200
RCM-75	252.3	39.0	45.97	13.9	219.5	5760	3470	8170
RCM-76	243.4	38.6	44.47	13.8	211.9	5620	3440	8170
Vijay composite	234.9	36.9	45.17	13.2	197.1	4950	3320	8000
Hemant	246.8	36.5	43.77	12.7	191.0	4870	3190	7380
DA 61 A	223.4	41.8	48.37	14.4	223.9	5850	3570	7940
Hybrid (JKMH)	210.5	35.5	45.37	13.0	196.3	4790	3180	7490
Local Yellow	224.6	37.7	44.67	14.0	179.6	4160	2960	7120
Local White	234.9	39.1	45.07	11.5	164.8	4100	2850	7020
CD(P=0.05)	15.58	3.03	2.69	1.09	14.2	710	380	690

Table 33.4. Soil physical and chemical properties after different varieties of maize under organic production system at 0-15 cm soil depth.

Varieties	Soil pH	SOC (%)	Bulk density (Mg/cm3)	Available N (kg/ha)	Available P (kg/ha)	Available K (kg/ha)
RCM-1-1	5.04	2.11	1.18	210.8	18.4	200.9
RCM-1-2	5.10	2.10	1.18	213.9	17.3	197.5
RCM-1-3	4.98	2.15	1.14	212.1	19.9	203.8
RCM-75	4.98	2.14	1.18	197.4	18.8	202.8
RCM-76	5.11	2.11	1.19	200.8	17.9	197.3
Vijay composite	5.08	2.11	1.20	203.7	18.7	195.2
Hemant	4.96	2.10	1.21	199.8	17.8	189.4
DA 61 A	5.02	2.15	1.17	199.4	18.8	201.3
Hybrid (JKMH-501)	5.09	2.09	1.21	197.3	15.5	194.2
Local Yellow	5.13	2.13	1.15	214.7	19.9	202.6
Local White	4.97	2.10	1.16	211.7	19.9	198.5
CD(*P*=0.05)	NS	0.07	0.09	7.99	2.51	NS

Table 33.5. Screening of maize varieties for fodder quality under organic production systems (90 DAS)

Varieties	Crude protein (%)	Crude fibre (%)	E.E (%)	Ash (%)	NFE (%)
RCM-1-1	10.9	24.9	1.29	12.4	50.9
RCM-1-2	12.5	24.8	1.41	11.4	50.7
RCM-1-3	12.3	29.3	1.64	11.1	46.6
RCM-75	11.6	26.6	1.25	14.2	47.3
RCM-76	11.6	26.5	1.29	10.1	51.5
Vijay composite	10.9	25.3	1.65	11.6	51.5
Hemant	12.1	25.5	1.54	10.9	50.8
DA 61 A	10.6	26.2	1.52	11.2	51.6
Hybrid (JKMH-501)	11.4	24.8	1.59	10.0	52.4
Local Yellow	10.9	28.4	1.26	9.9	50.2
Local White	11.3	24.7	1.44	10.2	53.1
CD (=0.05)	1.19	2.93	0.30	1.98	3.29

E.E- Extract ether, NFE-Nitrogen free extract

among the maize line/varieties. Significantly higher chlorophyll index (CI) at 30 and 60 DAS was recorded in DA 61 A (41.8 and 48.4) followed by RCM 1-3 (47.3) while, minimum chlorophyll index was recorded in variety RCM 1-1 (43.3) at 60 DAS.

The maximum cob length was recorded with variety DA 61-A (14.3cm) followed by local yellow (14.0cm) and RCM 75 (13.9cm), however, minimum cob length was recorded in the variety local white (11.5cm). Cob weight was found in the range of 164.8 - 223.9 maximum in variety DA 61-A (223.9 g) followed by RCM-75 (219.5 g). Green cob yield was recorded in the range of 4100-5850 kg/ha and maximum was with DA 61-A (5850 kg/ha) followed by RCM-75 (5760 kg/ha). DA 61-A recoded maximum grain yield (3570 kg/

Table 33.6: Screening of maize varieties against stem borer, (*Chilo partellus* Swinhoe)

Varieties	Stem borer infestation (%)		Leaf Injury Rating (LIR)	Resistance reaction
	Plant Infestation (%)	Dead Heart (%)		
RCM-1-1	77.2	7.8	8.3	HS
RCM-1-2	11.4	1.1	3.5	R
RCM-1-3	36.9	6.2	6.2	MS
RCM-76	56.8	6.9	6.7	HS
DA-61-A	38.8	5.1	6.1	HS
RCM-75	54.6	6.9	6.6	HS
Hybrid	40.2	5.1	6.3	HS
Sweet corn	31.8	4.7	4.7	MS
Local White	57.3	5.8	6.7	HS
Hemant	38.8	5.1	6.3	HS
Vijay Composite	62.8	6.2	7.2	HS
Local Yellow	68.3	10.1	7.9	HS
CD (p=0.05)	2.71	0.94		

LIR>3 or <6 = moderately susceptible (MS); LIR > 6 = Highly susceptible (HS); LIR d" 3 Resistance (R) (Kumar *et al.,* 2012)

ha) followed by RCM-75 (3450 kg/ha), whereas, lower grains yield was recorded in the local white (2850 kg/ha) followed by local yellow (2960 kg/ha) (Table 33.3).

Soil chemical and physical properties: Among the evaluated varieties/lines of maize, significantly higher soil organic carbon was recoded with both the variety DA 61 A and RCM 1-3 (2.15%) followed by RCM-75 and local yellow. Highest bulk density was recorded under Hemant and Vijay composite while, lowest was with Hybrid (JKMH-501) and Local white. The available N, P and K status in soil after growing of different maize varieties/line, maximum soil available N (214.7 kg/ha) and P (19.9kg/ha) recorded under Local yellow, whereas, maximum K was recorded under RCM 1-3 (203.8 kg/ha). while, minimum residual N. P and K was available with Hybrid (JKMH-501) (Table 33.4).

Performance of tomato and frenchbean under organic management at Umiam

Fodder quality: RCM-1-2 and RCM-1-3 were recorded the higher crude protein content among the maize varieties but crude fibre was found to be higher under RCM-1-3 and DA 61A. In respect to ether extract ether, RCM-1-3 and Vijay composite were recorded higher values. Ash were recorded in the range from 9.9-14.2% while nitrogen free extract found to be in ranged from 46.6-53.1% (Table 33.5).

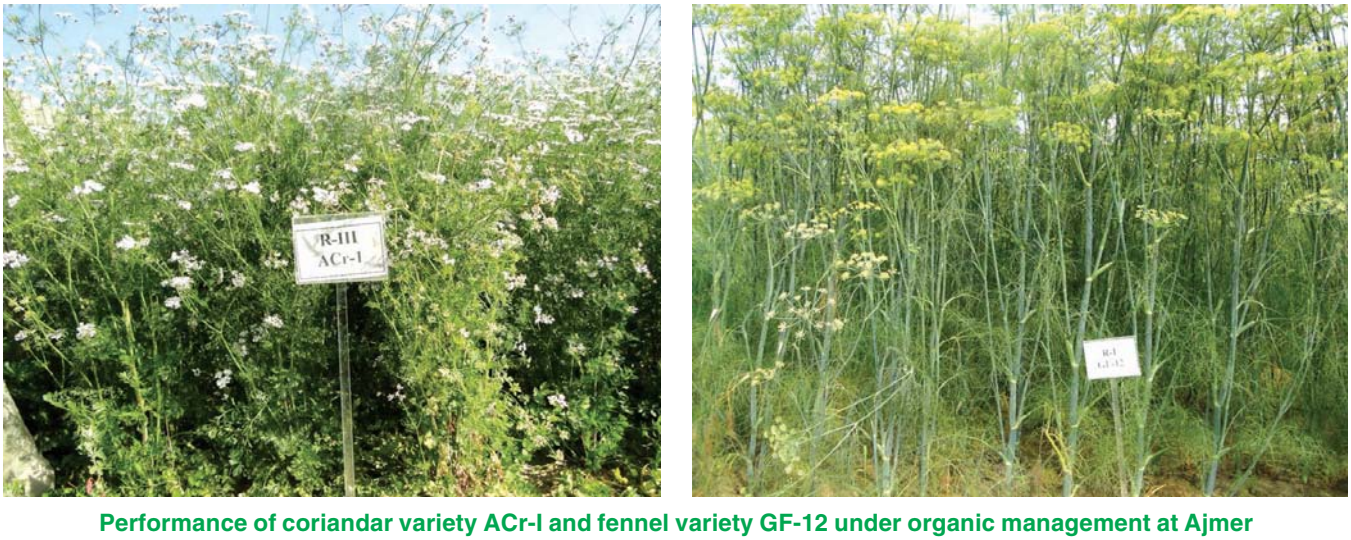
Stem borer infestation in Maize: Among the 11 varieties of maize, RCM-1-1 and Local yellow exhibited more stem borer infestation and leaf injury. RCM-1-2 found to be resistant for stem borer infestation. Leaf injury rating was recorded higher in RCM1-1 followed by vijay composite and local yellow and found to be high susceptible to the resistance reaction (Table 33.6).

Ajmer

The experiment was started from *rabi* 2015-16. The total eight varieties each of coriander and fennel during *rabi* were evaluated under organic cultivation. The coriander data presented in table 34.1 and fennel in table 34.2.

Coriander: reveal that there are significant difference was observed for all the variables. In coriander significantly higher plant height (121.5 cm), primary branches (8.3), secondary branches (26.5), number of umbels (44.0), number of umbellets (6.2) and seed yield (1247) was found to be higher in Azad dhania-1 followed by ACr-1 and Hissar Anand while lowest was recorded in RCR- 446 of plant height (113.9 cm), number of primary branches/plant (5.0), numbers of secondary branches /plant (20.2), number of umbel/plant (35.1), number of umbellate/umbel (4.3) and seed yield (989 kg/ha). Azad dhania-1 recorded minimum days for 50% flowering (73.7 days). This is clearly indicated that in coriander crop Azad dhania-1, Hissar Anand and ACr-1 performed better even than in organic management system in first year hence, these varieties are needed to be evaluated for longer period to assess the suitability to organic production system (Table 34.1).

Fennel: In fennel crop, plant height at harvest was significantly higher (222.4 cm) in GF-12, whereas lowest plant height (204.8 cm) was recorded in Co-1 which is at par with RF-101 (208.7 cm). In GF-12, another parameters such as primary branches (11.5), secondary branches (22.4), umbels per plant (45.7), umbellates per umbel (39.7) and seed yield (2366 kg/ha) was found significantly higher, while



Performance of coriandar variety ACr-I and fennel variety GF-12 under organic management at Ajmer

Table 34.1: Performance of coriander varieties to organic management practices

Treatment	Plant height (Cm) At harvest	No. of primary branches/plant	No. of secondary branches /plant	Days to 50% flowering	No. of Umbel /plant	No. of umbellate /umbel	Seed yield (kg/ha)
ACr-1	119.4	7.5	25.1	75.3	41.8	5.9	1218
Azad Dhania-1	121.5	8.3	26.5	73.7	44.0	6.2	1247
RCr- 435	117.9	6.3	22.9	77.0	37.6	5.1	1195
RCr- 436	114.4	5.4	20.3	78.7	35.2	4.5	1003
RCr- 446	113.9	5.0	20.2	79.3	35.1	4.3	989
RCr- 684	116.7	6.0	22.2	78.0	37.1	5.1	1147
HissarSugandha	115.5	5.8	21.8	78.3	36.2	4.8	1095
HissarAnand	118.1	6.5	23.6	77.3	39.5	5.2	1225
CD(P=0.05)	5.93	1.10	2.51	2.63	2.60	0.82	163

Table 34.2: Performance of fennel varieties to organic management practices

Treatment	Plant height (Cm) At harvest	No. of primary branches/plant	No. of secondary branches /plant	Days to 50% flowering	No. of Umbel /plant	No. of umbellate /umbel	Seed yield (kg/ha)
AF-1	221.0	11.4	22.3	97.3	45.0	39.4	2354
RF-101	208.7	7.6	15.6	100.7	35.0	30.0	1829
Co-1	204.8	7.0	14.4	101.0	33.9	29.7	1805
RajendraSaurabha	212.4	8.1	17.7	100.3	38.2	32.1	1951
GF-12	222.4	11.5	22.4	97.0	45.7	39.7	2366
RF-281	214.4	8.8	19.0	99.7	39.5	35.5	2100
RF-125	220.0	10.5	21.7	98.7	42.5	37.5	2276
GF-2	218.2	10.3	21.1	99.0	42.2	37.4	2279
CD(P=0.05)	10.44	1.34	2.26	2.14	5.92	4.45	358.1

Table 34.3: Total N, P, K uptake in different varieties of coriander and fennel under organic production system

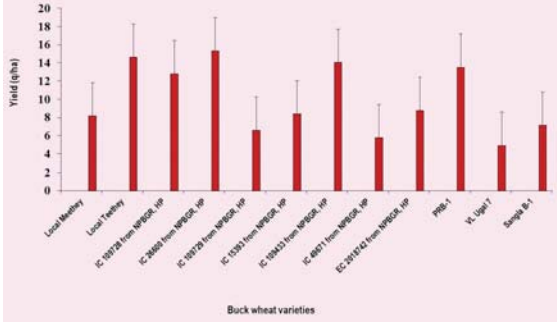
Treatment	N-uptake (kg/ha)	P - uptake (kg/ha)	K - uptake (kg/ha)
Coriander			
ACr-1	34.09	7.37	51.76
Azad Dhania-1	31.96	6.66	52.02
RCr- 435	29.68	7.36	49.32
RCr- 436	26.25	6.05	41.55
RCr- 446	26.45	6.12	38.93
RCr- 684	26.01	6.38	46.46
HissarSugandha	27.18	6.48	44.87
HissarAnand	29.38	6.62	50.07
CD (P=0.05)	4.78	0.91	7.20
Fennel			
AF-1	72.81	14.90	103.01
RF-101	52.84	11.25	80.09
Co-1	51.32	10.65	75.34
RajendraSaurabha	53.49	12.28	85.79
GF-12	68.65	14.79	102.19
RF-281	61.33	13.21	95.79
RF-125	62.91	13.82	100.30
GF-02	62.82	13.72	98.55
CD (P=0.05)	10.89	2.11	14.36

lowest performance in terms of primary branches (7.0), secondary branches (14.43), umbels per plant (33.9), umbellates per umbel (29.7) and seed yield (1805 kg/ha) was observed in variety CO-1 followed by RF-101 (Table 34.2).

Nutrient Uptake by coriander and fennel: Significant difference in N, P and K uptake were observed among different coriander varieties under organic system. Among coriander varieties, nitrogen uptake was found to be significantly higher in ACr-1 (34.09 kg/ha) followed by Azad dhania-1 (31.96 kg/ha) which was at par with RCr-435 (29.68 kg/ha) and Hissar anand (29.38 kg/ha). P uptake was significantly higher in ACr-1 (7.37 kg/ha) followed by RCr-435 (7.36 kg/ha) which was par with Azad dhania-1 (6.66 kg/ha), Hissar anand (6.62 kg/ha) and Hissar Sugandha (6.48 kg/ha). K uptake was significantly higher in Azad dhania-1 (52.02 kg/ha) followed by ACr-1 (51.76 kg/ha) which was at with Hissar anand (50.07 kg/ha), RCr-435 (49.32 kg/ha), RCr-684 (46.46 kg/ha) and Hissar Sugandha (44.87 kg/ha). Among different fennel varieties, N uptake was found to be significantly higher in AF-1 (72.81 kg/ha) followed by GF-12 (68.65 kg/ha) which was at par with RF-125 (62.91 kg/ha) and GF-02 (62.82 kg/ha). P uptake was significantly higher in AF-1 (14.90 kg/ha) followed by GF-12 (14.79 kg/ha) which was at with RF-125 (13.82 kg/ha), GF-02 (13.72 kg/ha) and RF-281 (13.21 kg/ha). K uptake was significantly higher in AF-1 (103.01 kg/ha) followed by GF-12 (102.19 kg/ha) which was at par with RF-125 (100.30 kg/ha), GF-02 (98.55 kg/ha) and RF-281 (95.79 kg/ha) (Table 34.3).

Gangtok

Evaluation of buckwheat varieties under organic management condition: Results revealed that the maximum yield was recorded on IC 26600 from NPBGR, HP (15.33 q/ha) followed by Local Teethey (14.62 q/ha) and IC 109433 from NPBGR, HP (14.05 q/ha).



Sardarkrushinagar

Eight verities of each crop of groundnut-potato-pearl millet system are grown under organic management.

Groundnut: Yield and economics of different varieties showed significant variations among groundnut varieties. Pod yield of different varieties ranged from 1630 kg/ha to 2978 kg/ha. Significantly higher pod yield was found in variety GG- 2G (2978 kg/ha) which is at par with GJG-17 (2770 kg/ha) and GG-5 (2682 kg/ha). Haulm yield of different varieties also followed the same pattern. Highest Net return and B: C ratio was obtained in GG- 2G (Rs. 130449/ha and 4.28) which is closely followed by variety GJG-17 (Rs. 120301/ha and 3.95). Lowest net profit and B: C ratio (Rs. 58997 and 1.94) was found in treatment GG-7 (Table 35.1).

Potato: Tuber yield, haulm yield and Net return showed significant variations among different potato varieties. Tuber yield of different varieties varies from 9481 kg/ha to 17185 kg/ha. Significantly higher tuber yield was found in variety Kufri Khyati (17185 kg/ha) which is significantly higher than other varieties but was on par with Kufri Chipsona. Haulm yield of different varieties also followed the same pattern. Highest Net return and B: C ratio was also obtained in Kufri Khyati (17185 kg/ha and 0.75). Loss in Net return was found in Kufri Surya and Kufri Pukhraj due to higher disease infestation in these varieties (Table 35.2).

Pearl millet: Yield and economics of different pearl millet varieties showed significant variations among varieties evaluated. Seed yield of different varieties varies from 2880 kg/ha to 5244 kg/ha. Higher seed yield was found in variety 86 M 84 (5244 kg/ha) which is at par with 86 M 19 (4705 kg/ha) and GHB-757 (4273 kg/ha). Dry fodder yield of different varieties also followed the same pattern. Highest Net return and B: C ratio was obtained in 86 M 84 (‘ 50979 and 0.87) which is closely followed by variety GJG-17 (‘ 120301/ha and 3.95). Lowest net profit and B: C ratio (‘ 9308 and 0.16) was found with GHB- 719 (Table 35.3).

Nutrient Uptake: Data revealed that total uptake of N, P and K was observed in treatment T_8 KDG-123-Kufri Frisona-86M64 (470.75, 97.75 and 459.92 kg/ha) followed by treatment T_5 i.e GJG-9 - K. Chipsona-Nandi 72 (449.25, 91.33 and 423.92 Kg /ha respectively). Soil organic carbon was found to be higher in T_6 i.e. GG5-K Surya- GHB-757 and T_7 i.e. GJG-17 - K. Himsona- GHB- 719 (0.24%) and it was increased 26% to their initial value. Residual N, P and K was available in the soil was in ranged N from 158-169 kg/ha, P ranged from 12.41-13.66 kg/ha and K range was from 156-169 kg/ha. Soil physiological characters were not much influenced due to the different varieties in the system mode to their initial value after completion of cropping cycle (Table 35.4 & 35.5).

Performance of groundnut, potato and pearlmillet varieties under organic management at Sardarkrushinagar

Table 35.1. Yield and economics of different Groundnut varieties during *kharif* at SK Nagar

Varieties	Pod yield (kg/ha)	Haulm yield (kg/ha)	Cost of cultivation (Rs./ha)	Gross return (Rs./ha)	Net return (Rs./ha)	B:C ratio
GJG-HPS-1	2489	3556	30484	135111	104627	3.43
GG- 2G	2978	4015	30484	160933	130449	4.28
GG-7	1630	2667	30484	89481	58997	1.94
TG-37	2193	3178	30484	119163	88679	2.91
GJG-9	1970	3807	30484	109941	79457	2.61
GG-5	2681	3926	30484	145852	115368	3.78
GJG-17	2770	4089	30484	150785	120301	3.95
KDG-123	2326	3289	30484	126163	95679	3.14
CD (P=0.05)	319.50	466.98				

Table 35.2. Yield (kg /ha) and economics (Rs./ha) of different potato varieties during *rabi* at SK Nagar

Varieties	Tuber yield	Haulm yield	Cost of cultivation	Gross return	Net return	B:C ratio	Disease
K. Badshah	13037	2417	99425	131579	32154	0.32	*
K. Pukhraj	9778	2667	99425	99111	-314	0.00	**
K. Khyati	17185	4222	99425	173963	74538	0.75	*
K. Anand	14370	4083	99425	145745	46320	0.47	*
K. Chipsona	15407	4500	99425	156324	56899	0.57	#
K. Surya	9481	4194	99425	96912	-2513	-0.03	*
K. Himsona	11852	4250	99425	120644	21219	0.21	*
K. Frysona	10519	4611	99425	107491	8066	0.08	**
CD (P=0.05)	3099.92	350.30					

** High disease infestation, *Low disease infestation & # No disease infestation

Table 35.3. Yield (kg/ha) and economics (Rs./ha) of different pearl millet varieties during summer at SK Nagar

Varieties	Seed yield	Dry fodder yield	Cost of cultivation	Gross return	Net return	B:C ratio
GHB- 538	3114	4424	58648	75553	16905	0.29
GHB-558	3665	6302	58648	92210	33562	0.57
GHB- 732	3825	7022	58648	82270	23622	0.40
GHB-744	3790	6711	58648	80767	22119	0.38
Nandi 72	4705	6990	58648	96252	37604	0.64
GHB-757	4273	6764	58648	88655	30007	0.51
GHB- 719	2880	7292	58648	67956	9308	0.16
86 M 64	5244	8572	58648	109627	50979	0.87
CD (P=0.05)	1357.23	3179.52				

Table 35.4. Total uptake (kg/ha) of major nutrients after completion of cropping cycle at SK Nagar

Season	*Kharif* (Groundnut)			*Rabi* (Potato)			Summer (Pearl millet)			Total uptake		
Treatment	N	P	K	N	P	K	N	P	K	N	P	K
T1	101.33	19.33	81.67	96.25	19.42	105.25	101.33	19.33	81.67	298.92	58.08	268.58
T2	128.33	24.67	109.67	82.42	16.58	100.75	128.33	24.67	109.67	339.08	65.92	320.08
T3	139.67	27.00	121.33	137.17	27.50	157.17	139.67	27.00	121.33	416.50	81.50	399.83
T4	134.67	25.67	117.33	121.75	23.42	147.75	134.67	25.67	117.33	391.08	74.75	382.42
T5	159.00	30.33	127.33	131.25	30.67	169.25	159.00	30.33	127.33	449.25	91.33	423.92
T6	147.33	29.33	121.33	96.67	20.33	138.50	147.33	29.33	121.33	391.33	79.00	381.17
T7	126.67	26.67	116.00	110.75	22.75	146.42	126.67	26.67	116.00	364.08	76.08	378.42
T8	181.00	37.67	152.00	108.75	22.42	155.92	181.00	37.67	152.00	470.75	97.75	459.92

Table 35.5. Soil properties after completion of crop sequence at SK Nagar

Tret.	SOC (%)	N (kg/ha)	P (kg/ha)	K (kg/ha)	Fe (mg/kg)	Mn (mg/kg)	Zn (mg/kg)	Cu (mg/kg)	EC (dSm^{-1})	pH	MWHC (%)	BD (gm/cc)
T1	0.22	164	12.88	161	3.24	7.18	0.32	0.34	0.08	7.06	30.20	1.43
T2	0.21	163	13.66	162	2.83	6.75	0.35	0.31	0.08	7.05	30.41	1.43
T3	0.20	169	12.94	166	2.79	6.32	0.38	0.36	0.08	7.04	29.77	1.44
T4	0.23	161	12.41	164	2.91	7.70	0.34	0.38	0.08	7.06	29.42	1.43
T5	0.23	165	12.92	156	3.17	7.22	0.28	0.33	0.09	7.08	30.94	1.43
T6	0.24	159	12.77	169	3.21	7.37	0.26	0.29	0.08	7.02	27.86	1.46
T7	0.24	158	12.56	163	3.00	5.77	0.33	0.29	0.09	7.07	29.32	1.44
T8	0.23	168	13.19	159	2.95	6.73	0.36	0.32	0.10	7.06	28.06	1.45
INITIAL	0.19	147	10.92	140	2.62	5.70	0.25	0.24	0.09	7.14	26.62	1.48

Udaipur

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

Yield attributes of maize: Yield attributes of twelve varieties of maize grown under organic farming showed that variety, Pratap Hybrid Maize-3 recorded higher number of cobs/plant, nos. of grains/row, grains weight/cob and 1000-seed weight among maize varieties grown for grain purpose. Among sweet corn varieties, Sugar 75 produced higher yield attributes while VL Amber popcorn varieties registered higher nos. of grains/row, grains weight/cob and 1000-seed weight except number of cobs/plant. Navjot in local varieties showed comparative better performance of yield attributes for different types of maize (Table 36.1).

Yield and economics of different varieties of maize: Among the different maize varieties, Pratap hybrid maize-3 recorded significantly higher grain yield (7021 kg/ha), net return and net return per rupees invested of Rs. 95,855 and 2.19 respectively as compared to other varieties. Among sweet corn varieties, sugar-75 gave significantly higher grain yield (6339 kg/ha), net return (Rs. 1,21,734/ha) and net return per rupees invested (2.22) as compared to Misthy and Madhula. In case of baby corn varieties, PM-3 recorded

Table 36.1. Effect of different varieties on yield attributes of maizeat Udaipur

Varieties	Number of cobs per plant	Number of grain rows per cob	Number of grains per cob	Weight of grain per cob (g)	1000 seed weight (g)
		Grain			
Pratap QPM Hybrid – 1	1.67	14.00	474.67	82.83	185.00
PM – 9	1.67	12.67	369.00	67.50	188.33
Pratap Hybrid Maize – 3	2.00	14.00	375.00	105.33	269.67
		Sweet corn			
Sugar 75	1.67	15.33	406.33	38.07	94.33
Madhula	1.33	13.33	294.33	14.33	49.20
Misty	1.67	13.33	373.00	22.97	63.67
		Baby corn			
PM- 3	1.67	-	-	-	-
PM- 5	1.00	-	-	-	-
		Pop corn			
VL Amber pop corn	1.00	12.00	412.33	62.10	150.67
Amber pop corn	1.33	10.67	278.00	18.07	71.00
		Local			
Navjot	1.33	12.67	314.33	59.03	184.33
Farmers selection	1.67	11.33	382.67	78.57	202.00
CD at 5 %	0.297	0.679	6.207	1.136	2.094

Table 36.2. Yield and economics of different varieties of maize grown under organic farming at Udaipur

Varieties	Grain yield (kg/ha)	Stover yield (kg/ha)	Maize grain Equivalent yield (kg/ha)	Cost of cultivation (Rs/ha)	Gross return (Rs/ha)	Net return (Rs/ha)	NRPRI
			Maize (Grain)				
Pratap QPM Hybrid – 1	5515	6114	5581	43786	114900	70114	1.60
PM – 9	4507	5185	4507	43786	94047	49261	1.13
Pratap Hybrid Maize – 3	7021	6927	7021	43786	140641	95855	2.19
			Sweet corn				
Sugar 75	6339	8167	9055	54736	177470	121734	2.22
Madhula	2391	7550	3479	54736	90685	34949	0.64
Misty	3828	9445	5467	54736	130178	74442	1.36
			Baby corn				
PM- 3	1315	8670	3756	43536	100557	56021	1.29
PM- 5	1118	7500	3194	43536	86160	41624	0.96
			Pop corn				
VL Amber pop corn	4139	1350	4139	42976	172458	128482	2.99
Amber pop corn	1203	850	1203	42976	52440	8464	0.20
			Local varieties				
Navjot	3946	4348	3946	43236	81367	37131	0.86
Farmers selection	5226	6206	5226	43236	110036	65800	1.52
CD at 5 %	6.026	3.551	2.254	-	437.8	437.8	-

higher grain yield (1315 kg/ha), net return and net return per rupees invested of Rs. 56,021 and 1.29 respectively as compared to PM-5 and there was observed not significant difference. Among popcorn

Table 36.3. Yield attributes of wheat varieties grown under organic farmingat Udaipur

Varieties	Number of spikelet/ear	Ear length (cm)	Number of grains/ear	Grains weight/ear	1000-seed weight (g)
Triticumaestivum					
HI-1531	18.67	7.33	48.00	2.40	49.87
MP-3288	18.33	10.63	51.00	2.45	48.07
Raj-3765	17.67	8.87	46.67	2.34	50.27
Raj-4037	14.00	7.40	34.67	1.91	55.00
Raj-4120	13.67	7.90	40.67	2.20	54.00
Triticumduram					
HI-8627	17.00	7.33	49.67	3.01	60.67
HI-8663	17.33	6.43	51.33	2.84	55.30
HI-8713	17.67	6.97	52.33	3.12	59.70
MPO-1215	17.33	7.03	40.33	2.57	63.53
HI-1500	17.33	7.97	41.00	2.09	50.93
Wheat (Local)					
Lok-1	14.33	7.63	32.00	1.51	47.23
C-306	15.33	9.60	44.33	2.23	50.40
CD at 5 %	1.612	1.707	4.886	0.32	4.31

Table 36.4. Yield and economics of wheat varieties under organic farmingat Udaipur

Varieties	Grain yield (kg/ha)	Straw yield (kg/ha)	Cost of cultivation (Rs./ha)	Gross return (Rs./ha)	Net return (Rs./ha)	NRPRI
Triticum aestivum						
HI-1531	4407	7630	45736	162309	116573	2.55
MP-3288	4333	7241	45736	158253	112517	2.46
Raj-3765	3111	6519	45736	120355	74619	1.63
Raj-4037	3380	7361	45736	132181	86445	1.89
Raj-4120	2991	6454	45736	116663	70927	1.55
Triticum duram						
HI-8627	4241	7611	45736	166046	120310	2.63
HI-8663	3824	6917	45736	149997	104261	2.28
HI-8713	4481	8111	45736	175796	130060	2.84
MPO-1215	3339	5920	45736	130362	84626	1.85
HI-1500	2926	7259	45736	124801	79065	1.73
Wheat (Local)						
Lok-1	2981	6648	45736	117373	71637	1.57
C-306	4278	7389	45736	157468	111732	2.44
CD at 5 %	908	1902	-	-	-	-

varieties, VL- Amber observed significantly higher grain yield (4139 kg q/ha), net return and net return per rupees invested of Rs. 1,28,482 and 2.99 respectively as compared to Amber popcorn. Among local varieties, farmer selection gave significantly higher grain yield (5226 kg/ha) net return (Rs. 65,800/ha) and net return per rupees invested (1.52) as compared to Navjot of 3946 kg/ha, 37,131 and 0.86 yield, net return and net return rupees per invested respectively (Table 36.2).

Yield attributes of wheat: Among them, variety HI- 8713 recorded significantly higher number of grains/ ear (52.33), grain weight/ear (3.12) and grain yield (4481 kg/ha) as compared to other wheat varieties but

it was at par with HI-8627, HI-8663, HI-1531 and MP-3288. In case of *Triticum aestivum* varieties, significantly higher number of grains/ear and grain weight/ear was recorded in MP-3288 (51.00 and 2.45, respectively) as compared to Raj-4037 and Raj-4120 but it was at par with HI-1531 (48.00 and 2.40, respectively) and Raj-3765 (46.67 and 2.34, respectively). In case of *Triticum durum*, HI-8713 recorded significantly higher number of grains/ear and grain weight /ear (52.33 and 3.12) as compared to MPO-1215 and HI-1500, and it was at par with HI-8627 (49.67 and 3.01, respectively) and HI-8663 (51.33 and 2.84, respectively), while MPO-1215 recorded highest 1000-seed weight (63.53g) and was om par with HI 8627. Among local wheat varieties, C-306 recorded significantly higher number of grains/ear and grain weight/ear (44.33 and 2.23, respectively) as compared to Lok-1 (32.00 and 1.51, respectively) (Table 36.3).

Yield & economics of wheat: Among 12 wheat varieties evaluated under organic management variety, HI- 8713 recorded significantly higher grain yield (4481 kg) as compared to other varieties and it was at par with HI-1531 (4407 kg), MP-3288 (4333 kg), HI-8627 (4241 kg), HI-8663 (3824 kg) and C-306 (4278 kg). Among *Triticum aestivum* varieties, variety HI-1531 recorded significantly higher grain and straw yield (4407 and 7630 kg/ha) as compared to other wheat varieties except MP-3288, which was at par with HI-1531. In case of *Triticum durum* varieties, variety HI-8713 gave significantly higher grain yield (4481 kg/ha) as compared to MPO-1215 (3339 kg/ha) and HI-1500 (2926 kg/ha) but it was at par with HI-8627 (4241 kg/ha), and HI-8663 (3824 kg/ha). In local wheat varieties, variety C-306 recorded significantly higher grain yield (4278 kg/ha) as compared to Lok-1 (Table 36.3).

In term of economics, HI- 8713 gave significantly higher gross and net return (Rs. 175796/ha and Rs. 130060/ha, respectively) as compared to other varieties, and it was at par with HI-8627, HI-1531, MP-3288, HI-8663 and C-306. Among *Triticum aestivum* varieties, HI-1531 gave significantly higher gross and net return (Rs. 162309/ha and Rs. 116573/ha) as compared to Raj-2765 and Raj-4120 which was at par with MP-3288 (Rs. 158253/ha and Rs.112571/ha, respectively) and Raj-4037 (Rs. 132181/ha and Rs. 86445/ha, respectively). Among *Triticum durum* varieties, HI-8713 recorded significantly higher gross return and net return (Rs. 175796/ha and Rs. 130060/ha, respectively) as compared to MPO-1215 and HI-1500 which was at par with HI-8627 (Rs. 166046/ha and Rs.120310/ha, respectively) and HI-8663 (Rs.149997/ha and Rs. 104261/ha, respectively). In local wheat varieties, C-306 gave significantly higher gross and net return (Rs. 157468/ha and Rs. 111732/ha, respectively) as compared to Lok-1 (Rs. 117373/ha and Rs.71637/ha, respectively) (Table 36.4).

7.4 Evaluation of bio-intensive complimentary cropping systems under organic production systems

Objectives

- To evaluate the various land configuration and intercropping options for managing the soil nutrient and pests under organic production system
- To assess the infestation level of insect, disease and weeds under bio-intensive complimentary systems

Treatments: Four land configuration methods in main plot and cropping system in sub plot were taken up.

Land Configuration: i) Conventional, ii) Furrow Irrigated Raised Bed, iii) Broad bed & Furrow and iv) Raised & Sunken Bed

Cropping system: Four location specific complimentary bio-intensive cropping systems were taken in sub plots**.** Experiment was conducted at Dharwad, Pantnagar and Umiam centres with 3 replications in split plot design.

Year of start: 2013-14

Results:

Dharwad

Evaluation of performance of different cropping systems influenced by different conservation agriculture practices and different land configuration with or without crop residues under organic management

Four systems namely soybean-wheat, groundnut +cotton (2:1) intercropping, green gram-sorghum and soybean + pigeon pea (2:1)intercropping were evaluated with four land geometry namely, broad bed furrow method of planting with crop residue, broad bed furrow method of planting without residue, conventional flatbed planting method with residue and conventional flatbed planting method without residue.

Yield and economics of different cropping systems as influenced by land configuration and crop residue management

Soybean yield (1769 kg/ha) was higher in broad bed and furrow planting method with crop residue which is increased by 7.4% than conventional flat bed with residue. Groundnut, cotton and pigeon pea recorded higher yield in conventional method of planting with crop residue of 2656, 468 and 488 kg/ha respectively while, greengram (1744 kg/ha) was higher without crop residue. Conventional planting method produced 25.5, 4.5, 6.6 and 18.5% higher yield for groundnut, cotton, pigeon pea and greeengram respectively. During *rabi,* wheat resulted in higher yield (666 kg/ha) in conventional method with crop residue while, sorghum recorded higher on broad bed and furrow with crop residue (2784 kg/ha) (Table 37.1). Conventional flatbed method of planting without crop residue produced higher gross return, net

Table 37.1. Yield and equivalent yield of various crops in cropping system as influenced by land configuration and crop residues management at Dharwad

Cropping systems	*Kharif* yield (kg/ha)					*Rabi* yield (kg/ha)					Systems equivalent yield (kg/ha)				
	Broad bed and furrow		Conventional flatbed		Mean	Broad bed and furrow		Conventional		Mean	Broad bed and furrow		Conventional flatbed		Mean
	with crop residues	without crop residues	with crop residues	without crop residues		with crop residues	without crop residues	with crop residues	without crop residues		with crop residues	without crop residues	with crop residues	without crop residues	
Soybean-wheat	1769	1271	1647	1184	1468	645	411	666	474	549	2197	1536	2076	1489	1825
Groundnut +	2116	1941	2656	2376	2272						3935	3684	4801	4247	4167
cotton (2:1)	448	462	468	386	441										
Green gram -sorghum	1472	1440	1290	1744	1487	2784	2593	2737	2529	2661	4427	4252	4059	4780	4380
Soybean +	1278	1014	1192	1145	1157						2093	1615	2060	1965	1933
pigeon pea (2:1)	458	338	488	461	436										

Table 37.2. Economics of different cropping systems as influenced by land configuration and crop residues management

Cropping systems	Gross return (Rs./ha)					Cost of cultivation (Rs./ha)					Net return (Rs./ha)					B:C ratio				
	Broad bed and furrow		Conventional flatbed		Mean	Broad bed and furrow		Conventional flatbed		Mean	Broad bed and furrow		Conventional flatbed		Mean	Broad bed and furrow		Conventional flatbed		Mean
	with crop residues	without crop residues	with crop residues	without crop residues		with crop residues	without crop residues	with crop residues	without crop residues		with crop residues	without crop residues	with crop residues	without crop residues		with crop residues	without crop residues	with crop residues	without crop residues	
Soybean-Wheat	94762	66977	90854	65587	79545	77628	78050	75940	76362	76995	17134	-11073	14914	-10775	2550	1.22	0.86	1.20	0.86	1.04
Groundnut + Cotton (2:1)	124591	16662	151912	134459	131906	89388	89388	86388	86388	87888	35204	65524	27275	48072	44019	1.39	1.31	1.76	1.56	1.51
Green gram - Sorghum	153936	146998	145562	160821	151829	68016	68016	66235	66235	67126	85921	78982	79327	94587	84704	2.26	2.16	2.20	2.43	2.26
Soybean +pigeon pea (2:1)	100885	78996	100323	95616	93955	50982	50982	47982	47982	49482	49903	52341	28014	47634	44473	1.98	1.55	2.09	1.99	**1.90**
Mean	118544	77408	122163	114121		71504	71609	69136	69242		47041	46444	37383	44880		1.71	1.47	1.81	1.71	

Table 37.3. Soil physical and chemical properties as influenced by land configuration and crop residues management

Cropping systems	Bulk density (g/cc)					pH					Electrical conductivity					Organic chemistry (g/kg)				
	Broad bed and furrow		Conventional flatbed		Mean	Broad bed and furrow		Conventional flatbed		Mean	Broad bed and furrow		Conventional flatbed		Mean	Broad bed and furrow		Conventional flatbed		Mean
	with crop residues	without crop residues	with crop residues	without crop residues		with crop residues	without crop residues	with crop residues	without crop residues		with crop residues	without crop residues	with crop residues	without crop residues		with crop residues	without crop residues	with crop residues	without crop residues	
Soybean -Wheat	1.21	1.27	1.26	1.31	1.26	7.42	7.65	7.40	7.59	7.52	0.19	0.21	0.19	0.24	0.21	6.67	6.47	6.50	6.60	6.56
Groundnut + Cotton (2:1)	1.20	1.28	1.26	1.30	1.26	7.35	7.61	7.53	7.55	7.51	0.21	0.23	0.20	0.22	0.21	6.57	6.43	6.40	6.50	6.48
Green gram -Sorghum	1.20	1.25	1.27	1.31	1.26	7.42	7.50	7.48	7.65	7.51	0.21	0.23	0.21	0.23	0.22	6.57	6.53	6.77	6.20	6.52
Soybean + pigeon pea (2:1)	1.20	1.28	1.24	1.33	1.26	7.43	7.39	7.54	7.59	7.49	0.22	0.22	0.22	0.22	0.22	6.60	6.40	6.57	6.20	6.44
Mean	1.20	1.27	1.26	1.32		7.41	7.54	7.49	7.60		0.21	0.22	0.20	0.23		6.60	6.46	6.56	6.38	
CD (P=0.05)	LCRM 0.03	CS NS	LCRM NS	X CS		LCRM NS	CS NS	LCRM NS	X CS		LCRM NS	CS NS	LCRM NS	X CS		LCRM 0.19	CS NS	LCRM NS	X CS	

Table 37.4. Available N, P and K at the end of cropping cycle as influenced by land configuration and crop residues management

Cropping systems	Available N (kg/ha)					Available P (kg/ha)					Available K (kg/ha)				
	Broad bed and furrow		Conventional flatbed		Mean	Broad bed and furrow		Conventional		Mean	Broad bed and furrow		Conventional flatbed		Mean
	with crop residues	without crop residues	with crop residues	without crop residues		with crop residues	without crop residues	with crop residues	without crop residues		with crop residues	without crop residues	with crop residues	without crop residues	
Soybean-wheat	297.6	273.2	274.8	237.2	270.7	31.0	29.2	34.4	27.6	30.5	380.6	347.6	366.6	335.0	357.5
Groundnut +cotton (2:1)	267.3	279.5	271.8	260.4	269.8	34.9	30.3	32.0	29.8	31.8	370.6	332.5	368.6	324.4	349.0
Green gram -sorghum	289.7	274.8	288.8	218.5	268.0	32.2	28.7	32.2	26.9	30.0	368.5	359.0	339.8	326.4	348.4
Soybean +pigeon pea (2:1)	276.7	286.0	280.7	272.9	279.1	33.6	33.2	30.3	27.7	31.2	362.4	343.7	343.1	352.3	350.4
Mean	282.8	278.4	279.0	247.3		32.9	30.4	32.3	28.0		370.5	345.7	354.5	334.5	
CD (P=0.05)	LCRM 14.1	CS NS	LCRM NS	X CS		LCRM 4.13	CS NS	LCRM NS	X CS		LCRM NS	CS NS	LCRM NS	X CS	

Table 37.5. Available micronutrients in the soil at the end of cropping cycle as influenced by land configuration and crop residues management

Cropping systems	Available copper (mg/kg)					Manganese (mg/kg)					Iron (mg/kg)					Zinc (mg/kg)				
	Broad bed and furrow		Conventional flatbed		Mean	Broad bed and furrow		Conventional flatbed		Mean	Broad bed and furrow		Conventional flatbed		Mean	Broad bed and furrow		Conventional flatbed		Mean
	with crop residues	without crop residues	with crop residues	without crop residues		with crop residues	without crop residues	with crop residues	without crop residues		with crop residues	without crop residues	with crop residues	without crop residues		with crop residues	without crop residues	with crop residues	without crop residues	
Soybean -Wheat	4.36	3.74	3.83	4.01	3.99	20.56	19.10	20.53	16.77	19.24	20.87	17.84	18.98	18.17	18.96	1.61	1.52	1.53	1.49	1.54
Groundnut + Cotton (2:1)	4.75	4.01	4.01	3.90	4.17	21.77	18.80	19.36	17.44	19.34	20.41	18.51	18.48	17.56	18.74	1.59	1.45	1.48	1.42	1.49
Green gram -Sorghum	4.61	3.87	3.96	3.84	4.07	20.71	18.23	19.56	17.55	19.01	21.06	18.12	18.85	18.02	19.01	1.60	1.48	1.51	1.49	1.52
Soybean + pigeon pea (2:1)	4.62	3.90	4.01	3.76	4.07	20.74	20.04	17.03	18.74	19.14	20.20	17.25	19.38	17.77	18.65	1.51	1.47	1.53	1.42	1.48
Mean	4.59	3.88	3.95	3.88		20.94	19.04	19.12	17.62		20.63	17.93	18.92	17.88		1.58	1.48	1.51	1.45	
CD (P=0.05)	LCRM 0.65	CS NS	LCRM NS	X CS		LCRM 2.69	CS NS	LCRM NS	X CS		LCRM 1.09	CS NS	LCRM NS	X CS		LCRM 0.10	CS NS	LCRM NS	X CS	

Table 37.6. Microbial activity in soil at grand growth periods of crop/s as influenced by land configuration and residues management

Cropping systems	Bacterial population (cfu x 10^6)					Fungal population (cfu x 10^4)					Population of actinomycetes (cfu x 10^3)					Phosphate solubilizing bacteria (cfu×10^5)				
	Broad bed and furrow		Conventional flatbed		Mean	Broad bed and furrow		Conventional flatbed		Mean	Broad bed and furrow		Conventional flatbed		Mean	Broad bed and furrow		Conventional flatbed		Mean
	with crop residues	without crop residues	with crop residues	without crop residues		with crop residues	without crop residues	with crop residues	without crop residues		with crop residues	without crop residues	with crop residues	without crop residues		with crop residues	without crop residues	with crop residues	without crop residues	
Soybean -Wheat	8.06	7.95	7.94	7.77	7.93	4.72	4.74	4.36	4.86	4.67	4.69	4.59	4.64	4.34	4.57	6.73	6.12	6.59	6.21	6.41
Groundnut+ Cotton (2:1)	7.84	7.69	7.78	7.81	7.78	4.92	4.56	4.98	4.46	4.73	4.64	4.41	4.63	4.60	4.57	6.69	5.70	6.26	6.72	6.34
Green gram -Sorghum	7.70	7.80	7.64	7.71	7.71	4.78	4.98	4.36	4.90	4.75	4.77	4.44	4.54	4.45	4.55	6.57	6.39	6.60	6.53	6.52
Soybean + pigeon pea (2:1)	7.89	7.72	7.82	7.40	7.71	4.93	4.51	4.96	4.83	4.81	4.72	4.28	4.64	4.32	4.49	6.27	6.54	6.49	6.66	6.49
Mean	7.87	7.79	7.80	7.67		4.84	4.70	4.67	4.76		4.71	4.43	4.61	4.43		6.57	6.19	6.48	6.53	

monetary returns and B:C ratio (Rs. 1,60,821, Rs. 95,587/ha and 2.43 respectively) in greengram sorghum system followed by broad-bed and furrow (BBF) method of planting with crop residues (Rs. 1,53,936, Rs. 85,921/ha and 2.06, respectively). Broad bed and furrow (BBF) method of planting and conventional flatbed (FB) method of planting in addition to recycling of crop residues produced higher net monetary returns and higher B:C ratio (Rs. 47,041 to 53,027/ha and 1.71 to 1.81, respectively) as compared to broad bed and furrow (BBF) method of planting and conventional flatbed (FB) method of planting without any crop residues (Rs. 30,800 to 44,880/ha and 1.47 to 1.71, respectively). The use of crop residues of component crops (either of companion crop or preceding crops) as a mulch for existing (standing) crop in different cropping systems and as incorporation to succeeding crop found more beneficial under both conventional flat (FB) method of planting and broad bed and furrow (BBF) method of planting. Among the cropping systems, greengram-sorghum recorded higher net return (Rs. 87,704/ha) and B:C ratio in term of per rupees invested (2.26). The use of crop residues as a mulch for existing crop in different cropping systems and incorporation for succeeding crop was found more beneficial under broad bed and furrow (BBF) method of planting (Table 37.2).

Physical and chemical properties of soil as influenced by land configuration and crop residue management

Broad bed and furrow (BBF) method of planting with crop residues decreased bulk density to 1.20 g/cm^3 from conventional flatbed (FB) method of planting without crop residue (1.32 g/cm^3). Improvement in bulk density was found to be 10%. The chemical properties namely soil pH and EC didn't differ significantly either due to land configuration or due to cropping system. The soil organic carbon increased significantly from flatbed method of planting without crop residue (6.38 g/kg) to broad bed furrow method of planting with crop residue (6.60 g/kg). The available N, and P_2O_5 increased significantly from 247.3 and 27.99 kg/ha with conventional flatbed method of planting without crop residue to 282.8 and 32.90 kg/ha, respectively with broad bed furrow method of planting with crop residue, while potassium didn't differ significantly but also was higher with broad bed furrow method of planting (370.5 kg/ha). All these nutrients were unaffected by cropping system. The available micronutrients namely, Cu, Zn, Mn and Fe increased significantly from 3.88, 1.45, 17.62 and 17.88 mg/kg with conventional flatbed method of planting without crop residue to 4.59, 1.58, 20.94 and 20.63 mg/kg, respectively with broad bed furrow method of planting with crop residue. The cropping systems were not affected significantly (Table 37.3 - 37.5).

Microbial population as influenced by land configuration and crop residue management

Among the planting methods for rhizosphere microbial population, broad bed and furrow (BBF) method of planting with incorporation of residues was found to be higher bacteria (7.87 x10^6 cfu/g), fungal population (4.84 x10^4 cfu/g), actinomycetes (4.71 x10^3 cfu/g) and P-solubilizing microorganism (6.57 x10^6 cfu/g), activity as compared to other land configurations. The differences in population of microorganisms and microbial activity between cropping systems were marginal (Table 37.6).

Pantnagar

Resource conservation techniques in different crops and cropping systems under organic cultivation

Yield, yield attributes and harvest index of paddy: yield attributing characters of basmati rice *viz*, plant height, effective tillers/m^2 and test weight were significantly influenced by different resource conservation

treatments. Significantly higher plant height (105 cm) was attained in SRI-wheat –*sesbania* cropping system, and was found *at par* with rice + pigeon-cowpea + okra on furrow-in-raised bed system. Significantly higher effective tillers/m^2 (260) was recorded under basmati rice-wheat-*sesbania* over all other resource conservation technologies. However, 1000-grains wt. of basmati rice (22.1 g) was significantly higher in DSR-wheat-Moong on broad-bed and furrow system.

There was significant influence of resource conservation practices on grain yield, straw yield and harvest index of basmati rice. DSR + soybean-vegetable pea + mustard on furrow in raised-bed system recorded significantly higher basmati rice grain yield (4581 kg/ha) over all other resource conservation techniques and was increased by 13.9% compared to basmati rice-wheat-*sesbania*, though, and straw yield was significantly higher under basmati rice-wheat-*sesbania* (4525 kg/ha) and was *at par* with SRI-wheat- *sesbania*, DSR- wheat(ZT)- *sesbania* and DSR + soybean-vegetable pea + mustard. Significantly higher harvest index (53.7) was also obtained with DSR + soybean-vegetable pea + mustard on furrow in raised bed system over all other resource conservation treatments (Table 38.1).

Nutrient uptake in rice crop: Significantly higher nitrogen (74.60 kg/ha), phosphorus (19.28 kg/ha) and potassium (63.8 kg/ha) uptake by basmati rice was recorded with basmati rice–wheat–*sesbania*. Nitrogen and phosphorus uptake in SRI-wheat- *sesbania* was found on par with basmati SRI- wheat- *sesbania* and FIRB:DSR+soybean-veg.pea+mustard *w*hile K uptake by basmati rice under SRI- wheat – *sesbania* was found on par with basmati rice- wheat- *sesbania*,. Significantly higher sulphur uptake by DSR-wheat (ZT)-*sesbania* (27.49 kg/ha) was found on par with basmati rice-wheat- *sesbania*, SRI-wheat- *sesbania* and DSR in furrow+ soybean-vegetable pea + mustard on raised bed under FIRB system (Table 38.2).

Yield and Yield attributes of *rabi* crops: Maximum plant height (100 cm) was attained under DSR-wheat (ZT)-*sesbania* and was found at par SRI-wheat-*sesbania* and basmati rice-wheat-*sesbania* however, spikes/m^2 (254) of wheat was observed in basmati rice-wheat-sesbania resource conservation practices and was statistically on par with SRI-wheat-*sesbania* and DSR-wheat (ZT)-*sesbania*. Higher Plant height and pods/plant of chickpea under DSR- chickpea- moong on broad bed and furrow system was 98 cm and 45, respectively. In case of vegetable pea, maximum plant height (94 cm) was observed in DSR+ soybean-vegetable pea + mustard on furrow in raised bed system as compared to DSR-vegetable pea – cowpea on broad bed and furrow system. However, pods/plant of vegetable were more (18) in DSR + soybean-vegetable pea + mustard under furrow in raised bed resource conservation techniques. Maximum no of grains/spike of wheat (41.8) was observed in basmati rice –wheat (ZT)-*sesbania* whereas, maximum 1000-grains wt. (47.7 g) of wheat was observed in basmati rice-wheat. Seeds/pods and 100-seeds of chickpea was recorded under DSR-chickpea-moong on broad bed and furrow system (2.0 and 29.6 g respectively). In case of vegetable pea, maximum seeds/pods (5.8) and 100-seeds wt. (46.0g) were recorded in DSR + Soybean-vegetable pea-mustard on furrow in raised bed system as compared to DSR +-vegetable pea + cowpea on broad bed and furrow system. Maximum grain yield of wheat (3742 kg/ha) was recorded in Basmati rice- wheat- *sesbania* while lowest grain yield (3103 kg/ha) was observed in DSR-wheat-(ZT)–*sesbania*. Green pod yield of vegetable pea was found to be higher (7612 kg/ha) in DSR+ soybean-vegetable pea+ mustard system as compared to in DSR-vegetable pea-cowpea on broad bed and furrow (7154 kg/ha). Chickpea yield recorded under DSR-chickpea-moong on broad-bed and furrow system (1565 kg/ha) (Table 38.3 & 38.4).

Table 38.1. Yield attributes and yieldof rice as influenced by different resource conservation practice

Treatments	Plant height(cm)	Effective tillers/m²	1000-grainswt. (g)	Grain yield (kg/ha)	Straw yield (kg/ha)	Harvest Index
Basmati rice-wheat–*sesbania*	99	260	21.6	4022	4525	47.1
SRI-wheat- *sesbania*	105	252	22.0	3778	4204	47.3
DSR-wheat(zero tillage) –*sesbania*	101	253	21.5	3578	3996	47.3
DSR-wheat–moong on broad bed and furrow	93	251	22.1	2544	2850	47.2
DSR-vegetable pea -cowpea on broad bed and furrow	98	250	21.1	2800	3153	47.0
DSR-chickpea–moong on broad bed and furrow	95	249	21.4	2975	3335	47.1
FIRB: DSR+ soybean–vegetable pea+ mustard	100	249	21.0	4581	4000	53.7
FIRB: rice +pigeon pea–cowpea +okra	102	250	21.3	2778	3129	47.0
CD(P=0.05)	3.42	6.03	0.72	413	643	3.29

Note: SRI-System rice intensification, DSR-Direct seeded rice, FIRB- Furrow irrigated raised bed

Table 38.2. Nutrient uptake (kg/ha) by paddy as influenced by resource conservation techniques

Treatments	N uptake (kg/ha)	P uptake (kg/ha)	K uptake (kg/ha)	S uptake (kg/ha)
Basmati rice-wheat–*sesbania*	74.60	19.28	63.8	27.15
SRI-wheat- *sesbania*	69.53	17.73	56.0	27.14
DSR-wheat(zero tillage) –*sesbania*	63.15	16.38	54.5	27.49
DSR-wheat–moong on broad bed and furrow	43.46	11.30	38.3	17.20
DSR-vegetable pea -cowpea on broad bed and furrow	49.23	13.29	41.4	19.82
DSR-chickpea–moong on broad bed and furrow	51.79	13.24	45.2	20.29
FIRB: DSR+ soybean–vegetable pea+ mustard	73.31	19.01	53.7	26.97
FIRB: rice +pigeon pea–cowpea +okra	49.96	12.24	42.0	18.00
CD(P=0.05)	8.41	2.58	7.74	4.02

DSR-Direct seeded rice; FIRB- Furrow irrigated raised bed

Table 38.3. Yield attributes and yields of *rabi* crops as influenced by different resource conservation techniques

Treatments	Plant height (cm)	Spikes/m² of wheat, Pods/plant of veg. pea and cowpea	No. of grains/spike of wheat, Pods/plant of veg. pea and cowpea	1000-grains wt. of wheat and 100 seeds wt. of veg. pea and cowpea
Basmati rice-wheat-*sesbania*	97	254	40.6	47.7
SRI-wheat- *sesbania*	98	239	41.8	45.4
DSR-wheat(Zero tillage) –*sesbania*	100	236	40.5	47.5
DSR-wheat-moong on broad bed and furrow	99	230	40.7	45.7
DSR-vegetable pea -cowpea on broad bed and furrow	94	17	5.8	41.8
DSR-chickpea–moong on broad bed and furrow	98	45	2.0	29.6
FIRB: DSR+ soybean -vegetable pea+ mustard	90	18	5.8	46.0
FIRB: rice +pigeon pea-cowpea +okra	-	-	-	-
CD(P=0.05)	3.15	31.2	1.1	3.4

Table 38.4. Yield of *rabi* crops and wheat equivalent yield as influenced by different treatments

Treatments	Yield of *rabi* crops (kg/ha)				
	Wheat	Vegetable pea	Chickpea	Coriander	Mustard
Basmati rice-wheat-*sesbania*	3742				
SRI-wheat- *sesbania*	3426				
DSR-wheat(Zero tillage) –*sesbania*	3103				
DSR-wheat-moong on broad bed and furrow	3734				
DSR-vegetable pea -cowpea on broad bed and furrow		7154		863	
DSR-chickpea–moong on broad bed and furrow			1565	789	
FIRB: DSR+ soybean -vegetable pea+ mustard		7612			96.2
FIRB: rice +pigeon pea-cowpea +okra	3742				

Table 38.5. Relative economics of different resource conservation technologies

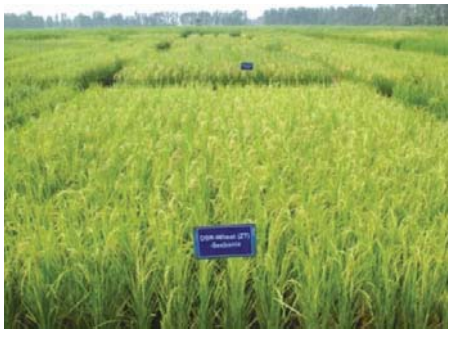
Treatments	System productivity (kg/ha)	Cost of cultivation (Rs./ha)	Net Return (Rs./ha)	B:C Ratio
Basmati rice-wheat-*sesbania*	6875	72355	99526	1.38
SRI-wheat- *sesbania*	6390	69480	90268	1.30
DSR-wheat (zero tillage) –*sesbania*	5944	68642	79951	1.16
DSR-wheat-moong on broad bed and furrow	5391	70250	64528	0.92
DSR-veg. pea -cowpea on broad bed and furrow	9897	65630	181795	2.77
DSR-chickpea–moong on broad bed and furrow	11017	61385	214042	3.49
FIRB:DSR+ soybean-vegetable pea+ mustard	9257	60923	170514	2.80
FIRB: rice +pigeon pea-cowpea +okra	5225	48405	82228	1.70
CD (P=0.05)	1310	-	-	-

Table 38.6. Nutrient status of soil after completion of crop cycle

Treatments	Organic carbon (%)	Available N (kg/ha)	Available P (kg/ha)	Available K (kg/ha)	Available S (kg/ha)
Basmati rice-wheat-*sesbania*	1.16	344	36.6	260	37.5
SRI-wheat- *sesbania*	1.20	367	35.3	265	34.9
DSR-wheat (Zero tillage) –*sesbania*	1.23	359	44.3	270	31.4
DSR-wheat-moong on broad bed and furrow	1.22	354	37.1	240	35.4
DSR-veg. pea -cowpea on broad bed and furrow	1.17	374	36.7	251	34.7
DSR-chickpea–moong on broad bed and furrow	1.21	395	36.9	252	33.9
FIRB:DSR+ soybean-vegetable pea+ mustard	1.09	328	38.6	267	38.2
FIRB: rice +pigeon pea-cowpea +okra	1.23	338	35.0	263	35.1
CD (P=0.05)	0.04	7.50	NS	7.27	0.59

System productivity and economics: Maximum net returns (Rs.2,14,042 /ha) and B:C ratio (3.49) was recorded in DSR- chickpea–moong on broad bed and furrow system followed by DSR+ soybean-vegetable pea +mustard in furrow irrigated raised bed system (FIRB). Minimum net returns (Rs. 64,258 /ha) and B: C ratio (0.92), was observed in DSR-wheat-moong on broad bed and furrow techniques. System productivity in terms of basmati grain equivalent yield was significantly influenced by resource conservation practices and significantly higher system productivity (11017 kg/ha) was observed in DSR-chickpea–moong on broad bed and furrow which was at par with DSR+ soybean –vegetable pea + mustard in furrow irrigated raised-bed system (9897 kg/ha) (Table 38.5).

Soil nutrient status: Nutritional status of soil after completion of crop cycle *viz*. organic carbon, available N, K and S were significantly influenced by resource conservation practices however, available P was not significantly influenced by different resource conservation techniques. Significantly higher but at par organic carbon was recorded in DSR-wheat (zero tillage)-*sesbania* (1.23%), rice+ pigeon pea-cowpea+ okra on furrow in raised bed system (1.23%) followed by DSR-wheat-moong on broad bed and furrow system (1.22), DSR-chickpea-moong on broad bed and furrow system (1.21%). Availability of nitrogen in the soil was in range from 328 to 395 kg/ha and significantly higher available N being observed in DSR-chickpea-moong on broad –bed and furrow system. Available phosphorus after completion of one crop cycle ranged from 35.0 to 44.3 kg/ha and maximum availability being observed in DSR-wheat (zero tillage)- *sesbania*. Availability of potassium was significantly higher under DSR-wheat (zero tillage)- Sesbania (270 kg/ha) and was on par with SRI-wheat-*sesbania*, DSR+ soybean–vegetable pea + mustard on furrow in raised bed system and rice + pigeon-cowpea + okra on furrow-in-raised bed resource conservation techniques. However, availability of sulphur was significantly higher in DSR+ soybean – vegetable pea + mustard on furrow in raised bed system among all other resource conservation technology (Table 38.6).



DSR wheat (ZT)-*sesbania*

DSR + soybean + vegetable pea + mustard

DSR+ pigeon pea + cowpea on FIRB

Umiam

Evaluation of bio-intensive complimentary cropping systems under raised and sunken bed techniques

The Raised and sunken bed were made in sequence for efficient drainage and inter-plot water harvesting with a fixed width i.e. 1 m for raised-bed and 1.25 m for sunken bed. The lengths of all the plots were same (8 m). The surface soil layer of each sunken bed was removed and deposited on the adjacent raised beds making about 30 cm bed height. All the crop residues and weed biomass were placed below the raised beds and covered properly. Transplanted rice was grown in sunken beds during *kharif* season with four

rice varieties namely Shahsarang-1, Lampnah, IR-64 and Vivek Dhan-82. Potato (*cv.* Kufri Jyoti), French bean (Naga local) and Carrot (New Kuroda) were grown during pre-*kharif* season (January to May) followed by okra in *kharif* season (June to August/Sept). *Kharif* rice was harvested by leaving at least 20 cm standing stubble during last week of November and thereafter in sunken beds lentil was grown under zero tillage. For growing lentil in sunken beds, the rice fields were drained at physiological maturity (Table 39.1).

Growth parameters and yield of rice on sunken bed: Among the rice varieties, the highest plant height was recorded in Vivek-Dhan-82 (95.8 cm) which was followed by Shahsarang-1 (81.8 cm) and IR 64 (73.9 cm) while variety Lampnah (71.6 cm) recorded the shortest plants. Tillers per square meter was recorded maximum in Shahsarang-1 (317) followed by Lampnah (270) and IR 64 (259). The lowest numbers of tillers were recorded in Vivek Dhan-82 (225). Numbers of panicle per square meter also followed the same trend as tillers per square meter. In rice based cropping systems on sunken beds, the rice yield in sunken beds ranged from 3390 to 4640 kg/ha under different sequences with mean productivity of 4060 kg/ha and 3960 kg/ha under rice-lentil and rice-pea cropping system, respectively. Among the rice varieties, Shahsarang-1 recorded the highest grain yield (4640 kg/ha) under rice-lentil cropping sequence. Higher yield of lentil was recorded with rice variety (Vivek dhan-82) of 1220 kg/ha among rice-lentil system whereas, pea yield (4830 kg/ha) was also higher with rice (Vivek dhan-82) in rice-pea system. The highest rice equivalent yield was recorded under rice (Lampnah)–pea (13320 kg/ha) followed by rice (VD-82) – pea 12690 kg/ha. Among rice lentil system, rice (Shahsarang-1)–lentil system recorded highest rice equivalent yield of 8270 kg/ha (Table 39.1).

Yield of vegetables on raised-bed: Potato, French bean and carrot recorded yield on raised bed of 16800, 17600 and 27900 kg/ha respectively. The yield of okra during *kharif* season ranged from 8500 to 9100 kg/ha and was higher with frenchbean (9100 kg/ha) in the system whereas, rice equivalent yield was recorded higher under carrot–okra cropping system (36500 kg/ha) (Table 39.2).

Physico-chemical properties of soil: French bean-okra cropping sequence recorded higher soil pH (5.20), soil organic carbon (2.36%), available nitrogen (269.9 kg/ha), phosphorus (25.9 kg/ha) and potassium (264.9 kg/ha) under raised beds planting technique followed by carrot-okra cropping sequence except soil pH where it is higher in potato-okra cropping sequence. In case of sunken beds, rice (Shahsarang-1)-lentil cropping sequence recorded maximum soil pH (5.21), OC (2.82%), available nitrogen (279.9 kg/ha), phosphorus (28.0 kg/ha) and (271.7 kg/ha) while among rice-pea system, rice (Shahsarang-1)-pea cropping sequence also recorded maximum pH, OC, N, P and K of 5.2,2.78%, 277.8,27.1 and 271.1 kg/ha respectively (Table 39.3).

Harvested potato crop on raised bed

Rice (sunken bed) and Okra (raised bed) during *Kharif* season

Table 39.1. Growth parameters and yield (kg/ha) *kharif* and *rabi* crops on sunken beds.

Cropping sequence	*Kharif*				*Rabi*	REY (kg/ha)
	Plant height(cm)	Tiller /m²nos.	Panicle /m²nos.	Rice yield yield	Lentil & Pea	
Rice (IR-64) - lentil	74.3	246	223	3720	1130	7480
Rice (VD-82) -lentil	92.0	197	185	3480	1220	7540
Rice (Shahsarang-1) -lentil	80.2	309	277	4640	1090	8270
Rice (Lampnah)-lentil	70.8	251	234	4390	1150	8230
Mean	79.3	251	230	4060	1150	7880
Rice (IR-64) - Pea	73.9	270	243	3680	4490	12670
Rice (VD-82) -Pea	95.8	225	208	3390	4830	13040
Rice (Shahsarang-1) -pea	81.7	317	305	4510	4090	12690
Rice (Lampnah) -pea	71.6	259	242	4260	4530	13320
Mean	80.7	268	249	3960	4480	12930

Table 39.2. Yield and rice equivalent yield of vegetable crops on raised bed

Cropping sequences	Yield of raised bed crops (kgha)		REY(kgha)
	Pre-*kharif*	*Kharif*	
Potato-okra	16800	8500	25300
French bean- okra	17600	9100	26700
Carrot- okra	27900	8700	36500
Mean	20700	8800	29500

Table 39.3. Physico-chemical properties of soil

Cropping sequences	pH	Soil organic carbon (%)	Available N (kg/ha)	Available P (kg/ha)	Available K (kg/ha)
		Raised bed			
Potato-Okra	5.17	2.21	252.5	22.3	262.7
French bean- Okra	5.20	2.36	269.9	25.9	264.9
Carrot- Okra	5.12	2.24	266.8	22.8	262.5
Mean	5.16	2.27	263.1	23.7	263.4
		Sunken bed			
Rice (IR-64) - Lentil	5.18	2.68	267.1	24.8	266.5
Rice (VD-82) -Lentil	5.19	2.75	267.9	25.9	266.7
Rice (Shahsarang-1) -Lentil	5.21	2.81	279.9	28.0	271.7
Rice (Lampnah) -Lentil	5.19	2.77	274.7	27.6	271.3
Mean	5.19	2.75	272.4	26.6	269.0
Rice (IR-64) - Pea	5.10	2.68	265.7	24.0	265.6
Rice (VD-82) -Pea	5.11	2.71	266.4	24.9	266.2
Rice (Shahsarang-1) -Pea	5.20	2.78	277.8	27.1	271.1
Rice (Lampnah) -Pea	5.20	2.78	272.2	26.8	270.0
Mean	5.15	2.74	270.5	25.7	268.2

7.5 Development of Integrated Organic Farming System Models

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, Vermicompost unit, Live fencing, seed/planting material production unit

Locations: Calicut, Coimbatore and Umiam

Year of start: 2013-14

Results:

Calicut

The 0.4 ha plot with spices, fodder and vegetables combination was established at Chelavoor farm. The crops, turmeric, ginger, pepper, coconut, fodder grasses (congo signal grass, CO-3, CO-4), Tapioca, Banana, pineapple, vegetable cowpea were planted and established. A yield of 375 kg turmeric, 100 kg ginger, 683 kg fodder grass, 5 kg vegetable cowpea, 75 kg Tapioca were produced and sold. A diary unit was also established with two cows (Jersey and Jersey cross) and their calves and a yield of 15 liters of milk is realized daily. An income of Rs. 79,631 was received from an area of one acre integrated farming system model.

Coimbatore

Composition of organic farming system (0.40 ha)

Components	Treatments/ Remarks
Crop component	**Cropping Systems:** 1. Bhindi + leaf coriander - maize + cowpea (fodder) - (0.12 ha) 2. Green manure - cotton - sorghum (0.12 ha) 3. Fodder grass CO CN (4) and desmanthus (0.10 ha)
Agro forestry	*Azardhiracta indica, Melia dubia, Sesbania sesban, Pongamia pinnata, Gmelina arborea, Ailanthus excelsa (500 m2)*
Dairy	Milch animal: 2 cows with calves
Vermi-compost	The residue of the crops and manure from the dairy unit were converted into vermi-compost and used as enriched manure for crops
Area under supporting activities	Manure pit, threshing floor etc.
Border plants	Desmanthus, Banana, *Glyricidia sp.*

Performance of okra + leaf coriander - maize + cowpea (fodder) system

Okra plant attained the maximum height of 66.7 cm with 1877 kg/ha of dry matter production. Availability of nutrients such as nitrogen, phosphorus and potassium in soil was 252, 8.6 and 473 kg/ha at the end of cropping cycle. Fruit length of okra was 11.7 cm, numbers of fruits/plant 17.5 with yield 8313 kg/ha was recorded in okra variety Anarva grown under okra + leaf coriander - maize + cowpea (fodder) system. Net return of Rs. 57,946/ha was obtained through okra under integrated organic farming model.

Table 40.1. Plant height, dry matter, soil fertility status and yield and economics of okra under organic farming system mode

Particulars (at harvest)	Okra
Plant growth parameters	
Plant height (cm)	66.7
DMP (kg/ha)	1877
Soil nutrient status	
Organic carbon (%)	0.47
N (kg/ha)	252
P (kg/ha)	8.6
K (kg/ha)	473
Yield parameters	
Fruit length (cm)	11.7
Fruit girth (cm)	5.37
No. of fruits plant-1	17.5
Fruit weight (g fruit-1)	15.0
Fruit yield ((kg/ha))	8313

Table 40.2. Plant height, dry matter, soil fertility, yield of maize under organic farming system mode

Particulars (at harvest)	Maize
Plant growth parameters	
Plant height (cm)	213
DMP (kg ha-1)	7753
Soil nutrient status	
Organic carbon (%)	0.48
N (kg/ha)	264
P (kg/ha)	12.4
K (kg/ha)	475
Yield parameters	
No. of rows cob-1	14.1
No. of grains row-1	31.7
100 Seed wt. (g)	24.7
Grain yield ((kg/ha))	4633
Straw yield ((kg/ha))	4656

Table 40.3. Plant height, dry matter, soil fertility, yield and economics of cotton under organic farming system mode

Particulars	Cotton	Sorghum
Plant growth parameters		
Plant height (cm)	65.3	166
DMP (kg ha-1)	3297	7268
Soil nutrient status		
Organic carbon (%)	0.49	0.49
N (kg/ha)	258	226
P (kg/ha)	10.2	10.9
K (kg/ha)	482	452
Yield parameters		
No of sympodial branches	13.3	
No of bolls per plant	26.2	
Seed cotton yield (kg/ha)	1558	
Grain yield of sorghum		2658
Straw yield of sorghum		5127

Table 40.4. Economic of different cropping systems under integrated organic farming systems mode

Cropping system	Area (ha)	Crop	Yield (kg ha^{-1})	Total cost (Rs. ha^{-1})	Gross return (Rs. ha^{-1})	Net return (Rs. ha^{-1})
Bhendi + leaf coriander - maize + cowpea (fodder)	0.12	Bhendi	8313	66,750	1,24,696	57,946
		Coriander (Leaf)				
		Maize	4656	30,682	55,596	24,914
		Fodder cowpea	Used as feed for dairy			
Green manure - cotton - sorghum	0.12	Cotton	1558	37,348	70,110	32,762
		Sorghum	2658	22,647	35,789	13,142
Fodder	0.10	Cumbu napier (Co (CN) 5)	220.5	Used as feed for dairy unit		

Maize var. COH (M) 6 was sown in the system attained the maximum plant height of 213 cm with 7753 kg/ha of dry matter production and it gave 4633 kg/ha of grain yield with 4656 kg/ ha of straw yield. Organic carbon of 0.48% was recorded in maize plot along with residual nutrient availability of nitrogen, phosphorus and potassium of 264.0, 12.4 and 475 kg/ha respectively. Maize recorded the net income of Rs. 24,914/ ha under integrated organic farming model.

Cotton recorded 3297 kg/ha of dry matter production at the stage of harvest with maximum height of 65.3 cm. Number of sympodial branches recorded in cotton 13.3 with 26.2 bolls/ plant resulted 1558 kg/ha Seed cotton yield. Net return of Rs. 32,762/ha was recorded. The grain and straw yield of sorghum was recorded of 2658 and 5127 kg/ha respectively, it gave Rs. 13142 as net return in the model.

Sardarkrushinagar

Development of Integrated Organic Farming System models of 0.4 ha is being develop with the objectives to characterize existing farming systems under organic production system and to develop integrated organic farming system model for enhanced system productivity, profitability and sustainability on long term basis.

Treatments details

Farming system components			Net Area (ha)
Crops	:	Groundnut-Potato-Pearlmillet	0.24
Green Fodder	:	F. Bajara- F. Maize+Oat- F. Bajara	0.15
Dairy	:	Livestock + Vermicompost	0.01
		Boundary Plantation	-

Results

IOFS model is consisting different components *viz*., crops (0.24 ha), green fodder crops (0.15 ha), boundary plantation, dairy and vermicompost (0.01 ha). Total net profit Rs. 42,751 was received by crop component from 0.24 ha area. Ardusa, Napier grass and lemon grass have been planted around the border and bunds incurred cost Rs. 1051. Total net profit from all the components of IOFS Model was Rs. 41,700.

Table 41. Yield (kg/ha) and economics (Rs./ha) of Integrated Organic Farming Systems Model (0.04 ha)

Farming system components	Total Area (ha)	Equivalent yield (kg/ha)	Gross return (Rs.)	Cost of cultivation	Net returns
Crops: Groundnut-Potato -Pearlmillet	0.24	5604	89668	46916	42751
Green Fodder : F.Bajara- F. Maize+Oat- F.Bajara	0.15	Construction of animal shade and purchases of animals is awaited due to unavailability of grant			
Livestock + Vermicompost	0.01				
Boundry Plantation	-	-		1051	-
	0.4		89668	47967	41700

Udaipur

Development of integrated Organic Farming System Model for Southern Rajasthan: An Integrated Organic Farming System for 0.45 ha consisting of field crops in 0.25 ha (Sweet corn + blackgram during *kharif* and wheat during *rabi*), fodder crops in 0.05 ha. (Fodder maize + fodder cowpea during *kharif* and berseem in *rabi* and sesbania green manuring during ziad), vegetables in 0.10 ha (tomato and cowpea), fruit crop in 0.04 ha (Papaya) and compost unit in 0.01 ha were evaluated during 2015-16. The total maize

equivalent yield of 5155 kg/ha and a net return of Rs. 43,202/ha was obtained during 2015-16 from the farming system.

Table 42. Yield and economics of different components of organic farming system

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 + Blackgram	0.25	264.25	906.73 (61.5)**	18536	27104.25	8568.25	0.46
Rabi	Wheat		781	1562	13892	31743	17851	1.28
2. Fodder								
Kharif	Fodder Maize + Cowpea	0.05	1350	1350 (250)	6542	8235	1693	0.26
Rabi	Berseem		1920	704	3650	10560	6910	1.89
Zaid	Sesbania		1580	N.A.	Used as green manuring			
3. Vegetable								
Kharif	Tomato	0.10	295	590	1900	8850	6950	3.65
Zaid	Cowpea		42	42	2100	3330	1230	0.59
4. Fruits								
	Papaya	0.04	N.A.	N.A.	N.A.	N.A.	N.A.	N.A.
5. Compost unit								
	NADEP compost	0.01	4000	-	-	-	-	-
	Vermicompost		543	-	-	-	-	-
	Enriched compost		645	-	-	-	-	-
	Vermiwash		400	-	-	-	-	-
	BD 500		700 g	-	-	-	-	-
	BD 501		520 g	-	-	-	-	-
	Earthworms		34	-	-	-	-	-
	Total		**6842**	**5154.73**	**47920**	**87122.25**	**43202.25**	**0.90**

**Figure in parenthesis indicate actual yield of intercrop.

Umiam

The IOFS model comprising different enterprises such as cereals (rice and maize), pulses (lentil, pea), oilseeds (soybean, rapeseed), vegetable crops (Frenchbean, 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 was established. A farm pond of 460 m^2 area with average depth of 1.5 m was part of the IOFS model for life saving irrigation and aquaculture. Climbing vegetables such as bottle gourd, chow-chow, cucumber, ridge gourd etc., were grown on a structure created above water bodies in one side of the pond dyke for vertical intensification. Pumpkin was raised in another side of the pond and allowed to crawl on the ground. The washings from the dairy unit were diverted to fish pond for promoting growth of zooplankton and phytoplankton for fish growth. The solid waste from cow shed was used for FYM making and vermicomposting.

The total cost of cultivation was recorded at Rs. 56,654/- per year under the IOFS model with an area of 0.43 ha. Maximum expenditure was incurred in crop component of the model with 46.6% of the total cost of cultivation. Dairy unit with one adult cow and one calf registered 37.7 % of the total cost of cultivation, while fishery component recorded 8.7 % of the total cost of cultivation (Table.41.6). For maintaining vermicomposting unit of 72 m^2 area and other important operations like hedgerow planting, residue recycling, rock phosphate application and liming, the expenditure incurred was Rs. 3950/- which account to 5.5 % of the total cost. A total net return of Rs. 71,442/- per year was achieved under the IOFS model which is much higher than the region's farmer common practices of rice mono-cropping or improved practice of rice-vegetables cropping system (Table 41.6). The highest contribution towards the total net return was contributed by crop component of the model (66.5%) followed by dairy (23.9%) and fishery component (15.2%). The fish production was 136 kg. The net return from dairy component was calculated only in terms of milk production since the cow dung produced was recycled back into the model which was used as manure for crop production. The quality of milk obtained under organic management of dairy has been observed in the Integrated Organic Farming System (IOFS) models experiment and was compared to the quality of milk obtained under conventional management.

Table 43.1. Economics of the IOFS model (area=0.43 ha)

Farming System components	Total area (ha)	Rice Equivalent Yield (tonne)	Cost (Rs)	Net returns (Rs)	Net return (Rs/ha)
Crops (Cereals, pulses, oilseeds, vegetables, fruits and fodder crops)	0.3743	4.93	26429	47487	-
Dairy (1 milch cow + 1 calf)	0.0036	2.56	21365	17065	-
Fishery (Composite)	0.046	1.05	4910	10840	-
Nutrient cycling(Vermicompost/FYM/Hedgerow planting/ Residue recycling/Rock phosphate application/Liming)	0.0072	-	3950	-3950	-
Total	0.4311	8.54	56,654	71,442	1,65,720
Net income/day	-	-	-	196	454

Table 43.2. On-farm nutrient supply balance sheet under IOFS model (area=0.43 ha)

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)	21.1	7.5	17.5	6.6	2.3	12.2	-14.5	-5.3	-5.3
Horticultural crops (Vegetables, Fruits)	31.8	11.4	26.6	14.8	3.1	11.0	-17.1	-8.3	-15.5
Dairy	0.0	0.0	0.0	12.0	4.5	6.0	12.0	4.5	6.0
Others (Oilseeds, Pulses, Green manuring crop, fodder, etc.)	11.9	4.3	9.9	29.1	9.3	24.8	17.1	5.1	14.9
Total	64.8	23.2	53.9	62.4	19.2	54.0	-2.4	-4.0	+ 0.1
							96%	83%	100%







Different vegetables and vermicompost unit under IOFS model at Umiam

For 0.43 ha area, the total nutrient requirement for organic crop production has been estimated at nitrogen (N)-64.8 kg, phosphorus (P_2O_5) - 23.2 kg and potassium (K_2O)-53.9 kg (Table 30). On farm nutrient recycling in IFOS could produce an amount of 62.4 kg N, 19.2 kg P_2O_5 and 54.0 K_2O. Hence, 96% of the total N requirement, 83% of the total P_2O_5 requirement and total K_2O requirement could be met within the model itself and only 4% of the total N requirement, 17 % of the total P_2O_5 requirement is required to be met from the external source to sustain the model. The nutrient requirement of the model from external source would be reduced substantially with the efficient recycling of pond silt, intercropping with legume, use of bio-fertilizers such as azotobacter, rhizobium, phosphorus solubilizing microorganism etc.

Considering the benefits from the IOFS model with a net return of Rs. 71,442/- per year from 0.43 hectare area, a net income of Rs. 5954/- per month or Rs. 196 /- per day was achieved which is a modest amount for living by a four member family (2 adults and 2 children). Assuming of food requirement and other expenditure per day for a four member family (2 adults and 2 children) for rice (1300 g, Rs. 33), dal (150 g, Rs. 15), oil (300 g, Rs.15), vegetables (1000 g, Rs. 25), fruits (400 g, Rs. 20,), fish (110 g, Rs.17), meat (100g, Rs.15), others (milk, egg etc. Rs. 15), a total of Rs. 155 is required per day towards food. However, there is further need to enhance the income to meet the other requirement of the family i.e. medicine, schooling, clothing etc.

7.6. Farm waste recycling techniques for organic farming

Objective

- To develop need-based cost-effective new techniques for farm-waste recycling

Locations: Almora, Dharwad and Modipuram

Year of start: 2014-15 (Modipuram); 2015-16 (Almora and Dharwad)

Treatments

Treatments	Description
T_1	Control (No additives, leaving the residues as such in the open)
T_2	Residue + earthworms (standard vermicomposting method)
T_3	Residue + *P. Sajorcaju* + *Trichoderma viridie* + CDS
T_4	Residue + *P. sajorcaju* + *Trichoderma viridie* starter N through leguminous residue
T_5	Residue + Bio-minerlizer (Microbial consortia)
T_6	Residue + Effective consortia of microorganisms (ECM)
T_7	Residue + *Pleurotus sajor-caju*, *Trichoderma harzianum*, *Aspergillus niger* and *Azotobacter chroococcum*

Modipuram

Evaluation of Farm waste recycling techniques for organic farming: The farm residue recycling experiment carried out with seven treatments i.e. i) Maize stover+ rice straw (3:1 ratio) + soil+ cow dung/urine (C:N ratio 30:1), ii) Maize stover+ rice straw (3:1 ratio) + soil + legume/*Leucaena* biomass + cow dung/urine (C:N ratio 30:1), iii) Maize stover+ rice straw (3:1 ratio) pre-treated with *Trichoderma* (15 days in advance)+ soil+ legume/*Leucaena* biomass + cow dung/urine (C:N ratio 30:1), iv) Maize stover+ rice straw (3:1 ratio) + soil +cow dung/urine + TNAU Biomineralizer@2kg/ton residue (C:N ratio 30:1), v) Maize stover+ rice straw (3:1 ratio) + soil +other farm residues + cow dung (Vermicomposting) in 2 feet high piles, vi) Maize stover+ rice straw (3:1 ratio) + soil +legume/*Leucaena* biomass + cow dung/urine + bio-enrichment at curing phase with *Azotobacter, PSB, Trichoderma* etc. (C:N ratio 30:1) and vii) Maize stover+ rice straw (3:1 ratio) in piles as Control. Treatment consisting maize stover+ rice straw (3:1 ratio) pre-treated with *Trichoderma* (15 days in advance)+ Soil+ legume/*Leucaena* biomass + cow dung/urine (C:N ratio 30:1)] showed fastest decomposition within 60 days with final volume of 0.530 M^3 against 0.970 M^3 in control. The constant temperature (25^{0}C) near to ambient was also noticed in case of treatment 3 [Maize stover+ rice straw (3:1 ratio) pre-treated with *Trichoderma* (15 days in advance)+ soil+ legume/*Leucaena* biomass + cow dung/urine (C:N ratio 30:1)]. Least rate of decomposition was found with control (total volume of 0.970 M^3 at 60 days) with higher temperature (42^{0}C) which shows the continuation of the active decomposition phase.

7.7. Documentation of ITK on organic production, pest & disease management

Objective

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

Locations: Ajmer, Gangtok, Narendrapur and Udaipur

Year of start: 2015-16

Results:

Ajmer

- Use of skin and spines and of bristle spined rat (*jahu chuvva* in hindi) for management of rotting and better fruit set in chilli and cucumber. Apart from this its debris are used as rat repellents in go downs and storage areas.
- Use of castor oil or mustard oil for safe storage of grains/pulses by smearing very small quantity of oil on the grains/pulses.
- Use of cow urine and cow dung along with irrigation water for nutrient management.
- Dusting of cow dung ash on vegetables, coriander, fenugreek and other field crops for the management of powdery mildew disease.
- Use of dry leaves of *Clerodendron phlomoides* (Arni) and Neem in storage of seed spices and cereals as insect repellent.

Gangtok

- Survey of Pakyong, East Sikkim and Lingee, South Sikkim has been done and collected the knowledge of various ITKs related to organic farming. It was observed that farmers are using cow urine @ 10% for improving the yield of tomato and cucurbitaceous vegetables. For the management of red ants in vegetables, farmers are using flood irrigation methods. Manual collection and destruction of cabbage butterfly larva is also being followed by the farmers to check the population of cabbage butterfly.
- Farmers are growing red cherry pepper near the trunk of Sikkim mandarin for better growth and yield
- Collected the knowledge of various ITKs related to organic farming from Niam, Panang North Sikkim and Sadam in South Sikkim. It was observed that farmers are using well decomposed cow dung extract for improving the production and productivity of vegetable crops. They are taking well decomposed cow dung (1kg) mixing with 10 lit of water and keeping it for 3-4 days and then filtering the extract with a cotton cloth. The filtrate is being used as drenching /spray on vegetable crops.

- The farmers in South Sikkim are managing aphids, red ants, mites and fruit borer by using 1 lit agave extract in liquid form, cow urine ½ lit and 250 g grinned chilly. They are mixing it thoroughly in plastic container and keeping the solution then it is ready to use as spray in 1:5 ratio by diluting with water.
- Validation trials have been initiated in vegetable crops.

Udaipur

Evaluation of Indigenous Panchgavya: Farmers of Southern Rajasthan spray use indigenous panchagavya 2% at different stages of growth and development of black gram and other crops. The proportion of 5 components (cow urine, milk, ghee, dung and curd) used in panchgavya vary from farmer to farmer therefore, evaluation of indigenous panchagavya and standard panchagavya was carried out on blackgram. It has the potential to play the role of promoting growth and providing immunity in plant system.

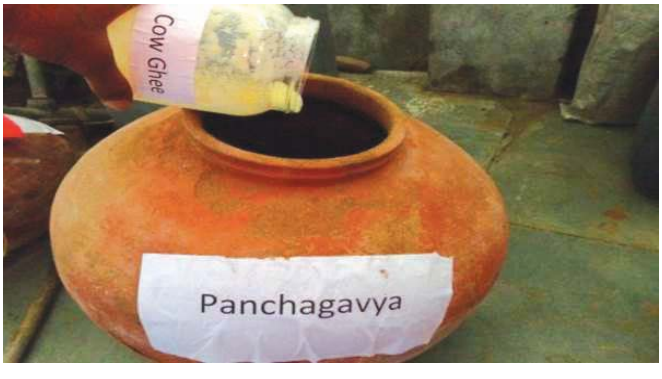
Formulation of panchagavya

The formulation of panchagavya was prepared in earthen container by mixing cow dung, cow ghee, cow urine, cow milk and cow curd in a proportion through the procedure mentioned below and was placed in a shady and open place. The mouth of earthen pot was kept covered with clean fine cotton cloth for ensuring aeration for fermentation and check common fly on it. The entire concoction is stirred well, using a neem stick twice a day morning and evening.

Procedure

Step-1: In an earthen container, first mix fresh cow dung 7 kg and cow ghee 1 kg thoroughly and keep it for 3 days. Mix it twice daily (morning/evening) at least for 15 minutes.

Add cow dung at 1st day



Add cow ghee at 1st day and mix well

Step-2: Add 10 litres cow urine and 10 litre water and mix thoroughly. Keep it for 15 days with regular mixing in morning and evening hours.

Add cow urine at 4th day and mix well

Step-3: Add 3 litre cow milk, 2 kg cow curd and also 500 gm jaggery as additive and mix them completely.

Add cow milk at 18th day and mix well

Add cow curd at 18th day and mix well

Step-4: This solution should be kept for 12 days and should be stirred twice daily (morning/evening) at least for 15 minutes each time facilitates aerobic microbial activity.

Step-5: Panchagavya stock solution will be ready after proper sieving through a fine cloth.

Indigenous panchagavya

Indigenous panchagavya was prepared as per the methods used by farmers in the region. Farmers prepare the panchagavya by mixing five products obtained from cow. The proportion of these products is as follows.

1. Cow dung : 5 kg
2. Cow ghee : 0.5 kg
3. Cow urine : 3 litre
4. Cow milk : 2 litre
5. Cow curd : 2 kg

Additives

1. Water : 5 litre
2. Jaggery : 1 kg

Evaluation of effect of Panchgavya on blackgram

PU 31 variety was sown in kharif season with 21 treatments combinations replicated threes in factorial RBD. Application of FYM 4 tonnes/ha before sowing and spray of panchagavya was given as per treatment. Two hoeing was done for weed control. Rainfed but irrigation was done during dryspells at critical growth stage. Plant protection measures for insect-pest and diseases were taken as per organic package of practices of the crop

Technical details

S. No.	Treatments	Symbols
	A. Doses of panchagavya	
1.	Control	P_0
2.	Panchagavya 2%	P_1
3.	Panchagavya 4%	P_2
4.	Panchagavya 6%	P_3
5.	Panchagavya 8%	P_4
6.	Panchagavya 10%	P_5
7.	Indigenous panchagavya 2%	P_6
	B. Stage of panchagavya application	
1.	Branching	S_1
2.	Flowering	S_2
3.	Branching + Flowering	S_3

Results

Effect on yield and economics

Application of panchgavya 4% recorded maximum seed & stover yield (801 kg and 1735 kg/ha, respectively), net return (Rs. 67042/ha) and significantly increased the seed yield, stover yield and net return by 17.6, 14, 74 and 24% over the application of indigenous panchgavya 2%. Application of panchagavya at branching + flowering stage of blackgram significantly increase the seed yield (751 kg/ha), stover yield (1617 kg/ha) and net return (Rs. 60977 kg/ha) by 18.3, 10.0 and 24.1% over the application of panchagavya at branching stage and by 12.6, 11.4 and 17.1% over the application of panchagavya at flowering stage, respectively. Further, that the seed yield of blackgram was maximum at application of panchagavya 4% and it decreased with increasing concentration of panchagavya *i.e.* at 6, 8 and 10%. The decrease in seed yield was to the tune of 10.74, 12.98 and 13.86% in comparison to maximum seed yield recorded at panchagavya 4%. The effect of indigenous panchagavya was on seed yield of blackgram was significant over control only recording 31.2% increase in seed yield of blackgram (Table 44.1).

Table 44.1. Effect of doses of panchagavya and its stage of application on yield & economics of organic blackgram

Treatments	Seed yield (kg/ha)	Stover yield (kg/ha)	Cost of cultivation (Rs/ha)	Gross return (Rs/ha)	Net return (Rs/ha)	Net return per rupee invested
Doses of panchagavya						
Control	519	1272	22000	58918	36918	1.68
Panchagavya 2%	686	1512	22300	76914	54614	2.45
Panchagavya 4%	801	1735	22600	89642	67042	2.96
Panchagavya 6%	715	1534	22900	79926	57026	2.49
Panchagavya 8%	697	1519	23200	78068	54868	2.36
Panchagavya 10%	690	1505	23500	77322	53822	2.29
Indigenous panchagavya 2%	681	1512	22374	76448	54073	2.42
SEm±	20	59	-	2121	2121	0.09
C.D.5%	57	168	-	6063	6063	0.27
Stage of panchagavya application						
Branching	635	1470	22464	71581	49116	2.19
Flowering	667	1451	22580	74644	52063	2.30
Branching + Flowering	751	1617	23045	84021	60977	2.64
SEm±	13	38	-	1389	1389	0.06
C.D.5%	37	110	-	3969	3969	0.18

Effect of Panchgavya on pest & disease

At 55 DAS, infestation ranged from 6.69% to 8.98% in different treatments compared to 11.65% in untreated control. Significant lowest mean population (22.48 aphids/5 plants) at 35 DAS was observed in panchagavya applied at branching + flowering stages at 35 DAS followed by flowering (24.91 aphids/5 plants) and branching alone (24.3 aphids/5 plants). Application of panchagavya at branching + flowering stages significantly reduced jassids population in comparison to application at branching alone and flowering alone. Mean population ranged from 3.89 to 7.78 jassids/5 plants in different treatments compared to 13.33 jassids/5 plants in untreated control.

Whiteflies population at 35 DAS ranged from 8.67 to 14.00 (whiteflies/5 plants) in different treatments compared to 17.11 (whiteflies/5 plants) in untreated control. The significant lowest population, 8.67 (whiteflies/5 plants) was recorded from panchagavya 4% followed by panchagavya 2% (13.89 whiteflies/5 plants), panchagavya 6% (3.22 whiteflies/5 plants), panchagavya 8% (13.67 whiteflies/5 plants), panchagavya 10% (13.89 whiteflies/5 plants) and indigenous panchagavya 2% (14.00 whiteflies/5 plants) (Table 44.2).

Table 44.2. Effect of doses of panchagavya and its stage of application on pests infestation in organic blackgram

Treatments	Pod borer (Pod Infestation %)	Mean population per 5 plant					
		Aphids		Jassids		Whiteflies	
	55 DAS	35 DAS	55 DAS	35 DAS	55 DAS	35 DAS	55 DAS
Doses of panchagavya							
Control	11.65 (19.91)*	28.56 (5.34)**	9.56 (3.09)**	13.33 (3.65)**	11.89 (3.44)**	17.11 (4.13)**	15.78 (3.97)**
Panchagavya 2%	8.87 -17.3	23.78 -4.87	6.44 -2.53	7.22 -2.68	6.78 -2.6	13.89 -3.72	8.89 -2.98
Panchagavya 4%	6.69 -14.94	17.89 -4.22	4.44 -2.1	3.89 -1.95	3.44 -1.85	8.67 -2.93	4.67 -2.15
Panchagavya 6%	8.76 -17.19	23.67 -4.86	6.22 -2.49	6.78 -2.59	6.67 -2.58	13.22 -3.63	8.67 -2.94
Panchagavya 8%	8.87 -17.28	23.78 -4.87	6.33 -2.51	7 -2.63	6.78 -2.6	13.67 -3.69	8.78 -2.96
Panchagavya 10%	8.92 -17.34	23.89 -4.88	6.56 -2.56	7.11 -2.66	6.89 -2.61	13.89 -3.72	8.89 -2.98
Indigenous panchagavya 2%	8.98 -17.42	24.11 -4.91	6.44 -2.53	7.78 -2.79	6.89 -2.62	14 -3.74	9 -3
SEm±	0.31	0.07	0.04	0.06	0.05	0.07	0.05
C.D.5%	0.88	0.21	0.12	0.16	0.16	0.89	0.14
Stage of panchagavya application							
Branching	9.35 -17.73	24.33 -4.92	7.05 -2.64	8.29 -2.84	7.43 -2.69	14.05 -3.73	9.62 -3.06
Flowering	9.26 -17.68	24.91 -4.91	6.76 -2.59	7.9 -2.78	7.57 -2.71	13.67 -3.68	9.57 -3.06
Branching + Flowering	8.27 -16.6	22.48 -4.72	5.9 -2.4	6.57 -2.49	6.14 -2.44	12.76 -3.55	8.52 -2.86
SEm±	0.2	0.05	0.03	0.04	0.04	0.04	0.03
C.D.5%	0.58	0.14	0.08	0.1	0.1	0.12	0.09

* Figure in parentheses are arcsine transformed values
** Figure in parentheses are square root transformed values of population

Effect on diseases

Application of panchagavya exhibited significant effect on incidence of leaf spot disease of blackgram. At 35 DAS mean minimum% disease index (PDI) 20.0% was observed with panchagavya 4% followed by panchagavya 2% (33.3%), panchagavya 6% (32.4%), panchagavya 8% (32.9%), panchagavya 10% (33.1%) and indigenous panchagavya 2% (33.4%) while maximum% disease index (PDI) could be observed in control (42.3%). Panchagavya 4% significantly reduced percent disease index (PDI) in comparison to control and other applications of panchagavya.

At 55 DAS mean minimum% disease index (PDI) 22.7% was observed in treatment with panchagavya 4% followed by panchagavya 2% (41.6%), panchagavya 6% (39.8%), panchagavya 8% (40.8%), panchagavya 10% (41.4%) and indigenous panchagavya 2% (42.0%).

Panchagavya applications on different stages indicate that minimum% disease index (30.2%) was observed at branching + flowering stages at 35 DAS followed by flowering alone (34.7%) and branching alone (32.5%).

Table 44.3. Effect of doses of panchagavya and its stage of application on percent disease index (PDI) in organic blackgram

Treatments	Leaf spot	
	35 DAS	55 DAS
Control	42.33 (40.57)*	60.54 (51.15)*
Panchagavya 2%	33.33 (35.24)	41.60 (40.15)
Panchagavya 4%	19.96 (26.49)	22.68 (28.40)
Panchagavya 6%	32.44 (34.68)	39.82 (39.09)
Panchagavya 8%	32.89 (34.96)	40.82 (39.70)
Panchagavya 10%	33.11 (35.08)	41.38 (40.02)
Indigenous panchagavya 2%	33.37 (35.28)	42.00 (40.39)
SEm±	0.73	0.87
C.D.5%	2.10	2.49
Stage of panchagavya application		
Branching	32.54 (34.66)	41.73 (40.11)
Flowering	34.68 (35.98)	43.34 (41.08)
Branching + Flowering	30.25 (33.21)	38.72 (38.35)
SEm±	0.48	0.57
C.D.5%	1.37	1.63

* Figure in parentheses are arcsine transformed values

Evaluation of indegenous & standard Panchgavya on blackgram

7.8. Evaluation of organic management practices for insect pest in various crops

Objectives

- 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, Almora and Gangtok

Ajmer

Evaluation of integrated pest Management modules against sucking pests infesting seed spices

Efficacy of six organic based integrated pest Management (IPM) modules including control was tested against aphid on coriander and fennel (Table 45.1 & 45.2). Observations were recorded from pests' initiation on crop to harvesting. The IPM module M-3 (garlic extract 10 ml/lit + azadirachtin 0.03% EC @ 5ml/lit + tumba fruit extract 10ml/lit.) was found most effective against aphid on both the crops followed by M-2 (field sanitation + NSKE 5ml/lit + Ker extract 10 ml/li.). Remaining treatments, IPM modules were found moderately effective against pest on both the crops.

Relative efficacy of six organic based IPM modules (including control) against thrips on coriander and fennel was tested. Observations were recorded right from pests' initiation on crop to harvesting. IPM module M-3 (garlic extract 10 ml/lit + azadirachtin 0.03% EC @ 5ml/lit + tumba fruit extract 10ml/lit.) was found most effective against thrips also on both the crops followed by M-2 (field sanitation + NSKE 5ml/lit + Ker extract 10 ml/li.). The remaining treatments IPM modules were found moderately effective against pest on both the crops.

Table 45.1. Field evaluation of IPM modules against aphids and thrips on coriander during

Treat	Aphids				Thrips			
	1st spray	2nd spray	3rd spray	Mean	1st spray	2nd spray	3rd spray	Mean
M1	50.56	57.92	62.45	56.98	49.18	54.00	57.00	53.39
M2	54.14	63.66	68.96	62.25	53.15	64.19	65.92	61.09
M3	60.33	64.29	71.52	65.38	52.80	62.10	68.72	61.21
M4	52.00	58.35	63.16	57.84	48.10	55.50	60.55	54.72
M5	54.00	63.10	67.33	61.48	47.98	56.15	57.39	53.84
M6	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Sem±	1.07	1.01	1.10		1.33	1.26	0.97	
CD@5%	3.22	3.05	3.30		3.99	3.81	2.93	

Table 45.2 Field evaluations of IPM modules against aphids and thrips on fennel during

Treat	Aphids				Thrips			
	1st spray	2nd spray	3rd spray	Mean	1st spray	2nd spray	3rd spray	Mean
M1	52.15	56.20	64.60	57.65	48.96	55.00	59.24	54.40
M2	60.13	60.82	73.55	64.83	55.12	63.19	65.12	61.14
M3	58.53	69.50	75.10	67.71	56.15	62.77	66.85	61.92
M4	55.37	62.00	68.15	61.84	51.00	53.18	62.00	55.39
M5	53.75	59.30	65.12	59.39	50.14	58.34	61.07	56.52
M6	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Sem±	0.92	1.24	0.87		0.86	0.84	0.78	
CD @5%	2.77	3.74	2.62		2.58	2.52	2.36	

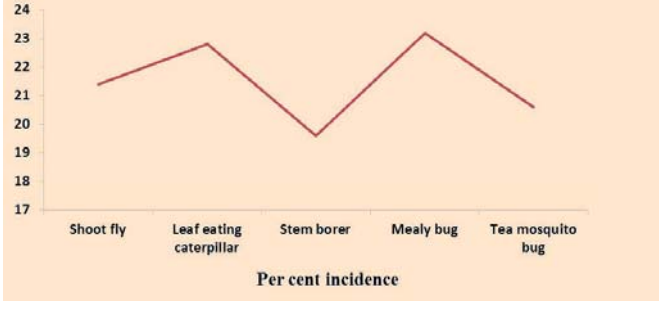
Gangtok

Organic insect pest management in large cardamom

The survey was conducted in some large cardamom fields of all four districts of Sikkim with the objective of to study the evaluation of some new bio-pesticides and organically permitted insecticides against insect pests of large cardamom during 2015. The percent incidence of different insect pests was recorded during the survey. Shoot fly, leaf eating caterpillar and stem borer are some common pests of this crop. Outbreak of mealy bug has been observed. Tea mosquito bug has been recorded for the first time in the large cardamom.

Table 46. Percent incidence of Insects in large cardamom

Name of insects	Per cent incidence
Shoot fly	21.40
Leaf eating caterpillar	22.80
Stem borer	19.60
Mealy bug	23.20
Tea mosquito bug	20.60



Percent incidence of Insects in large cardamom

Mealy bug infestation

Tea mosquito bug infestation

An experiment was conducted to evaluate the efficacy of some biopesticides *viz*., neem oil (1500 ppm) @ 4 ml/l, *Beauveria bassiana* 7 g/l, *Metarhizium anisopliae* 5 ml/l, petroleum oil based agrospray @ 10 ml/l, petroleum oil based horticultural spray @ 10 ml/l, *Bacillus thuringiensis* @ 2 g/land, spinosad 45 SC @ 0.3 ml/l against insect pests of large cardamom *viz*., stem borer, shoot fly, leaf eating caterpillar and tea mosquito bug. It was observed from the study that all the treatments showed effective results to control insect pests over control. However, among the treatments, spinosad 45 SC @ 0.3 ml/l was found to be the most effective to control all the pests (76.34 to 84.62% reduction of infestation over control) followed by neem oil (1500 ppm) @ 4 ml/l (68.22 to 72.86% reduction of infestation over control) and petroleum agrospray @ 10 ml/l (56.44 to 66.16% reduction of infestation over control).

Insect pest and disease management in maize-based cropping system

An experiment was carried out to evaluate the efficacy of some biopesticides *viz*., neem oil (1500 ppm @ 4 ml/l, *Beauveria bassiana* 7 g/l, *Metarhizium anisopliae* 5 ml/l, petroleum oil based agrospray @ 10 ml/l, petroleum oil based horticultural spray @ 10 ml/l, *Bacillus thuringiensis* @ 2 g/l and spinosad 45 SC @ 0.3 ml/l against the insect pests *viz*., semi looper, army worm and cob borer management in maize-based cropping system. It was observed from the study that all the treatments showed effective results to control insect pests over control. However, among the treatments, spinosad 45 SC @ 0.3 ml/l was found to be the most effective to control all the pests (58.26 to 88.46% reduction of infestation over control) followed by neem oil based formulation (1500 ppm) @ 4 ml/l.

Semi looper

Army worm

7.9. 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 and Gangtok

Ajmer

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

In coriander five different treatments were evaluated including soil solarization (21 days), *Trichoderma* (8 g/kg seed as seed treatment + 2.5 kg/ha as soil application), neem cake (500 kg/ha), caster cake (500 kg/ha) and control. Among the treatments soil solarization was found most effective (PDI 2.9) followed by caster & neem cake (PDI 5.9 & 6.6 respectively) while the disease (*Sclerotium* rot of coriander) was recorded maximum in control (PDI 10.1).

Table 47. Effect of various bioagents on management of *Sclerotium* rot of coriander

Treaments	*Sclerotium* rot (PDI)	No. Weeds /sq.m	Seed yield (q/ha)
Soil solarization (21 days)	0.5	4.25	6.72
Trichoderma (Soil & Seed App)	2.2	45.5	6.62
Neem cake (0.5 T/ha)	2.2	45.5	6.31
Caster cake (0.5 T/ha)	4.6	45	5.11
Control	9.2	49.5	5.21
SEm±	0.04	0.70	0.13
CD at 0.05%	0.13	2.16	0.39

Gangtok

Organic disease management in large cardamom

Survey was conducted with the objective the evaluation of locally available botanicals, commercially available bio-control agents and organically permitted fungicides against blight of large cardamom in different places like; Lingee (South Sikkim), Ravangla (South Sikkim), Dzongu (North Sikkim), Tadong (East Sikkim) and Darab (West Sikkim) during 2015. During survey, the diseases were observed Wilt (*Fusarium oxysporum*), Foorkey (*virus*) and Chirkey (*virus*) and blight is one of the important diseases in large cardamom which is caused by *Colletotrichum gloeosporioides*. Different organic treatments like {Garlic, Artimesia, Chilaoney (*Schima wallichii*), neem oil}, bio-control agents (*Trichoderma viride* and *Pseudomonas florescens*) and organically permitted fungicides (COC, copper hydroxide, Sulphex) were

evaluated against the blight pathogen *Colletotrichum gloeosporioides* in one year old large cardamom field. Among the treatments, copper oxychloride @ 0.25% was found most effective with low incidence of blight (0.78%) followed by copper hydroxide (0.89%). The highest number of tillers (6.55) was found in copper oxychloride treated plot followed by copper hydroxide treated plot. The plants treated with *Trichoderma viride* showed maximum height (62.70 cm).

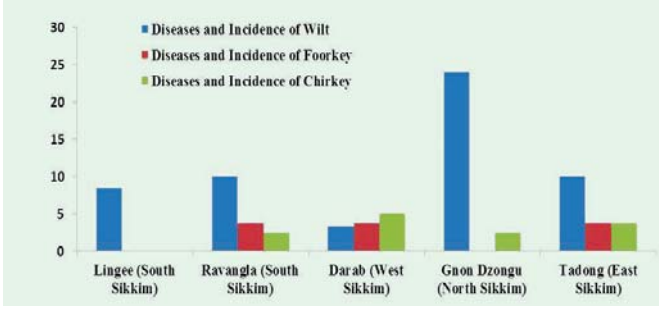
Wilt

Chirkey

Foorkey

Table 48. Diseases and Incidence of Wilt, Foorkey and Chirkey in large cardamom

Place	Diseases and Incidence		
	Wilt	Foorkey	Chirkey
Lingee (South Sikkim)	8.5	-	-
Ravangla (South Sikkim)	10.0	3.75	2.5
Darab (West Sikkim)	3.3	3.7	5
Gnon Dzongu (North Sikkim)	24.0	-	2.5
Tadong (East Sikkim)	10.0	3.7	3.7



Diseases and Incidence of wilt, Foorkey and Chirkey in large cardamom

7.10. Development of scientific organic package for large cardamom

Objective:

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

Year of start: 2015-16

Location: Gangtok

An experiment was started to standardize organic nutrient management package for large cardamom. The study consisted RBD having 10 treatments *viz.,* FYM @ 5 kg/clump + biofertilizers; FYM @7.5 kg/ clump + biofertilizers; FYM @ 10 kg/clump + biofertilizers; FYM @5 kg + Vermicompost @2.5 kg/ clump + biofertilizers; FYM @7.5 kg + Vermicompost @2.5 kg/ clump + biofertilizers; FYM @10 kg + Vermicompost @2.5 kg/ clump + biofertilizers; Vermicompost@ 5.0 kg/ clump + biofertilizers; Vermicompost @7.5 kg/ clump + biofertilizers; Vermicompost @10 kg/ clump + biofertilizers. The analysis showed that the treatment vermicompost @10 kg/ clump + biofertilizers (25 kg/ha) recorded highest average plant height (149.3±0.13 cm), immature tiller/clump (6.14±0.59), mature tiller/clump (5.32±0.64), bearing tillers/clump (5.6±0.38) and capsule yield (543.7 kg /ha) followed by the treatment vermicompost @7.5 kg/ clump + biofertilizers (25.0 kg/ha) which gave yield 516.4 kg/ha.

**Biofertilizers: Mixture of N fixer, P solubilizer and K mobilizer.*

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

Objective

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

Year of Start: 2015-16

Location: Narendrapur

Panchagavya and its preparation

Panchagavya has long been known as one of the most important organic liquid manures. In Sanskrit, '*pancha*' means 'five products' and '*gavya*' means obtained from cow products namely, dung, urine, milk, curd and ghee (Swaminathan, 2005). Since from the ancient times, *Panchagavya* is playing an important role in enhancing the biological efficiency of crops and the quality of fruits and vegetables (Natarajan, 2002).

Panchagavya was prepared in a wide mouthed beaker by mixing all the five ingredients i.e. cow dung, cow urine, cow milk, curd and ghee in the ratio of 5:3:2:2:1 and was incubated for 7 consecutive days. The mixture was stored in a shady place to avoid direct sunlight and was stirred twenty times with a stick in a clockwise and anti-clockwise direction during morning and evening in each seven days. After seven days of incubation, *Panchagavya* was prepared (SALoCT, 2011).

Characterization of isolated bacterial strains

1. Morphological Characterization

When grown on a different media, microorganisms exhibit visible physical differences in appearance in their isolated colonies. These morphological differences are employed for separating microorganisms into different taxonomic groups. The morphological characteristics of all known bacteria till date are contained in *Bergey's Manual of Systematic Bacteriology.*

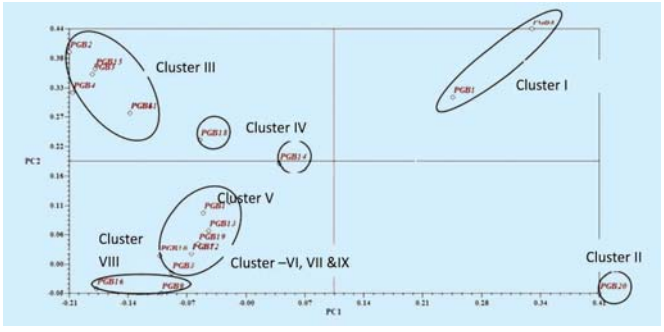
2. Physiological characterization

Bacteria can be grouped based on its shape and arrangement. Most bacteria are of one of three typical shapes— rod-shaped (bacillus), round (coccus), and spiral (spirillum). An additional group, vibrios appears as incomplete spirals. The cytoplasm and plasma membrane of most bacterial cells are surrounded by a cell wall, which differs in its composition among different bacteria. The difference in cell wall composition can be examined by Gram's staining procedure. Moreover, bacteria can also be characterized by their patterns of growth, such as the chain formation by streptococci or diplobacilli, and refractile inclusions by Negative staining. Some bacteria are capable of changing into dormant structures that are metabolically inactive and do not grow or reproduce. The structures formed inside the cells are

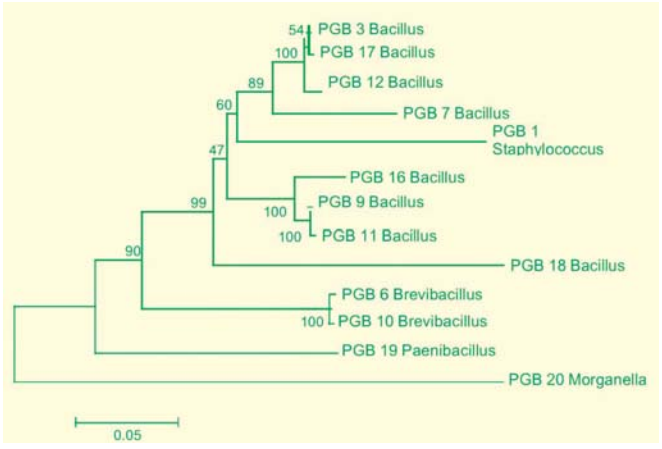
known as endospores and some are surrounded by a mucilaginous substance forming a viscous coat around the cell, called as capsules. These structures can be visualized by Endospore staining and Capsule staining respectively.

Table 49. Identification of bacterial isolates by NCBI-BLASTn analysis based on partial 16S rDNA sequences.

Isolate No	Putative Bacteria	Max	Total score	Query score	E cover	Identity Value	Accession
PGB1	*Staphylococcus sp. HKG 177 16S ribosomal RNA gene, partial sequence*	1293	1293	94%	0.0	96%	KF268367.1
PGB3	*Bacillus sp. BA-23 16S ribosomal RNA gene, partial sequence*	1528	1528	99%	0.0	99%	KX069231.1
PGB6	*Brevibacillus sp. mixed culture X6-20 16S ribosomal RNA gene, partial sequence*	1511	1511	98%	0.0	99%	KR029347.1
PGB7	*Bacillus sp. SO5.17 16S ribosomal RNA gene, partial sequence*	1262	1262	99%	0.0	94%	KC867296.1
PGB9	*Bacillus aryabhattai strain ST1C16S ribosomal RNA gene, partial sequence*	1502	1502	99%	0.0	99%	JX524506.1
PGB10	*Brevibacillus sp. mixed culture X6-20 16S ribosomal RNA gene, partial sequence*	1502	1502	98%	0.0	99%	KR029347.1
PGB11	*Bacillus megaterium strain wx4 16S ribosomal RNA gene, partial sequence*	1507	1507	99%	0.0	99%	KF963621.1
PGB12	*Bacillus cereus strain BC-7 16S ribosomal RNA gene, partial sequence*	1467	1467	99%	0.0	99%	KJ934381.1
PGB16	*Bacillus sp. AV-2011 16S ribosomal RNA gene, partial sequence*	1384	1384	98%	0.0	98%	HQ235640.1
PGB17	*Bacillus cereus strain BK4 16S ribosomal RNA gene, partial sequence*	1507	1507	99%	0.0	99%	KU258288.1
PGB18	*Bacillus vietnamensis strain SMT40 16S ribosomal RNA gene, partial sequence*	1245	1245	97%	0.0	95%	KF962968.1
PGB19	*Paenibacillus barcinonensis strain 103XG27YY7 16S ribosomal RNA gene, partial sequence*	1223	1223	94%	0.0	95%	FJ174659.1
PGB20	*Morganella morganii strain FWX5 16S ribosomal RNA gene, partial sequence*	1238	1238	95%	0.0	96%	KU942493.1



Principle Component Analysis (PCA) based on 18 different biochemical parameters of 20 different bacterial isolates



A phylogenetic tree analysis based on 16S rDNA sequences of bacterial isolates from *Panchagavya.* The tree was constructed with Neighbour Joining (NJ) method using Kimure two parameters model

3. Biochemical characterization

Biochemical tests are one of the techniques based on different biochemical characteristics of microbes for the identification of their respective species. Each microbial species has a well-defined set of metabolic activities which are controlled by the bacterial enzymes. Therefore biochemical tests are performed to identify the differences in carbohydrate, protein and fat metabolisms, certain enzyme production and utilization of a particular compound.

4. Molecular characterization

Prokaryotes contain 16S rDNA nucleotide sequence which codes for small ribosomal subunit. 16S rDNA sequence generated mostly by Sanger sequencing has been widely used for phylogenetic studies and considered a new standard for bacterial classification and identification. Studies suggest that if 16S rDNA nucleotide sequence shows e" 97% similarity, the isolate then belongs to same species. On the other hand, if the sequence shows < 97% similarity, the isolate then belongs to different species.

Observations and conclusion

In this study, twenty different bacterial strains were isolated which were selected on the basis of their distinct colonies formed on nutrient agar medium. Morphological (eleven) and biochemical (eighteen) characterization of these isolates were also accomplished accordingly. From the Cluster analysis based on 18 different biochemical parameters, twenty isolates were grouped into 9 clusters at 65% Jaccard's Similarity Coefficients. Among the twenty isolates, sixteen isolates were able to be identified using online micobiological laboratory software "ABIS online"- a tool for bacterial identification depending on their morpho-biochemical characteristics. The data reported that those isolates were grouped under different genera of *Bacillus, Paenibacillus, Viridibacillus and Aneurinibacillus* with their respective species. The identification through biochemical parameters was further confirmed by 16S rDNA sequencing of thirteen most distinct isolates. All those isolates were identified by the similarity of their partial 16S rDNA sequences to sequences in NCBI GeneBank Database. It was found that the isolated bacteria were belonging to the genus *Bacillus, Paenibacillus, Brevibacillus*, *Morganella* and *Staphylococcus*.

7.12. Cluster based demonstration of Organic Farming Package under Tribal Sub Plan

Umiam

Organic food production through integrated farming system- cluster approach

Name of the village: Mynsain

A village in Meghalaya namely Mynsain have been adopted for disseminating organic production technology developed in the Institute in participatory mode. The village is 20 km away from the institute (ICAR RC for NEH Region, Umiam), having 132 households with an approximate area of 60 ha. As per the interaction with the farmers and elderly peoples of the village, it is learnt that the village is totally organic and so far no inorganic input has been applied. The sensitization meeting with the villagers including village head (Headman), member of the SHGs, Department of agriculture (Gram Sabath) was organised, subsequently a group of farmers visited the ICAR, Umiam, to get first hand exposure to various technologies to be demonstrated under the programme. The improved seeds like maize, groundnut, frenchbean and some vegetables seeds were distributed to the farmers. The Survey (PRA) and farmers training were conducted to initiate the programme. As there is much awareness among the public about the organic produce, the adopted farmers may get premier price say 10% higher than the conventionally produced items. 100 farmers will be selected in first phase in a compact area for demonstration of organic farming practices through a model village concept. The component of the Model village would be as follows-

Base line data: The PRA was conducted to collect basic information about the village with regards to resources available, type of crops grown, soil quality, livestock, land use, productivity, forest etc. to workout the plan of activities.

Organic food production: Various crops, vegetables and fruits would be cultivated considering the local demand, agro-climatic condition, soil health etc. Efficient cropping systems for the locality will be identified.

Food-Feed Crop Production: Farmers was encouraged to grow crops such as sweet potato, maize, cucumber etc. as food for consumption purpose and as feed for livestock.

Livestock: As pig farming is mostly followed by the farmers, improved piggery were promoted. Some farmers practiced dairying. The cowdung would be used for vermicomposting, FYM preparation etc. for crop production and organic milk may be sold as comparatively higher price.

Community vermicompost unit: All the wastage, crop residues, weed biomass etc from the farmers' family and field will be collected and stored near the compost unit. This would help farmers to make quality vermicompost for organic agriculture. The villagers may also earn from selling vermicompost and earthworm for their livelihood. The additional organic manure may be procured by the Institute for various programmes.

Green manuring for crop production: Green manuring (GM) would be practiced wherever possible. GM crops such as crotolaria, dhaincha, ricebean, soybean, groundnut etc. would be grown in sequence

or as intercrop with rice, maize, other drops to enrich soil health and reduce soil loss (as cover crops) and to supply additional nutrient rich pulses to the farm families.

Green leaf manuring trees: Leguminous multipurpose trees such as Acacia auriculiformis (Japenese Acacia), Erythrina indica, Samanea saman (Acacia), *Delonix regia* (Gulmohar*), Pongamia glabra* (Pogamia) and *Azadirachta indica* (Neem) would be grown in wasteland, degraded community lands for green leaf manuring. Growing of leguminous tree in wastelands would rehabilitate the wastelands and make them productive.

Hedge row intercropping: In hill slopes, leguminous hedge row species such as Tephrosia, and Crotolaria spp. etc was grown at regular interval (10 to 20 m) depending upon the slope of the land. The hedge row species would be also grown around the farm to serve as fencing, conserve soils and water and supply nutrient rich green leaf manure. The interspaces would be used for crop production.

Planting of Mutipurpose trees, bamboos etc: The multipurpose trees (MPTs) & bamboo will be planted in the barren and degraded land for conserving soil, generating additional income as well as for environmental security.

Planting of tree bean: Tree bean is a leguminous tree, which produce high value beans with high protein content and mineral along high medicinal value. Tree bean is used for soil and water conservation measure and also add the nutrient to the soil being a leguminous tree. The people of North East India used a vegetable source which is very good for food nutrition security.

Development of water harvesting structure: Water harvesting structure such as ponds, jalkunds, farm ponds etc. would be developed to provide necessary additional water during off season or life saving irrigation for Rabi and pre-kharif crops.

Soil conservation measures: Terracing, half moon terracing, vegetative barriers etc. would be practiced for conserving soil and water.

Cultivation of fodder crops in degraded lands: Unused land in village would be used for community fodder cultivation (eg. Broom grass, congo-signal, napier etc) to supply green fodder to the dairy unit. Beside, cultivation of fodder in hill slopes would rehabilitate degraded land by reducing soil losss.

Organic outlet: A small low cost shed was constructed near highway for marketing organic produce from the village/Institute.

Soil Fertility status

For understanding IFS, soil samples from 0-15 and 15-30 cm were collected from various land type. A total of 160 samples were collected.

Particulars		Av N	Av P	SOC	pH
Lowland	0-15	210.1 ± 27.8	9.1 ± 6.4	1.00 ± 0.59	4.97± 0.62
	15-30	163.1 ± 22.9	10.0 ± 1.7	0.89 ± 0.60	
Upland	0-15	207.9 ± 55.7	21.2± 12.5	1.11 ± 0.39	5.01 ± 0.67
	15-30	166.1± 62.1	23.5 ± 18.1	1.07 ± 0.42	

Progress mode during 2013-16:

A. Development of farm pond for multiple use:

Two new ponds was constructed in farmer's land of Mynsain village. The ponds were constructed for multiple uses, such as, pisciculture and for rearing of animals, for irrigation purposes during lean period and for cultivation of crops. Liming (2 t/ha) and application of FYM (10 t/ha) was performed after digging new pond for developing soil fertility, an amount of Rs.50, 000 was incurred for construction of this pond. Apart from the new pond, three existing ponds were also renovated in farmer's field for multiple uses. The construction and renovation of these ponds were actively participated by the farmer's themselves which in turn added some amount of employment to the villagers. During the year 2015-16, a total quantity of 48 kg. fingerlings were distributed to the farmers for IFS models. Names of farmers, village and geographical coordinates of the demonstration sites have been provided in Table below.

List of beneficiary for pond and their geographical location of the demonstration site

Name of beneficiary	Area of pond (m^2)	Latitude (N)	Longitude (E)	Elevation above sea level (m)
Mrs. Pretywon Rynghang	300	092^{0}01.082	25^{0}44.340	863m
Mr. Rongdondor Makhroh	240	092^{0}00.920	25^{0}44.150	876m
Mr. Lamphrang Rympei	360	092^{0}01.214	25^{0}44.613	856m
Mr. Presion Mawlong	400	092^{0}01.157	25^{0}44.742	862m
Mr. Trias Makhroh	400	092'00.835	25'44.154	859 m
Mr. Thmubha Rynghang	400	092'01.293	25'44.622	889 m

The different fish species including of surface feeder (Catla), Column feeder (Grass Carp) and bottom feeder (Common carp) were adapted in farmer's pond. After 12 months it was found that Catla attained maximum weight (856.0 ± 117.2) and length (30.14 ± 2.06) whereas minimum weight and length was found in grass carp (513.8 ± 155.9) and length of (28.89 ± 1.78).

Growth analysis of fish species in Mynsain village (12 Months stocking)

Species	Weight (g)	Total Length (cm)	Girth (cm)
Catla	856.0 ± 117.2	30.14 ± 2.06	10.55 ± 1.10
Grass Carp	513.8 ± 155.9	28.89 ± 1.78	7.46 ± 0.82
Common Carp	1225.8 ± 271.4	34.32 ± 2.10	15.04 ± 1.75

B. *Jalkund*

A small rain water harvesting structure called *Jalkunds* suitable for hilltops was introduced in Mynsain village. The dimension was 5m x 4m x 1.5m which can store about 30,000 liters water were constructed in farmer's fields, as harvesting water is the main problems in these areas. Most of the farmers depend on rainfall as sources of irrigation but cultivation during winter season make them difficult to manage water, all they are depended is the amount of moisture retained in the soil as water source. *Jalkund* were constructed at higher elevations, so as water flowing down the slopes is collected in a *jalkund* that will roughly store an adequate amount of water for the farmers' to utilize for irrigation. Construction of *Jalkund* was done by the following ways:-

- Excavation of the *Jalkund* on selected site was done before onset of monsoon. The bed and sides of the kund were leveled by removing rocks, stones or other projections, which otherwise might damage the lining material.
- The inner walls including bottom of the kund are to be properly smoothened by plastering with mixture of clay and mudy soil.
- After clay plastering, about 3-5 cm thick cushioning was done with locally and easily available (long tall grasses) on the walls and bottom to avoid any kind of damage to the lining material from any sharp or conical gravel etc.
- It is followed by lying down of 250 GSM silpaulin sheets. The sheet was laid down in the kund in such a way that it touches the bottom and walls loosely and uniformly and stretched out to a width of about 50 cm all around the length and width of the kund. About 30 x 30 cm trench was dug all around the kund and 25 cm outer edge of the sheet was buried in the soil so that the sheet is tightly bound from all around.Farmers in mynsain village are using stored water for growing vegetables such as frenchbean, Cabbage, Brocolli, Tomato, Lettuce, Cucurbits and for rearing of animals such as pig and poultry. Using stored water economically in various farm activities is the most acceptable and profitable one particularly to those in hillstop wher drought is the major problem. Therefore, the stored water helps the farmers of this village to raised crops for the whole year. The names of farmers, village and their geographical location of the demonstration sites have been provided in Table. A total of

sixteen numbers *Jalkunds* having 30,000 liters capacity each was distributed to the farmers during the year 2015-16.

List of some beneficiaries for Jalkund and their geographical locations

Name of beneficiary	Latitude (N)	Longitude (E)	Elevation above mean sea level (m)	Multiple use
Mrs. Pynsan Rynghang	092°01.276	25°44.704	872m	For cultivation of vegetables (Broccoli, cabbage, lettuce, French bean)
Mrs. Skola Kurbah	092°01.236	25°44.542	859m	For cultivation of vegetables (Broccoli, cabbage, lettuce, French bean)
Mrs. Ladei Nongsiej	092°01.318	25°44.573	861m	For cultivation of vegetables (Broccoli, cabbage, lettuce, French bean)
Mr. Ambor Makhroh	092°00.056	25°44.313	875m	For cultivation of vegetables (Broccoli, cabbage, lettuce, French bean) and for rearing of pigs
Mr. Synsharsuk Rynghang	092°01.447	25°44.539	866m	For cultivation of vegetables (French bean) and vermicomposting unit
Mrs. Guardian Shadap	092°00.847	25°44.301	884m	For cultivation of vegetables (French bean)
Mrs. Hynniew Rynghang	092°01.261	25°44.602	874m	For cultivation of vegetables (lettuce, French bean) and for piggery and dairy.
Mrs. Trias Makhroh	092°00.835	25°44.222	882m	For cultivation of vegetables (Broccoli, cabbage, lettuce, French bean) and for rearing of pigs and poultry.
Mr. Aphilous Makhroh	092°00.068	25°44.317	869m	For cultivation of vegetables (Broccoli, cabbage, lettuce, French bean) and for rearing of pigs.
Mrs. Entinora Rynghang	092°01.296	25°44.557	860m	For cultivation of vegetables (Brocolli, cabbage, lettuce, french bean) for rearing pig and dairy.
Mr. Pynskhem Kharsohnoh	092°01.072	25°44.522	868m	For cultivation of vegetables (Chilli, French bean).
Mr. Phang Rympei	092°01.287	25°44.623	876m	For cultivation of vegetables (Broccoli, cabbage, lettuce, French bean) and for rearing of pigs.
Mr. Rongdondor Lapang	092°00.037	25°44.313	874m	For cultivation of vegetables (Tomato, Broccoli, cabbage, lettuce, French bean).
Mrs. Shandriana Rympei	092°01.338	25°44.745	876m	For cultivation of vegetables (Broccoli, cabbage, French bean) and for rearing of Poultry.
Mr. Bolbahadur Sarki	092°00.872	25°44.571	882m	For cultivation of vegetables (French bean) and for rearing Cows.
Mrs. Blianda Lapang	092°01.057	25°44.493	874m	For cultivation of vegetables (French bean).

C. Vermicomposting unit

Vermicomposting is a method of preparing enriched compost with the use of earthworms. It is one of the easiest methods to recycle agricultural wastes to produce quality compost. The crop residues and biomass can be recycled for vermicompost by earthworms; Degradation of organic waste by earthworms is one of the recent developments in biological sciences. They are responsible for the breakdown of complex organic residue into simpler till soluble-substances. Organic matter when subjected to decomposition with the help of earthworms, the product is called vermicompost and the process is known as vermicasting. The product is the result of organic waste consumed by earthworm, digested and excreted in the form of granules. The vermicompost, chiefly the faecal matter of earthworm is rich in plant nutrients, plant growth promoter.

Based on this method a community vermicomposting unit (size 6m x 8m x2.6m) consisting of eight composting tanks (size 2m x 1.5m x 0.75m) has been constructed in Mynsain village with an objective to recycle on farm biomass to increase the fertility of the soil. Vermicomposting unit were constructed with a rectangular bricks columns, Cement tanks which are filled with organic wastes and composting is taken up. The biomasses from farmer's field are collected by the community and were used for vermicomposting. During the year 2015-16, that the farmers could harvest 7 tonnes of vermicompost.

D. Vermi-beds

Vermi Beds are unique and latest technology concept for Earthworm farming, it is very portable, low cost, easy to handle and install and provision for collection of Vermi-wash. Fifteen numbers of such beds of the size 12'x'4' x 2' were introduced to the farmers for vermicomposting, and can produce about 1200 kgs to 1500 kgs vermicompost. Vermi-beds can be done on a small scale by farmers with household organic wastes. Crop residue and agricultural waste was collected and filled in this bed by the farmers and decomposition processes are under progress.

List of beneficiary for Vermi-beds and their geographical location of the demonstration site

Name of beneficiary	Latitude (N)	Longitude (E)	Elevation above sea level(m)
Mr. Noviroy Rympei	092'01.318	25'44.729	882
Mr. Skhemlang Lyngdoh	092'01.107	25'44.535	880
Mr. Jril Makhroh	092'01.041	25'44.516	871
Mr. Lanshon Wahlang	092'00.159	25'44.368	484

Name of beneficiary	Latitude (N)	Longitude (E)	Elevation above sea level(m)
Mrs. AirishaKyrsian	092'00.981	25'44.378	887
Mr. Bankhrawbor Rynghang	092°01.092	25°44.590	844
Mrs Pynsan Rynghang	092°01.276	25°44.704	872
Mrs. Ladei Nongseij	092°01.318	25°44.573	861
Mrs. Skola Kurbah	092°01.236	25°44.542	859
Mrs. Entinora Rynghang	092°01.296	25°44.557	860
Mrs. Rias Makhroh	092'00.863	25'44.265	880
Mrs. Krias Makhroh	092'01.173	25'44.298	854
Mr. Ambor Makhroh	092°00.056	25°44.313	875
Mrs. Guardian Shadap	092°00.847	25°44.301	884
Mrs. Bidiona Rympei	092'01.302	25'44.706	883

E. Improved Farm Yard Manure Storage tank

Five numbers of Improved FYM storage tank (Pit and shed) has been constructed in five farmer's field. Pit size of 4m x 3m x 1m was dug and was covered on top with grass and plastics to protect the pits from rainfall. Residues from field were collected inside the pits along with cow dung for decomposing. This will help the farmers to get on farm manure for crop cultivation.

List of beneficiary for Improved FYM storage tank and their geographical location of the demonstration site

Name of beneficiary	Latitude (N)	Longitude (E)	Elevation above sea level(m)
Mr. Brola Kyrsian	092'00.884	25'44.339	866
Mrs. Mercy Rynghang	092'01.279	25'44.561	869
Mrs. Batriti Rynghang	092'01.041	25'44.516	880
Mrs. Rilin Makhroh	092'00.857	25'44.144	888
Mrs. Wanroi Kyrsian	092'00.859	25'44.363	884

F. Land Development and modification

1. Terracing

Bench terraces were developed in different farmer's field to bring additional area under cultivation. Bench terraces are usually found on medium to steep slope, they consist of beds which are more or less level and risers (walls or bunds). It is easy to grow crops on the beds because it is fairly level. To be effective, bench terraces must be well

maintained. The risers planted with grass, and repair them if necessary. Use conservation agriculture on the beds to conserve the soil, encourage water to sink in, and maintain fertility. The newly prepared terraces were applied with lime (2t/ha), FYM (15t/ha) and other biomass to develop soil fertility. The vegetables like groundnut, rice bean, green gram, soybean etc are planned to cultivate in first year to develop soil fertility. At present, five bench terraces were constructed in different farmer's field of Mynsain village under TSP-NPOF.

List of beneficiary for Terracing and their geographical locations

Name of beneficiary	Area (m^2)	Latitude (N)	Longitude (E)	Elevation above sea level (m)
Mrs. Guardian Shadap	2700	092°00.836	25°44.305	884m
Mrs. Tiewlang Lapang	1332.93	092°00.036	25°44.313	874m
Mr. Ambor Makhroh	1800	092°00.048	25°44.301	873m
Mrs. Dapbiang Makhroh	1856.28	092°01.053	25°44.377	874m
Mrs. Shandriana Rympei	2386.23	092°00.335	25°44.736	872m
Mr. Synsharsuk Rynghang	2703	092°01.419	25°44.537	861m
Mr.. K.J War	2640	092°01.273	25°44.682	884m

2. Raised and Sunken beds

Raised and Sunken beds were developed after rice harvest in lowland for cultivation of vegetables. The dimensions of the raised bed were 0.75-1m Breadth, 10m length, 0.3-0.5m height and the drainage channel (Sunken bed) varies from 0.2-0.5m respectively. A total of 22755.4 m^2 area has been brought under vegetable cultivation in lowland through raised and sunken beds land configuration. Vegetables such as Tomato (Var;Avinash, Rocky) French bean (var. Naga local) Potato (var. Kufri megha) Carrot (var. New Kuroda), Lettuce etc are grown by the farmers on raised beds.

Location of demonstration sites and beneficiary details

Name of beneficiary	Area (m^2)	Latitude (N)	Longitude (E)	Elevation above sea level (m)	Crops Grown
Mr. Aphilous Makhroh	2183.6	092°00.869'	25°44.116'	864m	French bean, Tomato, Potato
Mr. Ambor Makhroh	1572.1	092°00.010'	25°44.253'	857m	French bean, Tomato, Potato
Mrs. Hostina Makhroh	1103.5	092°00.903'	25°44.218'	858m	Lettuce
Mrs. Dapbiang Makhroh	2933.0	092°01.016'	25°44.402'	870m	Tomato, Frenchbean
Mrs. Hunlang Makhroh	1746.9	092°00.882'	25°44.212'	860m	Tomato
Mr. Debinus Nongsiej	3709.0	092°01.100'	25°44.614'	840m	Carrot, Tomato, Potato, French bean
Mr. Rongdondor Makhroh	1863.8	092°00.942'	25°44.083'	873m	Tomato
Mr. Shaibor Makhroh	2497.5	092°00.879'	25°44.090'	866m	Tomato
Mr. Bankhrawbok Rynghang	1550.4	092°01.092'	25°44.590'	844m	Frenchbean
Mrs. Rina Lapang	1672.4	092°00.900'	25°44.151'	862m	Tomato, Potato, Frenchbean
Mrs. Paleiti Makhroh	1923.1	092°00.916'	25°44.094'	869m	Tomato
		Total Area = 22755.4 m^2			

Temporary Raised and Sunken bed developed by farmers in Mynsain Village

G. Fruit trees plantation

During the year 2015-16, 833 nos of Assam lemon and 200 nos. of Sweet orange seedlings were planted in different farmer's field in the month of July covering an area of about 1 Acre. Pits (size 1 x 1x 1 m) were dug at 5x 5 m apart and were incorporated with upper 30 cm soil along with 3 to 5 kg FYM. In the initial stages, trees were allowed to grow as a single upright stem up to a height of 70 to 80 cm. The shoots emerging from ground level or below the graft/bud union and dried twigs were removed periodically. The survival percentage is about 85%.

Location of Fruit plantation sites and beneficiary details

Name of beneficiary	Latitude (N)	Longitude (E)	Elevation above sea level(m)
Mrs. Ladeishisha Nongsiej	092^{0}01.360'	25^{0}44.618'	867
Mrs. Kynshew Rynghang	092^{0}01.303'	25^{0}44.657'	872
Mr. Alexander Rynghang	092^{0}01.012'	25^{0}44.432'	855
Mr. Lamphrang Rympei	092^{0}01.214	25^{0}44.613	856
Mr. Jrill Makhroh	092'01.041	25'44.516	871
Mr. K.J. War	092^{0}01.273'	25^{0}44.682'	884

H. Pineapple plantation

Three thousand numbers of pineapple suckers (Var. kew) were planted during monsoon of the year 2015 in one farmer field covering an area of 1 acre, plantation was done across the slope to ensure higher yield by reducing soil loss. Planting was done

at a spacing of 30 x 60 x 90 cm in double row method of planting, i.e. suckers were planted at a distance of 30 cm from plant to plant in the line and 60 cm in between two lines and 90 cm between two double rows. Well rotten FYM @ 1kg/pit were applied at the time of planting.

I. Improved maize varieties

Improved maize variety viz. DA-61A @100kg, RCM-1-3@20 kg were distributed to the farmers for comparison with the available local variety.

Area and production of different Maize variety in farmer's field

Name of beneficiary	Area (m^2)	Production (kg)	Yield (kg/ m^2)	Yield (t/ha)
		DA-61-A		
Mrs.Shalita Lyngdoh	275	86	0.31	3.13
Mrs. Entermi Lyngdoh	159	54	0.34	3.40
Mrs.Bahunlang Muktieh	209	67	0.32	3.21
Mr. Comfortable Muktieh	242	92	0.38	3.80
Mrs. Lilda Lyngdoh	249	80	0.32	3.21
Mrs. Tina Kyrsian	169	64	0.38	3.79
Mrs. Banriing Rynghang	259	69	0.27	2.66
Mrs. Sophimon Rynghang	153	50	0.33	3.27
Mrs. Entinora Rynghang	109	66	0.61	6.06
Mrs. Ladeishisha Nongsiej	165	68	0.41	4.12
Mrs. Skola Kurbah	249	97	0.39	3.90
Mrs. Balensar Makhroh	79	18	0.23	2.28
Mrs. Dapbiang Makhroh	119	63	0.53	5.29
Mrs. Wanroi Kyrsian	169	85	0.50	5.03
Mrs. Junior Lyngdoh	136	73	0.54	5.37
Mrs. Buromshai Lyngdoh	129	62	0.48	4.81
Mr. Jril Makhroh	129	61	0.47	4.73
Mr. Debinus Nongsiej	93	68	0.73	7.31
Mrs. Balahun Makhroh	69	43	0.62	6.23
Mrs. Bianglut Rympei	124	57	0.46	4.60
Mrs. Shalala Rympei	146	68	0.47	4.66
Mrs. Bedeona Rympei	64	33	0.52	5.16
Mrs. Shaldiana Rympei	129	63	0.49	4.88
Mrs. Elis Lapang	108	55	0.51	5.09
Mrs. Sorida Rynghang	69	31	0.45	4.49
Mrs. Bibirilang Rympei	64	33	0.52	5.16
Mrs. Mercy Rynghang	187	76	0.41	4.06
Mrs. B. Lyngdoh	170	58	0.34	3.41
Mr. Bensimai Nongsiej	86	40	0.47	4.65
Mrs. Perila Rynghang	81	36	0.44	4444.44
Mean	**146.30 ± 62.46**	**60.53 ± 18.95**	**0.44 ± 0.11**	**4.41 ± 1.09**
		RCM-1-3		
Mrs. Rina Lapang	150	30	0.200	2.000
Mrs. Brola Kyrsian	105	44	0.419	4.190
Mrs. Tiewlang Lapang	60	18	0.300	3.000
Mrs. Merinda	127	51	0.402	4.016
Mean	**122.38 ± 64.4**	**41.75 ± 21.1**	**0.35 ± 0.1**	**3.49 ± 1.1**
		Local		
Mean	**53.17 ± 29.64**	**10.82 ± 8048**	**0.18 ± 0.04**	**1.85 ± 0.4**

From the finding above, it was found that a total number of 34 farmers were provided with maize seeds of different variety i.e. DA 61 A and RCM 1-3 for comparison with the available local variety. According to the farmer's practices, it was found that the average production is higher in DA-61- A (54.20 ± 18.30) compared to RCM 1-3 (41.75 ± 21.14) and the local variety with the least production (10.82 ± 8048).

Maize variety DA 61 A

Local variety

J. Fodder cultivation

Cultivation of fodder crops in degraded land was done with an objective to supply green fodder to the dairy unit. Besides cultivation of fodders in hill slopes would rehabilitate degraded land by reducing soil loss. Fodder cultivation was done in two farmer's field (Mr. Aikylluid Rympei and Mrs. Ladei Nongseij) covering an area of 1 acre. Two varieties of fodder viz; Setaria and Co-4 (250 nos. each) were planted at a spacing of 50 x 50 cm along with multipurpose trees at 5 meter distance in Mr. Aikylluid Rympei field. FYM @ 250g/pit was also applied at the time of planting. A total number of 2500 slips of Napier, Congo signal and Guinea grass were supplied to Mrs. Ladei Nongseij during the year 2015.

K. Poultry

During the year 2015, 315 nos. poultry chicks (Breed-Vanaraja & gramapriya) and 2 bags poultry feed were distributed to 6 beneficiaries in order to increase the socio-economic condition of the villages. The average eggs layed by each poultry birds were 18-20 numbers per month. The average weight of the poultry bird was 3 kg. The farmers could also sell the poultry birds for meat purpose at an average price Rs. 300 per kg.

List of beneficiary for poultry rearing

Sl. No.	Name of Beneficiary	Nos./Units of Poultry	Income/ month (Rs.)
1.	Mrs. Nobilin Makhroh	100	4000
2.	Mrs. Rilin Makhroh	50	2500
3.	Mr. Jrill Makhroh	50	3000
4.	Mrs.Pynsan Rynghang	50	3000
5.	Mrs.Ladei Nongseij	50	3000
6.	Mrs Pretiwan Rynghang	15	1500


Beneficiaries benefitted from poultry rearing at Mynsain Village

L. Introduction of Improved Pig Variety

Farmers were provided with improved breeds (75% Hampshire and 25% mixed local) of livestock for higher productivity and income. Seven units (one male and one female) improved cross breed piglets was provided to each benificiary farmers in Mynsain village. Two units of local piglets were also included in farming system for comparisons. After one year, 19 pigs with an average weight 60 kg has been sold by the farmers at an average price of Rs 200/- per kg.



M. Hedge row Intercropping

Leguminous hedge row species such as *Tephrosia* sp. was grown at regular interval across the slope (10 to 20 m depending upon the slope). The hedge row species was also grown around the farm to serve as fencing, conserve soils and water and supply nutrient rich green leaf manure. The interspaces would be used for crop production.

N. Improved Rice production

Improved rice production technology has been introduced to the farmers

Variety: Shahsarang 1, Bhalum-1

Cultivation method: Integrated crop management
Spacing: 20 x 20 cm
Seedlings age: 20 days
No. of seedlings/hill:2

Var. Bhalum 1

Var. Mynri

Var. Shahsarang 1

Organic Vegetables and Crop Productions:

1) Leguminous crops

Crops like groundnut, soybean etc. were cultivated in newly constructed terraces to develop fertility of the soil. Groundnut (Var. ICGS 76 @ 30 kg) and Soybean (Var.JS 81) were demonstrated in different farmer's field and was found that 750 kg of groundnut were produce from an area of 3000 square meter.

Area and production of groundnut in farmers' field

Sl no.	Farmer's Name	Area (m^2)	Production (kg)	Production (kg/m^2)	Production (t/ha)
1	Mrs. Shaldiana Rympei	120	15	0.125	1.250
2	Mrs. Shalita Lyngdoh	66	6.25	0.095	0.947
3	Mrs. Guardian Shadap	90	10.5	0.117	1.167
4	Mr. Ambor Makhroh	56	7	0.125	1.250
5	Mrs. Dapbiang Makhroh	112.5	10	0.089	0.889
6	Mr. Rongdondor Makhroh	84	9	0.107	1.071
7	Mrs. Barisha Makhroh	49	4.125	0.084	0.842
8	Mr. Aphilous Makhroh	72	5.5	0.076	0.764
9	Mr. Phlan Kyrsian	75	8.5	0.113	1.133
10	Mrs. Rias Makhroh	105	10.2	0.097	0.971
	Mean	**82.95 ± 23.88**	**8.61 ± 3.11**	**0.10 ± 0.02**	**1.03 ± 0.17**

2) Turmeric Plantation

Turmeric is one of the major spices in northeastern region, though turmeric has not occupied a significant area in the region due to non-existence of processing industry but now some farmers of the adopted village have started growing turmeric. About 900 kg of turmeric rhizome (Var. Megha Turmeric-1) were distributed to different farmers. Most of the farmers were planted in raised bed (Bun System) at a spacing of 30 x 30cm and FYM applied @ 2kg/m^2.

List of beneficiary for Turmeric plantation and their Production

Name of beneficiary	Area (m^2)	Production (kg)	Yield (kg/ m^2)	Yield (t/ha)
Mrs. Krias Makhroh	330	603.2	2.08	20.80
Mrs. Burom Lyngdoh	275	661.92	2.76	27.58
Mrs. Rias Makhroh	260	364	1.40	14.00
Mrs. Ladei Nongsiej	300	735	2.45	24.50
Mrs. Trias Makhroh	286	612.04	2.14	21.40
Mrs. Briap Kyrsian	180	241.2	1.34	13.40
Mrs. Shalita Lyngdoh	156	117	0.75	7.50
Jopthiaw Makhroh	169	231.53	1.37	13.70
Mrs. Hynniew Rynghang	195	272.22	1.40	13.96
Mrs. Sharai Rynghang	130	326.82	2.51	25.14
Mrs. Sophimon Rynghang	192	192.77	1.00	10.04
Mrs. Elis Lapang	144	171.94	1.19	11.94
Mrs. Melis Rympei	120	224.4	1.87	18.70
Mr. Ambor Makhroh	182	318.5	1.75	17.50
Mrs. Rachel Lapang	145.2	297.66	2.05	20.50
Mr. Lanshon Wahlang	172.2	200.10	1.16	11.62
Mean	**197.59 ± 59.17**	**348.14 ± 193.84**	**1.70 ± 0.59**	**17.02 ± 5.88**

3) French bean

A total of 100 kg French bean seeds (Var. Naga local) were provided to twenty one numbers of beneficiaries in Mynsain village for crop diversification, the seed were planted at a spacing of 30 x 15 cm and FYM @ 10 t/ha was incorporated. The average production was found to be (1.67 ± 0.69 t/ha).

List of beneficiaries, Area and Production of French beans in Mynsain Village

Sl. No.	Name of Famers	Area (m^2)	Production (kg)	Yield (kg/ m^2)	Yield (t/ha)
		French bean (Var. Naga Local)			
1	Mrs. Melis Rympei	100	26	0.26	2.60
2	Mrs. Shandriana Rympei	80	10	0.125	1.25
3	Mrs. Entinora Rynghang	230	60	0.26	2.61
4	Mrs. Ladei Nongsiej	130	29	0.22	2.23
5	Mrs. Mercy Rynghang	150	30	0.2	2
6	Mrs. Pretiwon Rynghang	100	20	0.20	2.00
7	Mr. Synsharsuk Rynghang	110	30	0.27	2.73
8	Mrs. Guardian Shadap	140	40	0.29	2.86
9	Mrs. Skola Kurbah	150	10	0.07	0.67
10	Mrs. Pynsan Rynghang	350	58	0.17	1.66
11	Mrs. Paleiti Makhroh	120	20	0.17	1.67
12	Mrs. Hostina Makhroh	100	10	0.1	1
13	Mr. Consider makri	260	48	0.18	1.85
14	Mr. Ambor Makhroh	140	15	0.11	1.07
15	Mrs. Rachel Lapang	130	20	0.15	1.54
16	Mr. Rongdondor Makhroh	120	10	0.08	0.83
17	Mr. Aphilous Makhroh	300	27	0.09	0.90
18	Mr. Morning Lapang	100	10	0.1	1
19	Mr. Debinus Nongsiej	180	15	0.08	0.83
20	Mr. Bankhrawbok Rynghang	115	25	0.22	2.17
21	Mrs. Dapbiang Makhroh	225	35	0.16	1.56
	Mean	**158.57 ± 7**	**26.10 ± 15.2**	**0.17 ± 0.07**	**1.67 ± 0.69**

4) Potato

300 kg of potato tubers (Var. Kufri megha) were provided to eleven farmers in Mynsain village, the sprouted seeds tubers were planted in temporary raised beds made by the farmers in paddy field after rice harvesting. The tubers were planted in furrows at the spacing of 50 x 30cm and FYM @ 10-15 t/ha were applied in opened furrows before planting. The Average yield was (7.02 ± 3.24 t/ha).

Sl.No	Name of Famers	Area (m^2)	Production (kg)	Yield (kg/ m^2)	Yield (t/ha)
		Potato (Var. Kufri megha)			
1	Mrs. Perila Rynghang	8	11.85	1.48	14.81
2	Mr. Debinus Nongsiej	22.19	17	0.77	7.66
3	Mr. Aphilous Makhroh	13.51	9	0.67	6.66
4	Mr. Ompher Nongsiej	8.72	4	0.46	4.59
5	Mr. Bankhrawbok Rynghang	5.53	5	0.90	9.04
6	Mr. Ambor Makhroh	16.35	14	0.86	8.56
7	Mr. Bensimai Nongsiej	9.81	7.75	0.79	7.90
8	Mrs. Skola Kurbah	18.26	7.5	0.41	4.11
9	Mrs. Syrpai Rympei	10.9	6.42	0.59	5.89
10	Mrs. Tiewlang Lapang	6.66	3.45	0.52	5.18
11	Mrs. Merinda Lapang	8	2.25	0.28	2.81
	Mean	**11.63 ± 5.31**	**8.02 ± 4.63**	**0.70 ± 0.32**	**7.02 ± 3.24**

5) Bitter gourd

80g of Bitter gourd seeds (Var. Malay 101) were provided to three farmers in Mynsain village, before planting the soil were ploughed thoroughly 3-4 times through digging with spades and well rotten FYM @ 15 t/ha is mixed at the time of ploughing. The seeds are planted at the spacing of 1.5 to 2.5m (row to row) x 60 to120cm (plant to plant). The average yield was found to be (7.11 ± 1.86 t/ha).

Sl.No	Name of Famers	Area (m^2)	Production (kg)	Yield (kg/ m^2)	Yield (t/ha)
		Bitter Gourd (Var. Malay 101)			
1	Mr. Pynskhem Kharsohnoh	120	70	0.58	5.83
2	Mr. Debinus Nongsiej	40	37	0.93	9.25
3	Mr. Bankhrawbok Rynghang	40	25	0.63	6.25
	Mean	**66.67 ± 46.19**	**44 ± 23.30**	**0.71 ± 0.19**	**7.11 ± 1.86**

6) Cucumber

90g of Cucumber seeds (Var. Malini) were provided to farmers in Mynsain village, before planting the soil were ploughed thoroughly 3-4 times through digging with spades and well rotten FYM @ 15 t/ha is mixed at the time of ploughing. The seeds are planted at the spacing of 1.5 to 2.5m (row to row) x 60 to 90cm (plant to plant). The average yield was found to be (8.72 ± 0.81t/ha).

Sl.No	Name of Famers	Area (m^2)	Production (kg)	Yield (kg/ m^2)	Yield (t/ha)
		Cucumber (Var. Malini)			
1	Mrs. Hynniew Rynghang	90	73	0.81	8.11
2	Mrs. Skola Kurbah	100	96	0.96	9.60
3	Mrs. Guardian Shadap	78	60	0.77	7.69
4	Mrs. Rachel Lapang	105	88	0.84	8.38
5	Mrs. Sophimon Rynghang	60	52	0.87	8.67
6	J. Nongsiej	80	74	0.93	9.25
7	Mrs. Iarihun Lapang	84	85	1.01	10.12
8	Mr. Bolbahadur Syrki	120	105	0.88	8.75
9	Mr. Rophin Kurbah	75	59	0.79	7.87
	Mean	**88 ± 18.01**	**76.89 ± 18**	**0.87 ± 0.08**	**8.72 ± 0.81**

7) Lettuce

60g of lettuce seeds (Var. Iceberg Cabbage TYP) were provided to six numbers of farmers in Mynsain village, seedlings were planted on temporary raised beds in low land area after rice harvesting. The seedlings are transplanted at the spacing of 45 x 30 cm and FYM @ 10t/ha were applied at the time of planting. The average yield was found to be (4.11 ± 0.70 t/ha).

Sl.No	Name of Famers	Area (m^2)	Production (kg)	Yield (kg/m^2)	Yield (t/ha)
		Lettuce (Iceberg Cabbage TYP)			
1	Mrs. Hostina Makhroh	50	20	0.40	4.00
2	Mr. Shemphang Rympei	130	42	0.32	3.23
3	Mrs. Pynsan Rynghang	80	34	0.43	4.25
4	Mrs. Entinora Rynghang	60	32	0.53	5.33
5	Mrs. Ladei Nongsiej	115	47	0.41	4.09
6	Mrs. Phairi Rynghang	40	15	0.38	3.75
	Mean	**79.17 ± 36.39**	**31.67 ± 12.34**	**0.41 ± 0.07**	**4.11 ± 0.70**

8) Tomato

200g of tomato seeds (Var. Avinash and Rocky) were introduced to the farmers of Mynsain village, seedlings were planted on temporary raised beds in low land area after rice harvesting. The seedlings are transplanted at the spacing of 60 x 45 cm and FYM @ 20t/ha were applied at the time of planting. The average yield was found to be higher in Rocky (18.79 ± 4.19 t/ha) than in Avinash (17.15 ± 6.31).

Sl.no	Name of Famers	Area (m^2)	Production (kg)	Yield (kg/m^2)	Yield (t/ha)
		Tomato (Var. Avinash)			
1	Mrs. Sophimon Rynghang	27	60	2.22	22.22
2	Mrs. Jiaryngkhat Nongsiej	100.45	150	1.49	14.93
3	Mr. Lanshon Wahlang	40.39	100	2.48	24.76
4	Mrs. Ladei Nongsiej	145.75	250	1.72	17.15
5	Rophin Kurbah	54.05	50	0.93	9.25
6	Mrs. Hunlang Makhroh	96.82	140	1.45	14.46
7	Mr. Borkin Rynjah	76.86	60	0.78	7.81
8	Mr. Shlur Makhroh	496.7	900	1.81	18.12
9	Mrs. Skola Kurbah	132.6	340	2.56	25.64
	Mean	**130.07 ± 143.15**	**227.78 ± 269.94**	**1.71 ± 0.63**	**17.15 ± 6.31**
		(Var.Rocky)			
10	Mrs. Paleiti Makhroh	297.8	600	2.01	20.15
11	Mrs. Hostina Makhroh	100.34	180	1.79	17.94
13	Mr. Ambor Makhroh	330.07	800	2.42	24.24
14	Mr. Rongdondor Makhroh	329.3	780	2.37	23.69
15	Mr. Aphilous Makhroh	255.24	425	1.67	16.65
16	Mr. Morning Lapang	79.56	90	1.13	11.31
17	Mr. Debinus Nongsiej	136.2	270	1.98	19.82
18	Mrs. Dapbiang Makhroh	212	350	1.65	16.51
	Mean	**217.56 ± 101.73**	**436.88 ± 266.74**	**1.88 ± 0.42**	**18.79 ± 4.19**

9) Sweet potato

500 numbers of sweet potato cuttings (Var. Kokrajhar) were planted in two farmers at a spacing of 50 x 50 cm on raised beds, inter cultural operation (weeding and earthing up) followed after 30 days of planting by the farmers and FYM @ 10-15 t/ha were incorporated. The average yield was found to be (19 ± 1.41 t/ha).

Sl.No	Name of Famers	Area (m^2)	Production (kg)	Yield (kg/ m^2)	Yield (t/ha)
		Sweet potato cuttings (Var. kokrajhar)			
1	Mr.Lamphrang Rympei	16	28.8	1.800	18
2	Mrs.Skola Kurbah	18	36	2.000	20
	Mean	**17 ± 1.41**	**32.4 ± 5.09**	**1.90 ± 0.14**	**19 ± 1.41**

10) Community Nursery

One Community Nursery was constructed in the village (Mynsain) during the year 2015 for raising seedlings of cole crops like cabbage, broccoli and cauliflower. This activity was found to be very crucial for obtaining strong and healthy vegetable seedlings.

11) Cabbage

50g of cabbage seeds (Var. Fiesta) were introduced to five farmers in Mynsain village, nursery preparation and other inter cultural practices was done by the farmers, the seedling was transplanted at a recommended spacing of 45 x 45 cm and FYM @10-15 t/ha was incorporated before transplanting of the seedlings. The average yield was found to be (4.38 ± 1.62 t/ha).

Sl.No	Name of Famers	Area (m^2)	Production (kg)	Yield (kg/ m^2)	Yield (t/ha)
		Cabbage (Var. Hybrid Cabbage US 2125)			
1	Mr. Aphilous Makhroh	100	40	0.40	4.00
2	Mrs. Entinora Rynghang	180	63	0.35	3.50
3	Mrs. Melis Rympei	40	21	0.52	5.25
4	Mrs. Phairi Rynghang	60	15	0.25	2.50
5	Mrs. Pynsan Rynghang	6	4	0.66	6.66
	Mean	**77.20 ± 66.78**	**28.60 ± 23.24**	**0.44 ± 0.16**	**4.38 ± 1.62**

12) Broccoli

30 g of Broccoli seeds (Var. Green magic) were introduced to three farmers in Mynsain village, nursery preparation and other inter cultural practices was done by the farmers, the seedling was transplanted at a recommended spacing of 45 x 30 cm and FYM @10-15 t/ha was incorporated before transplanting of the seedlings. The average yield was found to be (3.90 ± 0.61 t/ha).

Integrated Farming System (IFS) practiced by the Farmers in Mynsain Village

At present seven farmers in Mynsain village have already started practicing organic farming in integrated farming system (IFS) mode. They integrated crops (Rice, Maize), Vegetables (Tomato, French bean, Potato, Lettuce, Carrot), Livestock (Dairy/ Piggery), Water harvesting (Jalkund) etc in IFS mode.

Integrated organic Farming System in Mynsain village

List of farmers for IFS model

Sl.No	Farmers	Farming Components	NRM
1	Rias Makhroh	Pineapple + Turmeric + Vegetables+ Dairy + Poultry	Jalkund
2	Ladeishisha Nongsiej	Fruit Trees (Guava, Carambola, Pomelo, Banana) + Vegetables + Dairy	Jalkund
3	Entinora Rynghang	Fruit Trees (Guava, Carambola, Banana) + Vegetables + Piggery + Dairy	Jalkund
4	Pynsanlang Rynghang	Vegetables + Piggery + Poultry + Apiculture	Jalkund
5	Lamphrang Rympei	Rice + Vegetables + Piggery + Poultry + Pisciculture	Pond
6	Trias Makhroh	Fruit Trees (Assam lemon, Pineaaple, Banana) + Vegetables	Pond
7	Skola Kurbah	Vegetables + Piggery + Dairy	Jalkund
8	Hynniew Rynghang	Vegetables + Piggery + Poultry	Jalkund

List of Training cum awareness programme conducted during 2015-16

Sl. No.	Date	Venue	Theme	Number of beneficiaries
1	05-11-2015	Mynsain village	Training cum awareness programme on "Role of integrated organic farming system"	63 nos.
2	10-03-2016	ICAR, RC for NEH region, Umiam	Field day on "Pulse production in rice fallow"	240 nos.
3	15-02-2016	ICAR, RC for NEH region, Umiam	Awareness programme on "Sustainable Hill Agriculture"	256 nos

Awareness programme on "Sustainable Hill Agriculture" dated 15th February, 2016

Field day on "Pulse production in rice fallow"

To celebrate the International Year of Pulses 2016, a field Day was organized on 'Pulse production in rice fallow' under Tribal Sub Plan (TSP) on 10th March, 2016 at ICAR Research Complex for North Eastern Hill (NEH) Region, Umiam, Meghalaya. The field day was organized to create awareness about pulses among farmers and disseminate no-till pulse cultivation technology in rice fallow.

A total of 250 farmers from 15 villages of Meghalaya participated in the programme. For demonstration on no tillage cultivation of pea and lentil in lowland rice fallow, field visit as well as practical demonstration was done. A scientists and farmers interaction programme was organized on various aspects of pulse production in the region. The farmers interacted with the experts and enquired about improved seed, production technology and insect pest and disease management options.

Infrastructure created and inputs distributed to the beneficiaries under the programme

Sl. No	Particulars	Quantity	Dimension/ Specification	Purpose	No. of beneficiaries
1	**Infrastructure:**				
	Ponds construction and Renovation.	6 nos.	20m X 20m	Water harvesting and fish culture	6
	Jalkund	33 nos.	5m x 4m x 1 m	Water harvesting	33
	Terracing	7 nos.	-	Bench terraces	7

Sl. No	Particulars	Quantity	Dimension/ Specification	Purpose	No. of beneficiaries
	Community Vermicomposting Units	1 no.	6m x 8m x2.6m	Vermicomposting	45
	Improved Farm Yard manure storage tank	5 nos.	4m x 3m x 1m	On farm manure production	5
	Vermi- beds	21 nos.	12' x 4' x 2'	On farm vermicompost	21
	Organic outlet	1 no.	-	Selling of organic produce	Community
2	**Seeds and Planting materials:**				
	French bean	150 kg	-	Crop diversification	21
	Broccoli	30g	-	Crop diversification	12
	Cabbage	200 g	-	Crop diversification	54
	Tomato	1000 g	-	Crop diversification	50
	Lettuce	1000 g	-	Crop diversification	30
	Beet root	500 g	-	Crop diversification	30
	Bitter Gourd	800 g	-	Crop diversification	5
	Pumpkin	1000 g	-	Crop diversification	15
	Cucumber	1500 g	-	Crop diversification	32
	Potato	300 kg	-	Crop diversification	10
	Pea	70 kg	-	Zero tillage	50
	Toria	30 kg	-	Zero tillage	20
	Groundnut	25 kg	-	Crop diversification	40
	Guava	400 nos	-	Integrated farming	3
	Peach	200 nos	-	Integrated farming	2
	Assam lemon	833 nos.	-	Integrated farming	25
	Sweet orange	200 nos.	-	Integrated farming	4
	Rice	200 kg	-	Introduction of improved varieties	15
	Maize	120	-	Introduction of improved varieties	60
	Fodder	2500 nos.	-	Supply fodder to dairy units	1
3	**Livestock and Fish:**				
	Poultry	300 nos.	-	Meat and egg	6
	Fingerlings	48 kg.	-	Composite fish culture	12
4	**Inputs for Livestock:**				
	Poultry feed	100 kg	-	Poultry nutrition	6
5	**Tools and Implements:**				
	Silpaulin	33 nos.	36 x30 ft. (250gsm)	Lining Jalkund	33
	Paddy Thresher	2 nos.	-	Paddy threshing	Community
	Maize Sheller	10 nos.	-	Shelling maize	Community
	HP electrical pump	1 no	-	Irrigation	Community
	Rake	5 nos.	-	Collecton on farm residue	Community
	Furrow opener	4 nos.	-	Zero tillage crop cultivaton	Community
	Cono weeder	2 nos	-	Paddy weeding	Community
	Knapsak sprayer	4 nos.	-	Spraying organic pesticides	Community
	Watering can	30 nos.	-	Kitchen garden	Community
6	**Training and Awareness programme:**				
	Field day	3	-		559
7	**Others**				
	Vermiworms	20000 nos.		Vermicomposting	21

8. PUBLICATIONS/HUMAN RESOURCE DEVELOPMENT AND WORKSHOPS/MEETINGS

8.1 Publications

8.1.1 Research Papers

Aher, S. B., Lakaria, B. L., Swami Kaleshananda, Singh, A. B., Ramana, S., Ramesh, K., and J. K. Thakur (2015). Effect of organic farming practices on soil and perfarmence of soybean (Glycine max) under semi arid tropical conditions in Central India, *Journal of Applied and Natural Science*, 7 (1): 67-71.

Choudhary R.S., Choudhary Roshan and Sharma S.K. 2016. Dynamism of Food Security and Agricultural Sustainability to face the Climate Scenario in the 21st century. *Journal of Progressive Agriculture* 7 (1): pp 1-8.

Das, Anup, Patel,D.P., Kumar, Manoj, Ramkrushna, G.I., Mukharjee, Atanu, Layek Jayanta, Ngachan, S.V. and Juri Buragohain 2016. Impact of seven years of organic farming on soil and produce quality and crop yields in eastern Himalaya, India. *Agriculture, Ecosystems and Environment*.

Das,Anup, Kumar Manoj, Ramkrushna G.I., Patel D.P., Layek Jayanta, Naropongla, Panwar, A.S. and S.V. Ngachan 2016. Weed management in maize under rainfed organic farming system. *Indian Journal of Weed Science*.

Kanwar Harshraj, Trivedi Amit and Sharma, S.K., 2016. Efficacy of eco-friendly management practices of powdery mildew, Alternaria blight and bacterial leaf blight of cluster bean under organic farming. *Advances in Life Sciences* 5(6), 2324-2332

Kanwar Harshraj, Trivedi Amit, Sharma, S.K., Singh Dashrath and Chakravarty Deepankar. 2015. Effect of age of host on development of powdery mildew, Alternaria blight and bacterial leaf blight of clusterbean. *The EcoScan* Special Issue.2015 (7): 153-156

Layek Jayanta, Ramkrushna G.I, Dauni Suting, B. Ngangom, Krishnappa R, Utpal Dey and Anup Das 2016. Evaluation of maize cultivars for their suitability under organic production system in North eastern hill region of India. *Indian Journal of Hill Farming*.

Parmar D.K., Thakur D.R., (2017). Improvement in soil physical, chemical and microbiological properties during cropping cycles inder differnent nutrient managenments in Western Himalayas. *Intenational Jurnal of Currnet Microbiological and Applied Sciences*, 6 (6)-in press.

Parmar, D.K., Thakur, D.R., Jamwal, R.S. and Arpana (2016). Effect of long term organic manure application on soil properties, carbon sequenstration, soil-plant carbon stock and productivity under teo vegtable production systems in Himachal Pradesh. *Journal of Environmental Biology, 37 (3): 333-339.*

Parmar, D.K., Thakur, Neha and Arpana (2016). Influence id selected organic manure on soil health if westrn Himalaya vegtable production system. Paper Presented in 4th *international Agronomy Congress* held from 22-26 November, 2016 at IARI, New Delhi.

Sharma S.K., Sharma Latika, Khatik Pratibha and Choudhary Roshan. 2015. Marketing behaviour of organic inputs in India: Some experiences. *Indian Journal of Agriculture marketing*. 29 (2): 172-184.

Singh D.K., Gupta Shilpi, Nanda, Gangadhar, Y. Sharma, Singh, V. V. and Dipti Bisarya (2017) Evaluation of rice varieties for yield under organic farming in Tarai region of Uttarakhand (India). *International J. Current Microbiology & Applied Sciences* **6**(4): 734-738.

Singh, A. B., Ramesh, K., Brij Lal Lakaria, Ramana, S., Thakur, J. K. ,Poonam Singh Rajput and SushmaParmar (2015). Impact of different Nutrient Management Practices on Crop Productivity and Soil Health in Soybean-wheat cropping system. *In Proceedings of EFAHPSC-2015*, 3rd International Conference held during 12-14, 2015 at Bhopal (M. P).

Singh, B and Aulakh, C.S. 2015. Performance of Wheat+Chickpea intercropping under limited moisture and otganically manured conditions. *Indian J Econ 42(2): 525-27 (*NAAS: 4.47)

Singh, P., Dubay, R.K., Aulakh, C.S. 2016. Effect of farm yard manure and nitrogen on growth and frond production in boston Fern (*Nephorlepisexaltata (*L.) Schott). *Agric Res J 53 (1) :* 46-52 (MAAS:3.01)

Walia S.S., Gill, R.S., Aulakh, C.S., Kaur, J. and Chaudhary, A. 2015. Evaluation of prominent bio-intensive complenmentary crooping systems in relation to internsification and diverstfivation under assured input conditions. *Indian H Ecol 12(2): 319-25(*NAAS: 4.47)

Walia, S.S., Aulakh, C.S., Gill, R.s., Dhawan, V. and Kaur, Jaspreet. 2016 intensive intergrated farming system approach- A vaccination to cure agrarian crisis in the Punjab. *Indian J Econ Dev12(2)29-23 (NAAS:4.01)*

8.1.2 Popular article/folders

Anup Das, Ramkrushna GI, Jayanta Layek, SV Ngachan, AS Panwar and Dauni Suting (2016). Integrated Organic Farming System -*Innovations for healthy food and environmental security*.

Anup Das, Ramkrushna G.I., Jayanta layek, SV Ngachan, Bidyapati Ngangom, Utpal Dey and Dauni Suting. Package of Practices for Rice-Carrot cropping system (lowland) under Organic Crop Production.

Anup Das, Ramkrushna G.I., Jayanta layek, SV Ngachan, Bidyapati Ngangom, Dauni Suting and Utpal Dey. Package of Practices for Rice-tomato cropping system (lowland) under Organic farming.

Anup Das, Ramkrushna G.I., Jayanta layek, SV Ngachan, Bidyapati Ngangom, Utpal Dey and Dauni Suting. Package of Practices for Maize + soybean- French bean (Upland) cropping system under Organic Production technology

आर एस. चौधरी, रोशन चौधरी एवं एस.के. शर्मा. 2016. भारतीय कृषि उत्पादन एवं विकास का आर्थिक दर्पण, खाद्य पत्रिका। कुल पृ. सं. 6।

Ravishankar, N., Sharma, S.K., Singh, D.K. and Panwar, A.S. (2016). Organic Farming in India: Production issues and strategies. *Indian Farming* 66(8):16-23.

8.1.3 Books/ Book Chapter/ Bulletins/Mannual

एस.के. शर्मा, रोशन चौधरी, अमित त्रिवेदी, जी.एस. आमेटा एवं रविन्द्र जैन. 2016. फार्म पर जैविक आदान उत्पादन एवं उपयोग विधियां, अनुसंधान निदेशालय, महाराणा प्रताप कृषि एवं प्रौद्योगिकी विश्वविद्यालय, उदयपुर। कुल पृ. सं. 6।

एस.के. शर्मा, रोशन चौधरी, अमित त्रिवेदी, जी.एस. आमेटा एवं श्रवण कुमार यादव. 2016. जैविक खेती में बायोडायनेमिक खादों का उपयोग अनुसंधान निदेशालय, महाराणा प्रताप कृषि एवं प्रौद्योगिकी विश्वविद्यालय, उदयपुर।

फसलों में जैविक खेती तकनीक. 2015. एस.के. शर्मा, एवं अन्य, अनुसंधान निदेशालय, महाराणा प्रताप कृषि एवं प्रौद्योगिकी विश्वविद्यालय, उदयपुर, पृ. सं. 52।

Aulakh, C.S., Walia, S.S., and Gill, R.S. (2016). Trans-Gangetic Plains: Punjab. *Orgamic Farming: Technologies and Strategies* (Eds) B Gangwar and NK Jat. Today & Tomorrow's Printers and Publishers, New Delhi. pp 149-171.

Choudhary, Roshan and Choudhary R. S. 2016. Vermicomposting: Recycling wastes into valuable organic fertilizer Pp 194-196.

Kumar, Sunil. Jha, S.K., Bhambri, M.C. and Banjara G.P. (2015). *Practical manual on Organic farming* (64 pages)

Manual on Organic Farming (Agron-313) by R S Choudhary, M K Kaushik, S K Sharma and Roshan Choudhary

Sharma S. K., Triwedi Amit, Choudhary Roshan, Jajoria D. K. and Ameta O. P. (2015) Status and Research Experiences on Organic Farming in Rajasthan, DOR, MPUAT, Udaipur

Sharma, S. K. (2016). Agro-Ecological Research for Pest Management under Organic Production System. *In*: Compendium on ICAR Summer School on "Technological Advances and Productive Strategies in Organic Agriculture and Their Internalization with Agro-ecosystems" from 1-21 June, 2016 at MPUAT, Udaipur (Raj.).pp 219-226.

Sharma, S. K. (2016). Biodynamic Farming: Concept, Principles & Practices. *In*: Compendium on ICAR Summer School on "Technological Advances and Productive Strategies in Organic Agriculture and Their Internalization with Agro-ecosystems" from 1-21 June, 2016 at MPUAT, Udaipur (Raj.).pp 211-218.

Sharma, S. K. (2016). Gopal Lal Choudhary and Roshan Choudhary. Methods and Strategies for use of Panchagavya in Organic Crop Production. *In*: Compendium on ICAR Summer School on "Technological Advances and Productive Strategies in Organic Agriculture and Their Internalization with Agro-ecosystems" from 1-21 June, 2016 at MPUAT, Udaipur (Raj.). pp. 249-253.

Sharma, S. K. (2016). Organic Agriculture: History, Concept, Principles & Future Challenges. *In*: Compendium on ICAR Summer School on "Technological Advances and Productive Strategies in Organic Agriculture and Their Internalization with Agro-ecosystems" from 1-21 June, 2016 at MPUAT, Udaipur (Raj.), pp 7-15.

Sharma, S. K. (2016). Organic Food and Impact on Human Health. *In*: Compendium on ICAR Summer School on "Technological Advances and Productive Strategies in Organic Agriculture and Their Internalization with Agro-ecosystems" from 1-21 June, 2016 at MPUAT, Udaipur (Raj.).pp 245-248.

Sharma, S. K. (2016). PROM: Concept & Strategies to use as an Organic Alternative to Phosphatic Chemical Fertilizers. *In*: Compendium on ICAR Summer School on "Technological Advances and Productive Strategies in Organic Agriculture and Their Internalization with Agro-ecosystems" from 1-21 June, 2016 at MPUAT, Udaipur (Raj.).pp 227-232.

Sharma, S. K. and D.K. Jajoria (2016). Utilising Organic Agriculture to Adapt to Changing Ecology and Climate. *In*: Compendium on ICAR Summer School on "Technological Advances and Productive Strategies in Organic Agriculture and Their Internalization with Agro-ecosystems" from 1-21 June, 2016 at MPUAT, Udaipur (Raj.). pp 187-193.

Sharma, S. K. and Jajoria, D. K. 2016. Principles and strategies for improving soil health under organic production system – An overview Lead Paper *In*: 25th National conference on Natural Resources Management in Arid & Semi arid region for Climate Resilience & Rural Development at Bikaner from 17 to 19th Feb., 2016.

Sharma, S. K., Jajoria, D. K. and Choudhary, R. 2016. Utilizing Organic Agriculture to Adapt to Changing Climate. Lead Paper, *In*: 25th National conference on Natural Resources Management in Arid & Semi arid region for Climate Resilience & Rural Development at Bikaner from 17 to 19th Feb., 2016.

Sharma, S. K., Roshan Choudhary and Dinesh Jajoria (2016). Organic certification: Ways & Means. *In*: Compendium on ICAR Summer School on "Technological Advances and Productive Strategies in Organic Agriculture and Their Internalization with Agro-ecosystems" from 1-21 June, 2016 at MPUAT, Udaipur (Raj.).Pp 64-72.

Sharma, S. K., Sharma, R. P. and Sharma, S.K. Management of soil pH for good soil health and high productivity, May, 2015, Indian Farming 65 (2) : pp 2-4.

Singh, A. B., K. Ramesh, Brij Lal Lakaria, S. Ramana and J. K. Thakur (2016) Technologies and strategies for Organic Farming in Madhya Pradesh. In: Organic Farming: Technologies and Strategies Book (Eds. B Gangwar and N K Jat, Today and Tomarrows Printers & Publishers, New Delhi), pp 193-211.

Singh, D.K. and Shilpi Gupta (2016). Organic Farming: Technologies and Strategies Western Himalayan Region of Uttarakhand (B. Gangwar and N.K. Jat *Eds.*). *Today and Tomorrow Printer and Publishers*, New Delhi p 51-72.

Verma, Arvind and Choudhary Roshan. 2016. Recent Advances in weed management in organic farming Pp 111-118

Zenab Akhtar, Shilpi Gupta and D.K.Singh. 2016. Methane and Nitrous oxide: Emission and measurement in rice field. *Indian Farmers' Digest*. June 42-49.

8.1.4 Participation in Conferences/ Meeting/Seminar/ Symposium/ /Workshop

Choudhary, Roshan and Choudhary, R.S.. Organic weed management strategies in field crops. 2015. In: Proceedings 25th Asian-Pacific Weed Science Society Conference on "Weed Science for Sustainable Agriculture, Environment and Biodiversity", Hyderabad, India during 13-16 Oct, 2015 pp: 502.

Mandale, Poonam, Lakaria, B.L., Singh, A.B., Ramesh, K., Ramana, S. and J.K. Thakur. 2015. Nutrient acquisition pattern and performance of maize cultivars under organic farming. In: *National Seminar on Soil Health Management and Food Security:* Role of Soil Science Research and Education, 8-10 October, 2015, Kolkata. P. 85

Ramesh, K., Singh A. B., Ramana S., LakariaBrij Lal and Thakur J. K. (2016). Organic Village Clusters for the promotion of organic farming-Study of organic cultivation in Chandpur village, Madhya Pradesh. In: *81 Annual Convention of Indian Society of Soil Science*, held during October, 20-23, 2016 at RVSKVV, Gwalior.

Ramesh, K., Singh, A. B., Ramana, S., Lakaria, B.L., Thakur, J. K. and Patra, A. K. 2015. Organic Package of Practices in aiding below and above ground biodiversity. In: *International conference on sustainability development goals through organics*" at Angamali, Kochi (Kerala) during 5-7, Nov 2015.

Sahu, R. P., Shukla, V. K., Vishwakarma, S. K. and Raghuwanshi, Chanchlesh. Effect of Different Nutrient Management Practices on Productivity of Various Rice Based Cropping Systems. In "National Conference on Organic Farming and National Food Security (NCOF-2016)" held on 19-20 February, 2016 at School of Agriculture, ITM University Gwalior (M.P.) pp. 98.

Sahu, R.P. participated and presented Research paper (Oral) on Effect of Different Nutrient Management Practices on Productivity of Various Rice Based Cropping Systems. In *National Conference on Organic Farming and National Food Security* (NCOF-2016)" held on 19-20 February, 2016 at School of Agriculture, ITM University Gwalior (M.P.)

Sharma S. K., Jajoria, D. K. and Choudhary Roshan. 2016. Utilization organic agriculture to adapt to changing climate 25th National conference on Natural Resources Management in Arid & Semi arid region for Climate Resilience & Rural Development during 17 to 19th Feb. at Bikaner.

Shukla, V.K., Vishwakarma, S.K., R.P. Sahu participated as member of committee in a two day State level workshop on "*Identification on Researchable Issues and Development of strategies for promotion of organic farming* in M.P." at JNKVV, Jabalpur (M.P.) on 25-26 February 2016.

Singh, A. B., K. Ramesh, B.L. Lakaria, S. Ramana, JK Thakur, P. S. Rajput and S. Parmar. 2015. Impact of different nutrient management practices on crop productivity and soil health under soybean-wheat cropping system. In: *Third International conference on environment friendly agriculture, horticulture in planning of a smart city*, Bhopal (MP), 12-14 Dec 2015. P. 81-85.

Singh, A. B, B. L. Lakaria, K. Ramesh, S. Ramana, J. K., Thakur, PS Rajput and S Parmar. 2015. Tikaoo Udhpadhan me carbonic padhartho ka ayogyadha. In: *National conference on carbon materials for energy applications* 15-16 Oct 2015. P. 22.

Singh, A. B., Brij Lal Lakaria, K. Ramesh , S Raman, J. K. Thakur and Ashok K Patra (2016).JaivikKrishiPranali: Tecau Utpadhakta Evam Mridha Swasthya Ke LiyeVerdan . In: N*ational Science Seminar in Hindi on Prach in Evam Aadhuneek Bharat mein Vigyan Evam Urjake Aayam* held during November, 09-11, 2016 at Atal Bihari Vajpayee Hindi Vishwavidyalaya, Bhopal.

Singh, A. B., Ramesh, K., Lakaria BrijLal, Ramana S. and Thakur J. K. (2016). Quality evaluation of soybean genotypes to organic crop management practices under rainfed vertisols of Madhya Pradesh. In: *81 Annual Convention of Indian Society of Soil Science*, held during October, 20-23, 2016 at RVSKVV, Gwalior.

Singh, A.B. K. Ramesh, Brij Lal Lakaria, S Raman, J. K. Thakur, P S Rajput, Sushma Parmar and A K Patra (2016). Impact of different Nutrient Management Practices on Crop Productivity and Soil Health in Soybean-Chickpea Cropping System.*Interational Conference on Environment and Agriculture* in the U. N Sustainable Development Goals heldduring December, 17-19, 2016 at Noor-us-Sabha, Bhopal.

Singh, D.K., Pandey, P.C., Gupta, Shilpi, Sharma, Yogesh and Vishal. V. Singh. 2016. Organic Farming: A way to sustaining productivity and environmental security. *In: Technical Compendium of National Conference on Hill Agriculture in Perspective* organized by Directorate of Experiment station G.B.Pant University of Agriculture and Technology at College of Agriculture, Pantnagar during 26-28 February, p623-625.

Singh, D.K., Gupta, Shilpi, Sharma, Yogesh and V.V. Singh. 2017. Organic Farming: Way for Social and nutritional security of small and marginal farmers of Uttarakhand. International conference on Technological advancement for Sustainable and Rural Development (TASARD- INDIA, 2017) NOIDA.

Singh, D.K., Gupta, Shilpi, Sharma, Yogesh, Singh, V.V. and Gangadhar Nanda. 2017. Resource management options under organic production system for small and marginal farmers of hilly areas. In: 30th National Convention of Agricultural Engineers and National Seminar on Technological Innovations for enhancing profitability of small and marginal farms organized by College of technology, G.B.Pant university of Agriculture and technology during Feb. 27-28. Pp 235-237.

Tripathi A. K., Manna M. C. and Singh A. B. (2016). Comparative effectiveness of vermi-compost and enriched compost on crop productivity and available NPK status under soybean-wheat cropping system in vertisolIn: *81 Annual Convention of Indian Society of Soil Science*, held during October, 20-23, 2016 at RVSKVV, Gwalior

Utpal Dey, Anup Das, Pankaj Baiswar, Ramkrushna G.I., Jayanta Layek, Rachna Pande, Dauni Suting, A.S. Panwar and S.V. Ngachan 2016. *Abs.* Integrated insect pests and disease management in tomato (Solanum lycopersicum) through organic means

Vishwakarma, S.K. attended National Seminar on "*Weather and Climate risks in Agriculture under Changing Climate: Management and Mitigation*" and participated in the poster session on "Productivity and economics of scented rice (Oryza sativa)- potato (Solanum tuberosum) high value cropping system as affected by different nutrient management practices" held at College of Agriculture, Tikamgarh during 12-13 March, 2015

Vishwakarma, S.K. attended National symposium on "*Organic Agriculture*" and participated in the poster session on "Studies on Comparitive efficiency of organic chemical and Integrated nutrient management practices on crop productivity and Soil health under various cropping system " to be held on 26-27 Feb 2015 at Agriculture Collage and Research Institute, Madurai.

Vishwakarma, S.K. attended the National Symposium on *Organic Agriculture for Sustainable Food Security Challenges and opportunities* Organized at Agricultural College and Research Institute, Tamil Nadu Agricultural University, Madurai from February 26-27, 2015.Paper Present entitled" Studies on Comparative efficiency of organic , chemical and INM on Crop Productivity and soil health under various cropping system.

8.1.5 Radio/TV talk

TV programme performed by Dr A.B. Singh on "organic farming and vermicomposting" on dated 18/02/2016 at Bhopal, Doordarshan Kendra, Bhopal.

TV programme on *Jevikkheti de miar ate tasdeekikarn (KhetiKhabran)* 06.05.2016 at Ludhiana.

8.2 Human Resource Development

8.2.1 Sponsored training organised for farmers

Training on "Soil health management in Organic farming" on 01/10/2015, arranged by DDA, ATMA, Bhopal at CIAE, Bhopal.

Training on "Components of Organic Pest management" on dated 13/10/2015, arranged by State Institute of Agriculture Extension & Training, Bhopal.

Training on Organic farming in the Kisan Sangosthi, arranged by DDA, ATMA, Bhopal on 31/10/2015 at Phanda Farm Bhopal.

Training on "Natural resource management and organic farming for sustainable productivity" on dated 03/11/2015, arranged by State Institute of Agriculture Extension & Training, Bhopal.

Training on "Jaivik Khadva Kenchwa Khad Banane ki Bidhi" to the farmers on 08/12/2015, arranged by ICAR- IISS, Bhopal.

Training on "Efficient utilization of organic nutrient sources to INM and Organic Farming for sustainable productivity" to the Extension Officer/ Agriculture Officers on dated 09/12/2015, arranged by State Institute of Agriculture Extension & Training, Bhopal.

Training as resource person under Sansad Adarsh Village on Organic nutrient management and importance of Soil health" 02/01/2016.

Training on "Concept of Farming System and Integrated Organic farming & Soil Health" on dated 19/01/2016, arranged by State Institute of Agriculture Extension & Training, Bhopal.

Training on Integrated Nutrient Management (INM) under NABARD supported SRI/SWI project at Village Chattarpura District Raisen on 17/02/2016.

Training as resource person in Capacity Building Programme on Improving quality of agricultural produce through organic farming for economic sustainability" during 27-29, February, 2016, College of Agriculture, Khandwa, Madhya Pradesh.

Training on Organic farming and its importance in soil health, on dated 10/03/2016, organised by Department of Farmer Welfare and & Agriculture, Govt. of M. P at ICAR-IISS, Bhopal.

Training on Organic farming and its importance in soil health, on dated 21/03/2016, organised by Department of Farmer Welfare and & Agriculture, Govt. of M. P. at ICAR-IISS, Bhopal.

Training on "Soil health management for sustainable agriculture" and to the Extension Officer/ Agriculture Officers on dated 28/06/2016, arranged by State Institute of Agriculture Extension & Training, Bhopal.

Attended Krishi Manthan Workshop, Organized by Department of Agriculture, Govt. of Madhya Pradesh on 31/10/2015 at Administration Academy, Bhopal.

ICAR Sponsored 21 days Summer School entitled "*Technological Advances and Productive Strategies in Organic Agriculture and their Internalization with Agro-ecosystems*" was organized during 01 – 21 June, 2016 at Directorate of Research, MPUAT, Udaipur.

Workhop on Organic farming: Cancerns about crop productivity and soil health on 07.01.2016 at Modipuram. Organise by ICAR-IIFS, Deptt of Agri, Coop and Farmers welfare, GOI

National Seminar on, 'Organic farming: Necessity and Feasibility on 14.08.2015 at Patiala. Organise by Asian Educatoin Institute & DST

8.2.2 Training organized

Organized Jai Kisan Jai Vigyan -2015 Programme on 28/12/2015 at ICAR-IISS, Bhopal and 29/12/2015 at Perwalia Sadak Bhopal.

Training on "Jaivik Khad Evam Kenchua Khad Banane ki Vidhi" on 07/12/2015 at ICAR-IISS, Bhopal.

Organized International Year of the Soil 2015, at ICAR-IISS, Bhopal on 19/11/15.

Organised Kisan Sangosthi during World Soil Day Celebration and distribution of soil health card to farmers on 5th Dec 2015 at ICAR-IISS, Bhopal.

Organized One day State Level programme in the institute in collaborations with M P Jan AbhiyanParishad Bhopal on 25/01/2016.

Organised one day Kisan Sangosthi on 16/03/2016 at Perwalia Sadak Bhopal under MGMG

During 2015-16, 26 exposure visits and training of farmers extension functionaries, officers and other stakeholders were conducted and 974 stakeholders participated in these programmes at Directorate of Research, MPUAT, Udaipur.

8.3 Workshops/Group Meetings

XII Annual Group Meeting of Network Project on Organic Farming Organized at ICAR-Indian Institute of Farming Systems Research, Modipuram (Uttar Pradesh)

The 12th Annual Group Meeting of Network Project on Organic Farming was organized at ICAR-Indian Institute of Farming Systems Research, Modipuram (Uttar Pradesh) during 18-19 December 2017 as approved by ICAR (F.No. NRM-7-7/2015-AFC dated 27 November 2017). Agenda items such as Action Taken Report of the previous group meeting, review of centre wise performance based on results and publications, formulation new experiment on zero budget farming and special lecture on pest and disease management under organic production system including liquid manures besides review of progress of Tribal Sub Plan activities were taken up. The programme was attended by all the NPOF centres and special invitees.

The group meeting started with ICAR song followed by welcome of the participants by the Dr AS Panwar, Director, ICAR-IIFSR, Modipuram. Dr S. Bhaskar, Assistant Director General (Agronomy, Agroforestry and Climate Change), NRM division, ICAR was Chief guest while Dr Krishan Chandra, Director, National Centre of Organic Farming (NCOF), Ghaziabad was Guest of honour. Dr Manoj Kumar, Joint Director, ICAR-Central Potato Research Institute Campus, Modipuram participated as special invitee. Dr A.S. Panwar, Director, ICAR-IIFSR while welcoming the guests and participants, presented the brief scheme report in which he highlighted that the area under organic farming is growing steadily over the years due to the government interventions in the form of Parambaraghat Krishi Vikas Yojana (PKVY) and Mission Organic Value Chain Development Scheme for North Eastern hill region and there is a dire need to provide technological back stopping for these schemes. In this connection, NPOF has developed package of practices for 47 cropping systems suitable to 12 states and have been compiled in the form of Organic Farming: Crop Production Guide. He also highlighted that stability analysis training has been conducted for all the centres which will help to identify the best varieties suitable to organic farming. Further, he emphasized that as per the need of present government, the issues such as zero budget farming, evaluation of indigenous products are need to be undertaken by this project. Dr Manoj Kumar, Joint Director, ICAR-CPRIC, Maodipuram in his special invitee address highlighted that organic farming is need of the hour to provide safe food to the people and also informed that potato can also be taken up under organic farming with specific management practices. Dr Krishan Chandra, Director, NCOF while briefing about the schemes and PGS certification system introduced by the government, informed that more collaboration between ICAR-IIFSR and NCOF will further strengthen the cause of organic farming in India. He also briefed about waste decomposer developed by NCOF and how it is benefitting the farmers. Dr S. Bhaskar, ADG (AAFCC) and other dignitaries released the publications of the scheme brought out by different centres of the scheme. In his Chief guest address, Dr S. Bhaskar, highlighted the various initiatives taken by the council to promote organic farming which included education programmes for farmers, development of course curriculum for post graduate *etc.* He also categorically emphasized that organic farming in India should be aimed only for niche crops and areas. Dr Bhaskar also pointed that the package of practices for organic production needs to be fine-tuned and improved continuously as per the changing scenario. Organic farming in farming systems perspective needs to be given more emphasis with plan on Integrated Organic Farming System concepts, he pointed out. Dr N. Ravisankar, National PI, NPOF proposed the vote of thanks. The following publications of NPOF were released in the inaugural function.

Sl. No.	Publication	NPOF Centre	Year	By
1.	Annual Report 2015-16 of NPOF	ICAR-IIFSR, Modipuram	2017	N. Ravisankar Vipin Kumar M. Shamim
2.	Traditional Organic Farming Practices	TNAU, Coimbatore	2017	E. Somasundaram
3.	*Masalo ka gyvik ulpadan. Kalimirch, Adarak and Haldhi*	ICAR-IISR, Calicut	2017	Rashid Pervez, S. Prasannakumari, V. Srinivasan, C.K. Thankamani, S. Hamza, T. John Zacharia, R. Dinesh and R. Praveena
4.	Organic production of rabi cauliflower in Himachal Pradesh Organic production of kharif okra in Himachal Pradesh Organic production of rabi pea in Himachal Pradesh	HAREC, Bajaura	2017	D.K. Parmer
5.	*Jaivik Krishi Takniken avam Sifarishen Go Mutra Adharit Utpadon ka Jaivik Krishi me Upyog*	MPUAT, Udaipur	2017	S K Sharma and Roshan Chaudhary

The consolidated recommendations of the group meeting is given below

A. Research

1. New experiment on *"Evaluation of zero budget farming practices in basmati rice-wheat system"* should be conducted at Ludhiana (Punjab), Modipuram (Uttar Pradesh) and Pantnagar (Uttarakhand) by NPOF centres and at Kurukshetra by AICRP-IFS centre, CCSHAU, Haryana.
(Action: National PI / PI at respective centres of NPOF/Chief Agronomist, AICRP-IFS, CCSHAU)

2. Experiment on "Evaluation of bio-intensive complimentary cropping systems under organic production systems" undertaken at Dharwad, Pantnagar and Umiam centres are approved for conclusion and final report should be submitted within 3 months.
(Action: PI at respective centres of NPOF/National PI)

3. Comparison of different production systems should be made based on total energy analysis instead of equivalent yield. Total factor productivity should be worked out instead of B:C ratio.
(Action: PI at all centres / National PI)

4. Crop wise package and yield gap analysis using NPOF & farmers survey data should be made by all the centres. Stability analysis of varietal experiment should also be done on priority.
(Action: PI at all centres / National PI)

5. Climate resilient production systems for major crops, cropping systems and states should be identified and documented.
(Action: Dr M. Shamim, Associate, NPOF/National PI)

6. Identification of niche area (district as unit) and crop for organic farming in each state should be made by using common methodology developed by ICAR-IIFSR. A national level compilation in the form of bulletin should be brought out within 8 months.
(Action: National PI/PI at all centres)

Release of Publications in 12th AGM of NPOF scheme at ICAR-IIFSR, Modipuram

12th AGM in procession at ICAR-IIFSR, Modipuram

Confered best NPOF centre award to Dr. Jayanta Layak, ICAR-RC-NEH, Umiam by Hon'ble Vice Chancellor, SVPUA&T, Meerut

Group photo of participants of 12th AGM

8 दैनिक जागरण मेरठ, 20 दिसंबर 2017 मेरठ जागरण

'पर्यावरण सुरक्षा के लिए जरूरी है जैविक खेती'

जागरण संवाददाता, मोदीपुरम : सरदार वल्लभभाई पटेल कृषि एवं प्रौद्योगिकी विवि के कुलपति प्रो. गया प्रसाद ने कहा कि देश की खाद्य एवं पोषण सुरक्षा के साथ मानव स्वास्थ्य, मृदा स्वास्थ्य व पर्यावरण सुरक्षा के लिए जैविक खेती जरूरी है।

मंगलवार को भारतीय कृषि प्रणाली अनुसंधान संस्थान, मोदीपुरम में चल रहे जैविक खेती नेटवर्क परियोजना के दो दिवसीय वैज्ञानिक समागम के समापन पर बतौर मुख्य अतिथि उन्होंने कहा कि जैविक खेती में गोबर, गोमूत्र व अन्य पोषक तत्वों का संतुलित प्रयोग करें। शोध कार्यों की प्रगति तेज करने की सलाह दी।

कृषि प्रणाली संस्थान के निदेशक डॉ. आजाद सिंह पंवार ने खाद्य, पोषण, स्वास्थ्य व पर्यावरण सुरक्षा सुनिश्चित करने के लिए जैविक खेती नेटवर्क परियोजना को महत्वपूर्ण बताया।

कार्यक्रम में 16 राज्यों के 20 केंद्रों से आए करीब 70 वैज्ञानिकों ने भाग लिया। मुख्य अतिथि समेत रिसर्च करने वालों को सम्मानित किया। डॉ. एमपी सिंह, डॉ. एलआर मीणा, डॉ. पीयूष पुनिया और डॉ. चंद्रभानु आदि वैज्ञानिक मौजूद थे।

कृषि प्रणाली अनुसंधान संस्थान में दो दिवसीय वैज्ञानिक समागम के समापन कार्यक्रम में मुख्यअतिथि कुलपति प्रो. गया प्रसाद को सम्मानित करते हुए।

मेरठ LIVE कैंपस

बुधवार, 20 दिसंबर 2017 18

हिन्दुस्तान

मंगलवार को दो दिवसीय जैविक खेती कार्यशाला का समापन हो गया। • हिन्दुस्तान

दो दिवसीय कार्यशाला संपन्न

कृषि प्रणाली अनुसंधान संस्थान में बल को दो दिवसीय जैविक खेती की कार्यशाला का मंगलवार को समापन हो गया। इसमें देशभर के 25 से ज्यादा कृषि वैज्ञानिकों ने हिस्सा लिया था। इस दौरान मुख्य अतिथि कृषि विश्वविद्यालय मेरठ के कुलपति डा. गया प्रसाद ने कहा कि जैविक खेती को देश की खाद्य एवं पोषण सुरक्षा के साथ-साथ मानव स्वास्थ्य, मृदा स्वास्थ्य, एवं पर्यावरण सुरक्षा के लिए जरूरी है। उन्होंने कृषि वैज्ञानिकों को जैविक खेती में पोषकों के पोषण प्रबंधन के लिए आवश्यक गोबर, गोमूत्र व अन्य जरीय खादों की आवश्यक मात्रा का सही से आकलन करने की सलाह दी। कृषि प्रणाली संस्थान के निदेशक डा. आजाद सिंह पंवार, डा. एन. रविशंकर, डा. एमपी सिंह, डा. एलआर मीणा, डा. पीयूष पुनिया आदि रहे।

Media coverage of 12th AGM, NPOF

B. Others

1. Repository of available published references/ information pertaining to organic farming should be created at ICAR-IIFSR. All PIs of centres should send soft copy of literatures including published papers through email to the National PI. This repository should be accessible to all centers for ready reference.

   (Action: PI at all centres / National PI)

2. Efforts should be made to certify organic products produced by Tribal Sub Plan farmers under Participatory Guarantee System (PGS) of certification by making a group of farmers.

   (Action: PI at all TSP centres)

3. Efforts should be made to get external grant for the scheme to undertake basic research on organic farming. A suitable project proposal may be developed by convening a meeting of selected NPOF centres.

   (Action: National PI/PI at all centres)

4. The identified centres (new) such as Almora, SK Nagar, Thiruvananthapuram and Udaipur for developing integrated organic farming system (IOFS) model should explore external funding from state government schemes/Rashtriya Krishi Vikas Yojana (RKVY)/Model organic farm schemes of Government of India for integration of livestock component.

   (Action: PI of respective centres)

9. APPENDIX

Details of crops and varieties used in Evaluation of organic, inorganic and integrated production systems for crops and cropping systems at various locations

Crop	Variety
Bajaura	
Black gram (*Kharif*)	Palampur- 93
Lady's Finger (*Kharif*)	P-8
Tomato (*Kharif*)	Roma
Cauliflower (*Rabi*)	PSBK-1
Pea (*Rabi*)	Azad P-1
French bean (*Summer*)	Falguni
Tomato (*Summer*)	HeemSohna
Summer Squash (*Summer*)	Australian Green
Bhopal	
Soybean	JS-335
Durum wheat	HI-(Malwa Shakti) 8498
Mustard	Pusa Bold
Chickpea	JG-130
Linseed	JL-9
Calicut	
Ginger	Varada, Rejatha and Mahima
Turmeric	Prathibha , Alleppey Supreme, Varna, Sobha, Sona, Kanthi, Suvarna, Sudarsana, Kedaram, Prabha
Black Pepper	Sreekara, Panniyur -1
Coimbatore	
G M (Sunnhemp)	CO 1
Cotton	Suraj
Maize	COH(M) 6
Chillies	PKM 1
Sunflower	COSFV5
Beetroot	Ruby queen
Maize	COH(M) 6
Dharwad	
Cowpea	C 152
Safflower	A 1
Pigeonpea	TS-3R
Greengram	DGGV 2
Sorghum	M 35-1
Groundnut	GPBD 4
Hy. cotton	DHB 1062
Maize	ARJUN
Chickpea	A1

Crop	Variety
Karjat	
Rice	Karjat – 4
Groundnut	SB – XI
Maize (Sweet corn)	Sugar – 75
Mustard	Varuna
Dolichos bean (Green pod vegetable)	Konkan Bhushan
Jabalpur	
Basmati rice	Pusa Basmati -1
Wheat	HD 4672
Chickpea	JG-322
Berseem	J B - 1
Vegetable pea	Arkel
Maize	TGK 54
Sorghum fodder	MP Chari
Ludhiana	
Basmati rice	Panjab basmati 3
Pigeonpea	PAU 881
Moong	PAU 911
Wheat	HD 2967
Chickpea	GPF 2
Modipuram	
Basmati rice	PB-6
Rice	Saket-4
Maize Grain	Bajaura pop corn
Green cob	Madhuri
Wheat	HI - 8498
Okra	Arka Anamika
Potato	Chipsona-3
Barley	DWRB-91
Green gram	Pusa vishal
Mustard	Pusa bold
Pantnagar	
Sesbania	Ses pant-1
Basmati rice	Pusa basmati-1
Wheat	UP-2572
Chickpea	Pant kabuli chana-1
Vegetable Pea	Arkel
Potato	Kufri bahar 3797
Coriander	Harit RS-5
Sesbania	Pant Ses-1
Rice	Pusa-1121

Crop	Variety
Soybean	PS 1347
Maize	PSM-3
Pigeon pea	UPAS 120
Moong	PM-5
Cowpea	PL-2
Mustard	PR-15
Okra	ArkaAnamika
Raipur	
Soybean	JS – 335
Maize	Sugar-75
Vegetable pea	Pant sabjimatar" (PSM 3)
Chilli	Agnirekha
Onion	Nasik red

Crop	Variety
Ranchi	
Rice	Birsamati
Wheat	K- 9107
Lentil	PL 406
Potato	KufriAshoka
Linseed	Shekhar
Umiam	
Rice (sunken bed) *kharif*	Shahsarang-1, Lampnah, IR 64 and Vivek Dhan-82
Rice (raised bed)	Bhalum-1
Carrot	New Koroda
Potato	Kufrijyoti
French bean	Naga local
Tomato	Rocky

10. ANNEXURE

ICAR-Network Project on Organic Farming
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ACRONYMS

ALE : Aquous leaf extract

ASE : Aquous seed extract

BBF : Broad bed and furrow

B:C : Benefit:Cost

BD : Biodynamic

CC : Cost of cultivation

CDM : Cowdung manure

Cu : Copper

DSR : Direct seeded rice

DTPA : Diethylene triamine penta acetic acid

EC : Enriched compost

ECe : Electrical conductivity

Fe : Iron

FB : Flat bed

FYM : Farm yard manure

GLM : Green leaf manure

GM : Green manure

GR : Gross returns

IOFS : Integrated organic farming system

ITK : Indigenous technical knowledge

K : Potassium

KC : Karanj cake

Mn : Manganese

MOP : Muriate of potash

N : Nitrogen

NC : Neem coated

NEOC : Non edible oil cakes

NPV : Nuclear Polyhedrosis virus

NR : Net returns

NRPRI : Net return per rupee invested

OC : Organic carbon

P : Phosphorus

PG : Panchagavya

pH : Negative logarithum of hydrogen ion concentration

PPM : Parts per million

RBD : Randomized block design

RP : Rock phosphate

RSB : Raised and sunken bed

SRI : System of rice intensification

SSP : Single super phosphate

TSP : Tribal sub plan

VC : Vermicompost

Zn : Zinc

CONTACT / lEid l=

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