Annual Report

2017-18

भाकृअनुप
ICAR

जैविक खेती पर अखिल भारतीय नेटवर्क क्रार्यक्रम

All India Network Programme on Organic Farming

ICAR-Indian Institute of Farming Systems Research
Modipuram, Meerut-250110 (U.P.)

ICAR-IIFSR

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

Vision

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

Mission

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

Mandate

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

All India Coordinating Coordinated Research Project on Integrated Farming System (AICRP on IFS) is an integral part of ICAR-IIFSR with 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 Program on Organic Farming (AI-NPOF) with 20 centres

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ALL INDIA NETWORK PROGRAMME ON ORGANIC FARMING

ICAR-Indian Institute of Farming Systems Research

MODIPURAM, MEERUT-250 110 (U.P.)

Correct citation:

All India Network Programme on Organic Farming. Annual Report 2017-18, ICAR-Indian Institute of Farming Systems Research, Modipuram, Meerut- 250 110, pp. 235.

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Important Notes:

- This compilation is a joint contribution of all the scientists involved in All India Network Programme on Organic Farming (AI-NPOF) at 20 centres including 7 new centres started from 2015-16 and ICAR-IIFSR, Modipuram (report writing, compilation, editing and printing).
- The AnnualReport 2017-18 is based on experimental data generated during *kharif*, *rabi* and *summer* seasons of 2016-17. The other details are relevant up to 31 March 2018.
- The report includes both processed and semi-processed data, generated in different experiments under All India Network Programme on Organic Farming (AI-NPOF) and as such no material/ data should be reproduced in any form without prior written permission of the Director, ICAR-Indian Institute of Farming Systems Research and due credit to the concerned scientist (s).

ACKNOWLEDGEMENT

Network Project on Organic Farming (NPOF) initiated in 2004 is operating 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. In the SFC (2017-20), the name of the scheme has been changed as All India Network Programme on Organic Farming (AI-NPOF). The data of the experiments conducted during 2016-17 at 20 co-operating centres are processed, compiled and published as Annual Report 2017-18. 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 his constant inspiration, technical inputs on researchable issues and critical comments for the scheme. I extend my gratefulness to Dr. K. Alagusundaram, Acting Deputy Director General (Natural Resource Management) for his valuable support extended to the scheme. The time to time technical and administrative inputs 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)is thankfully acknowledged as the issues raised and inputs sharedwere of immense value in taking new initiatives 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 setting 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 needs to be acknolwedged for overall coordination of technical, administrative and financial management of the scheme and super vision of preparing the report. I also extend my appreciation to Dr M. Shamim, Scientist, Dr Raghuveer Singh, Scientist, Dr Vipin Kumar, Chief Technical Officer and Dr GautamVeer Chauhan, Research Associate for their dedicated 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. The significant findings ofrelated to organic, towards organic management packages, varieties, integrated organic farming systems, yield and technological gap identified through Geo-tagged characterization will pave way for initiation of schemes and support for farmers and other stakeholders who are involved in promotion of organic farming.

(A.S. Panwar)

Director

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सारांश

अखिल भारतीय जैविक खेती नेटवर्क कार्यक्रम के अंतर्गत वर्ष 2016–17 के दौरान किए गए मुख्य शोध निष्कर्ष नीचे दिये गये है।

1. जैविक, रसायनिक और एकीकृत (जैविक की ओर) उत्पादन प्रणालीयों का मूल्यांकन

- **बाजौरा** (हिमाचल प्रदेश) में सब्जी आधारित फसल प्रणालियों का मूल्यांकन किया गया जिसमें टमाटर फूलगोभी–फ्रेंचबीन प्रणाली मे टमाटर की अधिकतम उपज 2190 कि.ग्रा./हे. जैविक उत्पादन प्रणाली के अंतर्गत (75 प्रतिशत जैविक + नवीन प्रयोग के साथ) पाई गई। इसी तरह गर्मी में उगाए जाने वाले टमाटर की अधिकतम उपज (10360 कि.ग्रा./हे.) भी जैविक प्रबंधन के अन्तर्गत (75 प्रतिशत जैविक और 25 प्रतिशत नवीन प्रयोग) प्राप्त की जो रसायनिक उत्पादन प्रणाली की तुलना में 111.5 प्रतिशत अधिक थी। रबी फूलगोभी की अधिकतम उपज 12400 कि.ग्रा./हे. रसायनिक उत्पादन प्रणाली के साथ दर्ज की गई। एकीकृत प्रबंधन प्रणाली (50 प्रतिशत प्रत्येक जैविक और 50 प्रतिशत रसायनिक) के अन्तर्गत उड़द, भिंडी और मटर की अधिकतम उपज क्रमशः 1008 कि.ग्रा., 9911 कि.ग्रा. एवं 1925 कि.ग्रा. दर्ज की गई जबकि फ्रेंचबीन और कद्दू की अधिकतम उपज क्रमशः 7500 और 15560 कि.ग्रा./हे. एकीकृत प्रबंधन प्रणाली के साथ दर्ज हुई। रबी फसल फूलगोभी और मटर, खरीफ उड़द और भिंडी की उपज में क्रमशः 43.6, 72.6 और 70.4 प्रतिशत की वृद्धि एकीकृत प्रबंधन प्रणाली के अन्तर्गत पाई गई। रासायनिक की तुलना में ग्रीष्म फ्रेंचबीन और कद्दू की उपज में 60.3 और 68 प्रतिशत की वृद्धि देखा गया।

- **भोपाल** (मध्य प्रदेश) में सोयाबीन आधारित फसल प्रणालीयों का मूल्यांकन किया गया। सोयाबीन की अधिकतम औसत उपज जैविक उत्पादन प्रणाली के अन्तर्गत 1121 किग्रा./हे. दर्ज की गई जो अजैविक उत्पादन प्रणाली की तुलना में 23.1 प्रतिशत अधिक थी। जैविक पोषक तत्वों के प्रबंधन के साथ गेहूँ, सरसों,चना और अलसी की अधिकतम उपज क्रमशः 3139, 1285, 1828 और 1530 कि.ग्रा./हे. दर्ज की गई जो रसायनिक उत्पादन प्रणाली उपज की तुलना में क्रमशः 12.2, 17.6, 13.3, और 11.4 अधिक था।

- **कालीकट** (केरल) में अदरक और हल्दी जैसे मसाला फसलों का मूल्यांकन अलग–अलग फसल उत्पादन प्रणाली के अंतर्गत किया गया। हल्दी की अधिकतम उपज (29900 कि.ग्रा./हे.) एकीकृत उत्पादन प्रणाली के अन्तर्गत दर्ज की गई। उसके बाद जैविक खादों के माध्यम से शत प्रतिशत जैविक खाद के रूप में प्रयोग करने पर हल्दी की उपज (29100 कि.ग्रा./हे) पाई गई। हल्दी की सभी किस्मों ने एकीकृत प्रबंधन के अन्तर्गत अच्छा प्रदर्शन किया। एकीकृत प्रबंधन (50 प्रतिशत प्रत्येक जैविक और रसायन) के साथ किस्म सुदर्शना (40800 कि.ग्रा./हे.) के बाद, सुगुन ने जैविक उत्पादन प्रणाली के अंतर्गत अधिकतम उपज (41800 कि.ग्रा./हे.) दर्ज की। अदरक की अधिकतम उपज एकीकृत पोषण प्रबंधन अर्थात 50 प्रतिशत जैविक+ अजैविक या 75 प्रतिशत जैविक और 25 प्रतिशत रसायनिक खाद के प्रयोग करने पर क्रमशः 22500 और 22760 कि.ग्रा. प्रति हेक्टेयर दर्ज हुई जो रासायनिक उपज की तुलना में 168.4 और 165.3 प्रतिशत अधिक थी

- **कोयम्बटूर** (तमिलनाडु) मे विभिन्न उत्पादन प्रणाली के अन्तर्गत सभी फसलों ने रसायनिक उत्पादन प्रणाली की तुलना में एकीकृत प्रबंधन के अन्तर्गत (75 प्रतिशत जैविक + 25 प्रतिशत रासायनिक) अधिक उपज दर्ज की। एकीकृत प्रबंधन के अंतर्गत 50 प्रतिशत प्रत्येक पोषक तत्वों (जैविक और अजैविक) के प्रयोग के साथ कपास की उपज में क्रमशः 15.5 और 10.5 प्रतिशत

रसायनिक और जैविक उत्पादन प्रणाली की तुलना में अधिक पाई गई। जबकि मक्का (6685 कि.ग्रा./हे.), सूरजमुखी (4772 कि.ग्रा./हे.), मिर्च (5840 कि.ग्रा./हे.) और चुकंदर (2400 कि.ग्रा./हे.) की उपज अधिकतम एकीकृत प्रबंधन (75 प्रतिशत जैविक + 25 प्रतिशत रसायनिक) के अन्तर्गम दर्ज की गई। जो रासायनिक प्रबंधन की तुलना में क्रमशः 19.3, 13.3, 7.2 और 36.4 प्रतिशत अधिक थी।

- **धारवाड़** (कर्नाटक) में लोबिया, कुसुम, और अरहर की अधिकतम उपज एकीकृत प्रबंधन में दर्ज की गयी जबकि ज्वार और चना की अधिकतम उपज जैविक प्रबंधन के अन्तर्गत दर्ज हुई। जैविक प्रबंधन के साथ रसायनिक उत्पादन प्रणाली की तुलना में ज्वार और चने की फसल ने क्रमशः114.3 और 26.7 प्रतिशत की वृद्धि दर्ज की। मूंगफली, कपास और मक्का की उपज में क्रमशः 13.4, 25.0 और 23.8 प्रतिशत की गिरावट जैविक प्रबंधन के अन्तर्गत पाई गई।

- **जबलपुर** (मध्य प्रदेश) में गेहूँ, चना, चारा मक्का, बरसीम, सब्जी मटर और ज्वार को बसमती धान के साथ 4 फसल क्रमों में उगाया गया। धान की अधिकतम औसत उपज (3332 किग्रा./हे.) रसायनिक पोषक तत्व प्रबन्धन के अन्तर्गत दर्ज की गई जो जैविक और एकीकृत पोषक प्रबन्धन की तुलना में क्रमशः 8.2 और 7.5 प्रतिशत कम थी। रबी में गेहूँ (5030 किग्रा./हे.), बरसीम (273 किग्रा./हे. बीज ओर 73100 किग्रा./हे. चारा), सब्जी मटर (3420 किग्रा./हे.) तथा ग्रीष्म काल के दौरान मक्का चारा (48492 किग्रा./हे.) एवं ज्वार चारा (80640 किग्रा./हे.) की उपज भी रसायनिक पोषक तत्व प्रबन्धन के साथ अधिक पाई गई। जबकि चना (581 किग्रा./हे.) की अधिकतम उपज एकीकृत पोषण प्रबन्धन के अन्तर्गत दर्ज की गई। रसायनिक पोषक प्रबन्धन की तुलना में जैविक प्रबन्धन के साथ गेहूँ, बरसीम बीज और चारा, सब्जी मटर, मक्का चारा, और ज्वार चारा उपज में क्रमशः 16.0, 9.0, 13.6, 28.7, 13.4, और 20.9 प्रतिशत की गिरावट पायी गयी।

- **कर्जट** (महाराष्ट्र) में धान आधारित फसल प्रणालियों में धान की अधिकतम पैदावार (4656 किग्रा./हे.) एकीकृत प्रबन्धन में दर्ज की गई। धान की पैदावार में रसायनिक प्रबन्धन (4581 कि.ग्रा./हे.) का स्थान दूसरा रहा। विभिन्न पोषक तत्व प्रबन्धन के मध्य शत प्रतिशत जैविक स्त्रोत द्वारा पोषण एकीकृत एवं रासायनिक की तुलना में 2.2, 10.3 और 3.01 की कमी देखी गयी। अन्य फसल जैसे बैगंन ने अधिकतम उपज (49985 किग्रा./हे.) अजैविक प्रबन्धन के अन्तर्गत दर्ज की। चना और प्याज की उपज एकीकृत पोषण प्रबन्धन के अन्तर्गत अच्छी पायी गयी जो कि क्रमशः 1657 और 17379 किग्रा./हे. थी।

- **लुधियाना** (पंजाब) में जैविक खाद के प्रयोग द्वारा बासमती धान–गेहूँ प्रणाली मे धान की अधिकतम उपज (4490 किग्रा./हे.) दर्ज की गई। ग्वारफली की भी अधिकतम उपज जैविक प्रबन्धन के अन्तर्गत प्राप्त हुई जो लगभग 69.5 प्रतिशत अधिक थी। सोयाबीन की अधिकतम उपज (1800 किग्रा./हे.) जैविक प्रबन्धन (75 प्रतिशत जैविक् + नवीन प्रयोग के साथ) के अन्तर्गत प्राप्त की गई जो रसायनिक उत्पादन प्रणाली की तुलना में 42.5 प्रतिशत अधिक थी। रबी के दौरान चना की अधिकतम उपज (590 किग्रा./हे.) एकीकृत पौषण प्रबंधन से प्राप्त हुई जो रसायनिक उत्पादन प्रणाली की तुलना में 59.5 प्रतिशत अधिक थी। गेहूँ की अधिकतम उपज (6040 कि.ग्रा./हे.) रसायनिक उत्पादन प्रणाली के अन्तर्गत प्राप्त हुई जो जैविक की तुलना में लगभग 16.7 प्रतिशत अधिक थी।

- **मोदीपुरम** (उत्तर प्रदेश) में धान और मक्का आधारित फसल प्रणाली जैसे कि रबी में गेहूं, जौ, आलू, और सरसों तथा गर्मियों में भिंडी का मूल्यांकन किया गया। जैविक प्रबन्धन के साथ बासमती धान की अधिकतम उपज (4125 कि.ग्रा./हे.) पाई गई जो क्रमशः 18.6 और 11.2 प्रतिशत रासायनिक पोषक तत्व प्रबन्धन की तुलना में अधिक थी। मोटे धान की अधिकतम उपज (4250 कि.ग्रा./हे.) राज्य द्वारा अनुशंसित उत्पादन

प्रणाली में पाई गई। रसायनिक उत्पादन प्रणाली की तुलना में 50 प्रतिशत जैविक और 50 प्रतिशत अजैविक पौषक तत्व प्रबंधन के अन्तर्गत लगभग 7 प्रतिशत अधिक अनाज की उपज दर्ज की गई। इसी तरह पॉपकार्न मक्का और मीठी मकई की अधिकतम उपज एकीकृत प्रबंधन (75 प्रतिशत जैविक + 25 प्रतिश रसायनिक) के अन्तर्गत दर्ज हुई। जो जैविक एवं रसायनिक उत्पादन की तुलना में क्रमशः 20.3 और 40. 2 प्रतिश अधिक थी। जबकि मीठी मकई की अधिकतम उपज राज्य द्वारा संस्तुति उर्वरक उत्पादन तकनीकी के अन्तर्गत पाई गई तथा जैविक उत्पादन प्रणाली के साथ उपज में 26.8 प्रतिशत की कमी दर्ज की गई। रबी में गेहूँ और सरसों की अधिकतम उपज अजैविक प्रबन्धन के अन्तर्गत पाई गई जो शत प्रतिशत जैविक की तुलना में 42.6 और 17.2 प्रतिशत कम थी। जौ और आलू की अधिकतम उपज एकीकृत प्रबन्धन (50 प्रतिशत जैविक एवं 50 प्रतिश रासायनिक) के अन्तर्गत क्रमशः 4594 और 26540 कि.ग्रा./हे. दर्ज की गई। ग्रीष्म काल के दौरान मूंग और भिंडी की अधिकतम उपज प्रबन्धन के साथ (क्रमशः 641 एवं 1334 कि.ग्रा. /हे.) एकीकृत उत्पादन प्रणाली के अन्तर्गत दर्ज की गई। जैविक प्रबंधन के अन्तर्गत भिंडी और मूंग की उपज में 19.5 और 2 प्रतिशत की कमी पायी गई।

पंतनगर (उत्तराखंड) में विभिन्न पोषक तत्व प्रबंधन के अन्तर्गत बासमती धान आधारित फसल प्रणालियों का मुल्यांकन किया गया। शत प्रतिशत जैविक उत्पदन प्रणाली के अन्तर्गत बासमती धान की अधिकतम उपज (4973 किग्रा./हे.) पायी गयी उसके बाद 75 प्रतिशत जैविक+ नवीन प्रयोग के साथ (4819 किग्रा./हे.) रही जो क्रमशः 39.9 और 27.9 प्रतिशत रासायनिक प्रबंधन पैकेज की तुलना में अधिक थी। रबी में गेहूँ की अधिकतम उपज (5115 किग्रा./हे.) एकीकृत पोषण प्रबन्धन (50 प्रतिशत जैविक और अजैविक) में पायी गयी जो लगभग एकीकृत (75 जैविक+25 प्रतिशत रासायनिक) के बराबर थी एवं 8.6 और 7.1 प्रतिशत रासायनिक की तुलना में अधिक थी। धनिया को अन्य फसल जैसे चना सब्जी मटर के साथ 4:2 के अनुपात में उगाया गया। धनिया की उपज को समतुल्य उपज में दर्ज किया गया है जिसके अन्तर्गत चना समतुल्य उपज (2135 किग्रा./हे.) एकीकृत प्रबन्धन (75 जैविक + 25 प्रतिशत रसायनिक) में अधिकतम पायी गयी। जबकि मटर की अधिकतम उपज (12850 किग्रा./हे.) जैविक प्रबन्धन (75 प्रतिशत जैविक + 25 प्रतिशत नवीनतम प्रयोग) के अन्तर्गत प्राप्त हुई। अजैविक की तुलना में जैविक के साथ चने और मटर की उपज में 12.8 और 25.3 प्रतिशत की वृद्धि पाया गया।

- **रायपुर** (छत्तीसगढ़) में सोयाबीन आधारित फसल प्रणालीयों में सोयाबीन, मक्का, मटर, मिर्च और प्याज का मुल्याकन किया गया। सोयाबीन की अधिकतम उपज (2153 किग्रा./हे.) जैविक प्रबन्धन के अन्तर्गत (75 प्रतिशत जैविक + 25 प्रतिशत नवीन प्रयोग यानि 10 प्रतिशत वर्मीवॉस का स्प्रे 20 दिनों के अन्तराल पर दर्ज की गई। अजैविक की तुलना में सोयाबीन की उपज में अन्तर क्रमशः 16.3 और 15.9 प्रतिशत जैविक एवं एकीकृत के अन्तर्गत अधिक पाया गया। अन्य फसले जेसे मक्का (मीठी मक्का), मटर और मिर्च की अधिकतम उपज (14850, 8007 एवं 9081 किग्रा./हे.) भी जैविक प्रबन्धन के अर्न्तगत (75 प्रतिशत जैविक + 25 प्रतिशत या फिर नवीन प्रयोग यानि 10 प्रतिशत वर्मीवॉस का स्प्रे 20 दिनों के अन्तराल पर) प्राप्त हुआ। प्याज कंद की अधिकतम उपज (17643 किग्रा./हे.) राज्य संस्तुति उर्वरक प्रबंधन के अन्तर्गत पाई गई जो जैविक की तुलना में 17.1 प्रतिशत अधिक थी। मक्का (मीठी मक्का), मटर और मिर्च की उपज में अतंर क्रमशः 11.8, 13.5 और 10.5 प्रतिशत जैविक प्रबंधन के साथ अधिक पाया गया।

- **रांची** (झारखंड) में गेहूँ, आलू, अलसी, और मसूर जैसी विभिन्न फसलों के साथ धान आधारित फसल प्रणालियों का मूल्यांकन किया गया। जिसमे धान की अधिकतम उपज (4436 किग्रा./हे.) जैविक प्रबन्धन के अन्तर्गत (75 प्रतिशत जैविक और 25 प्रतिशत नवीनतम प्रयोग यानि (अजोला+वर्मीवॉश स्प्रे) दर्ज की गई। शत प्रतिशत जैविक से जैविक की और (एकीकृत, 75

प्रतिशत जैविक + 25 रसायनिक) एवं रसायनिक उत्पादन प्रणाली के बीच में अन्तर 9.7 एवं 24.6 प्रतिशत था। गेहूँ की अधिकतम उपज रासायनिक उत्पादन प्रणाली के अन्तर्गत 2927 किग्रा./हे. दर्ज की गई। जो शत प्रतिशत जैविक और एकीकृत प्रबन्धन के साथ रसायनिक उत्पादन प्रणाली की तुलना में 14.6 और 7.1 प्रतिशत कम थी। आलू और अलसी की अधिकतम उपज 23027 और 981 कि.ग्रा./हे. क्रमशः जैविक उत्पादन प्रणाली के अन्तर्गत शत प्रतिशत जैविक पोषक तत्व के प्रयोग से प्राप्त हुई थी जबकि मसूर की अधिकतम उपज (575 कि.ग्रा./हे.) एकीकृत पोषण प्रबन्धन (50 प्रतिशत जैविक + 50 प्रतिशत रासायनिक) के साथ दर्ज की गई। रासायनिक और एकीकृत पौषण प्रबन्धन की तुलना मे जैविक उत्पादन प्रणाली के अन्तर्गत आलू और अलसी की उपज में क्रमशः (67.1 और 39.9 प्रतिशत) तथा (30.1 और 27.2 प्रतिशत) की वृद्धि पायी गई।

- **उमियम** (मेघालय) में चार सब्जी आधारित फसल प्रणालीयों को उच्चीकृत क्यारी में और चार धान की किस्मों को नीची जलमग्न क्यारी (संकन बेड़) पर मूल्यांकन किया गया। इसमें ब्रोकली की अधिकतम उपज (16480 कि.ग्रा./हे.) ऊँची क्यारी तकनीक में ब्रोकली–फ्रेंचबीन फसल प्रणाली के साथ दर्ज की गई। उच्चीकृत क्यारी पर रसायनिक उत्पादन प्रणाली की तुलना में ब्रोकली की उपज 15.2 प्रतिशत अधिक दर्ज हुई। उच्चीकृत क्यारी पर गाजर व आलू की अधिकतम उपज क्रमशः 16930 और 17450 किग्रा./हे. एकीकृत पोषण प्रबन्धन में 75 प्रतिशत पोषक तत्व जैविक के रूप में + 25 प्रतिशत रासायनिक के रूप देने पर प्राप्त हुई। जबकि फ्रेंचबीन और टमाटर की अधिकतम उपज क्रमशः 9940 और 18870 कि.ग्रा./हे. जैविक प्रबन्धन के अर्न्तगत प्राप्त की गई। फ्रेंचबीन और टमाटर की उपज में वृद्धि जैविक प्रबन्धन के साथ अजैविक की तुलना में 22.0 और 19.7 प्रतिशत हुई वही एकीकृत प्रबन्धन में जैविक की ओर उत्पादन प्रणाली के अन्तर्गत आलू गाजर की उपज में वृद्धि जैविक की तुलना में 18.8 और 47.2 प्रतिशत पाई गई। विभिन्न पोषण प्रबंधन के अतंर्गत नीची जलमग्न क्यारी (संकन बेड़) पर धान की अधिकतम उपज 4625 कि.ग्रा./हे. एकीकृत उत्पादन प्रणाली के अन्तर्गत दर्ज की गई इसके बाद शत प्रतिशत जैविक के साथ उपज 4565 किग्रा./हे. पाप्त हुई। धान की विभिन्न किस्मों में किस्म साहसारगं1 नें अधिकतम उपज 4690 किग्रा./हे. पाप्त की इसके बाद लैम्पनेह (4520 किग्रा./हे.), मेधा सुगंधित 2 (4440 किग्रा./हे.) और नगोवा (4050 किग्रा./हे.) में पाई गई।

- **अजमेर** (राजस्थान) में मूगं और ग्वारफली के साथ बीज मसालों जैसे धनिया और सौंफ का समावेश कर उसका मूल्यांकन किया गया। मूगं और ग्वारफली की अधिकतम उपज एकीकृत पोषण प्रबंधन (75 प्रतिशत जैविक और 25 प्रतिशत अजैविक) के अतंर्गत क्रमशः 1060 एवं 2021 क्रिग्रा./हे. दर्ज की गई। धनिया और सौंफ की अधिकतम उपज भी एकीकृत प्रबन्धन के अर्न्तगत (75 प्रतिशत जैविक और 25 प्रतिशत अजैविक) क्रमशः 1308 और 683 किग्रा./हे. पायी गई। इसके बाद में राज्य उर्वरक संस्तुति के अन्तर्गत 1249 और 650 किग्रा./हे. दर्ज की गई। राज्य द्वारा की गई उर्वरक संस्तुति की तुलना में जैविक की ओर मूगं, ग्वारफली, धनिया और सौंफ की उपज में क्रमशः 17.5, 3.8, 45.0 और 21.9 प्रतिशत की वृद्धि पाया गया।

- **नरेन्द्रपुर** (पश्चिम बंगाल) में धान की किस्म से सोहीनी और शताब्दी ने अधिकतम उपज क्रमशः 2691 और 5988 एकीकृत प्रबन्धन (प्रत्येक गेहूँ 50 प्रतिशत जैविक और अजैविक) के अन्तर्गत दर्ज की। एकीकृत प्रबन्धन से शत प्रतिशत जैविक और रसायनिक उत्पादन प्रणाली के बीच क्रमशः 11.1 और 3.1 प्रतिशत सोहीनी के लिए तथा 3.5 और 3.9 प्रतिशत का अन्तर शताब्दी के लिए पाया गया। विभिन्न प्रणालियों में अन्य फसलें जैसे, ब्रोकली, सरसों, शिमला मिर्च और फ्रेचंबीन ने 26. 3, 11.9, 17.6 एवं 14.9 प्रतिशत अधिक उपज रसायनिक प्रबन्धन की तुलना में जैविक प्रबंधन के साथ प्राप्त की। जबकि ग्रीष्म में तिल और मूंग ने जैविक (75

प्रतिशत जैविक और 25 प्रतिशत अभिनव प्रयोग) प्रबंधन के अतंर्गत उच्च उपज प्राप्त की जो क्रमशः 13.1 एवं 9. 3 प्रतिशत अधिक थी।

- **सरदार क्रुर्शीनगर** (गुजरात) में विभिन्न फसल प्रणालियों को तीन पोषक तत्व प्रबंधन के अन्तर्गत मूल्यांकन की गई। सभी फसलों ने राज्य उर्वरक संस्तुति के अन्तर्गत अधिक उपज दर्ज की। फसलें जैसे मूंगफली, गेहूँ, मूंग, सब्जी लोबिया और सौंफ की अधिकतम उपज क्रमशः 2172, 4665, 700, 5708 एवं 1809 कि.ग्रा./हे. राज्य द्वारा सिफारिश पैकेज के अन्तर्गत दर्ज की गई जो शत प्रतिशत जैविक उत्पादन प्रणाली के अन्तर्गत राज्य द्वारा संस्तुति उत्पादन प्रणाली की तुलना में क्रमशः 25.6, 17.8, 17.7, 24.6 एवं 34.3 प्रतिशत कम थी।

- **तिरुवनंतमपुरम** (केरल) मे दो कन्द फसलों जैसे कसावा और अरबी के साथ लोबिया, मूगंफली, उड़द और मूंग के फसल प्रणालीयों का मुल्यांकन किया गया। मूगं की अधिकतम उपज (766 किग्रा./हे.) जैविक प्रबन्धन के अन्तर्गत दर्ज की गई जबकि लोबिया की उच्च उपज 75 प्रतिशत जैविक + 25 प्रतिशत नवीन प्रयोग के अंतर्गत 4065 कि.ग्रा./हे. दर्ज हुई। मूगंफली और उड़द की उच्च उपज रसायनिक उत्पादन प्रणाली के साथ क्रमशः 1888 एवं 936 किग्रा./हे. दर्ज की गई। जैविक उत्पादन प्रणाली के अंतर्गत मूंग और लोबिया की पैदावार रसायनिक उत्पादन प्रणाली की तुलना में क्रमशः 79.0 और 85.7 प्रतिशत अधिक पाई गई। वही मूगंफली और उड़द की पैदावार में 2.9 एवं 41.6 प्रतिशत की कमी जैविक उत्पादन प्रणाली के अन्तर्गत दर्ज हुई।

- **उदयपुर** (राजस्थान) मे मक्का और उसमें अन्त फसल उड़द की अधिकतम उपज (5669 कि.ग्रा./हे. समतुल्य उपज) एकीकृत उत्पादन प्रणाली (50 प्रतिशत जैविक + 50 प्रतिशत रसायनिक) में पायी गयी। जबकि मीठी मक्का और अन्त फसल उड़द में अधिकतम उपज (8538 क्रि.ग्रा./हे.) रसायनिक उत्पादन प्रबन्धन के साथ दर्ज की गई। अकेले उड़द की अधिकतम उपज (350 क्रि.ग्रा./हे.) उस उत्पादन प्रणाली जिसमें 75 प्रतिशत पोषक तत्व की आपूर्ति जैविक खाद के साथ + नवीन प्रयोग करने पर प्राप्त हुई। गेहूँ ने (डयूरम 4285 किग्रा./हे. एस्टीवम 3142 कि.ग्रा./हे.) शत प्रतिशत रसायनिक प्रबन्धन के अन्तर्गत अच्छा प्रदर्शन किया और जैविक की तुलना में 31.7 एवं 15.0 प्रतिशत अधिक पैदावार दी। सोयाबीन ने भी एकीकृत उत्पादन प्रणाली (75 प्रतिशत जैविक + 25 प्रतिशत रासायनिक) के अन्तर्गत (643 क्रिग्रा./हे.) अच्छा प्रदर्शन किया। मेथी ने रसायनिक उत्पादन प्रणाली के साथ (1207 किग्रा. /हे.) अधिक उपज प्राप्त की जो जैविक की तुलना में 20.1 प्रतिशत अधिक थी।

2. जैविक खेती के लिये मुख्य फसल के किस्मों की प्रतिक्रिया का मूल्याकंन

- **बजौरा** (हिमाचल प्रदेश) मे खरीफ एवं ग्रीष्म काल के दौरान टमाटर की किस्मों में फलों की पैदावार का अंतर क्रमशः 880 से 2410 किग्रा./हे. और 1963 से 15480 किग्रा./हे. दर्ज किया गया। टमाटर की किस्म सिओक्स ने सबसे कम उपज दी, जबकि खरीफ में रेडगोल्ड ने फलों की संख्या/पौधा (5.7) के साथ अधिकतम उपज दर्ज की। उल्लेखनीय रूप से उच्च फल का आकार क्रमशः खरीफ और गर्मियों के दौरान आरके –123 (25.2 वर्गसेमी) और मारग्लोब (36.1 वर्गसेमी) के साथ दर्ज किया गया था। भिंड़ी की किस्म चमेली –015 ने उल्लेखनीय रूप से उच्च उपज 8576 कि.ग्रा./हे., फल की अधिक संख्या (25.0), फल की लंबाई (11.5 से.मी.) और पौधे की ऊंचाई (173.9 सेमी) के साथ दर्ज की। उसके बाद उपज (7683 कि.ग्रा./हे.) के साथ इन्द्रानिल का स्थान देखा गया। मटर की किस्म टेनप्लस ने सबसे ज्यादा हरी फली की उपज (5600 किग्रा./हे.) और उसके बाद निराली (5020 कि.ग्रा. /हे.) द्वारा दर्ज की गई। किस्म पीबी–89 ने सबसे कम पैदावार (3740 किग्रा./हे.), कम संख्या (फली और बीज/पौधा) के साथ प्राप्त की। यद्यपि सबसे बड़ा फूलगोभी के फूल का आकार केटी–25 (200.4

वर्गसेमी) का था लेकिन अधिकतम फूल का वजन (470. 6 ग्राम) होने के साथ फूलगोभी की उच्च पैदावार अन्य किस्मों जैसे चंद्रमुखी (8830 किग्रा./हे.) की तुलना में यूएस –178 (10270 किग्रा./हे.) के साथ प्राप्त हुई।

- **भोपाल** (मध्य प्रदेश) मे सोयाबीन–गेहूं और मक्का–चना प्रणाली में फसलों की विभिन्न किस्मों का मूल्यांकन किया गया जिसमें सोयाबीन की विभिन्न किस्मों में आरवीएस–2002–4 ने उल्लेखनीय रूप से 1290 किग्रा./हे. की अधिकतम उपज, फलीयाँ/पौधा (47.7) के कारण दर्ज की थी जबकि जेएस–93–05 ने सबसे कम उपज 680 किग्रा./हे. सबसे कम फलीयाँ प्रति पौधा (2.6), (31.1 बीज प्रति फली) के कारण दर्ज की गई। गुणवत्ता के लिहाज से जेएस 97–52 की तुलना में आरवीएस 2002–7 ने 7.6 प्रतिशत अधिक तेल की मात्रा दर्ज की। गौरतलब है कि उच्चतर प्रोटीन (37.43 प्रतिशत) जेएस–93–05 में पायी गई और इसके बाद जेएस 20–29 (37.36 प्रतिशत) थी। मक्का की किस्म कंचन पौधों की ऊँचाई (158 सेमी), भुट्टा/पौधा (1.4), भुट्टा/पंक्तियों (12.6), बीज/पंक्ति (20.8) और बीज उपज और बायोमास (2907 और 6393 किग्रा./हे.) के साथ अग्रणी किस्म रही। मूल्यांकन किए गए सभी गुणवत्ता मानकों में, प्रोग्रो – 4412 ने अधिक प्रोटीन और ट्रिप्टोफैन (क्रमशः 10.04 प्रतिशत और 0.91 ग्राम/16 जीएन) दर्ज किया। गेहूं की किस्मों में, जीडब्लयू–366 ने बालीयों/मीटर पंक्ति (100), बीज/बाली (76.7) के साथ अनाज और जैव उपज (3356 और 6985 किग्रा./हे.) और फसल सूचकांक (48.0 प्रतिशत) उलेखनीय रूप से अधिकतम दर्ज किये गये। सी–306 ने सबसे कम पैदावार (2067 किग्रा./हे.) का उत्पादन किया। चनें की किस्मों में, जेजी–130 ने जैव उपज (5217किग्रा./हे.), बीज/फली (2.1) और फली/पौधे (95) के परिणाम स्वरूप उच्च बीज उपज (2154 किग्रा./हे.) दर्ज की, इसके बाद आरवीजी–203 (2077 किग्रा./हे.) और जेजी–16 (1817 किग्रा./हे.) रही।

- **कालीकट** (केरल) मे जैविक और अजैविक स्थिति में हल्दी की 11 किस्मों का मूल्यांकन किया गया, जिसमें अधिकतम उपज सुगुना (41800 कि.ग्रा./हे.) ने और उसके बाद सुदर्शन (39900 कि.ग्रा./हे.) ने दर्ज की। हल्दी की अन्य किस्मों में विविधता 18900 किग्रा./हे. (प्रथिभा) से लेकर 34000 कि.ग्रा./हे. (सोभा) तक दर्ज की गई थी। हल्दी की गुणवत्ता के संदर्भ में, सोभा ने अधिकतम तेल की मात्रा (6.0 प्रतिशत) दर्ज की, जो सोना (5.9 प्रतिशत), वर्ना, कंठी, सुवर्णा (5.8 प्रतिशत) और प्रभा (5.4) के समतुल्य थी और सबसे कम तेल की मात्रा को प्रतिभा में देखा गया था। अलेप्पी सुप्रीम सुगुन और केदाराम ने अधिकतम ओलेरोसिन 14.3 और 14.1 प्रतिशत दर्ज किया, जबकि अलेप्पी ने अधिकतम करक्यूमिनिकी मात्रा (6.2 प्रतिशत) दर्ज की, जिसके बाद सुगुना (5.9 प्रतिशत) की थी।

- **कोयम्बटूर** (तमिलनाडु) मे धान की विभिन्न किस्मों के मूल्यांकन में धान की सभी किस्मों ने 2710 से 5500 किग्रा./हे. के बीच में पैदावार दी। किस्म सीबी 05022 में सबसे अधिक अनाज की उपज (5500 किग्रा./हे.) पाई गई। धान की विभिन्न किस्मों में, मपिल्लई सांबा ने अधिकतम कुल आय (रु119765/हे.), शुद्ध आय रू. 79175/हे. और शुद्ध आय प्रति रुपया (2.95) दर्ज कराया। इसके बाद किचिदी सांबा और आईडब्ल्यू पोनी का स्थान रहा जबकि, केडीएमएल–105 ने प्रति निवेश शुद्ध आय(1.50) के साथ रू. 25050/हे. का न्यूनतम शुद्ध लाभ दिया।

- **धारवाड़** (कर्नाटक) मे चने की किस्म एमएबीसी–27 का सबसे लम्बा पौधा 40.4 सेमी. रहा जबकि, बीजीडी–103 सबसे अधिक फलीयां/पौधा (46.1), बीज का वजन/पौधा (2.17 ग्राम) एवं 1000 दानों का वजन (357.5 ग्राम) दर्ज किया। जैविक उत्पादन के अतंर्गत चने की अधिकतम उपज (3172 किग्रा/है.) दर्ज की जबकि, किस्म एवन ने चने की अधिकतम उपज (3653 किग्रा/है.) दर्ज की। किस्म जाकी–9218 ने सबसे कम उपज (2806 किग्रा/है.) दर्ज की। गेंहूँ

की किस्म यूएएस 347 ने उच्च उपज (2380 किग्रा/है.) प्राप्त की जबकि, डीडब्लूआर–2006 ने न्युनतम पैदावार दी।

- **जबलपुर** (मध्य प्रदेश) मे धान की किस्मों में किस्म पीएस–3 ने 5800 किग्रा./हे. की उच्च उपज दर्ज की उसके बाद का स्थान पी एस–5 (5490 किग्रा/है.) का रहा। सबसे कम उपज बीवीडी–109 में 3780 किग्रा/हे. दर्ज की गई। गेंहूँ की विभिन्न किस्मों में एचआई–1500 ने (5180 किग्रा/हे.) के साथ उल्लेखनीय रूप से उच्च उपज दर्ज की जो एचआई–1418, सी–306 एवं एचडी–2987 के समतुल्य थी।

- **कर्जट** (महाराष्ट्र) मे चार श्रेणियों में वर्गीकृत धान की किस्मों के बीच, अगेती बुआई की दशा में धान की किस्म साहयाद्रि–3,4 5 और जया जो किसानों के बीच लोकप्रिय है ने उल्लेखनीय रूप से क्रमशः 6841, 6786, 6597, और 6114 किग्रा./हे. की उच्च उपज दर्ज की लेकिन यह सभी किस्म सांख्यकी रूप से एक दूसरे के बराबर थी। किस्म कर्जत–4 सबसे कम पैदावार वाली किस्म रही। मूंगफली की विभिन्न किस्मों में टीजी–269 ने सबसे अधिक पैदावार 3172 किग्रा./हे. दी उसके बाद का स्थान कोंकण गौरव, टीएजी–24, फुले–6021 का रहा परंतु यह सभी मूंगफली की किस्में आपस में एक दूसरे के उपज में बराबर रही। कोपरगांव–1 ने सबसे कम उपज 2015 कि.ग्रा./हे. दर्ज की।

- **लुधियाना** (पंजाब) मे विभिन्न किस्मों में बासमती धान की पैदावार 67 प्रतिशत के साथ 3200 से 5353 किलोग्राम प्रति हेक्टेयर के बीच रही। पूसा बासमती–1509 ने किल्लो की संख्या प्रति वर्ग मीटर (366) के साथ उल्लेखनीय रूप से सबसे अधिक उपज (5353 किग्रा./हे.) दर्ज की परंतु यह आरवाईटी–3404, ई1, ई2 और आरवाईटी–3390 की उपज के बराबर थी। पूसा बासमती ने सबसे कम पैदावार 3202 किग्रा./हे. दर्ज कराई। गेहूं की विभिन्न किस्मों के बीच में अंतर 3430 से 4673 किग्रा./हे. रहा वही गेहूं की किस्म एचडी 3086 ने अन्य की तुलना में उल्लेखनीय रूप से सबसे अधिक पैदावार (4673 किग्रा./हे.) दी परंतु यह पीवीडब्ल्यू–590, एचडी–2967, बीबीडब्ल्यू–658, बीबीडब्ल्यू–660, एचपीबीडब्ल्यू–01 के सांख्यिकीय रूप में बराबर रही। पीबीडब्ल्यू–550 ने सबसे कम उपज 3433 किग्रा./हे. दर्ज कराई।

- **मोदीपुरम** (उत्तर प्रदेश) मे मक्का की विभिन्न किस्मों के बीच में अनाज की उपज का अंतर 10000 किग्रा./हे. से 15000 किग्रा./हे. रहा। विवेक क्यूपीएम–9 में सबसे अधिक उपज (15000 किग्रा./हे.) पाई गई उसके बाद पीएमएच–1 रही जिसने 14000 किग्रा./हे. की पैदावार दी जबकि पीएमएच–1 की पैदावार (10000 किग्रा./हे.) सबसे कम रही। सरसों की विभिन्न किस्मों में से आरजीएन–48 ने सबसे अधिक उपज 1775 किग्रा./हे. प्राप्त की परंतु यह उर्वशी के साथ सांख्यिकी रूप से बराबर थी। सरसों की किस्म पूसा सरसों ने न्यूनतम उपज 972 किग्रा./हे. दर्ज कराई।

- **पंतनगर** (उत्तराखंड) में खरीफ के दौरान धान की 14 किस्मों जिसमें सात महीन अनाज (बासमती धान) और सात मोटे अनाज की किस्में और रबी में चौदह गेहूं की किस्मों का मूल्यांकन किया गया। मोटे अनाज वाली धान की किस्मों की पैदावार 4706 से 5181 किग्रा./हे. तक रही जबकि बारीक अनाज वाली धान की किस्में की पैदावार 3189 से 4693 किग्रा./हे. के बीच दर्ज की गई। मोटे अनाज वाली धान की किस्म एनडीआर–359 (5181 किग्रा./हे.) ने अधिकतम पैदावार दर्ज कराई, जो पीडी–19 (5056 किग्रा./हे.), पीडी–18 (4958 किग्रा./हे.), पीडी–4 (4861 किग्रा./हे.) और आईआर–64 (5014 किग्रा./हे.) के बराबर थी। महीन अनाज वाली धान की किस्मों के बीच उल्लेखनीय रूप से अधिकतम अनाज की पैदावार पंत बासमती–1 (4599 किग्रा./हे.) में देखी गई, जो पूसा–1121 (4343 किग्रा./हे.) और यूपीआर–3488621 (4693 किग्रा./हे.) के बराबर थी। विभिन्न गेहूं किस्मों की अनाज की पैदावार 3362 से 4733 किग्रा./हे. के बीच रही। उल्लेखनीय रूप से गेहूं की उच्चतम उपज एचडी–2967 (4733 किग्रा./हे.) में देखी गई जो यूपी–2572 (4803 किग्रा./हे.), डीबीडब्लू–62150

(4313 किग्रा./हे.), यूपी–2565 (4622 किग्रा./हे.) और डीबीडब्लू–17 (4642 किग्रा./हे.) के सांख्यकीय रूप से सान्तुल्य थी। जैविक खेती की स्थिति में सबसे कम उपज किस्म पीबीडब्लू–550 की थी।

- **रायपुर** (छत्तीसगढ़) मे 15 पारंपरिक/बेहतर सुगंधित धान की किस्मों और 15 चना की किस्मों जो उस क्षेत्र में लोकप्रिय है, उनके प्रदर्शन के आधार पर मूल्यांकन किया गया। धान की विभिन्न किस्मों के बीच में अंतर 2532 किग्रा./हे. से लेकर 3978 किग्रा./हे. तक रहा। अन्य सभी किस्मों के मुकाबले सीजी–सुगंधित भोग ने सबसे अधिक उपज (4578 किग्रा./हे.) दर्ज की सिवाय सीआर सुगंधित धान–907, इंदिरा सुगंधित धान, जिनका उत्पादन क्रमशः 4326 और 4169 किग्रा./हे. रहा। चने की सभी किस्मों के बीच में भी भिन्नता पाई गई और उपज में अंतर 1171 किग्रा./हे. से लेकर 1726 किग्रा./हे. तक पाया गया। चने की किस्म जॉकी ने सबसे अधिक 1726 किग्रा./हे. की उपज दर्ज कराई जो उल्लेखनीय रूप से अन्य किस्मों के मुकाबले अधिक थी। जैसे की जेजी –16, विशाल, आरजी 2009–16 एवं जेजी–130 जिन्होंने क्रमशः 1685, 1652, 1593 और 1546 किग्रा./हे. की उपज प्राप्त की जबकि आरजी 2009–01 सबसे कम उपज वाली किस्म रही।

- **रांची** (झारखंड) मे 1000 दानों का वजन और अनाज की उपज के लिए भिन्नता 21.3 ग्राम से लेकर 24.2 ग्राम तक रही वही उपज में भिन्नता 3289 कि.ग्रा. से लेकर 4511 किग्रा./हे. के बीच थी। धान की किस्म एमटीयू–10 ने सबसे अधिक 1000 दानों का वजन और उपज (23.2 ग्राम और 4511 किग्रा./हे.) दर्ज कराई उसके बाद बिरसा धान–201 और अक्षय ने 1000 दोनों का अधिकतम वजन 23.2 और 23.1 ग्राम एवं ललत द्वारा 4400 किग्रा./हे. उपज प्राप्त की। बीवीडी–110 की सबसे कम उपज (3244 किग्रा./हे.) रही। गेहूं की किस्म के–0307 द्वारा उल्लेखनीय रूप से प्रति वर्गमीटर किल्लो की संख्या, बालियों की लंबाई, दानों की संख्या प्रति बाली और उपज 3258 किग्रा./हे. अधिकतम दर्ज की गई जो सांख्यिकीय रूप से राज–4229 (3116 किग्रा./हे.), जीडब्ल्यू 366 (3038 किग्रा./हे.) बीबीडब्ल्यू–39 (3004 किग्रा./हे.) और बीजी–3 (2912 किग्रा./हे.) के बराबर थी।

- **उमियम** (मेघालय) में तीन प्रमुख फसलें जैसे मक्का फ्रेंचबीन और टमाटर का मुल्यांकन किया गया। विभिन्न किस्मों के बीच भुट्टे की अधिकतम लंबाई (14.9 सेंटीमीटर), भुट्टे का वजन (224.3 ग्राम), हरे भुट्टे की उपज (6000 किग्रा./हे.) और दानों की पैदावार (3700 किग्रा./हे.) डीए–16ए में पाई गई जो आरसीएम–75 और आरसीएम–76 के समतुल्य थी, वही न्यूनतम भुट्टे की लंबाई, भुट्टे का वजन लोकल वाइट के साथ क्रमशः 11.7 और 165.2 ग्राम रहा जबकि सबसे कम हरे भुट्टे और दानों की उपज विजय कंपोजिट (3900 और 2200 किग्रा./हे.) में पाई गई। जहां तक चारे की गुणवत्ता का सवाल है, आरसीएम 1–3 में सबसे अधिक क्रूड प्रोटीन पाया गया जबकि सबसे कम क्रूड प्रोटीन डीए–16ए और आरसीएम 1–1 में पाई गई। किस्म विजय कंपोजिट द्वारा सबसे अधिक *एब्सटैक्ट ईथर* (1.7 प्रतिशत) दर्ज किया गया जबकि सबसे कम आरसी–375 में दर्ज किया गया। टमाटर के मामलों में उपज में भिन्नता 7600 किग्रा./हे. से लेकर 21790 किग्रा./हे. तक रही। टमाटर की किस्म एमटी–2 ने 21790 कि.ग्रा./हे. की दर से सबसे अधिक उपज दर्ज की जो उसमें सबसे कम फली बेधक कीड़ों के प्रकोप के कारण रहीं और जो ओ–17, एमटी–11x एमटी–2 पंतटी–10 के उपज में सांख्यकी रूप से समतुल्य थी। न्यूनतम प्राथमिक शाखाओं और सबसे अधिक फल बेधक घटनाओं के कारण टमाटर की किस्म रॉकी ने सबसे कम उपज (7600 कि.ग्रा./हे.) दर्ज की। फ्रेंचबीन की विभिन्न किस्मों में नागा लोकल ने आरसीएमएफबी 18 (8000 कि.ग्रा./हे.), आरसीएम एफबी 19 और आरसी एमएफबी 80 (5800 कि.ग्रा./हे.) के मुकाबले सबसे अधिक पैदावार (9200 कि.ग्रा./हे.) प्राप्त की। सबसे कम उपज किस्म मरम में दर्ज की गई। फ्रेंचबीन के दानों की पैदावार भी उसकी फली की तरह नागा लोकल में (4230 कि.ग्रा./हे.) में सबसे अधिक पाई गई

जबकि मरम में न्यूनतम (800 किग्रा./हे.)पाई गई।

- **अजमेर** (राजस्थान) में रबी में बीज मसाले वाली फसलों (धनिया और सौंफ) सहित खरीफ में मूंग और ग्वारफली की अलग–अलग किस्मों का मूल्यांकन किया गया। मूंग की किस्म एस.एम.–2 ने पौधे की ऊँचाई, प्राथमिक शाखाओं की संख्या, गांठ प्रति पौधा, बीज की संख्या/फली, बीज उपज और जैव उपज के लिए भी बेहतर प्रदर्शन किया।इसने 984 किग्रा./हे. बीज की उपज दर्ज की जो एसएमएल–668 और एमएसजी–118 को छोड़कर बाकी किस्मों के बराबर रही, जिन्होने क्रमशः 722 और 658 कि.ग्रा./हे. सबसे कम उपज दर्ज की। ग्वारफली की किस्म आरजीसी–1038 ने प्राथमिक शाखाएं (12.3), फली प्रति पौधे की संख्या (68.9), फली प्रति बीज की संख्या (8.5), प्रति हेक्टेयर बीज की अधिकतम उपज (1486कि.ग्रा./हे.) और प्रति हेक्टेयर जैवउपज (6142 कि.ग्रा./हे) के साथ दर्ज कीऔर यह आरजीसी–1055 के बराबर पाया गई। आरजीसी –12–1 द्वारा प्राथमिक शाखाओं (12.3), फली की संख्या प्रति पौधा (21.3), बीज की संख्या प्रति फली (35.1),उपज प्रति हेक्टेयर (1476 किग्रा./हे.) और जैवउपज (1475 किग्रा./हे.) के संदर्भ में सबसे कम प्रदर्शन किया। प्राथमिक शाखाओं (7.7) और माध्यमिक शाखाओं (26.9), पुष्पछत्र की संख्या (44.0), छत्रक की संख्या (6.1) और बीज की उपज (1703 किग्रा./हे.) एसीआर–1 और हिसार आन्नद के बाद आजाद धनिया–1 में अधिक पाई गई। जबकि आरसीआर–446 द्वारा सबसे कम प्राथमिक शाखाओं की संख्या/पौधों (5.8), द्वितीय शाखाओं की संख्या/ पौधा (20.6), पुष्पछत्र की संख्या/पौधा (35.1), छत्रक की संख्या/पौधा (3.8) और बीज की उपज (1220 किग्रा./हे.) तथा उपज 1220 किग्रा./हे. दर्ज की गई। सौंफ की फसल में, प्राथमिक शाखाएँ (10.2), द्वितीयशाखाएँ /पौधे (21.3), पुष्पछत्र की संख्या/ पौधा (35.1), छत्रक की संख्या/पौधा (26.1) और बीज की उपज (1476 किग्रा/हे) भी जीएफ–2 में काफी अधिक पाई गई, जबकि सबसे कम प्रदर्शन बीज की उपज के संदर्भ में (1149 किग्रा/हे.) आरएफ–101 में देखा गया।

- **गैगटाँक (सिक्किम)** में जैविक प्रबंधन के अन्तर्गत मक्का और कुट्टु का मूल्यांकन किया गया। विवेक शंकुल–35 ने 2940 किग्रा/हे. की पैदावार के रूप में बेहतर प्रदर्शन किया, जो कि विवेक शंकुल–31, सेथी मकई और आरसीएम–75 के बराबर रही, जबकि सबसे कम पैदावार साठेया (1361किग्रा/हे.) ने दर्ज की। उपज के लिए कुट्टु की किस्मों के बीच अंतर 670–2780 किग्रा/हे. रहा। आईसी–49671 सबसे अधिक उपज वाली किस्म थी और वीएलउगल सबसे कम उपज वाली किस्म रही थी।

- **सरदार क्रुशीनगर** (गुजरात) में मूंगफली की किस्म जीजी2जी ने 2089 किग्रा/हे.की उल्लेखनीय रूप से अधिकतम उपज प्राप्त की जो जीजेजी–17 (2044 किग्रा/हे.) और टीजी–37 (1896 किग्रा/हे.) सांख्यकी रूप से समतुल्य रहा। गेहूं के अनाज की उपज में भिन्नता 3256 कि.ग्रा/हे. से लेकर 3971 कि.ग्रा/हे. तक पाई गई। अधिकतम पैदावार जीडब्ल्यू–496 (3971 कि.ग्रा/हे.) की रही जो अन्य किस्मों की तुलना में अधिक है, लेकिन जीडब्ल्यू–451, जीडब्ल्यू–273 और जीडीडब्ल्यू–1255 के बराबर थी। मूंग की फसल की पैदावार में अंतर 485 किग्रा/हे. से लेकर 566 किग्रा/हे. तक दिखाई दिया जबकि मूंग की उच्च उपज जीएम–4 (566 किग्रा/हे.) में पाई गई, जो कि के–851 (4705 किग्रा/हे.), पीडीएम–139 (485 किग्रा/हे.) को छोड़कर अन्य बराबर है। आईपीएम–410–3 सबसे कम उपज देने वाली किस्म रही।

- **तिरुवनंतमपुरम** (केरल) में 12 किस्मों में से, एच–226 में सबसे अधिक (46.7 टन/हे.) उत्पादन दर्ज हुआ लेकिन सीआर–24–4 (45.8 टन/हे.), श्रीअथुल्य (36.3 टन/हे.) और श्री पवित्रा (33.4 टन/हे.) के साथ सांख्यकीय रूप से बराबर रही। कल्पका में न्यूनतम उपज (8.9 टन/हे.) दर्ज हुआ। मूल्यांकन की गई किस्मों में, जैविक उत्पादन के अंतर्गत एच–226 और सीआर–24–4 की खेती लाभदायक रही क्योंकि इन

किस्मों से लाभ क्रमशः रु 5,32,229 और 5,18,855/हे. तथा लाभ लागत अनुपात (4.16 और 4.08) प्राप्त हुआ। श्री अथुल्य और श्री पवित्रा किस्मों ने भी अच्छा प्रदर्शन किया और क्रमशः शुद्ध लाभ रु 3,76,022 और रु 3,33,182 तथा लाभ लागत अनुपात 3.23 और 2.98 प्राप्त किया।

- **उदयपुर** (राजस्थान) में विभिन्न मक्का किस्मों में, संकर किस्मों में, पीएचएम–3 ने पीक्युपीएम–1 (5833 किग्रा/हे.) और पीएम–9 (4462 किग्रा/हे.) की तुलना में अधिकतम उपज (6296 किग्रा/हे.) दर्ज की। स्वीट कॉर्न किस्मों में, मिश्ठी ने (5972 किग्रा/हे.) और मधुला किस्म ने (5621 किग्रा/हे.) की तुलना में सुगर–75 ने अधिकतम उपज (6348 किग्रा/हे.) दर्ज की। बेबी कॉर्न किस्मों में पीएम–5 किस्म ने (3887 किग्रा/हे.) की तुलना में पीएम–3 की उच्च उपज (5183 किग्रा/हे.) दर्ज की गई। पॉपकॉर्न किस्मों के बीच, वीएल–एम्बर ने एम्बर पॉपकॉर्न (1633 किग्रा/हे.) की तुलना में पैदावार (2926 किग्रा/हे.) प्राप्त की। गेहूं की किस्मों में, एचआई–8713 ने अन्य किस्मों की तुलना में उच्च उपज (6796 किग्रा/हे.) और शुद्ध लाभ (रू. 211325/हे.) दर्ज किया। अन्य गेहूं की किस्मों *ट्रिटिकुम एस्टिवम* किस्मों में, एमपी–3288 में अधिकतम अनाज की पैदावार (4815 किग्रा/हे.) के साथ शुद्ध प्रतिफल (रू. 124023/हे.) प्राप्त किया। गेहूं की *ट्रिटिकुम एस्टिवम* किस्मों में एचआई–8713 ने उलेखनीय रूप से अनाज उपज (6796 किग्रा./हे.) और शुद्ध आय (रु. 211325/हे.),एचआई–1500 3537 किग्रा./हे. और एमपीओ–1215 4500 किग्रा/हे. की तुलना में सबसे ज्यादादर्ज की थी।

3. जैव उत्पादन प्रणालियों के अंतर्गत जैव–सघन पुरक फसल प्रणालियों का मूल्यांकन

- **धारवाड़** (कर्नाटक): जैविक प्रबन्धन के अतंर्गत विभिन्न कृशि संरक्षण प्रथाओं, भूमि विन्यास और फसल अवशेशों के साथ और उसके बिना प्रभावित विभिन्न फसल प्रणालियों के प्रदर्शन का मूल्यांकन किया गया। चौंड़ी क्यारी और कूड़ बुआई विधि में फसल अवशेश समावेशन के साथ सोयाबीन की अधिकतम उपज (1590 किग्रा./हे.) दर्ज कि गई थी जो परम्परागत समतल क्यारी बुआई विधि की तुलना में 10.8 प्रतिशत अधिक थी। खरीफ में मूँगफली, मूँग और कपास तथा रबी में ज्वार और अरहर की अधिकतम उपज परम्परागत समतल क्यारी विधि में फसल अवशेश समावेशन के साथ क्रमशः 1314, 452, 1065, 1353 और 990 किग्रा./हे. दर्ज की गई। परम्परागत रोपण विधि में मूँगफली, कपास, अरहर और मूँग की उपज में क्रमशः 15.9, 11.5, 16.1 और 5.1 प्रतिशत की वृद्धि होना पाई गई। फसल अवशेश समावेशन के साथ परम्परागत बुआई विधिने कुल प्रतिफल और शुद्ध आय (रू. 1,49,934 और रू. 70, 561) अधिकतम रूप में मूँगफली+कपास (2:1) प्रणाली के साथ प्राप्त की। इसके बाद चौड़ी क्यारी कूड़ रोपण विधि + फसल अवशेश समावेशन के साथ ने अधिकतम कुल और शुद्ध आय (रू. 1,30,832 और रू. 48,459/हे.) प्राप्त किया। जबकि अधिकतम लाभ लागत अनुपात सोयाबीन + अरहर (2:18) में फसल अवशेषों का प्रयोग आच्छादन के रूप में करने पर परम्परागत रोपण विधि में पाया गया।

- **पंतनगर** (उत्तराखंड) में जैविक खेती के अतंर्गत विभिन्न फसलों और फसल प्रणालियों में संसाधन संरक्षण तकनीक का मूल्यांकन किया गया। बासमती धान–गेहूँ–ढ़ेंचा प्रणाली ने अन्य सभी संसाधन संरक्षण तकनीकों के आधार पर बासमती धान की अधिकतम उपज (4107 किग्रा./हे.) दर्ज की, जो एसआरआई –गेहूँ–ढ़ेंचा प्रणाली के बराबर थी। गेहूँ की अधिकतम उपज (3953 किग्रा./हे.) बासमती चावल–गेहूँ–ढ़ेंचा में दर्ज की गई, जबकि सबसे कम धान की पैदावार (3245 किग्रा./हे.) डीएसआर–गेहूँ (शुन्य कषर्ण)–ढ़ेंचा में पायी गई। सब्जी मटर की हरी फली की पैदावार डीएसआर+सोयाबीन–सब्जी मटर+सरसों में उच्चीकृत क्यारी पर 7748 किग्रा./हे. अधिक पाई गई। चने की अधिकतम उपज चौड़ी क्यारी और कूड़ विधि (1662 किग्रा./हे.) पर डीएसआर– चना–मूँग के अतंर्गत दर्ज

की गयी। धनिया (422 किग्रा./हे.) की अधिकतम पैदावार डीएसआर– मटर– लोबीया के तहत चौड़ी क्यारी कूड़ं पर दर्ज की गई, जो डीएसआर–चना–मूंग में (386 किग्रा./हे.) चौड़ी क्यारी और कूड़ विधि के बराबर थी।

- **उमियम** (मेघालय) में ऊँच्चीकृत और जलमग्न (नीची) क्यारी तकनीक के तहत जैव–गहन मानार्थ फसल प्रणालियों का मूल्यांकन किया गया। जलमग्न (नीची) क्यारीमें धान आधारित फसल प्रणालियों में, शाहसरंग–1 ने चावल–मसूर फसल क्रम में सबसे अधिक अनाज की उपज (4700 किग्रा./हे.) दर्ज की। धान–मसूर प्रणाली में मसूर की अधिकतम पैदावार धान की किस्म (विवेक धान–82) के साथ 1200 किग्रा./हे. दर्ज की गई, जबकि मटर की पैदावार (4840 किग्रा./हे.) धान की किस्म (विवेक धान–82) के साथ ही अधिक थी। सबसे अधिक धान समतुल्य उपज धान (लैंपनाह)–मटर (13,310 किग्रा./हे.) धान (वीडी–82) –मटर 13,180 किग्रा./हे. के बाद दर्ज की गई थी। सब्जियों में आलू, फ्रेंच बीन और गाजर की अधिकतम उपज क्रमशः 18,200, 12,100 और 22,700 किग्रा./हे. ऊँच्चीकृत क्यारी पर दर्ज की गई। खरीफ के दौरान भिंडी की उच्च उपज फ्रेंचबीन (9900 किग्रा./हे.) के साथ अधिक थी।

4. समेकित जैविक कृषि प्रणाली (IOFS) मॉडल का विकास

- **कालीकट** (केरल) में मसालों, चारें और सब्जियों के समायोजन के साथ एक समेकित जैविक कृषि प्रणाली मॉडल का विकास किया गया। फसलों में मिर्च, हल्दी, चारा घास (कांगो सिग्नल घास, सीओ–3 और 4), टैपिओका, केला, लोबीया और अनानास लगाए गए। उन मॉडल में पशुधन अवयन के रूप में गायों और उनके बछड़ों को रखा गया है। फसल प्रणाली अवयव से चारा घास 700 कि.ग्रा., टैपिओका 50 किग्रा. और लोबिया 12 कि.ग्रा. प्राप्त हुआ। फार्म में रखी गई गायों को चारा घास खिलाया गया। एक एकड़ के एकीकृत यह जैविक कृषि प्रणाली मॉडल से रूपये 1 लाख 8 हजार का लाभ प्राप्त हुआ। शुद्ध प्रतिफल में सबसे अधिक योगदान मॉडल के दूध घटक (85 प्रतिशत) द्वारा दिया गया।

- **कोयम्बटूर** में हरी खाद (ढ़ेंचा) + मक्का प्रणाली के साथ उगाई गई भिंडी किस्म सीओबी–1 ने अधिकतम उपज 12,229 किग्रा./हे. दर्ज की। तथा इससे शुद्ध प्रतिफल रु. 58,740/हे. प्राप्त हुआ। मक्का की किस्म सीओएच (एम) 6 ने 4733 किग्रा./हे. आनाज की पैदावार एवं 4700 किग्रा./हे. भूसे की उपज दर्ज करायी। मक्का से रुपये 41,370/हे. की शुद्ध आय प्राप्त हुई। कपास की फसल में 3622 किग्रा./हे. शुष्क पदार्थ का उत्पादन दर्ज किया गया, जिसकी अधिकतम उचांई 73.3 सेमी है। कपास की पैदावार 1385 किग्रा./हे.प्राप्त हुई। एक एकड़ समेकित जैविक कृषि प्रणाली मॉडल से रू. 27,475/हे.का शुद्ध लाभ प्राप्त हुआ।

- **सरदार क्रुषीनगर** (गुजरात) में विभिन्न घटकों अर्थात फसलों (0.24 हेक्टेयर), हरे चारे की फसलों (0.15 हेक्टेयर), सीमा वृक्षारोपण, डेयरी और वर्मी–कम्पोस्ट (0.01 हेक्टेयर) से युक्त एक समेकित जैविक कृषि प्रणाली मॉडल विकसित किया गया। 0.24 हेक्टेयर में फसल घटक से रू. 14,098 का शुद्ध लाभ प्राप्त किया गया जबकि चारा इकाई (0.15 हेक्टेयर) से रू. 12,141 प्राप्त हुए। वर्ष 2016–17 के दौरान 0.4 हेक्टेयर क्षेत्र के मॉडल के सभी घटकों से कुल शुद्ध लाभ रू. 26,239 प्राप्त हुआ।

- **उदयपुर** (राजस्थान) में 0.25 हे.में फसल (स्वीट कॉर्न+उड़द) खरीफ के दौरान और गेहूँ रबी के दौरान 0.05 हे. में चारा फसले (चारा मक्का + लोबिया खरीफ के दौरान और बरसीम रबी में) 0.10 हेक्टेयर में सब्जिया (टमाटर और लोबिया), 0.04 हेक्टेयर में फलों की फसल, 0.01 हे. में अमरूद और 0.01 हे. में कम्पोस्ट का वर्श 2016–17 के दौरान मूल्यांकन किया गया। कुल मक्का समतुल्य उपज 4,213 किग्रा./हे. और शुद्ध आय

रू. 20,539/हे. कृषि प्रणाली मॉडल से प्राप्त किया गया।

- **उमियाम** (मेघालय) में समेकित जैविक कृषि प्रणाली मॉडल में अनाज (धान और मक्का), दालें (मसूर और मटर), तिलहन (सोयाबीन और रेपसीड), सब्जी की फसलें (फ्रेंचबीन, टमाटर, गाजर, भिंडी, बैंगन, गोभी, आलू, ब्रोकोली, फूलगोभी, मिर्च, धनिया, आदि) फल (असम नींबू, पपीता, आड़ू), डेयरी इकाई (एक दुधारू गाय. बछड़ा), चारा फसलों, एक तालाब, खाद के गड्ढों और वर्मी कम्पोस्टिंग इकाई जैसे विभिन्न उद्यम सहित का विकास किया गया। बेलदार सब्जियां जैसे लौकी, चाउ–चाउ, ककड़ी, तुरई आदि तालाब के तटबधों के ऊपर उगाए गए थे। कद्दू को तालाब के दूसरी तरफ उगाया गया। मछली के विकास के लिए जोप्लांकटन और फाइटोप्लेंक्टोन के अधिक उत्पादन हेतु डेयरी यूनिट के धुलाई अवशेष को मछली तालाब में उपयोग किया गया। गोबर का उपयोग वर्मीकम्पोस्टिंग के लिए किया गया। खेती की कुल लागत का 47.21 प्रतिशत फसल घटक में व्यय किया गया था जो कि सर्वाधिक व्यय था। जबकि कुल लागत का 37.0 प्रतिशत एक वयस्क गाय और एक बछड़े के साथ डेयरी इकाई पर किया गया। मत्स्य घटक ने खेती की कुल लागत का 8.52 प्रतिशत दर्ज किया। 72 वर्गमीटर क्षेत्र के वर्मीकम्पोस्टिंग यूनिट और अन्य महत्वपूर्ण घटक जैसे हेज, फसल अवशेष पुर्नचक्रण इत्यादि के लिए, व्यय रुपये 4120/हे. था। जो कुल लागत का 7.15 प्रतिशत है। प्रतिवर्ष कुल शुद्ध लाभ रु 73,005 समेकित जैविक कृषि प्रणाली मॉडल से प्राप्त हुआ। मॉडल से प्राप्त वार्षिक शुद्ध लाभ में फसल प्रणाली का योगदान 66.8 प्रतिशत के साथ सर्वाधिक रहा जिसके बाद डेयरी इकाई (23.37 प्रतिशत) तथा मत्सय घटकों के (15.9 प्रतिशत) का योगदान देखा गया।

ABSTRACT

The salient research findings made during 2016-17 under All India Network Programme on Organic Farming is given below.

1. Evaluation of organic, inorganic and integrated production systems

Bajaura: Among the crops evaluated under vegetable based cropping systems, all the management practices in tomato-cauliflower-frenchbean system recorded more or less similar tomato fruit yield during *kharif* however, higher tomato fruit yield (2190 kg/ha) was observed with organic package (75% organic + innovative organic practices). Like that tomato yield (10360 kg/ha) in *summer* was also found to be higher with organic package (75% organic + innovative organic practices) and the yield difference over inorganic and integrated was to the tune of 111.5 and 19.8%.The maximum curd yield of cauliflower (12400 kg/ha) in *rabi* was recorded with 100% inorganic. Response of black gram (1008 kg/ha), lady finger (9911 kg/ha) and pea (6975 kg/ha) were found to be higher in integrated package consisting of 50% organic+50% inorganic management approach while, *summer* frenchbean and summer squash recorded higher yield (7500 and 15560 kg/ha respectively) under integrated package with 75% nutrient from organic + 25% nutrient sources. However, yield was increased for black gram and okra to the tune of 43.6 and 72.6% respectively during *kharif* and 70.4% for pea whereas; *summer* frenchbean and squash yield was increased of 60.3 and 68% respectively over inorganic.

Bhopal: Soybean based cropping systems were evaluated. Higher mean yield of soybean (1121 kg/ha) was recorded under 100% organic management followed by management practices either with 75% nutrients through organic manures +innovative practices (1017 kg/ha) or under integrated (1074 kg/ha). The yield of soybean was found to be higher by 23.1% and 17.9% compared to inorganic package respectively. The yield of *duram* wheat, mustard, chickpea and linseed was recorded maximum in 100% organic management of 3139, 1285, 1828 and 1530 kg/ha respectively.The yield difference between organic and inorganic management was 12.2, 17.6, 13.3, and 11.4 % for *durum* wheat, mustard, chickpea and linseed respectively.

Calicut: Spices crops such as ginger and turmeric were evaluated under different management packages. Integrated package consisting of 75% nutrient through organic manure +25% inorganic recorded higher yield of turmeric (29900 kg/ha) followed by 100% application of nutrients through organic manures resulted in higher yield of turmeric (29100 kg/ha). Among varieties, Suguna recorded maximum yield (41800 kg/ha) with organic package followed by Sudarshna (40800 kg/ha) under integrated management practice (50+50%). All the turmeric varieties performed better with integrated package of 75% organic+25% inorganic. In case of ginger, yield was higher under integrated nutrient management either 50% each organic and inorganic manure or 75% organic + 25% inorganic manure of 22500 and 22760 kg/ha respectively and in comparison to inorganic the yield of ginger was increased to the tune of 168.4 and 165.3% respectively.

Coimbatore: Among the management practice, all the crops registered higher yield towards organic with 75% nutrients supply through organic manures+25% through inorganic under integrated management compared to 100% nutrients through organic and inorganic sources. Cotton yield was increased to the tune of 15.5 and 10.5% with integrated nutrient package of 50% each nutrient through organic and

inorganic manure whereas the yield of maize (6685 kg/ha), sunflower (4772 kg/ha), chilli (5840 kg/ha) and beetroot (2400 kg/ha) was recorded higher with 75% nutrient through organic+25% inorganic in integrated management. The yield was increased by 19.3, 13.3, 7.2 and 36.4% over inorganic management respectively.

Dharwad: Cowpea, safflower and pigeon pea recorded higher yield under integrated nutrient management whereas, sorghum and chick pea recorded higher with organic package. Under organic nutrient management, the yield of sorghum and chickpea was increased to the tune of 114.3 and 26.7% respectively over inorganic. Reduction in yield was found to be 13.4, 25.0 and 23.8% in groundnut, cotton and maize respectively compare to organic production package.

Jabalpur: Basmati rice was grown in all 4 cropping system along with wheat (*duram*), chickpea, maize (fodder), berseem, vegetable pea and sorghum in *rabi*. Mean grain yield of rice across the cropping systems (3332 kg/ha) was recorded under 100% inorganic management which was slightly decreased to the tune of 8.2 and 7.5% in 100% organic and integrated (50% organic + 50% inorganic) management respectively. Yield of wheat (5033 kg/ha), berseem fodder and seed (73100 and 273 kg/ha), vegetable pea (3420 kg/ha) during *rabi* and maize fodder (48492 kg/ha) and sorghum fodder (80640 kg/ha) during summer were also recorded higher under inorganic nutrient package with 100% inorganic nutrient management. Only chick pea yield was higher with integrated of 581 kg/ha.The reduction in the yield of wheat, berseem fodder and seed, vegetable pea, maize fodder, and sorghum fodder with100% organic management manure was found to be 16.0, 9.0 & 13.6, 28.7,13.4 and 20.9% respectively over inorganic nutrients management.

Karjat: Among the rice based cropping systems, higher mean yield of rice (4656 kg/ha) was recorded with integrated (50% organic +50% inorganic) nutrient from organic and inorganic manures/fertilizer followed by 100% inorganic management (4581 kg/ha) and found to be on par to each other.The yield variation by management package with 100% organic and reduced dose of organic manure was recorded only 2.2, 10.3 and 3.01% lower than the integrated management i.e. 50% each nutrient of organic and inorganic source. Other crops such as brinjal also resulted in higher with inorganic condition (49985 kg/ha). Integrated nutrient management practices found to be better for chick pea and onion with 50% nutrient supply through organic and 50% through inorganic sources (1657, and 17379 kg/ha).

Ludhiana: In case of basmati rice, maximum basmati rice yield (4490 kg/ha) recorded with organic management through application of 100% organic manure in basmati rice-wheat system. Higher seed yield of soybean (1800 kg/ha) was also obtained under organic package with 75% organic + innovative practice and it was 45.2% higher to inorganic packages. Crop clusterbean was also higher with 100% organic management and it was increase to the tune of 69.5%. During *rabi, c*hickpea (590 kg/ha) performed better under organic with 75% organic + 25% inorganic practice under integrated and produced significantly 59.5% more seed yield compared to 100% inorganic practices. However, wheat recorded higher yield (6040 kg/ha) under inorganic package about 16.7% less yield was recorded with 100% organic management.

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. Basmati rice yield was increased by 18.6 and 11.2% with organic management along with highest grain yield of 4125 kg/ha. Coarse rice yield was found to be higher with state recommendation (4250 kg/ha). About 14.3 and 11.8% yield reduction was observed with 100% organic and integrated (50%

each organic and inorganic) nutrient management compared to state recommendation package. Highest maize popcorn as well as sweet corn cob yield (5940 and 7660 kg/ha) was found to be higher also with state recommendation package. The reduction in cob yield with organic and integrated was found to be 20.03 and 18.5% while under integrated, 8.3 and 7.7% yield was decrease compared to state recommendation production system, respectively. During rabi wheat, barley, potato mustard and okra yield also recorded higher with state recommendation, the reduction in the yield were found to be 35.2, 11.7, 22.2, 8.94 and 12.9% respectively under 100% organic package. In summer, green gram resulted in higher yield (725 kg/ha) with integrated (50% each organic and inorganic) nutrient management.

Pantnagar: Basmati rice based cropping system was evaluated under different management packages. Grain yield of basmati rice (4973 kg/ha) found to be higher with 100% organic package followed by 75% organic+innovative practices (4819 kg/ha) and It was increased by 39.9 and 27.9% over inorganic. In *rabi*, wheat yield (5115 kg/ha) was highest under integrated package (50% organic+50% inorganic) which was on par to 75% organic+25% inorganic, and it was increased by 8.6 and 7.1% compare to inorganic. Coriander was raised as intercrop of 2 rows with chickpea and vegetable pea. Chickpea equivalent yield recorded highest (2135 kg/ha) in integrated package with (75% organic+25% inorganic) whereas pea equivalent yield being highest (12850 kg/ha) in organic package with 75% organic +innovative technology. Organic management package was increased for chickpea and pea equivalent yield to the tune of 12.8 and 25.3% over inorganic practice. Potato was found to be under organic management and increase in yield was found to be 22.3% over inorganic.

Raipur: Soybean based cropping systems were evaluated with maize, pea, chilli, and onion under organic, inorganic and integrated management packages. Soybean yield was higher under organic production management with 75% organic manure +innovative practices of foliar spray of vermiwash (10%) followed by cow urine (10%) at 20 days interval (2153 kg/ha). The enhancement in yield was found by 16.3 and 15.9% over to 100% inorganic and integrated nutrient management. Other crops such as maize (sweet corn), pea, and chilli also resulted higher yield (14850, 8007 and 9081 kg/ha respectively) under 75% organic manures+ innovative practices (foliar spray of vermiwash (10%) followed by cow urine (10%) while, onion bulb yield resulted in higher with state recommendation (17643 kg/ha) and yield reduction in onion with organic was found to be 17.1%. The yield differences from 100% organic to inorganic were found to be 11.8, 13.5 and 10.5% for maize, pea and chilli respectively.

Ranchi: Rice based cropping systems were evaluated in system mode with different crops such as wheat, potato, linseed, & lentil. In rice, higher yield (4436 kg/ha) was found under organic management with 75% organic nutrient through organic sources +innovative practices (*Azolla* along with vermiwash spray). The differences from 100% organic to towards organic (75% organic maures+25% inorganic source) and inorganic were found to be 9.7 and 24.6% respectively. Wheat recorded highest yield (2927 kg/ha) under inorganic package with 100% inorganic nutrients package. The yield was decrease with 100% organic and towards organic (75% organic+25% inorganic) by 14.6 and 7.1% respectively. Potato and linseed recorded higher yield (23027& 981 kg/ha) under organic package with 100% nutrient supply through organic sources while, lentil recorded higher yield (575 kg/ha) under integrated package (50% organic+50% inorganic). The yield was increased with organic in potato and linseed to the tune of 67.1 & 39.9% and 30.1 & 27.2% respectively over inorganic and integrated package.

Umiam: The experiment consists of four vegetable based cropping systems on raised bed and four rice varieties on sunken beds were evaluated. The higher broccoli yield was recorded with broccoli-frenchbean cropping systems (16480 kg/ha) under organic 100% manure. The yield of broccoli was enhanced on raised bed by 15.2% over inorganic. Carrot and potato recorded highest yield 16930 and 17450 kg/ha under integrated nutrient package towards organic with 75% nutrient supplied through organic manures+25% inorganic however, frenchbean and tomato grown on raised bed recorded highest yield (9940 and 18870 kg/ha) under organic package with 100% organic manures. Yield of frenchbean and tomato was increased with organic management to the tune of 22 and 19.7% over inorganic whereas, integrated management towards organic, carrot and potato produced 18.8 and 47.2% more yield compared to 100% inorganic.

Among the management practices on sunken beds, the higher rice yield (4625 kg/ha)was recorded with integrated package having 50% organic+50% inorganic nutrients followed by 100% organic (4565 kg/ha). Among the rice varieties, Shahsharang-1 produced maximum grain yield (4690 kg/ha) followed by Lampnah (4520 kg/ha), Megha Aromatic 2 (4440 kg/ha) and Ngoba (4050 kg/ha).

Ajmer: The experiment consisted of seed spices coriander and fennel was evaluated with green gram and cluster bean.The yield of green gram (1060 kg/ha) and cluster bean (2021 kg/ha) found to be higher with integrated nutrient management (75% Organic+25% Inorganic). Among nutrient management practice, seed yield of coriander and fennel was recorded higher also in integrated approach towards organicwith 75% organic + 25% inorganic (1308 and 683 kg/ha respectively) followed by state recommendation (1249 and 650 kg/ha). The increase in yield of green gram, cluster bean, coriander and fennel was found to be17.5, 3.8, 45.0 and 21.9% respectively from inorganic to towards organic (75% organic +25% inorganic).

Narendrapur: Paddy variety sohini and shatabdi recorded maximum grain yield (2691 and 5988 kg/ha respectively) under integrated nutrient management having 50% each nutrient through organic and inorganic followed by 75% nutrient through organic sources+25% inorganic. The differences in yield of paddy were found to be 11.1 and 3.1% for Sohini and 3.5 and 3.9% for shatabdi from integrated to organic and inorganic nutrient package. Other crops in the systems such as broccoli, mustard, capsicum and frechbean during *rabi* resulted higher yield by 26.3, 11.9, 17.6 and 14.9% with organic compare to inorganic respectively. Whereas, sesame and green gram during summer also recorded maximum yield in organic with (100%organic) and (75% organic +innovative technology) and being higher by 13.1 and 9.3% respectively.

Sardarkrushinagar: Among the crops evaluated under different cropping systems and nutrient management package, all the crops recorded higher yield under state recommendation. Crops groundnut, wheat, green gram, vegetable cowpea and fennel resulted in higher yield (2172, 4665, 700, 5708 and 1809 kg/ha respectively) with state recommendation and reduction in the yield from state recommendation to 100% organic management were found to be 25.6, 17.8, 17.7, 24.6 and 34.3% respectively.

Thiruvananthapuram: Crops cowpea, groundnut, blackgram and greengram involving two tuber crops such as cassava and taro were evaluated under four cropping systems. Green gram yield (766 kg/ha) was higher in organic management with 100% manure supplied through manure while, vegetable cowpea was higher in 75% organic +innovative practice (4065 kg/ha) under organic. Groundnut (kernel yield) and blackgram resulted in higher yield in inorganic package (1888 and 936 kg/ha) followed by organic

with 75% organic + innovative practice. The yield differences from organic to inorganic for green gram and cowpea being 79 and 85.7%. The reduction in yield for groundnut and blackgram was found to the tune of 2.9 and 41.6% respectively.

Udaipur: Maize + blackgram intercrop resulted in higher yield (5669 kg/ha in term of equivalent) under integrated packages with 50% organic +50% inorganic whereas, maximum yield of sweet corn (2928 kg/ha) and maize equivalent yield of sweet corn – blackgram (2:2) intercropping system (8538 kg/ha) was obtained under 100% inorganic nutrient management. Sole black gram recorded maximum yield (350 kg/ha) with reduced dose of manure 75% organic+25% innovative practice and state recommendation followed by organic 100%. Yield of 4285 and 3142 kg/ha for wheat *duram and astivum* respectively recorded higher in inorganic package with state recommendation and difference in yield from organic to inorganic was found to be 31.7 and 15.0. Soybean (643 kg/ha) performed better towards organic with 75% organic +25% inorganic under integrated package. Maximum yield of fenugreek was also recorded under inorganic management of 1207 kg/ha and compare to organic it was reduced by 20.1%.

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

Bajaura: Fruit yield difference was recorded among the tomato varieties ranged from 880 to 2410 kg/ha and 1963 to 15480 kg/ha during *kharif* and *summer* respectively. Sioux showed lowest yield while Red gold had highest fruit yield with higher number of fruits/plant (5.7) in *kharif*. Significantly higher fruit size was recorded with RK-123 (25.2 cm^2) and Marglobe (36.1 cm^2) during *kharif* and *summer* respectively. Okra variety Chameli-015 recorded significantly higher fruit yield (8576 kg/ha) because of higher number of fruits/plant (25.0), fruit length (11.5 cm) and plant height (173.9 cm) followed by Indranil with yield and fruit length (7683 kg/ha and 11.5 cm) compared to others. Pea variety Ten plus gave the highest pod yield (5600 kg/ha) followed by Nirali (5020 kg/ha). Pb 89 produced the lowest yield (3740 kg/ha) with lower number of pods and seeds/plant. Though higher curds size of cauliflower was obtained in KT-25 (200.4 cm^2) but significantly higher marketable curd was obtained in US-178 (92.1%) along with higher curd weight (470.6 g) resulted in higher curd yield (10270 kg/ha) as compared to other varieties followed by Chandramukhi (8830 kg/ha). Variety KT-25 recorded lower yield (6560 kg/ha).

Bhopal: Response of different varieties/hybrids of crops in soybean-wheat and maize-chickpea system were evaluated. Among the soybean varieties, RVS-2002-4 resulted in significantly higher seed yield (1290 kg/ha) owing to higher pods/plant (47.7) and biomass (4735 kg/ha) while, JS 93-05 recorded lower soybean yield (680 kg/ha) with least pods/plant (31.1), seeds/pod (2.6) and biomass (2323 kg/ha). In term of quality, 7.6% more oil was recorded in RVS 2002-7 compared to JS 97-52. Significantly higher protein (37.43%) was recorded with JS-93-05 followed by JS 20-29 (37.36%). Maize variety Kanchan was the leading variety in plant height (158 cm), cobs/plant (1.4), rows/cob (12.6), seed/row (20.8) and seed and biomass yield (2907 and 6393 kg/ha respectively). Among all the quality parameters assessed, Proagro-4412 recorded more protein and tryptophan (10.04% and 0.91 g/16gN respectively). Among the wheat varieties, GW-366 recorded significantly higher number of spikes/meter row length (100), seeds/spike (76.7) resulted in higher grain and biomass yield (3356 and 6985 kg/ha) and harvest index (48.0%). C-306 produced lower yield (2067 kg/ha) with total biomass (4974 kg/ha). Among the chickpea varieties, JG 130 recorded higher seed yield (2154 kg/ha), correspondingly higher biomass yield of 5217 kg/ha, seeds/pod (2.1) and pod/plant (95) followed by RVG

203 (2077 kg/ha) and JG 16 (1817 kg/ha).

Calicut: Among the 11 varieties of turmeric evaluated under organic and inorganic situation, maximum yield was recorded by Suguna (41800 kg/ha) followed by Sudarshana (39900 kg/ha). Variation in other turmeric varieties was recorded in range from 18900 kg/ha (Prathibha) to 34000 kg/ha (Sobha). In term of quality of turmeric, Sobha recorded maximum oil content (6.0%) which was on par with Sona (5.9%), Varna, Kanthi, Suvarna (5.8%) and Prabha (5.4) and the least oil content was noticed in Prathibha and Aleppey Supreme. Suguna and Kedaram recorded maximum oleoresin 14.3 and 14.1% while, Aleppey supreme recorded maximum curcumin content (6.2%) followed by Suguna (5.9%).

Coimbatore: Difference in grain yield among the varieties ranged from 2710 to 5500 kg/ha. KDML 105 showed lowest grain yield (2710 kg/ha) while CB05022 had highest grain yield (5500 kg/ha). Among the different varieties of rice, Mappillai Samba fetched maximum gross return (Rs. 119765/ha), net return (Rs. 79175/ha) and net returns per rupee invested (2.95) followed by Kitchidi Samba and IW Ponni, while, KDML105 gave minimum net return of Rs.25050/ha with net return rupee per invested (1.50).

Dharwad: Chickpea Variety MACB 27 recorded taller plants (40.4 cm), while BGD-103 gave higher number of pods/plant (46.1), seed weight/plant (22.17g) and 1000-grains weight (357.5 g). Organic production practice produced higher seed yield of chickpea (3172 kg/ha) as compared to inorganic (application of recommended rates of fertilizers along with farmyard) (3098 kg/ha). Among the varieties, A1 recorded maximum yield of 3653 kg/ha whereas, JAKI 9218 produced lower yield of 2806 kg/ha under organic condition. Higher grain yield of wheat (2380 kg/ha) was recorded with UAS 347 while, minimum was noted with DWR 2006.

Jabalpur: Among the varieties, maximum grain yield was recorded with PS-3 (5800 kg/ha) followed by PS-5 (5490 kg/ha). The lowest yield was recorded in BVD-109 (3780 kg/ha). Among the wheat varieties, significantly higher wheat yield was recorded with HI 1500 (5180 kg/ha) and found to be on par with HI 1418 (5157 kg/ha), C-306 (5058 kg) and HD 2987.

Karjat: Among the rice varieties grouped in four categories, variety Sahyadri-5, Sahyadri-3, Sahyadri-4 and Jaya which is popularly among farmers recorded significantly higher grain yield over rest of varieties (6841, 6786 6597 and 6114 kg/ha respectively) but these are statistically on par to each other. Karjat 4 recorded lowest yielded variety among the rice varieties. Significantly higher pods yield of ground nut (3172 kg/ha) recorded in TG 26 followed by Konkan Gaurav TAG 24, Phule 6021 but these are statistically at par to each other. Kopergaon-1 produced lower yield (2015 kg/ha) among the varieties.

Ludhiana: Among the varieties, basmati rice yield significantly varied from 3200 – 5353 kg/ha with a variation of 67%. Number of effective tillers/m^2 and grain yield (388 and 5353 kg/ha respectively) recorded significantly higher with Pusa basmati 1509 as compared to other varieties but statistically on par with RYT 3404, E1, E 2 and RYT 3390. The lowest grain yield was given by Punjab basmati-2 (3203 kg/ha). The wheat grain yield varied from 3430kg -4673 kg/ha among different varieties. Significantly higher grain yield of wheat (4673 kg/ha) was observed in HD 3086 than the other varieties of wheat which were statistically at par with all other varieties PBW 590, HD 2967, PBW 658, PBW 660 and HPBW 01 . The lowest grain yield was recorded with PBW 590 (3433 kg/ha).

Modipuram: Grain yield was significantly varied among the varieties of maize from 10000-15000 kg/ha and higher grain yield was found to be in Vivek QPM-9 (15000 kg/ha) followed by PMH-1 (14000 kg/ha) while lowest yield recorded in VMH 39 (10000 kg/ha). Among the mustard varieties, significantly higher seed yield was recorded with RGN-48 (1775 kg/ha) and

it was statistically at par with Urvashi. Variety Pusa Mustard-25 gave minimum yield of 972 kg/ha.

Pantnagar: 14 varieties of rice including seven fine grain basmati rice and seven coarse grain varieties during *kharif* and fourteen varieties of wheat in *rabi* were evaluated. Grain yield of coarse grain rice varieties ranged from 4706 to 5181 kg/ha while fine grain rice varieties recorded range from 3189 to 4693 kg/ha. Among coarse grain rice varieties, significantly higher grain yield was observed in NDR-359 (5181 kg/ha) which was at *par* with PD-19 (5056 kg/ha), PD-18 (4958 kg/ha, PD-4 (4861 kg/ha) and IR-64 (5014 kg/ha). Significantly higher grain yield among fine grain rice varieties was observed in Pant basmati-1(4599 kg/ha) which was at par with Pusa-1121 (4343 kg/ha) & UPR-3488621 (4693 kg/ha). Grain yield of different wheat varieties ranged from 3362 to 4733 kg/ha. Significantly highest grain yield was noticed in HD-2967 (4733 kg/ha) which was at par with UP-2572, DPW- 62150, UP- 2565 (4622 kg/ha) and DPW-17(4642 kg/ha). Lowest yielded variety was PBW-550 under organic farming situation.

Raipur: Fifteen traditional /improved scented rice varieties and 15 popular chickpea varieties in the region were evaluated for their performance. The difference in grain yield among the varieties ranged from 2532 to 4578 kg/ha. Significantly grain yield of rice variety C.G. Sugandhit Bhog (4578 kg/ha)n recorded highest yielded which was significantly superior over rest of the varieties except CR Sugandha dhan 907 Indira sugandhit dhan which produced 4326, and 4169 kg/ha respectively. Seed yield of chickpea was also varied among varieties ranged from 1171 to 1726 kg/ha. Higher seed yield was obtained from Jaki (1726 kg/ha) which was significantly higher over other varieties JG-16, Vishal, RG2009-16 and JG-130 (1685, 1652, 1593 and 1546 kg/ha respectively) whereas RG-2009-01 been the lowest yielded variety.

Ranchi: The variation for 1000-grains weight and grain yield were in range between 21.3-24.2g and 3289 and 4511 kg/ha. The maximum 1000-grains weight and grain yield of rice (24.2g and 4511 kg/ha) was obtained with MTU-10 followed by Birsa dhan 201 and Akhchhai for test wt. (23.2 and 23.1g) and Lalat (4400 kg/ha). Lower seed yield recorded with BVD-110 of 3244 kg/ha. K-0307 wheat variety recorded significantly higher number of tiller m^{-2}, spike length, number of grains/spike and grain yield of 3258 kg/ha which was statistically at par with Raj 4229 (3116 kg/ha), GW 366 (3038 kg/ha), DBW 39 (3004 kg/ha) and BG-3 (2912kg/ha).

Umiam: The experiment consisted of three major crops *viz*., maize, frenchbean and tomato. Among the varieties, maximum cob length, cob weight, green cob yield and kernel yield were recorded with variety DA 61-A (14.9cm 224.3g, 6000 kg/ha and 3700 kg/ha respectively) and found to be on par with RCM-75 and RCM-76 whereas, minimum cob length and cob weight was recorded in the variety local white (11.7cm and 165.2g respectively). However, lower green cob yield and kernel yield was recorded in the Vijay composite (3900 and 2200 kg/ha respectively). Fodder quality crude protein content among the maize varieties was found to be higher under RCM-1-3 while lower was recorded with DA-16-A and RCM1-1. In respect to ether extract either, Vijay composite were recorded higher of 1.70% while lower was with RCM-75. In case of tomato, the range of fruit yield of tomato were from 7600 to 21790 kg/ha among the different varieties. Tomato cultivars MT-2 produce higher fruit yield (21790 kg/ha) compared to other cultivars due to the less pod borer incidence and being at par with 0-17, MT11XMT2 and Pant T10. The lowest yield of tomato was recorded in the cultivar Rocky (7600 kg/ha) due to the less secondary branches and heavy pod borer incidence. Among the frenchbean varieties, highest green pod yield was recorded in Naga local (9200 kg/ha) followed by RCM-FB-18 (8000 kg/ha) RCM-FB-19 and RCM-FB-80 (5800 kg/ha). Lowest

green yield was recorded in Maram (1100 kg/ha). Seed yield also shown the similar trend as in green pod which had recorded highest in Naga local (4230 kg/ha) and lowest in Maram (800 kg/ha).

Ajmer: Seed spice crops including different varieties of coriander and fennel in *rabi* season and green gram and cluster bean in *kharif* were evaluated/screened for organic farming. Green gram variety Mum-2 performed significantly better in term of plant height, number of primary branches, number of nods/plant, number of seeds/pod, also for seed yield and biomass yield. It recorded 984.4 kg/ha seed yield and being at par to rest of varieties except SML 668 and MSG 118 which produced lower yield of 721.8 and 658.3 kg/ha respectively**.** Cluster bean variety RGC-1038 recorded maximum primary branches (12.3), number of pods per plant (68.9), number of seeds per pod (8.5), seed yield per hectare (1485.8 kg/ha) and biomass yield per hectare (6141.7 kg) and it was found at par with RGC-1055. Lowest performance in terms of primary branches (12.3), number of pods per plant (21.3), numbers of seeds per pod (35.1), seed yield per hectare (1475.8 kg) and biomass yield per hectare (1475.8 kg) was observed in variety RGC-12-1. Among coriander variety, primary branches (7.7) and secondary branches (26.9), number of umbels (44.0), number of umbellets (6.1) and seed yield (1703 kg/ha) was found to be higher in Azad dhania-1 followed by ACr-1 and Hissar Anand while lowest was recorded in RCr-446 with number of primary branches/plant (5.8), numbers of secondary branches /plant (20.6), number of umbel/plant (35.1), number of umbellate/umbel (3.8) and seed yield (1220 kg/ha). In fennel crop, primary branches (10.2), secondary branches 21.3), umbels per plant (35.1), umbellates per umbel (26.1) and seed yield (1476 kg/ha) was also found significantly higher in GF-2, while lowest performance in terms of seed yield (1149 kg/ha) was observed in variety RF-101.

Gangtok: Maize and buckwheat under organic management were evaluated. Vivek sankul -35 performed better in term of grain yield (2940 kg/ha) which were on par with Vivek sankul -31, Sethe Makkai and RCM -75 while lowest yield was recorded in Satheya (1361 kg/ha). Significant differences among the buckwheat varieties for yield ranged from 670-2780 kg/ha. IC 49671 was the highest yielded variety and Vl ugal was the lowest yielded variety.

Sardarkrushinagar: Groundnut-wheat-green gram system was grown. Significantly higher pod yield was found in variety GG- 2G (2089 kg/ha) which is at par with GJG-17 (2044 kg/ha) and TG-37 (1896 kg/ha). Grain yield of wheat showed significant variations from 3256 kg/ha to 3971 kg/ha. Significantly higher yield was found in variety GW-496 (3971 kg/ha) which is higher than other varieties but was on par with GW 451, GW-273 and GDW-1255. Seed yield of green gram varied from 485 kg/ha to 566 kg/ha. Higher seed yield was found in variety GM 4 (566 kg/ha) which is at par to THE other except K851 (4705 kg/ha), PDM 139 (485 kg/ha) and IPM-410-3 it resulted lower yield.

Thiruvananthapuram: Among the 12 varieties, H-226 produced the highest yield (46.7 t ha^{-1}), but on par with CR-24-4 (45.8 t ha^{-1}), Sree Athulya (36.3 t ha^{-1}) and Sree Pavithra (33.4 t ha^{-1}). Kalpaka produced the lower yield (8.9 t/ha). Among the varieties evaluated, cultivation of H-226 and CR-24-4 under organic practice was profitable as these varieties generated higher profit (Rs. 5,32,229 ha^{-1} and Rs. 5,18,855 ha^{-1} respectively) and B: C ratio (4.16 and 4.08). Sree Athulya and Sree Pavithra were the next good performers (net returns of Rs. 3,76,022 and Rs. 3,33,182 ha^{-1}; B:C ratio of 3.23 and 2.98 respectively).

Udaipur: Among the different maize varieties, variety PHM-3 recorded significantly higher yield (6296 kg/ha) as compared to PQPM-1 (5833 kg/ha) and PM-9 (4462 kg/ha). Among sweet corn varieties, sugar-75 gave significantly higher yield (6348 kg/ha) as compared to Misthy (5972 kg/ha) and Madhula variety (5621kg/ha). In case of baby corn varieties, PM-3 recorded higher yield (5183 kg/ha) as compared to

PM-5 variety (3887 kg/ha). Among popcorn varieties, VL- Amber observed yield (2926 kg/ha) as compared to Amber popcorn (1633kg/ha). Among wheat varieties, HI-8713 recorded significantly higher yield (6796 kg/ha) and net return (Rs. 211325 ha^{-1}) as compared to other varieties. Among *Triticum aestivum* varieties, variety MP-3288 recorded significantly higher grain yield (4815 kg/ha) and net return (Rs. 124023 ha^{-1}) as compared to other wheat varieties In case of *Triticum durum* varieties, variety HI-8713 gave significantly higher grain yield (6796 kg/ha) and net return (Rs. 211325 ha^{-1}) as compared to HI- 1500 (35.37 q/ha) and MPO- 1215 (4500 kg/ha).

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

Dharwad: Soyabean yield (1590 kg/ha) was higher in broad bed and furrow planting method with crop residue which is increased by 10.8% than conventional flat bed with residue. Groundnut and green gram during *khrif* and cotton, sorghum and pigeon pea during *rabi* recorded higher yield of 1374, 452, 1065, 1353 and 990 kg/ha respectively in conventional method of planting with crop residue. Conventional planting method recorded 15.9, 11.5, 16.1 and 5.1% higher yield for groundnut, cotton, pigeon pea and green gram respectively. Conventional flatbed method of planting with crop residue produced higher gross return and net monetary returns of Rs. 1,49,934 and Rs. 70,561/ha respectively) in groundnut + cotton (2:1) intercropping system followed by broad-bed and furrow (BBF) method of planting with crop residues (Rs. 1,30,832 and Rs. 48,459/ha respectively). Whereas, benefit cost ratio was found to be higher (2.18) in soybean + pigeonpea (2:1) intercropping with conventional flat method of planting with crop residue.

Pantnagar: Basmati rice-wheat-sesbania system recorded significantly higher basmati rice grain yield (4107 kg/ha) over all other resource conservation treatments, and was at par with SRI-wheat-sesbania treatment. Maximum grain yield of wheat (3953 kg/ha) was recorded in Basmati rice- wheat- *sesbania* while lowest grain yield (3245 kg/ha) was observed in DSR-wheat-(ZT)–*sesbania*. Green pod yield of vegetable pea was found to be higher (7748 kg/ha) in DSR+ soybean-vegetable pea+ mustard on furrow raised bed system. Chickpea yield recorded under DSR-chickpea-moong on broad-bed and furrow system (1662 kg/ha). Higher grain yield of coriander (422 kg/ha) was recorded under DSR-vegetable pea-cowpea on broad bed and furrow which was at par with DSR-chickpea-moong on broad-bed and furrow system (386 kg/ha).

Umiam: In rice based cropping systems on sunken beds, Shahsarang-1 recorded the highest grain yield (4700 kg/ha) under rice-lentil cropping sequence. Higher yield of lentil was recorded with rice variety (Vivek dhan-82) of 1200 kg/ha among rice-lentil system whereas, pea yield (4840 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 (13310 kg/ha) followed by rice (VD-82) –pea 13180 kg/ha. Yield of vegetables on raised-bed like; potato, french bean and carrot recorded yield on raised bed of 18200, 12100 and 22700 kg/ha respectively. The yield of okra during *kharif* was higher with frenchbean (9900 kg/ha) in the system.

4. Development of Integrated Organic Farming System Models (Area: 0.4 ha)

Calicut: The plot with spices, fodder and vegetables combination was established at Chelavoor farm. The crops pepper, turmeric, fodder grasses (Congo signal grass, CO-3, CO-4), tapioca, banana, cowpea and pineapple were planted and established .Two cows and their calves are maintaining at IISR farm. Fodder grasses 700 kg; Tapioca 50 kg and vegetable cowpea 12 kg were harvested. Fodder grass fed to the cows that are maintained at IISR farm. A profit of Rs 1.08 lakhs was received from one acre integrated farming

system model. The highest contribution towards the total net return was contributed by milk component (85%) from the model.

Coimbatore: Maximum yield 12,229 kg/ha was recorded in okra variety COBh 1 grown with green manure (*Daincha*) + maize system. Net return of Rs. 58,740/ha was obtained through okra under integrated organic farming model. Maize variety COH (M) 6 was sown in the system gave 4700 kg/ha of grain yield with 4733 kg/ha of straw yield. Maize recorded the net income of Rs. 41,370/ ha under integrated organic farming model. Cotton recorded 3622 kg/ha of dry matter production at the stage of harvest with maximum height of 73.3 cm. Cotton resulted 1385 kg/ha Seed cotton yield. Net return of Rs. 27,475/ha was recorded in the model.

Sardarkrushinagar: IOFS model is comprised of different components viz., crops (0.24 ha), green fodder crops (0.15 ha), boundary plantation, dairy and vermi-compost (0.01 ha). Total net profit of ` 14098 was received by crop component from 0.24 ha area and ` 12141 was received by fodder unit (0.15 ha.). Total net profit from all the components of IOFS Model during 2016-17 was ` 26,239 from 0.4 ha area.

Udaipur: An integrated 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 + cowpea during *kharif* and berseem in *rabi* and *sesbania* green manuring during *zaid*), vegetables in 0.10 ha (tomato and cowpea), fruit crop in 0.04 ha (guava) and compost unit in 0.01 ha were evaluated during 2016-17. The total maize equivalent yield of 4213 kg/ha and a net return of Rs. 20539 /ha was obtained from the farming system.

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. 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. Maximum expenditure was incurred in crop component of the model with 47.21% of the total cost of cultivation. Dairy unit with one adult cow and one calf registered 37.09 % of the total cost of cultivation, while fishery component recorded 8.52 % of the total cost of cultivation. 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 was incurred of Rs. 4120/- which account to 7.15 % of the total cost. A total net return of Rs. 73,005/- per year was achieved under the IOFS model. The highest contribution towards the total net return was contributed by crop component of the model (66.84%) followed by dairy (23.37%) and fishery component (15.91%).

INTRODUCTION

01

The rate of national agricultural growth was not able to keep pace with population growth during pre-green revolution period (up to 1960s) 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 50.83 million tonnes in 1950-51 to 283.37 million tonnes in 2018-19 – indicating 5.57 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 94.46 million ha in 2014-15) and increase in fertilizer nutrient consumption (0.07 million tonnes in 1950-51 to 27.35 million tonnes in 2018-19). 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 2233 kg/ha in 2017-18) 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 made impact in only very few states which have contributed for food production mostly of cereal based production systems. Despite all technological advancements, the nutrient use efficiency is on lower side. On the other hand, it has been proved scientifically and convincingly that use of organic manures improves the use efficiencies of the nutrients 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, 112.2 million ha area in 181 countries is under organic agriculture which includes both cultivated (69.8 million ha; 1.4 % of total agricultural land) and wild harvest (42.4 million ha) during 2017-18 (FiBL, 2019). Market size during 2017 was 97 billion USD. Although 181 countries grow, but markets are concentrated in European Union and North America (32 countries) and 90% of international trade is within these two regions. The sector is growing at 12 % cumulative annual growth rate. India, emerging from 42,000 ha under certified organic farming in 2003-04, the organic agricultural area has grown many folds and by March 2019, India has brought 3.566 m ha under organic production in which 56 % area is of cultivated agricultural lands. Currently only 1.3% of net cultivable area is under certified organic production systems and as per targets, government is aiming for 4 % in 2025 considering the growth rate of this sector. During 2018-19, India exported 6,14,089 t of produces worth Rs 5151 crores. Among the states, 59 % of cultivated farm area under organic production is shared by 3 states namely Madhya Pradesh (35 % of total cultivated farm area under organic agriculture in India), Maharashtra (13 %) and Rajasthan (11 %) shares higher area. Currently, India ranks 8th in terms of cultivable land under organic certification. 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. It

is expected that the domestic market will be the main growth driver in next 5 years. The estimated accessible and market potential in top 8 Metros indicates, it is having accessible potential of Rs 5620 million for various commodities.

In order to develop package of practices for organic farming in a system perspective, a Network Project on Organic Farming (NPOF) was initiated during 2004-05 by Indian Council of Agricultural Research (ICAR), New Delhi with ICAR-Indian Institute of Farming Systems Research (IIFSR) as lead centre. Initially, the project was operating with 13 centres covering 12 states. During XII plan, the numbers of centres of have been increased to 20 covering 16 states. The results of farmer participatory study on geo-referenced characterization of organic farmers, documentation and validation of organic farming ITKs, eight on-station experiments, one lab study on bio-chemical characterization of indigenous organic inputs and farmer participatory demonstration under TSP at various locations are presented in the report. Besides the study results, the other activities under taken by the centres such as publications, human resource development *etc* is also included.

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

Location of the centres of AI-NPOF

OBJECTIVES AND METHODOLOGY

02

Scheme Objectives

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

Methodology

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

LOCATION

03

Multi-location experiments were conducted during 2016-17 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.

Sr.	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, Nabi Bagh, Berasia Road, Bhopal – 462 038
3.	Calicut	Kerala	ICAR-Indian Institute of Spices Research, P.B. No. 1701, Marikunnu PO, Calicut – 673 012
4.	Coimbatore	Tamil Nadu	Tamil Nadu Agricultural University, Coimbatore – 641 003
5.	Dharwad	Karnataka	University of Agricultural Sciences, Yettinagudda Campus, Krishinagar, Dharwad-580 005
6.	Jabalpur	Madhya Pradesh	Jawaharlal Nehru Krishi Viswa Vidyalaya, Jabalpur-482 004
7.	Karjat	Maharashtra	Dr. Balasaheb Sawant Konkan Krishi Vidypeeth, RARS, Karjat, Dist. Raigad – 410 201
8.	Ludhiana	Punjab	Punjab Agricultural University, Ludhiana-141 004
9.	Modipuram	Uttar Pradesh	ICAR-Indian Institute of Farming Systems Research, Modipuram, Meerut -250 110
10.	Pantnagar	Uttarakhand	G.B.Pant University of Agriculture Sciences and Technology, Pantnagar, Udham Singh Nagar – 263 145
11.	Raipur	Chhattisgarh	Indira Gandhi Krishi Vishwavidyalaya, 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
Centres functioning from 2015-16			
1.	Ajmer	Rajasthan	ICAR-National Research Centre on Seed Spices, Tabiji, Ajmer-305 206,
2.	Almora	Uttarakhand	ICAR-Vivekananda Parvatiya Krishi Anusandhan Sansthan, Almora-263 601
3.	Gangtok	Sikkim	ICAR Research Complex for NEH Region, Sikkim Centre, Tadong, Gangtok
4.	Narendrapur	West Bengal	School of Agriculture & Rural Development, Ramakrishna Mission Vivekananda University, PO Belur Math, Howrah-711 202,
5.	Sardar Krushinagar	Gujarat	Sardar Krushinagar-Dantiwada Agricultural University, Sardar Krushinagar, Banaskantha –385 506
6.	Thiruvananthapuram	Kerala	ICAR-Central Tuber Crops Research Institute, Sreekariyam, Thiruvananthapuram - 695 017
7.	Udaipur	Rajasthan	Agricultural Research Station, Maharana Prataprana University of Agriculture and Technology, Udaipur

MANPOWER

04

No regular posts, in any category, have been provided and the responsibility was assigned to a scientist, nominated as Principal Investigator of AI-

NPOF, by the parent institute/ university (Names and contact addresses of PI's are given in Annexure10).

The scientists of related disciplines were also involved in the research programme by the respective institution. In addition, two senior research fellows (as contractual staff) have been provided at each centre.

SOIL AND CLIMATE

05

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

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

Sl. No.	Name of centre	Soil Type	Weather Rainfall(mm)	Temperature (°C) Max.	Mini.	R.H (%)	Latitude (N)	Longitude (E)
			Centres functioning from 2004-05					
1.	Bajura	Silty loam	499.7	21.8	5.3	88.6	-	-
2.	Bhopal	Vertisols, Clay Montmorillonite/ 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	Sandy, Clay, Loam soil	789	29.8	21.3	86	11°	77°.0′
5.	Dharwad	Clay loam	790.6	30.9	18.8	63.8	15°26′	75°07′
6.	Jabalpur	Vertisoils, Chromusterts	1662.4	33.9	14.4	75.0	-	-
7.	Karjat	Red and medium black	3457	42.9	11.6	-	18°92′	77°33′
8.	Ludhiana	Ustochrepts-Ustic pramments association, alluvial, sandy & sandy loam	721.7	33.52	17.02	76.22	24°35′	74°42′
9.	Modipuram	Alluvium soils Typic ustochrept	517	40.3	4.3	72.7	29°4′	77°46′

10.	Pantnagar	Hapludolls, very deep alluvium coarse loomy soils	1191.5	30.1	17.7	84.2	29°N	79°30′
11.	Raipur	Ochraquals association, deep black soil	1004.43	32.97	21.38	81.31	21°16′	81°36′
12.	Ranchi	Ultic Palesustalfs, very deep soils	588.4	34.35	19.31	85.04	-	-
13.	Umiam	Clay loam	2631.9	26.2	15.3	63.6	24°44′	76°48′
		Newl Centres functioning from 2015-16						
14.	Ajmer	-	450	-	-	-	35°39′	22°31′
15.	Almora	-	-	-	-	-	-	-
16.	Gangtok	-	2853.3	24.51	15.32	88.56	27032′	88060′
17.	Narendrapur	-	-	31.6	23	72.05	-	-
18.	Sardar Krushinagar	-	931.2	34.31	20.32	61.33	-	-
19.	Thiruvana -nthapuram	-	800.0	-	-	-	-	-
20.	Udaipur	Clay loam	721.7	33.52	17.02	76.22	24°35'	74°42'

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	-	-	-	-	-	-	-	-	-
Bhopal	0.53	154.2	12.8	530	4.92	5.52	0.74	7.85	0.50
Calicut	1.7	193	5.3	130	-	34	0.78	4.7	.28
Coimbatore	0.66	247	17.5	495	-	30.40	4.10	8.3	0.06
Dharwad	5.87	273.9	28.40	359	13.06	9.50	1.46	7.5	0.13
Jabalpur	0.68	263	12.6	296	9.6	2.39	0.35	7.3	0.39
Karjat	1.14	230	20.0	327	-	-	1.72	7.02	0.28
Ludhiana	0.56	278	36.3	134	-	-	-	8.1	0.50
Modipuram	0.59	-	-	-	-	-	-	-	-
Pantnagar	1.04	350	35.8	235	30.8	30.24	0.84	6.8	0.29
Raipur	0.64	237	13.0	274	-	-	-	7.67	0.28
Ranchi	0.38	320	48.0	270	-	59.8	1.22	5.56	-
Umiam	1.32	-	-	-	-	-	-	-	-
New Centres functioning from 2015-16									
Ajmer	-	130.46	12.06	359	-	-	-	7.10	0.13
Almora	-	-	-	-	-	-	-	-	-
Gangtok	0.93	320.7	17.9	417.8	23.78	-	2.18	5.57	-
Narendrapur	0.89	-	79.03	262.83	-	-	-	5.07	-
Sardar Krushinagar	-	168	12.15	172	8.1	3.5	0.37	7.21	0.14
Thiruvananthapuram	-	-	-	-	-	-	-	-	-
Udaipur	0.56	-	-	-	-	-	-	-	-

BUDGET

06

A total budget of Rs. 185 lakhs was released to 21 centers during 2016-17. The centre wise allocations of funds are given below.

Sl. No.	Name of University/ Institutes	Grant-in-Aid, Other than NEH & TSP					Grant-in-Aid TSP General	Grant-in-Aid, under NEH Component				
		Sub-head					Sub-heads	Sub-heads				
		T.A.	Other Cont.	Cont. Services	Information technology	Total Other than TSP & NEH	Other Contingencies	T.A.	Other cont.	Cont. Services	Total NEH	Grand Total
1.	HAREC, Bajaura	0.30	2.25	4.80	0.00	7.35	0.00	0.00	0.00	0.00	0.00	7.35
2.	ICAR-IISS, Bhopal	0.30	3.70	9.60	0.00	13.60	0.00	0.00	0.00	0.00	0.00	13.60
3.	ICAR-IISR, Calicut	0.39	1.96	4.00	0.00	6.35	0.00	0.00	0.00	0.00	0.00	6.35
4.	TNAU, Coimbatore	0.40	3.50	3.75	0.00	7.65	0.00	0.00	0.00	0.00	0.00	7.65
5.	UAS, Dharwad	0.35	3.00	4.00	0.00	7.35	0.00	0.00	0.00	0.00	0.00	7.35
6.	JNKVV, Jabalpur	0.20	2.25	4.00	0.00	6.45	0.00	0.00	0.00	0.00	0.00	6.45
7.	ARS, Karjat	0.15	1.50	2.85	0.00	4.50	0.00	0.00	0.00	0.00	0.00	4.50
8.	PAU, Ludhiana	0.20	1.50	3.61	0.00	5.31	0.00	0.00	0.00	0.00	0.00	5.31
9.	ICAR-IIFSR, Modipuram	0.11	4.70	2.39	0.00	7.20	0.00	0.00	0.00	0.00	0.00	7.20
10.	National PI, ICAR-IIFSR, Modipuram	0.75	5.28	4.00	0.00	10.03	0.00	0.00	0.00	0.00	0.00	10.03
11.	GBPUA&T, Pantnagar	0.40	4.66	5.50	0.00	10.56	0.00	0.00	0.00	0.00	0.00	10.56
12.	IGKV, Raipur	0.20	2.40	5.25	0.00	7.85	0.00	0.00	0.00	0.00	0.00	7.85
13.	BAU, Ranchi	0.10	1.25	3.50	0.00	4.85	0.00	0.00	0.00	0.00	0.00	4.85
14.	ICAR-RC-NEH, Umiam	0.00	0.00	0.00	0.00	0.00	0.00	0.50	6.75	7.12	14.37	14.37
15.	ICAR-NRCSS, Ajmer	0.30	3.50	5.75	0.00	9.55	0.00	0.00	0.00	0.00	0.00	9.55
16.	ICAR-VPKAS, Almora	0.40	5.32	4.88	0.00	10.60	0.00	0.00	0.00	0.00	0.00	10.60
17.	ICAR-NOFRI, Gangtok	0.00	0.00	0.00	0.00	0.00	0.00	0.50	4.75	5.38	10.63	10.63
18.	RMVU, Narendrapur (W.B.)	0.30	5.75	2.26	0.00	8.31	0.00	0.00	0.00	0.00	0.00	8.31
19.	SKDAU, Sardar Krushinagar	0.30	3.00	5.50	0.00	8.80	0.00	0.00	0.00	0.00	0.00	8.80
20.	ICAR-CTCRI, Thiruvananthapuram	0.34	4.72	6.43	0.00	11.49	0.00	0.00	0.00	0.00	0.00	11.49
21.	MPUA&T, Udaipur	0.40	5.80	6.00	0.00	12.20	0.00	0.00	0.00	0.00	0.00	12.20
	Total	5.89	66.04	88.07	0.00	160.0	0.00	1.00	11.50	12.50	25.00	185.00

(Rs. in lakhs)

RESEARCH RESULTS

07

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 farms household was fixed as target for collection of information. However, some centers have collected information from less or more number of farmers depending on the resources. The objective of the study was

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

Ajmer:

A total 63 farmers from Baran district of Rajasthan were Characterized during 2016-17

- 100 % farmers are having soil type of clay (black cotton soil) nature.
- 100% farmers are using only FYM while, 30% farmers are using FYM as well as vermi-compost as nutrient source for crop production.
- 4% farmers are having organically converted land, holding less than 1.0 ha, 60% farmers having between1.0 - 2.0 ha land holding and 36% are having more than 2.0 ha.
- Major crops in *kharif* are soybean, urad, maize and sesame whereas in *rabi* wheat, fenugreek, coriander, mustered and chickpea are the major crops.
- All the farmers are following hand weeding for controlling weeds and most of them are using *Trichoderma,* neem oil, Bt., *datura* extract, cow urine and cow dung ash as fungicide and insecticide.
- Average yield in wheat is 3600 kg/ha, fenugreek is 1800 kg/ha, coriander 1600-1800 kg/ha, mustered 1600 kg/ha and chickpea 1800 kg/ha.
- 100% of farmers are selling their produce in local market and not getting any premium price.
- 100% of farmers are adopted organic farming is due to harmful effect of chemicals on human and soil health.
- 100 % of the farmers are said that low yield and usual market price are the main drawback in organic farming. Among them 25% of the farmers are not able to manage pest and disease incidence.

Bajaura:

Geo-referenced characterization survey of organic clusters involving 23 households in village Bakrot of Ponta tehsil in district Sirmour, Himachal Pradesh were conducted.

- Total land holding in the village was 69.9 hectare and total area under organic farming was 26.3ha. The survey results indicated that 61% of farmers were marginal and 31% were small farmers.
- 13% of farmers had power tillers, 4% of farmers had thresher and power tiller both. In case of livestock inventory of the village, 100% of the farmers had cows and 57% had calves. Approximately 52% farmers also rear sheep/goats.
- In the village, gross area under vegetables, cereals, spices and oil seed crop was 56.9ha, 11.1ha, 8.5ha and 2.5ha with average production of 6510, 4320, 7730 and 3330 kg per hectare, respectively,

- Pea crop covered maximum area (13.2 ha) and total production (81.21 tonnes) in *kharif* season followed okra (7.54 ha. and 49.39 tonnes) and maize (5.56 ha. and 18.1 tonnes). A large proportion of the vegetable produce is sold in the market, however maize is consumed by the farmers.
- During *rabi* season, again pea occupied highest area (9.8 ha.) as well as total production (53.4 tonnes) followed by garlic and wheat which covered an area of 8.5 ha and 5.6 ha with a total production of 59.76 tonnes and 17.44 tonnes, respectively. The vegetables and spices produce is being marketed but cereal and oilseed is kept for their own consumption.
- Farmers grow only vegetables like cabbage and potato during summer season.Potato is grown in maximum area (16.8 ha.) than cabbage (9.5 ha.). Only a small quantity of their produce is kept for self-consumption and rest is sold in the market. The spices were found to be more remunerative with a net profit of rupees 244506/ha as compared to vegetables (rupees 50399/ha).
- The computation of gap in yield in NOPF experiments and farmers field revealed that all the crops had higher yield under experiment than farmers yield. The cabbage crop showed maximum yield increases (33.2%), whereas other crops

Bhopal:

Organic cluster survey has been carried out at selected villages' viz., Khamkheda, Kanera and Golkhedi, in Bhopal (M.P) and an inventory of the available resources of the village was prepared.

- Among the respondents, the highest total land holding size of the farmers was found to be 16.0 acres while minimum was 1.0 acre. Out of which the maximum area under organic farming was 3 acre and minimum was 0.5 acre.
- Farmyard manures (FYM) and vermin-compost are the major sources of the organic farming and mostly farmers used these organic manures.
- Crop residue availability for recycling of organic manures and farmers varied between 2–10 tonnes crop residue for organic recycling annually.
- Most of the farmers are growing soybean crop during *kharif* season and chickpea during *rabi* season while some farmers also growing wheat in some pockets areas during *rabi* season as per water availability.
- Neem oil and mattha are used as organic pesticide for the control of insect, pest and diseases in soybean and wheat crops.
- Farmers keep only 10-20 % of total farm organic produces for house hold consumption and the remaining produce are sold out in Krishi Mandi or local market.
- The reasons for behind adoption of organic farming include minimum purchase of external inputs while maximizing of on-farm inputs, good quality of farm products and farmers also realized that organic sources of nutrients improved the soil quality.
- Slow response of towards organic farming due to non-availability of good quality of organic sources of nutrient,
- Organic produce price are not stable and keep fluctuating time to time, lack of market infrastructure and cold storage facilities (very important for fruits and vegetables).

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 are pepper, coffee, coconut, arecanut, ginger, nutmug and banana.

- Land characterization of farmers are; Large-Nil/Medium-2/Small-30
- Farmers possessing farm animals - 19 and farm machineries - 17
- 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 is Hand Weeding

Characterization of organic cluster at Irulam Calicut

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	1.00	1,94,900
Ginger	6	0.42	1,11,510
Banana	8	0.72	64,583

- Major reason for adoption of organic farming-for healthy and safe food.
- Major Constraints-Low price , lack of Govt. support and labour

Gangtok:

- Thanka Martam village is situated in East district of Sikkim lying 27016'58"N lat 880 32'20"E long and 4511 ft. altitude., where geo-referenced characterization survey for organic farming were conducted.
- Total households 31 nos. of farm families reside in the village and base line survey has been completed in the village.
- Survey results showed that mostly small and marginal farmers (91.4%) in the village. The cropping intensity of the village is hardly 128 per cent. Crop production with low organic input was practices by the farmers resulting in very low yield of the crops. During winter season litter or no rainfall was observed in the village since last few years.
- Demonstration on organic ginger production technology was done under TSP has been initiated in Thanka village of East Sikkim during 2016.
- No–till vegetable pea technology was demonstrated in the village around 0.4 ha area and compared it with the conventional sowing and found that 24.4% increase in the yield in no-till planted over conventional planting.
- From the survey it was revealed that following cropping systems are followed: Maize-fallow, Maize-Tori/vegetablepea/mustard sag/cole crops/potato/onion/buckwheat, Maize-soybean (relay cropping), rice- fallow, ginger-maize/beans and large cardamom
- Some of the major constraints are Irrigation during winter season is one of the major problems. There is lack of water resource in this village especially in winter season and farming becomes very difficult in this condition. Insect pests and diseases infestation are the common and serious problems. Unavailability of organic high yielding seeds.

Karjat:

- Geo-referenced characterization of organic cluster at karjat in district raigad, Maharashtra was surveyed in organic cluster namely mhasala, mangaon and mahad. Total 30 farmers were characterized in which 9.02 ha. (26.35%) of land was found under organic farming with latitute-180.05.5995 to180.32.2683 longitude- 730.07.8476 to 730.42.7094.
- Cropping systems rice-vegetables was followed

Area, production and productivity of crops in gangtok:-

Crops	Area (ha)	Variety	Production (q/ha)	Productivity (q/ha)
Rice 3.3	Thulo Attey	59.33	17.98	
Maize	3.5	Local	56.42	16.12
Ginger	1.4	Local	33.95	24.25
Leafy vegetables	0.88	Local	23.33	26.54
Potato	0.7	(Sombarey) Local	22.54	32.20
Toria	0.36	Local	7.74	21.51
Pea	0.14	Local	5.21	37.25
Onion	0.025	Local	1.03	41.23
Buckwheat	0.161	Meethi phapar	1.19	7.43

including, in kharif rice crop, in rabi season, brinjal, okra, tomato, cucumber, snake gourd, ridge gourd, bottle gourd, bitter gourd, dolichos bean, chilli and onion were the major crops. Fruit crops (perennial mango, cashew, jackfruit and coconut) were adopting the farmers,

- Total lend holding 34.23 ha and soil type- red and medium black.
- Land holding size characterization of farmers are; Large-3(10%)/Medium-3 (10%) 2/Small-20(66.67%) under area 14.10 ha. under organic farming 9.02 (26.35%).
- Farmers possessing farm animals - 86, buffalo-11 Nos., cow-25 Nos., bullock-50 nos. and farm machineries - 17
- Crop residue availability within the farm for recycling shed waste-69.94%, straw-29.98% and poultry wast-0.08%.
- Plant protection measures for controlling the weeds through hand weeding in seasonal crops and animal grazing in rainfed fruit crops.
- Major organic inputs used : FYM, compost and vermin-compost
- Insect pest management: cow urine and Dashparni Aark.

Constraints:

Scarcity of laborer's and high wage rates due to urbanization and industrialization. Lack of information about organic inputs, Non-availability of labours at the time of transplanting and harvesting, Fluctuation in market prices and lack of co-operative marketing

Modipuram

- Information was collected from 20 farmers who had experienced the cultivation of organic farming.
- All the farmers belong to irrigated farming situation.
- Among all, 25% of the farmers were adopted organic farming on their entire land holding.
- Area under organic cultivation varies from 0.16 to 6.4 hectare where, one farmer started organic farming in ninetieth decade, whereas majority of the farmer 17 out of 20 initiated organic farming during 2005 and onward.
- Out of 20 harmers, 45% farmers (9 number) discontinued organic farming. Lower yield, lack of technical awareness, non-availability of organic inputs such as varmi compost, manure in sufficient quantity responsible for the

discontinuation.

- Marketing was an important aspect in the adoption as well as in sustainment 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. Produced of their farmers is going through personal efforts.
- While collecting information on reason for adoption, health consciousness found to be the top among successful organic farmer. Some of them however reported persuasion by the NGO or government machinery.
- Apparently there was no direct relation with number of organic farmers and number of animal reared. Only few farmers were found to produce vermicompost whereas majority of them dependent on farmyard manure.
- Paddy 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 14 farmer growing paddy organically 3 farmers recorded paddy yield 4000 kg per hectare whereas, 5 farmers recorded paddy yield between between 2000 to 4000 kg per hectare and 6 farmers recorded less than 2000 kg per hectare.
- During rabi, wheat was the major crop grown organically where majority (76%) farmers recorded wheat yield less than 3000 kg per hectare.
- Regarding plant protection, almost all the farmers control with manually (hand weeding). The incidence of insects was very low whereas bio pesticides were used bijamrit, panchagaya, vermin-wash or some other herbal preparation/extract. Except one, all the farmer for uncertified. The only one was reported to be certified USOCA. Some of them were associated with Organic Farmers Association of India, Lok Bharati Uttar Pradesh and one by RSS.

Pantnagar

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

- Among the 40 farmers surveyed, the highest total land holding size of the farmers under organic was found to be 1.0 ha while minimum was 0.08 ha. Out of which the 10% organic farmers having 1 ha land, 40% farmers having 0.08 ha and 50% farmer land holding size found to be in ranged 0.20 to 0.28ha.
- Number of farmers and area under organic farming has been increased specially area under organic basmati rice has also increased.
- Increase in income by organic basmati rice with less transit losses and without rejection at mandi has been observed.
- Organic basmati proved to more remunerative as compared to conventional basmati rice.

Thiruvanthapuram

- Geo-referenced characterization a survey of 33 farmers practising organic farming in Varkala, Neyyattinkara and Vamanapuram blocks, in Thiruvananthapuram district, Kerala, was done .

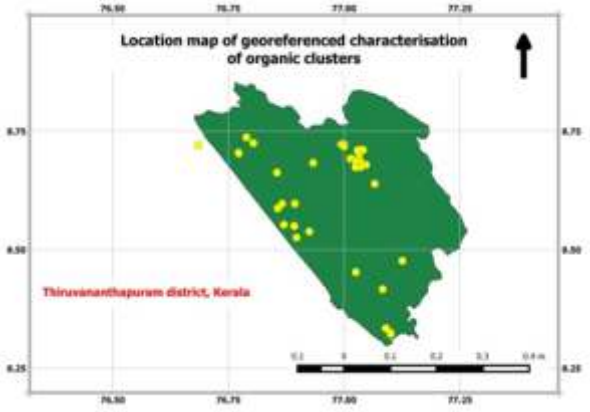


Fig.1.Location maps of georeferenced characterization of organic clusters in Thiruvanthapuram

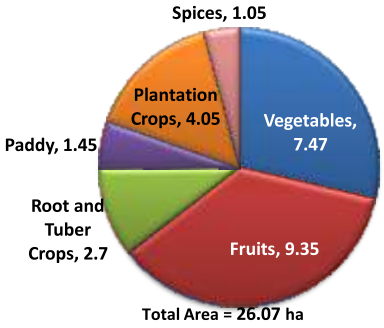


Fig. 2. Area occupied by crops

- About 61% of farmers had a land holding size < 1 ha, 33% 1-2 ha and 6% >2 ha in Thiruvanthapuram.
- The farming situation was rainfed (100%), but irrigated during summer.
- Soil type was laterite (100%).
- Being health conscious and aware of the quality of the organic produce, all the farmers used the organic produce for their house-hold consumption (100%), and the surplus was sold to the market by 93.93% of the farmers.
- Major Crops: Fruit crops (banana, papaya, pineapple); Vegetables (okra, brinjal, bitter gourd, chillies, tomato, amaranth, vegetable cowpea); Root and tuber crops (cassava, sweet potato, yams, taro); Spices (ginger, turmeric) and Plantation crops (coconut, arecanut, rubber) .
- About 48.5% of the surveyed farmers owned cow, 21.21% had goat, 48.48% had poultry (hen and duck) as an integral part of organic farming. Pisciculture was also practiced on a small scale (6.06%).

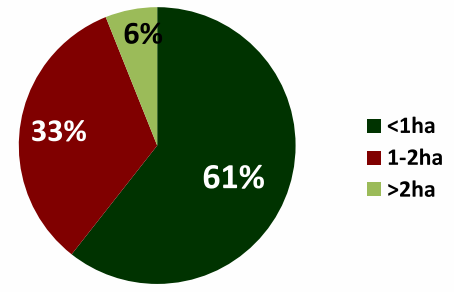


Fig. 3. No. of farmers based on land holding size

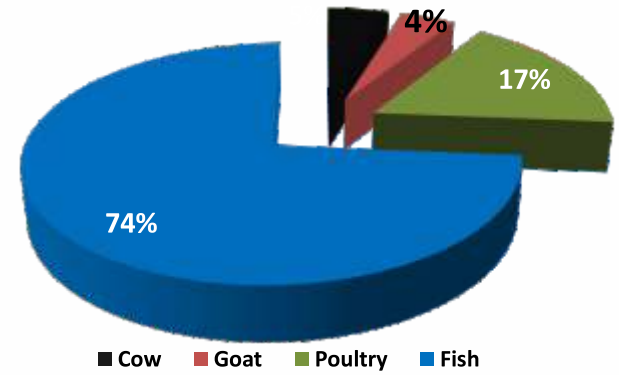


Fig. 4. Relative share of farm animals

- **Organic recycling units:** Organic recycling units: Animal wastes were converted to excellent manures using biogas (in 18.18% cases) and vermi compost units (18.18% farms) (with an average capacity to produce nearly 200 kg compost/annum).
- **Organic sources:** Nutrient sources for organic farming constituted cow dung slurry (100%), poultry manure (90.9%), vermicompost (78.78%), biogas slurry (18.18%), bio-formulations like *Jaivavalachaya* (3.03%), *Jeevamrutham* (6.06%), *Amritapani* (3.03%), *Ezhilakuttu* (6.06%), egg amino acid (30.3%), fish amino acid (30.3%), *Panchagavya* (60.6%), *Anchilavaratti* (6.06%), groundnut cake (48.48%) and *Gliricidia* (72.72%). Majority of farmers conducted soil testing before raising the crop.
- **Type of farm**: Uncertified (100%), but certified as safe-to eat (6.06%).
- **Constraints faced**: High input cost, non availability of quality organic manures, labour shortage, small and fragmented land holdings, low price of the produce, damage due to pig attack

Udaipur

Total 56 households selected from four tehsils i.e. Sarada, Salumber, Gogunda and Jhadol of Udaipur District and one tehsil i.e. Bhopalsagar of Chittorgarh




Glimpses of the survey at Thiruvananthapuram district

district were surveyed during 2016-17 The highlights of the Geo-referenced on–farm characterization of organic growers of Rajasthan are given below.

- Average land holding size is 1.68 ha whereas, average land holding size under organic farming is 0.63 ha.
- Average number of animals per household is 5.57.
- Average number of animals per ha is 3.24.
- Average vermicomposting production is 4.66 tonnes year^{-1}.
- Crop residues available for recycling is 2.26 ton/household.
- Majority of farmers grow maize in *kharif* and wheat in Rabi.
- Average yield of maize is 19.2 q/ha and average yield of wheat is 40.0 q/ha.
- Fruit and vegetables were grown organically for


Survey at village (Namala)


Survey at village (Tulsiyo ka Namla)

- ***Jaivavalachaya*** is used for early flowering and fruiting. Prepared by mixing 5 kg cowdung + 5 litres urine + 1 kg neem cake + 1 kg groundnut + 1 kg banana and kept for 10 days.
- ***Egg amino acid*** is prepared by mixing 15 eggs + lime juice (1.5 kg), after 10 days deshelling is done and 500 g jaggery is added.
- ***Anchilavaratti*** is a herbal preparation out of 5 herbs, ie., neem leaf, *Nochi*, *Casuarina* (*Konna)*, *Kiriyath* and *Thulsi* + cow urine.

home consumption.

- On average, 3.50 ton FYM/ha in maize during *Kharif* and 1.81 tonne FYM/ha in wheat during *Rabi* was used.
- Use of neem leaves and Go mutra based indigenous botanical concoctions were used for plant protection in crops, fruit and vegetables.
- On average, 6.57 kg neem leaves were used as insecticide during *Kharif* & *Rabi.*
- For weed management during *Kharif* & *Rabi* season, only hand weeding is done.
- On average 36 man-days during *kharif* and 25 man-days during *rabi* were used in weeding.
- 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.
- Farmers are registered with Fair Certification Private Ltd for organic certification.
- Organic Certification
  - : Fair Certification Private Ltd
  - : Organic in-conversion


Survey at village (Padada)


Survey at village (Bobas)


Survey at village (Badwai)


Survey at village (Chanda ji gudha)

Geo-referenced on – farm characterisation of organic growers of Rajasthan

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 systemsand its influence on crop productivity and soil health.

Objectives

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

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

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

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

Main Plot	Organic management (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	5. 50% organic + 50% inorganic source of nutrients and management
	(Towards organic)	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 integratedmanagement 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	0.76	1.8	0.32
	Neem cake	1.45	0.36	1.45
	Ash	-	0.25	6.6
	Vermi-compost	0.66	0.93	0.54

	Green leaf manure	2.15	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	.025	0.50
	Glyricidia(Green leaf manure	0.50	0.32	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	-
	Tephrosiaspp	3.31	0.44	1.46
Narendrapur	Vermicompost	1.5	1.0	0.5
	Sashyagavya	1.0	0.015	0.125
SardarKrushinagar				
Thiruvananthapuram	Green manure cowpea	2.80	0.52	2.02
	FYM	1.28	0.50	0.28
	Neem cake	0.95	0.29	0.59
	Vermi compost	0.97	0.42	0.45
	Ash	1.40	0.29	4.65
	Panchagavya	0.22	0.061	0.40
	Vermi wash	0.02	0.004	0.20
	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 2016-17 for each centre are presented and discussed below.

Studies on comparative efficiency of organic, inorganic and integrated management practices on economic yield, straw yield and system equivalent yield of different cropping systems (Table 1-3)

Bajaura:

Among the crops evaluated under vegetable based cropping systems, all the management practices in tomato-cauliflower-frenchbean system recorded more or less similar tomato fruit yield during *Kharif* however, higher tomato fruit yield (2467 kg/ha) was observed with organic package with (75% organic + innovative organic practices). Like that tomato yield (10280 kg/ha) in *summer*was also found to be higher with organic package (75% organic + innovative organic practices) and the yield difference over inorganic and integrated was observed to the tune of 111.5 and 19.8%.The maximum curd yield of cauliflower (12400 kg/ha) in *rabi* was recorded with 100% inorganic but integrated package with 50% each organic and inorganic nutrient source also produced good yield i.e. 12000 kg/ha. Response of black gram (1008 kg/ha),lady finger (9911 kg/ha) and pea (6975 kg/ha) were found to be higherin integrated package consisting of 50% organic+50% inorganic management approach while, *summer* frenchbean and summer squash recorded higher yield (7500 and 15560 kg/ha respectively) under integrated package with 75% nutrient from organic + 25% nutrient sources. However, yield was increased for black gram and okra to the tune of 43.6 and 72.6% respectively during *kharif* and 70.4% for pea whereas; *summer*

Cauliflower and tomato towards organic management at Bajaura

frenchbean and squash yield was increased of 60.3 and 68% respectively over inorganic.

In terms of system equivalent yield, blackgram-cauliflower-summer squash resulted in higher cauliflower equivalent yield (28435 kg/ha) among the cropping systems. Among different management practices, integrated management with 50% organic+50% inorganic dose of nutrients resulted in higher equivalent yield (27023 kg/ha) followed byapplication of 75% nutrients only through organic manures+ 25% nutrient supply through inorganic sources (25879 kg/ha). The equivalent yield in term of cauliflower equivalent was increased to the tune of 56 and 23.3% with integrated nutrient (50% each organic and inorganic) overinorganic and organic nutrient management.

Bhopal:

All the crops in the systems recorded higher yield under organic management compared to inorganic and integrated management practices.Organic management practice with75% 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 (1121 kg/ha) was recorded under 100% organic management followed bymanagement practices either with 75% nutrients application through organic manures +innovative practices (1017 kg/ha) or under integrated (1074 kg/ha). The yield of soybean was found to be higher by 23.1% and 17.9% compared to inorganic

Soyabean and wheat crop under organic management at Bhopal

package respectively. The yield of *duram* wheat, mustard, chickpea and linseed was recorded maximum in 100% organic management of 3139, 1285, 1828 and 1530 kg/ha respectively.The yield difference between organic andinorganic management was 12.2, 17.6, 13.3, and 11.4 % 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 equivalent yield (3075 kg/ha) with 100% nutrients through organic manures followed by integrated with75% nutrients application through organic manures + 25% inorganic (2983 kg/ha)than inorganic management packages.The soybean equivalent yield was increased with organic management of 16.6over inorganic however, 75% nutrient supply was made through organic manure +25% inorganic under integrated management recorded on par equivalent yield. Among the cropping systems, soybean-chickpea recorded higher yield (3201 kg/ha) followed by soybean-wheat (2906 kg/ha).

Calicut:

Spices crops such as ginger and turmeric were evaluated under different management packages. Among the 11 turmeric varieties evaluated under different management systems, integrated package consisting of 75% nutrient supply through organic manure +25% inorganic recorded higher yield of turmeric (29900 kg/ha) followed by 100% application of nutrients through organic manures resulted in higher yield of turmeric (29136 kg/ha). Among varieties, Suguna recorded highest yield (41800 kg/ha) with organic package followed by Sudarshna (40800 kg/ha) under integrated management practice (50+50%). All the turmeric varieties performed better with integrated package of 75% organic+25% inorganic. In case of ginger, yield was higher under


Turmeric – field view


Turmeric rhizome


Ginger – field view


Ginger rhizome

integrated nutrient management either 50% each organic and inorganic manure or 75% organic + 25% inorganic manure of 22500 and 22760 kg/ha respectively and in comparison to inorganic the yield of ginger was increased to the tune of 168.4 and 165.3% respectively.

Coimbatore:

Among the management practice, all the crops registered higher yield towards organic with 75% nutrients supply through organic manures+25% through inorganic source under integrated management compared to 100% nutrients supply through organic sources and inorganic management. Cotton yield was increased to the tune of 15.5 and 10.5% with integrated nutrient package of 50% each nutrient through organic and inorganic manure whereas the yield of maize (6685 kg/ha), sunflower (4772 kg/ha), chilli (5840 kg/ha) and beetroot (2400 kg/ha) was recorded higher with 75% nutrient through organic+25% inorganic in integrated management. The yield was increased by 19.3, 13.3, 7.2 and 36.4% over inorganic management respectively.

Beetroot and sunflower crop under organic production system at Coimbatore

Dharwad:

Cowpea, safflower and pigeon pea recorded higher yield under integrated nutrient management whereas, sorghum and chick pea recorded higher with organic package. Groundnut, maize and cotton performed better under inorganic management practice. Under organic nutrient management, the yield of sorghum and chickpea was increased to the tune of 114.3 and 26.7% respectively over inorganic. Reduction in yield was found to be 13.4, 25.0 and 23.8% in groundnut, cotton and maize respectively compare to organic production package.

Cotton and sorghum crop under organic production systems at Dharwad

Jabalpur:

During *kharif* season, basmati rice was grown in all 4 cropping system along with wheat (duram), chickpea, maize (fodder), berseem, vegetable pea and sorghum in rabi. Mean grain yield of rice across the cropping systems was affected with the different nutrient management, however the maximum grain yield of rice (3332 kg/ha) was recorded under 100% inorganic management with overall mean (3197 kg/ha)which was slightly decreased to the tune of 8.2 and 7.5% in 100% organic and integrated (50% organic + 50% inorganic) nutrient management respectively. Yield of wheat (5033 kg/ha), berseem fodder and seed (73100 and 273 kg/ha), vegetable pea (3420 kg/ha) during rabi and maize fodder (48492 kg/ha) and sorghum fodder (80640 kg/ha) during summer were also recorded higher under inorganic nutrient package with 100% inorganic nutrient management. Only chick pea yield was higher with integrated of 581 kg/ha.The reduction in the yield of wheat, berseem fodder and seed, vegetable pea, maize fodder, and sorghum fodder with100% organic management manure was found to be 16.0, 9.0 & 13.6, 28.7,13.4 and 20.9% respectively over inorganic nutrients management. Total productivity of cropping system in terms of basmati rice equivalent was recorded higher with 100% inorganic nutrient management (6914 kg/ha/year).Among the crop-sequences, rice-vegetable pea- sorghum fodder led to record highest rice equivalent yields (6997 kg/ha/year) followed by rice-berseem (fodder and seed), rice-wheat and rice-chickpea-maize fodder in descending order.

Soybean and chickpea crop under organic production system at Jabalpur

Karjat:

The rice based cropping systems have been changed from 2016-17. Therefore, the rice grown during *kharif* 2016 was followed by previous systems. Among the different crops, across the cropping systems, higher mean yield of rice (4656 kg/ha) was recorded with integrated application of 50% organic +50% inorganic nutrient from organic and inorganic manures/fertilizer followed by 100% inorganic management (4581 kg/ha) and found to be on par to each other. The yield variation by management package with 100% organic and reduced dose of organic manure was recorded only 2.2, 10.3 and 3.01% lower than the integrated management i.e. 50% each nutrient of organic and inorganic manure. Other crops such as brinjal also resulted in higher with inorganic condition (49985 kg/ha). Field bean recorded higher yield with organic nutrient package having 100% nutrient supply through organic sources and yield was found to be higher only 20kg/ha over inorganic nutrient management. Integrated nutrient management practices found to be better for chick pea and onion with 50% nutrient supply through organic and 50% through inorganic sources (1657, and 17379 kg/ha). System equivalent yield in term of rice equivalent, rice-

brinjal system grown with organic package of 100% nutrient by organic sources produced maximum rice equivalent yield (53303kg/ha)compared to other treatments followed by same system grown under 75% organic + innovative practices (48396 kg/ha). Among the management package, organic management with 100% nutrient supply through organic sources recorded 38.0 and 15.4% higher over inorganic management practice respectively.

Dolichos bean and rice crop under organic production system at Karjat

Ludhiana:

In case of basmati rice, organic, inorganic and integrated management did not influence, however maximum basmati rice yield (4490 kg/ha) was recorded with organic management through application of 100% organic manure in basmati rice-wheat system. During *kharif*, higher seed yield of soybean (1800 kg/ha) was also obtained under organic package with 75% organic + innovative practice and it was 45.2% higher to inorganic packages. Crop clusterbean was also higher with 100% organic management and it was increase to the tune of 69.5%. During *rabi,* chickpea (590 kg/ha) performed better under organic with 75% organic + 25% inorganic practice under integrated and produced significantly 59.5% more seed yield compared to 100% inorganic practices. However, wheat recorded higher yield (6040 kg/ha) under inorganic package about 16.7% less yield was recorded with 100% organic management. Among the management practices,system equivalent yield resulted in higher with 75% organic + 25% in integrated management, but it was on par to inorganic and organic management with application of 75% organic manure + 25% in innovative practice (8477kg/ha). Among the cropping systems, wheat equivalent yield was found to be higher (8692 kg/ha) in basmati rice-wheat system.

Basmati rice and maize+cowpea crops under organic production system at Ludhiana

Modipuram:

Rice and maize crops during *kharif* with different crops such as wheat, greengram, barley, potato, mustard in *rabi* and okra in summer were evaluated under cropping system mode. During *kharif*, basmati rice yield was increased by 18.6 and 11.2% with organic management along with highest grain yield of 4125 kg/ha. Grain yield of coarse rice was found to be higher under state recommendation (4250 kg/ha). About 14.3 and 11.8% yield reduction was observed with 100% organic and integrated (50% each organic and inorganic) nutrient management compared to state recommendation package. Highest maize popcorn as well as sweet corn cob yield (5940 and 7660 kg/ha) was found to be higher also with state recommendation package. The reduction in cob yield with organic and integrated was found to be 20.03 and 18.5% while under integrated, 8.3 and 7.7% yield was decrease compared to state recommendation production system, respectively. During *rabi* wheat, barley, potato and mustard yield also recorded higher with state recommendation, the reduction in the yield were found to be 35.2, 11.7, 22.2 and 12.9% respectively under 100% organic package. In summer, green gram resulted in higher yield (725 kg/ha) with integrated (50% each organic and inorganic) nutrient management. Okra recorded higher yield (6150 kg/ha) under inorganic condition with state recommendation. The reduction in yield for okra was noticed by 8.94 and 8.3% with organic management and integrated respectively. Straw yield for different crops followed the same trends. The system equivalent yield were higher (9236 kg/ha) in organic packages while all other nutrient management systems being on par. Among the cropping systems, higher system equivalent yield (10796 kg/ha) was recorded with maize (sweet corn)-mustard followed by maize (popcorn)-potato-okra system because of higher yield of potato and good premium price.

Okra and summer moong under organic production system at Modipuram

Pant Nagar:

Basmati rice based cropping system was evaluated under different management packages. Grain yield of basmati rice (4973 kg/ha) found to be higher (4819 kg/ha) with 100% organic package followed by 75% organic+ innovative practices (4819 kg/ha) as compared to inorganic and integrated management. It was increased by 39.9 and 27.9% over inorganic. In *rabi*, wheat yield (5115 kg/ha) was highest under integrated package (50%organic+50% inorganic) which was on par to 75% organic+25%inorganic, that indicate better performance towards the organic production system and it was increased by 8.6 and 7.1% compare to inorganic. Coriander was raised as intercrop of 2 rows with chickpea and vegetable pea in

the manner of 4: 2 ratio. Equivalent yield of inter crops was calculated and reported. Chickpea equivalent yield as influenced by different nutrient management practices recorded highest (2135 kg/ha) in integrated package with (75% organic+25% inorganic) whereas pea equivalent yield being highest (12850 kg/ha) in organic package with 75% organic +innovative technology. Organic management package was increased for chickpea and pea equivalent yield to the tune of 12.8 and 25.3% over inorganic practice.A remarkable difference in tuber yield of potato was found to be under organic managementand increase in yield was found to be 22.3% over inorganic. System productivity in terms of basmati rice equivalent yield was found to be higher (10383 kg/ha) with organic management having 100% nutrients through organic manures followed by 75% organic nutrients +innovative practices (10284 kg/ha). Among all the cropping systems, higher system productivity was recorded with rice-vegetable pea +coriander-*sesbania* (12274 kg/ha) followed by rice-chickpea +coriander-*sesbania* system (11788 kg/ha).

Basmati rice and Chick Pea crop at Pant nagar

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 higher under organic production management with 75% organic manure +innovative practices of foliar spray of vermiwash (10%) followed by cow urine (10%) at 20 days interval (2153 kg/ha). The enhancement in yield was found by 16.3 and 15.9% over to 100% inorganic and integrated nutrient management. Other crops

Onion and Soybean crop under organic production systems at Raipur

such as maize (sweet corn), pea, and chilli also resulted higher yield (14850, 8007 and 9081 kg/ha respectively) under 75% organic manures+ innovative practices (foliar spray of vermiwash (10%) followed by cow urine (10%) while, onion bulb yield resulted in higher with state recommendation (17463 kg/ha) and yield reduction in onion with organic was found to be 17.1%. The yield differences from 100% organic to inorganic were found to be 11.8, 13.5 and 10.5% for maize, pea and chilli respectively. The straw yield of all crops was also found to be in same trend. The productivity of cropping system converted into soybean equivalent yield and the maximum mean soybean equivalent yield (10308 kg/ha) was recorded under organic management with 75% organic nutrient + innovative practices and it was increased by 23.2% over inorganic. Soybean-onion registered higher soybean equivalent yield (10460 kg/ha) among the cropping systems.

Ranchi:

Rice based cropping systems were evaluated where, different crops such as wheat, potato, linseed, & lentil were grown with basmati rice variety Birsamati. In rice, higher yield (4436 kg/ha) was found under organic management with 75% organic nutrient through organic 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) and inorganic were found to be 9.7 and 24.6% respectively. Wheat recorded highest yield (2927 kg/ha) under inorganic package with 100% inorganic nutrients package. The yield was decrease with 100% organic and towards organic (75% organic+25% inorganic) by 14.6 and 7.1% respectively. Potato and linseed recorded higher yield (23027 & 981 kg/ha) under organic package of nutrient with 100% nutrient supply through organic sources while, lentil recorded higher yield (575 kg/ha) under integrated package (50% organic+50% inorganic).The yield was increased with organic in potato and linseed to the tune of 67.1 &39.9% and 30.1 & 27.2% respectively over inorganic and integrated nutrient package. Among the management practice, systems equivalent yield was higher (8705 kg/ha) in organic nutrient package with 100% organic source of nutrients followed by 75% organic + innovative practices. Among the cropping systems, rice-potato recorded highest system equivalent yield (13569 kg/ha) while rice-linseed recorded lower equivalent yield (4811 kg/ha).

Rice and Lentil crop under organic production systems at Ranchi

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% iInorganic		
	Kharif	*Rabi*	*Summer*	*Kharif*	*Rabi*	*Summer*	*Kharif*	*Rabi*	*Summer*	*Kharif*	*Rabi*	*Summer*	*Kharif*	*Rabi*	*Summer*	*Kharif*	*Rabi*	*Summer*
Bajaura																		
Tomato-cauliflower- french bean	2404	9320	6210	2467	9780	6700	2240	8250	4680	2422	12400	6650	2437	12000	7260	2396	11700	7500
Fallow-cauliflower-tomato		7300	9850		7580	10280		6760	4860		9789	6690		8584	8620		8142	7860
Black gram-cauliflower- summer squash	902	8900	10660	898	9430	11780	702	6150	9260	985	9700	11320	1008	11410	14540	942	11030	15560
Lady finger-pea	6671	5721		6921	5921		5741	4092		7101	6830 P		9911	6975		8830	6511	
Bhopal																		
Soybean-durum wheat	1139	3139	-	1009	2892	-	944	2797	-	927	2785		956	2816	-	1094	3133	-
Soybean- mustard	1090	1285	-	1037	1178	-	858	1093	-	901	1063		935	1137	-	1093	1248	-
Soybean- chickpea	1167	1828	-	975	1732	-	849	1613	-	891	1587		1036	1692	-	1079	1754	-
Soybean- linseed	1089	1530	-	1048	1463	-	991	1374	-	976	1380		951	1415	-	1029	1494	-
Soybean mean	1121			1017			911			924			970			1074		
Calicut																		
Turmeric	29136	-	-	24873	-	-	21091	-	-	-	-	-	27618	-	-	29900	-	-
Ginger	14780	-	-	18590	-	-	8480	-	-	-	-	-	22500	-	-	22760	-	-
Blackpepper	1960	-	-		-	-	2050	-	-	-	-	-	2310	-	-	-	-	-
Coimbatore																		
Cotton - maize	1523	5461	-	1720	6042	-	1489	5876	-	1410	6225	-	1645	5959	-	1560	6416	-
Chillies - sunflower	5047	3919	-	5367	4378	-	5450	4212	-	5612	4583	-	4933	4278	-	5840	4772	-
Beetroot - maize	1980	5298	-	1940	5140	-	1760	5605	-	1930	6120	-	2020	6230	-	2400	6685	-
Dharwad																		
Cowpea-safflower	5872	475		6094	422		6571	515		6537	620		6849	650		6134	474	
Pigeon pea (Sole)	951			855			1111			1108			952			1308		
Green gram-sorghum	532	2132		260	1846		519	995		614	696		465	1458		477	1413	
Groundnut + hybrid cotton (2:1)	1022+1187			1329+1127			1362+1006			1267+1373			1171+1242			1183+1119		
Maize-chickpea	4556	1720		4211	1492		5975	1357		5976	1580		5224	1519		4087	1462	
Jabalpur																		
Basmati rice–wheat (durum) -green manure	2898	4231	-	2506	3829	-	3233	5033	-	2032	4762	-	3110	4791	-	3045	4623	-
Basmati rice–chickpea - maize fodder	2876	406	42000	2524	387	27000	3027	571	48492	2278	423	37200	3369	581	43440	2977	442	35640
Basmati rice–berseem (fodder and seed)	3010	66500 (F) 236 (S)	-	2713	62300 (F) 209 (S)	-	3332	73100 (F) 273 (S)	-	2466	65200 (F) 216 (S)	-	3185	61700 (F) 263 (S)	-	3055	54900 (F) 234 (S)	-
Basmati rice–vegetable pea- sorghum (fodder)	2952	2440	63744	2647	2010	58740	3197	3420	80640	2831	2970	72480	3024	3210	73680	2878	2840	72240
Basmati rice mean	2934			2598			3197			2402			3172			2989		
Karjat																		
Rice-brinjal	-	45057		-	41100		-	49985		-	35960		-	46270		-	44676	
Rice-chickpea	-	1557		-	1357		-	1408		-	1236		-	1657		-	1647	
Rice-field bean	-	1070		-	907		-	1050		-	879		-	1064		-	979	
Rice-onion (White)	-	16368		-	11311		-	14672		-	11180		-	17379		-	13041	
Rice mean	4555			4174			4581			4303			4656			4516		
Ludhiana																		
Basmati rice-chickpea-GM	4210	210		4340	370		4370	370		4340	330		4200	520		4260	590	
Basmati rice-wheat-GM	4490	4060		4430	4090		4090	4980		4140	4960		4120	4580		4170	4120	
Cluster bean-wheat-summer moong	1390	5950		1260	5940		820	5760		950	5760		1260	5960		1230	5780	
Soybean -wheat	1770	5030		1800	5080		1240	6040		1180	5950		1490	5600		1350	5770	
Modipuram																		
Basmati rice– wheat (*durum*) - *sesbania* green manure	4125	2950		3868	3130		3478	4490		3630	4550		3540	3850		3500	3490	
Rice– barley (*malt*) – green gram	3640	3930	530	3520	4080	480	4130	4390	540	4250	4450	590	3750	4230	725	3550	4100	660
Maize (*pop corn*) – potato– okra -*sesbania* green manure	4750	20739	5600	4520	19703	5100	5760	25009	5950	5940	26639	6150	5450	22998	5640	4900	21892	5386
Maize (*sweet corn*) – mustard - *Sesbania* green manure	6250	2530		6000	2360		7420	2815		7670	2905		7080	2710		6670	2570	
Pantnagar																		
Basmati rice-wheat	-	4654		-	4520		-	4710		-	4740		-	5115		-	5042	
Basmati rice – chickpea (4 rows chickpea + 2 rows coriander)	-	1045+1052(*2022)		-	995+1180 (*2091)		-	910+1058 (*1892)		-	960+985 (*1875)		-	960+1165 (*2087)		-	1010+1212 (*2135)	
Basmati rice -vegetable pea (4 rows vegetable pea +2 rows coriander)	-	6125+1180 (*12517)		-	6160+1235(*12850)		-	5900+1005(* 10255)		-	5820+1012(* 10205)		-	6100+1060(*10693)		-	6150+995 (*10642)	
Basmati rice -potato	-	14020		-	13550		-	11460		-	11005		-	13112		-	12460	
Bsmati rice mean	4973			4819			3769			4035			4302			4573		
		*chickpea and vegetable pea equivalent yield																

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*
Raipur																		
Soybean-maize	2013	13613		2166	14850		1827	13279		1721	13731		2096	11625		1772	10794	
Soybean-pea	2403	6952		2107	8007		2030	7053		2052	7968		1665	7851		1927	6111	
Soybean-chilli	2110	8444		2114	9081		1903	8221		1928	9010		1740	8656		1665	8779	
Soybean-onion	1762	14481		2225	16896		1655	14835		2035	17463		1927	10333		1729	14835	
Soybean mean	2072			2153			1854			1934			1857			1773		
Ranchi																		
Rice -wheat	4420	2499		4463	2370		3684	2927		3056	2071		3998	2642		3827	2713	
Rice -lentil	4284	464		4505	411		3491	525		3070	375		3970	575		3784	543	
Rice -potato	4377	23027		4598	21170		3670	13780		3206	11138		4277	16458		4077	18671	
Rice -linseed	3991	981		4177	915		3392	721		2856	660		3927	771		3756	857	
Rice mean	4268			4436			3559			3047			4043			3861		
Umiam																		
Vegetable-vegetable systems on raised bed																		
Broccoli -carrot	13250	16500		12220	13350		12240	14250		-	-		13710	16930		-	-	
Broccoli - potato	13570	17120		11920	16500		11850	14910		-	-		13250	17450		-	-	
Broccoli -french bean	16480	9940		14500	16930		13960	8150		-	-		15460	9670		-	-	
Broccoli -tomato	15670	18870		14380	14250		13150	15770		-	-		15110	17520		-	-	
Broccoli mean	14743			13255			12800			-	-		14383			-	-	
Rice- fallow system on sunken bed																		
Megha aromatic 2–fellow	4330			3590			4530			-			4570			-		
Shasharang –fellow	5100			4220			4320			-			4830			-		
Ngoba –fellow	4310			3990			3720			-			4490			-		
Lampnah –fellow	4520			4370			4260			-			4610			-		
Mean	4565			4043			4208			-			4625			-		
New centres started from 2015-16																		
Ajmer																		
Green gram – fennel	580	1157		843	1093		902	1073		990	1249		923	1147		1060	1308	
Green gram - coriander	580	556		843	617		902	570		990	650		923	607		1060	683	
Cluster bean - fennel	1689	1157		1803	1093		1948	1073		2000	1249		1977	1147		2021	1308	
Cluster bean – coriander	1689	556		1803	617		1948	570		2000	650		1977	607		20213	683	
Gangtok																		
Maize + ginger-french Bean	2430 + 10290	3890		1950 + 9490	3670		-	-		1560 + 7840	2380		1810 + 8530	2930		-	-	
Maize + soybean-buckwheat	2430 + 1020	1580		1950 + 940	1330		-	-		1560 + 720	670		1810 + 900	930		-	-	
Maize +turmeric-rajmash	2430 + 24840	3000		1950 + 21730	2110		-	-		1560 + 18100	1870		1810 + 19810	1960		-	-	
Maize+ pigeon pea	2430 + 850	-		1950 + 790	-		-	-		1560 + 610	-		1810 + 740	-		-	-	
Narendrapur																		
Paddy (sohini 2)–broccoli –*sesbania* green manure	2610	1628		2681	1522		2422	1290		2428	1277		2691	1336		2610	1479	
Paddy (satabdi)– mustard– green gram	5705	2326	1298	5339	2260	1321	5010	2079	1168	5130	1998	1159	5915	2152	1226	5850	2240	1200
Paddy (satabdi)– capsicum– green gram (Samrat)	5603	2412	1301	5383	2156	1314	5198	2051	1119	5215	2007	1133	5983	2002	1227	5890	2408	1214
Paddy (satabdi)–french bean – sesame	5785	2436	1316	5683	2200	1221	5766	2121	1204	5811	2108	1298	5988	2181	1098	5896	2081	1058
Paddy mean	4926			4772			4599			4646			5144			5062		
Sardar Krushinagar																		
Groundnut- wheat- green gram	1616	3833	576	1750	3708	614	2028	4253	652	2172	4665	700	2027	4101	610	1989	4083	626
Greengram- cumin- vegetable cowpea	588	-	4306	592	-	4103	646	401	5025	670	525	5708	605	389	4756	617	361	5033
Greengram-fennel- fennel cont.	551	1189	-	586	1150	-	647	1633	-	673	1809	-	594	1586	-	621	1447	-
Thiruvananthapuram																		
Cassava-veg. cowpea		-					-	-		-			-			-		-
Cassava-groundnut		1834			1841		-	1888		-	1161		-	1643		-	1473	-
Taro-black gram		547			838		-	936		-	289		-	537		-	639	-
Taro-greengram		766			605		-	428		-	271		-	651		-	652	-
Udaipur																		
Maize + Blackgram (2:2) – durum wheat – Sesbania (GM)	1464+197 (*4717)	2928	-	1857+179 (*4763)	3428	-	2493+160 (*5178)	4000	-	1621+180 (*4480)	4285	-	2714+157 (*5669)	4142	-	1886+179 (4928)	3357	-
Sweet corn + blackgram (2:2) – chickpea	1928+160 (*5955)	-	-	2285+189 (*6861)	-	-	2928+203 (*8538)	-	-	2786+203 (*8315)	-	-	2214+174 (*6691)	-	-	1571+203 (*5575)	-	-
Blackgram – wheat (Triticum aestivum)	345	2671	-	350	2285	-	330	2785	-	350	3142	-	329	2642	-	336	2713	-
Soybean – fenugreek	-	964	-	257	914	-	307	1207	-	193	1143	-	-	1114	-	643	1014	-
	*maize+blackgram euivalent yield																	

Table 2. Influence of organic, inorganic and integrated packages on straw 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%iInorganic		
	Kharif	Rabi	Summer	Kharif	Rabi	Summer	Kharif	Rabi	Summer	Kharif	Rabi	Summer	Kharif	Rabi	Summer	Kharif	Rabi	Summer
Bajaura																		
Tomato-cauliflower- french bean	1790	2790	1650	1745	3250	1900	1620	1720	1260	1810	5870	2150	1820	5460	1860	1776	5120	1850
Fallow-cauliflower-tomato		2080	2800		1760	2710		1540	2460		3960	3130		2760	2850		2320	3960
Black gram-cauliflower- summer squash	1727	2380	-	1723	2910	-	1625	1130	-	1733	3180	-	1800	4890	-	1767	4510	-
Lady finger-pea	1770	-	-	1920	-	-	1620	-	-	1910	-	-	2060	-	-	2250	-	-
Bhopal																		
Soybean-durum wheat	3409	3783		2876	3475		2645	3440		2601	3334		3052	3457		2161	3737	
Soybean- mustard	2152	3274		2782	3089		2558	2992		3003	2804		2526	3015		3346	3122	
Soybean- chickpea	3208	2489		2666	2446		3137	2480		2585	2478		2721	2462		2522	2490	
Soybean- linseed	2147	2404		2665	2371		2387	2452		2607	2427		2365	2415		2852	2429	
Mean	2729	-		2748	-		2681	-		2699	-		2666	-		2720	-	
Jabalpur																		
Basmati rice–durum wheat-green manure	4289	4686		3709	4400		4785	6215		3007	5841		4603	7612		4507	7150	
Basmati rice–chickpea - maize fodder	4256	2431		3736	2266		4480	2959		3371	2574		4986	2431		4406	2266	
Basmati rice–berseem (fodder and seed)	4441	-		4015	-		4931	-		3650	-		4714	-		4521	-	
Basmati rice–vegetable pea- sorghum (fodder)	4369	-		3918	-		4732	-		4190	-		4476	-		4259	-	
Karjat																		
Rice-Brinjal	4302			3554			1408			1236			1657			1647		
Rice-Chickpea	3083			3013			3081			2891			3554			3172		
Rice-Field bean	3928			3447			4190			3247			4008			4008		
Rice-Onion (White)	857			501			824			496			955			578		
Ludhiana																		
Basmati rice-chickpea-GM	6400	810		6270	1450		6390	870		5640	890		5760	1320		5740	1370	
Basmati rice-wheat-GM	6830	5070		6860	5160		6090	6240		5860	5770		6130	5290		6030	5360	
Cluster bean-wheat-summer moong	2560	7440		2640	7410		1850	6930		2020	7060		2480	7000		2590	7690	
Soybean -wheat	3350	6240		3550	6470		2680	7340		2450	7030		3690	6840		3330	7410	
Modipuram																		
Basmati rice– wheat (*durum*) - *sesbania* green manure	8450	4625	-	7630	4738	-	7050	6428	-	7520	6650	-	7425	5840	-	7200	5580	-
Rice– barley (*malt*) – green gram	5650	5640	1730	5440	5825	1520	6338	6420	1740	6450	6550	1870	5825	6330	2050	5780	6040	1940
Maize (*pop corn*) – potato– okra +*Sesbania* green manure	6877	-	-	6991	-	-	7786	-	-	8005	-	-	7143	-	-	6923	-	-
Maize (*sweet corn*) – mustard - *Sesbania* green manure	5597	6468	-	5107	5873	-	7262	7398	-	7698	7584	-	7094	7272	-	5568	6440	-
Pantnagar																		
Basmati rice-wheat	5129	5428		5077	5180		4937	5510		4983	5550		5186	5775		5197	5650	
Basmati rice -chickpea (4rows+2rows coriander)	5129	3110		5077	2990		4937	2880		4983	2900		5186	2970		5197	3000	
Basmati rice -vegetable pea (4 rows vegetable pea +2 rows coriander)	5129	-		5077	-		4937	-		4983	-		5186	-		5197	-	
Basmati rice -potato	5129	-		5077	-		4937	-		4983	-		5186	-		5197	-	
Raipur																		
Soybean-maize	3537	-		3817	-		3255	-		3633	-		3552	-		3153	-	
Soybean-pea	4060	-		3632	-		3427	-		3211	-		3315	-		3233	-	
Soybean-chilli	3244	-		3827	-		3499	-		3415	-		3280	-		2977	-	
Soybean-onion	3400	-		4059	-		3086	-		3584	-		3010	-		2894	-	
Mean soybean	3560	-		3834	-		3317	-		3461	-		3289	-		3064	-	
Umiam																		
Rice- fallow system on sunken bed																		
Megha aromatic 2–fellow	6800																	
Shasharang –fellow	6630																	
Ngoba –fellow	6930																	
Lampnah –fellow	6800																	
Mean	7020			6460			6550						7130					
Udaipur																		
Maize + blackgram (2:2) – durum wheat –*sesbania* (GM)	5974			5280			1970			5120			5682			5824		
Sweet corn + blackgram (2:2) – chickpea	3256			3290			4185			4357			3450			3481		
Blackgram – wheat	860			955			840			861			878			901		
Soybean - fenugreek	-			879			1086			750			1814			-		
New centre started from 2015-16																		
Sardarkrushinagar																		
Groundnut- wheat- green gram	1944	5583	1150	2000	5528	1244	2722	6142	1271	2986	6861	1413	2689	6444	1268	2611	5917	1190
Greengram- cumin- vegetable cowpea	1308	-	2046	1411	-	2050	1530	739	2515	1586	797	2844	1358	731	2380	1421	719	2410
Greengram-fennel- fennel cont.	1110	3190	-	1280	3265	-	1369	4230	-	1493	4557	-	1184	3931	-	1180	3829	-

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)		
	100% organic	75% organic + innovative organic practices	100% inorganic	State recommendation	50% organic + 50% inorganic	75% organic+ 25% inorganic	Mean
Bajaura							
Tomato-cauliflower- frenchbean	22408	23647	18970	26111	26554	26492	24030
Fallow-cauliflower-tomato	27000	28140	16480	23169	25824	23862	24079
Black gram-cauliflower- summer squash	26831	28059	20747	29067	33199	32707	28435
Lady finger-pea	16523	17123	13111	21032	22515	20455	18460
Mean	23190	24242	17327	24845	27023	25879	
Bhopal							
Soybean-durum wheat	3170	2880	2754	2730	2779	3122	2906
Soybean-mustard	2602	2423	2144	2152	2273	2562	2359
Soybean- chickpea	3533	3216	2937	2945	3226	3350	3201
Soybean- linseed	2997	2872	2709	2702	2720	2897	2816
Mean	3075	2848	2636	2632	2750	2983	
Dharwad							
Cowpea-safflower	829	790	1011	1113	1122	844	952
Pigeon pea	951	855	1111	1108	952	1308	1048
Sorghum-green gram	2826	2185	1671	1471	2064	2035	2042
Groundnut +hybrid cotton (2:1)	1908	2065	1966	2267	2068	1954	2038
Maize-chickpea	3440	2708	4526	3337	4319	3103	3572
Mean	1991	1721	2057	1859	2105	1849	
Jabalpur							
Basmati rice – wheat (durum) – green manure	6477	5017	6319	5554	5909	5667	5824
Basmati rice – chickpea – maize fodder	4122	4387	5611	4941	5083	4551	4783
Basmati rice-berseem (fodder and seed)	6853	6044	7935	6818	6615	5931	6699
Basmati rice – vegetable pea–sorghum (fodder)	6650	5948	7790	7330	6988	7276	6997
Mean	6026	5349	6914	6161	6149	5856	
Karjat							
Rice-binjal	53303	48396	46639	34643	43674	42087	44790
Rice-chickpea	13325	12097	10279	9497	11388	11291	11313
Rice-field bean	13748	12184	1099	9755	10899	10456	9690
Rice-onion (white)	48793	35381	35581	28135	4131	32091	30685
Mean	32292	27015	23400	20508	17523	23981	

Cropping Systems/ Management practice	Organic		Inorganic		Integrated (towards organic)		
	100% organic	75% organic + innovative organic practices	100% inorganic	State recommendation	50% organic + 50% inorganic	75% organic+ 25% inorganic	Mean
Ludhiana							
Basmati rice-chickpea	8550	5260	5290	5160	5493	5727	5913
Basmati rice-wheat	8920	8439	8972	9002	8609	8209	8692
Moong-wheat	2650	9948	8330	8756	9967	9692	8224
Pigeon pea -wheat	3570	10237	9542	9278	9841	9598	8678
Mean	5923	8471	8033	8049	8477	8306	
Modipuram							
Basmati rice– wheat (durum) -*sesbania* green manure	7121	7047	7126	7327	6668	6311	6933
Rice– barley (malt) – green gram	8330	8180	7355	7613	7453	7050	7664
Maize (popcorn) – potato– okra +*sesbania* green manure	9781	9282	9402	9925	8837	8253	9247
Maize (sweet corn) – mustard -*sesbania* green manure	11710	11083	10773	11127	10324	9757	10796
Mean	9236	8898	8664	8998	8321	7843	
Pantnagar							
Basmati rice-wheat	8122	7917	7207	7220	7408	8220	7682
Basmati rice -chickpea (4rows+2rows coriander)	12523	12453	10855	11023	11450	12426	11788
Basmati rice -vegetable pea (4 rows vegetable pea+2 rows coriander)	12598	12643	11665	11568	12721	12448	12274
Basmati rice -potato	8291	8124	6121	6910	8131	7475	7509
Mean	10383	10284	8962	9181	9928	10142	9813
Raipur							
Soybean-maize	10302	11237	8797	8168	10049	10391	9824
Soybean-pea	7516	8656	8487	6606	7625	8615	7918
Soybean-chilli	8520	9163	8734	8858	8295	9091	8777
Soybean-onion	10437	12177	7447	10337	10692	11670	10460
Mean	9194	10308	8366	8492	9165	9942	
Ranchi							
Rice -wheat	7048	6956	6763	5234	6777	6681	6577
Rice -lentil	5348	5447	4695	3930	5288	5029	4956
Rice -potato	17081	16278	11273	9049	13357	14378	13569
Rice -linseed	5344	5439	4386	3766	4991	4937	4811
Mean	8705	8530	6779	5495	7603	7756	7478
Umiam							
Vegetable-vegetable systems*on raised bed*							
Broccoli -carrot	-	-	-	-	-	-	37590
Broccoli - potato	-	-	-	-	-	-	35030
Broccoli -french bean	-	-	-	-	-	-	36270
Broccoli -tomato	-	-	-	-	-	-	39070
Mean	39790	34950	34200	-	39020	-	

Cropping Systems/ Management practice	Organic		Inorganic		Integrated (towards organic)		
	100% organic	75% organic + innovative organic practices	100% inorganic	State recommendation	50% organic + 50% inorganic	75% organic+ 25% inorganic	Mean
Gangtok							
Maize + ginger (1.1)-french bean	-	-	-	-	-	-	5600
Maize + soybean (1:1)-buckwheat	-	-	-	-	-	-	2220
Maize +turmeric (1:1)-rajmash	-	-	-	-	-	-	12230
Maize+ pigeon pea (2:1)	-	-	-	-	-	-	2230
Mean	5520	6470	-	4440	5840	-	
Sardar Krushinagar							
Groundnut- wheat- green gram	4622	4766	4471	4855	4393	4327	4572
Greengram- cumin- vegetable cowpea	4286	4144	5012	5784	4757	4872	4809
Greengram-fennel- fennel cont.	2187	2205	2049	2216	1942	1872	2079
Mean	3698	3705	3844	4285	3697	3690	3820
Udaipur							
Maize + blackgram (2:2) – durum wheat – sesbania (GM)	10280	11276	12778	12622	11306	13539	11967
Sweet corn + blackgram (2:2) – chickpea	2431	2496	2332	2462	2382	2348	2409
Blackgram – wheat	11030	11203	13830	14285	10595	11846	12132
Soybean - fenugreek	1607	2204	2827	2421	3369	1857	2381
Mean	6337	6795	7942	7948	6913	7398	

Umiam:

Four management practices viz. 100% organic, 75% organic + innovative practice i.e. (10 % vermiwash and 10% cow urine), integrated management with 50% inorganic + 50% organic and 100 % inorganic have been undertaken to carry out the experiment. The experiment consists of four vegetable based cropping system namely broccoli-carrot, broccoli -potato, broccoli -french bean, broccoli -tomato on raised beds and four rice based cropping systems namely rice (Var. Megha Aromatic 2)-fallow, rice (Var. Shahsarang-1)-fallow, rice (Var. Ngoba)-fallow and rce (Var. Lampnah)-fallow on sunken beds were evaluated. The higher broccoli yield was recorded with broccoli-frenchbean cropping system (16480 kg/ha) among the different management package along with average yield (14743 kg/ha) under organic 100% source through organic manure. Integrated (50% organic and inorganic manure) remains statistically at par with each other on broccoli average yield. The yield of broccoli was enhanced on raised bed by 15.2% over inorganic.Carrot and potato recorded highest yield 16930 and 17450 kg/ha under integrated nutrient package towards organic with 75% nutrient supplied through organic manures+25% through inorganic sources however, frenchbean and tomato grown on raised bed recorded highest yield (9940 and 18870 kg/ha) under organic package with 100% organic manures. Yield of frenchbean and tomato was increased with organic management to the tune of 22 and 19.7% over inorganic whereas, integrated management towards organic, carrot and potato produced 18.8 and 47.2% more yield compared to 100% inorganic.

Rice-pulse/vegetable cropping sequence on raised and sunken bed at Umiam

Among the management practices on sunken beds, the higher rice yield (4332 kg/ha) was recorded with integrated package having 50% organic+50% inorganic nutrients followed by 100% organic (4781 kg/ha).Among the rice varieties, Shahsharang-1 produced maximum grain yield (4690 kg/ha) followed by Lampnah (4694 kg/ha), Megha Aromatic 2 (4628 kg/ha) and Ngoba (4218 kg/ha).Rice equivalent yield of broccoli-vegetables cropping system were recorded higher under 100% organic (39790 kg/ha) followed by integrated treatment (39020 kg/ha). Among cropping sequences, broccoli–tomato cropping system recorded maximum REY (39070 kg/ha) followed by broccoli-carrot, broccoli- frenchbean and broccoli -potato cropping system.

Ajmer:

The experiment consisted of seed spices coriander and fennel was evaluated with green gram and cluster bean. The yield of green gram (1060 kg/ha) and cluster bean (2021 kg/ha) found to be higher with integrated nutrient management (75% Organic+25% Inorganic). Among nutrient management practice, seed yield of coriander and fennel was recorded higher also in integrated approach towards organic with 75%

Coriander and fennel crop under organic management at Ajmer

organic + 25% inorganic (1308 and 683 kg/ha respectively) followed by state recommendation (1249 and 650 kg/ha). The increase in yield of green gram, cluster bean, coriander and fennel was found to be17.5, 3.8, 45.0 and 21.9% respectively from inorganic to towards organic (75% organic +25% inorganic).

Almora

Evaluation of organic, inorganic and integrated production systems under rainfed system

Different nutrient sources were evaluated for fingermillet + black soybean (2:1 ratio – substitution of row)-wheat + toria (2:1 ratio – substitution of row) and grain amaranth-wheat + lentil (2:1 ratio – substitution of row) under rainfed system. Among crop management system, application 100% N requirement of crop through organic manure and100% N requirement of crop through organic manure along with 3% panchagavya and vermiwash produced highest wheat equivalent grain yield of 5339 and 3713 kg/ha for grain amaranth-wheat + lentil and fingermillet + black soybean-wheat + toria, which were 68 and 99% higher than 100% inorganic package, respectively (Fig. 5).

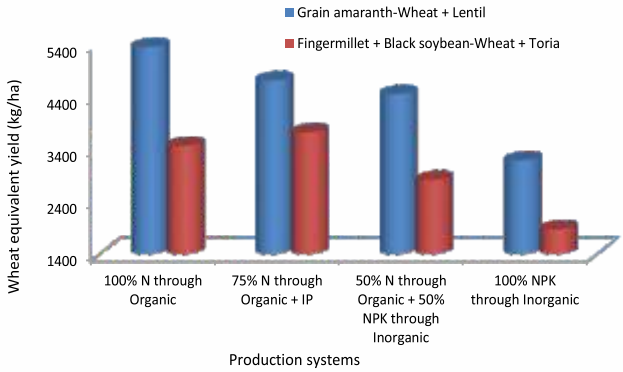


Fig. 5. Wheat equivalent grain yield of fingermillet + black soybean-wheat + *toria* and grain amaranth-wheat + lentil in different crop mnagement system (IP = Innovative practices – 3% *Panchagavya* and vermiwash)

Narendrapur:

The experiment consisting of four cropping systems including two rice varieties sohini and shatabdi in *kharif* with different crops namely broccoli, mustard, capsicum, frenchbean during *rabi* and greengram, sesame in *summer* evaluated under organic, inorganic and integrated nutrient management. Paddy variety sohini and shatabdi recorded maximum grain yield (2691 and 5988 kg/ha respectively) under integrated nutrient management having 50% each nutrient through organic and inorganic followed by 75% nutrient through organic sources+25% inorganic. The differences in yield of paddy were found to be 11.1 and 3.1% for Sohini and 3.5 and 3.9% for shatabdi from integrated to organic and inorganic nutrient package.Other crops in the systems such as broccoli,

mustard, capsicum and frechbean during *rabi* resulted higher yield by 26.3, 11.9, 17.6 and 14.9% with organic compare to inorganic respectively. Whereas, sesame and green gram during summer also recorded maximum yield in organic with (100%organic) and (75% organic +innovative technology)and being higher by 13.1 and 9.3% respectively.

Sardar krushinagar:

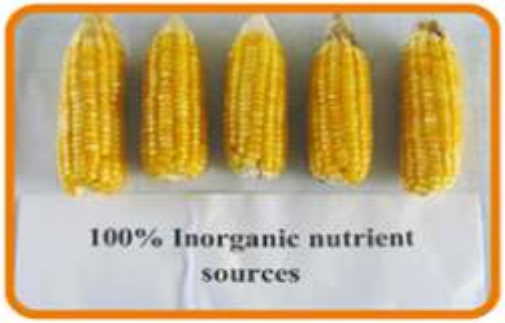
Among the crops evaluated under different cropping systems and nutrient management package,all the crops recorded higher yield under state recommendation. Crops groundnut, wheat, green gram, vegetable cowpea and fennel resulted in higher yield(2172, 4665, 700, 5708 and 1809 kg/ha respectively) with state recommendation and reduction in the yield from state recommendation to 100% organic management were found to be 25.6,17.8, 17.7, 24.6 and 34.3% 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 (525 kg/ha) with state recommendation and reduction in yield with integrated package recorded to the tune of 31.2%.In term of groundnut equivalent yield,response of different cropping systemswas found to be higherin inorganic package wherein, greengram- cumin- vegetable cowpea system recorded highest groundnut equivalent yield (15029 kg/ha). Among nutrient management packages, inorganic practice recorded superior across the cropping system.

Thiruvananthapuram:

Crops cowpea, groundnut, blackgram and greengram involving two tuber crops such as cassava and taro were evaluated under four cropping systems. The highest yield of vegetable cowpea was recorded with 75% organic + 25% innovative practice (4065 kg\ha) under organic management. Green gram yield (766 kg/ha) was higher in organic management with 100% manure supplied through manure while, vegetable cowpea was higher in 75% organic+innovative practice (4065 kg/ha) under organic. Groundnut (kernel yield) and blackgram resulted in higher yield in inorganic package (1888 and 936 kg/ha) followed by organic with 75% organic + innovative practice.The yield differences from organic to inorganic for green gram and cowpea being (79 and 85.7%). The reduction in yield for groundnut and blackgram was found to the tune of 2.9 and 41.6% respectively.

Cassava and Taro crop under organic production system at Thiruvananthapuram

75% organic + Innovative organic practices



100% organic package

50% organic and 50% inorganic package in Soybean

100% inorganic package in wheat

75% organic + Innovative organic practices in wheat

100% organic in wheat

Effect of organic, Inorganic and integrated systems on different *Kharif* and *rabi* crops maize based cropping systems at Udaipur

Udaipur:

The experiment consisting of four cropping systems maize + blackgram (2:2) – durum wheat–sesbania (GM), sweet corn + blackgram (2:2) – chickpea, blackgram – wheat (*Triticum aestivum*) and soybean - fenugreekwere evaluated for response of organic, inorganic and integrated production systems. Maize+ blackgram intercrop resulted in higher yield (5669 kg/ha in term of equivalent) under integrated packages with 50% organic +50% inorganic whereas, maximum yield of sweet corn (2928 kg/ha) and maize equivalent yield of sweet corn – blackgram (2:2) intercropping system (8538 kg/ha) was obtained under 100% inorganic nutrient management. Sole black gram recorded maximum yield (350 kg/ha) with reduced dose of manure 75% organic+25% innovative practice and state recommendation followed by organic 100%. Yield of4285 and 3142 kg/ha for wheat *duram and astivum* respectively recorded higher in inorganic package with state recommendation and difference in yield from organic to inorganic was found to be 31.7 and 15.0. Soybean (643 kg/ha) performed better towards organic with75% organic +25% inorganic under integrated package. Maximum yield of fenugreek was also recorded under inorganic management of 1207 kg/ha and compare to organic it was reduced by 20.1%. Among the management practices, blackgram-wheat (*aestivum*) cropping system gave maximum maize equivalent yield under state recommendation practice (14285 kg/ha) with overall mean of 7948 kg/ha followed by 100% inorganic nutrient management (13830 kg/ha). Out of four cropping systemsmaximum maize equivalent yield (12132 kg/ha) was higher with blackgram-wheat system.

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 properties of soil in terms of pH, organic carbon, available N, P and K have been estimated and reported. The soil pH indicated range from 6.30 -7.40 in all the treatments. The soil pH in different cropping systems as influenced by nutrient management was higher with integrated management either 50% each organic and inorganic or 75% organic+ 25% inorganic package whereas lower value of soil pH was recorded in inorganic management.Different cropping systems and nutrient management package recorded soil organic carbon ranging from 0.70 as minimum under inorganic to 1.48% as maximum in organic management with 100% nutrients through organic manures in tomato-cauliflower-frenchbean system. Organic management recorded 80.5% higher organic carbon compare to inorganic.Availability of residual N, P and K in soil was higher with integrated nutrient management practices at the end of cropping cycle. Due to the presence of leguminous crop of pea in lady finger-pea system, higher soil available N (254.1 kg/ha) and P (73.3 kg/ha) was noticed in this systemwith 50% organic+50% inorganic or 75% nutrients through organic manure+25% inorganic as compared to inorganic packages. Among the cropping systems, 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 in residual N, P and K with integrated over inorganic was found to be higher by 12.3, 87 and 54.5%.

Bhopal:

Physical chemical properties of soil were estimated except bulk density. The soil electrical conductivity and pH varied from 0.15 to 0.20 dsm^{-1} and 6.30 to 7.40 respectively due to different nutrient management and the cropping system. Higher EC (0.20 dsm^{-1}) was recorded with integrated management in soybean-

linseed system while, lower EC being found with inorganic management. Soil organic carbon was recorded higher with 100% organic management (0.94%) followed by 75 % organic + innovative practices (0.90%) while, lowest was found in inorganic nutrient management which was higher by19.0 and 13.9% than inorganic packages respectively. Among the copping systems, the variation in soil organic carbon did not varied. The soil available N varied from 180 kg ha^{-1}as lowest in state recommendation to 245 $kgha^{-1}$ as highest in 100% organic package. Similarly, the variation in P was observed from 39.0 to 103.3 kg ha^{-1} in different management practices. Higher K was recorded in state recommendation package (511 kg/ha).

Calicut:

pH, organic carbon, available N, P and K has been estimated. In ginger and turmeric, higher pH (7.0 and 6.10 respectively) was recorded in 100% organic management while, lowest was being with inorganic cultivation (5.5 and 4.9 respectively). Similarly, organic carbon content in ginger (2.6%) and in turmeric (1.6%) was higher under organic package and it was found to be higher by 62.5 and 128.5% than inorganic in both the crops respectively. Residual N in the soil was found to be higher with organic condition ginger (316 kg/ha) and turmeric (184 kg/ha). However, K in the soil was found to be higher (397 and 326 kg/ha in ginger and turmeric respectively with integrated nutrient management. In case of available P It was higher in inorganic package.

Coimbatore:

Variation in pH did not differ across the cropping systems and nutrient management. It recorded range from 8.30 to 8.60. Similarly, organic carbon recorded 0.57 as lowest under integrated package to 0.63 in organic as highest. Higher available N and K was recorded under integrated management with 75% organic through manure and 25% inorganic sources (304.3 and 472.0 kg/ha respectively). Among the management practices, higher available P (11.5 and 12.2 kg/ha) was recorded under inorganic management with 100% inorganic as well as state recommendation. Out of three systems, cotton-maize recorded highest available P (11.9 kg/ha) followed by chilli-sunflower in the soil but both was at par.

Dharwad:

At the end of cropping cycle, the physical properties like bulk density decreased significantly from 1.31 g/cm^3 with 100% inorganic to 1.16 g/cm^3 with 100% organic management. The chemical properties like soil pH and EC didn't differ significantly either due to nutrient management or cropping system showever, higher pH was recorded in inorganic package while, lower was in organic (7.12 g/kg). The organic carbon increased significantly from 6.49 g/kg with 100% inorganic to 7.44 g/kg with 100% organic and it was increased by 14.6%. In case of major nutrients, available N, P and k291.3, 30.2 and 384.9kg/ha recorded higher with 100% organic respectively and this was followed by integrated systems. All 3 nutrients i.e. N,P and K didn't vary significantly due to cropping systems however, pigeon pea (sole) resulted higher N and K.

Jabalpur:

Soil physical and chemical properties were estimated. Among the nutrient managements, lower bulk density (1.28) was recorded with organic management either 100% organic or 75% organic+innovative practices and it was decreased by 9.2% over inorganic. The soil electrical conductivity varied from as lowest (0.57) in organic to inorganic (0.74 dsm^{-1}) as maximum. Cropping systems did not influence to each other for electrical conductivity and bulk density. The pH was neutral in reaction ranging from 7.17 with organic to 7.32 in state recommendation. The treatments receiving organic nutrient management either fully (100% organic) or integrated exhibited organic content in the soil. Management practice under organic condition, holding 16.3% more organic carbon content over inorganic. Among the cropping

Table 4. Influence of organic, inorganic and integrated package on soil physical properties (bulk density and electrical conductivity) at the end of cropping cycle at various locations

	Bulk density (g/cc)							Soil EC (ds/m)						
	Organic		Inorganic		Integrated (towards organic			Organic		Inorganic		Integrated (towards organic)		
Treatments / Management practice	100% organic	75% organic +innovative organic practices	100% Inorganic	State recommend ation	50% organic + 50% inorganic	75% organic + 25% inorganic	Mean	100% organic	75% organic +innovative organic practices	100% Inorganic	State recommend ation	50% organic + 50% inorganic	75% organic + 25% inorganic	Mean
Bhopal														
Soybean- wheat	-	-	-	-	-	-	-	0.19	0.19	0.15	0.17	0.19	0.17	0.18
Soybean- Mustard	-	-	-	-	-	-	-	0.17	0.16	0.16	0.16	0.18	0.18	0.17
Soybean- Chickpea	-	-	-	-	-	-	-	0.17	0.18	0.15	0.15	0.19	0.19	0.17
Soybean- Linseed	-	-	-	-	-	-	-	0.16	0.15	0.16	0.15	0.2	0.17	0.17
Mean	-	-	-	-	-	-	-	0.17	0.17	0.16	0.16	0.19	0.18	0.17
Coimbatore														
Cotton - maize	-	-	-	-	-	-	-	0.50	0.70	0.60	0.80	0.90	0.60	0.68
Chillies - sunflower	-	-	-	-	-	-	-	0.70	0.80	0.70	0.80	0.70	0.80	0.75
Beetroot - maize	-	-	-	-	-	-	-	1.00	0.70	1.20	0.90	1.60	1.30	1.12
Mean	-	-	-	-	-	-	-	0.73	0.73	0.83	0.83	1.07	0.90	
Dharwad														
Cowpea-safflower	1.17	1.24	1.28	1.25	1.25	1.25	1.24	0.20	0.21	0.21	0.23	0.19	0.19	0.20
Pigeon pea (Sole)	1.16	1.25	1.31	1.27	1.26	1.24	1.25	0.18	0.21	0.17	0.21	0.20	0.20	0.19
Green gram-sorghum	1.18	1.26	1.29	1.28	1.23	1.27	1.25	0.23	0.21	0.19	0.19	0.20	0.21	0.21
Groundnut + hybrid cotton (2:1)	1.15	1.27	1.30	1.29	1.28	1.32	1.27	0.25	0.24	0.20	0.21	0.20	0.20	0.21
Maize-chickpea	1.17	1.23	1.32	1.24	1.27	1.26	1.25	0.22	0.22	0.19	0.21	0.19	0.18	0.21
Mean	1.16	1.25	1.30	1.26	1.26	1.27		0.21	0.22	0.19	0.21	0.20	0.20	
Jabalpur														
Basmati rice –wheat (duram)-green manure	1.26	1.27	1.39	1.39	1.35	1.36	1.34	0.60	0.61	0.74	0.73	0.68	0.66	0.67
Basmati rice – chickpea - maize fodder	1.29	1.29	1.43	1.41	1.36	1.35	1.36	0.59	0.59	0.69	0.67	0.62	0.61	0.63
Basmati rice – berseem (fodder and seed)	1.29	1.28	1.42	1.41	1.36	1.36	1.35	0.57	0.58	0.69	0.68	0.63	0.62	0.63
Basmati rice – vegetable pea-sorghum (fodder)	1.29	1.29	1.40	1.39	1.35	1.34	1.34	0.61	0.62	0.66	0.66	0.67	0.65	0.65
Mean	1.28	1.28	1.41	1.40	1.36	1.35		0.59	0.60	0.70	0.69	0.65	0.64	
Karjat														
Rice-brinjal	-	-	-	-	-	-	-	-	-	-	-	-	-	0.35
Rice-chickpea	-	-	-	-	-	-	-	-	-	-	-	-	-	0.34
Rice-field bean	-	-	-	-	-	-	-	-	-	-	-	-	-	0.34
Rice-onion (white)	-	-	-	-	-	-	-	-	-	-	-	-	-	0.35
Mean								0.35	0.34	0.36	0.35	0.35	0.36	
Ludhiana														
Basmati rice-chickpea-GM	-	-	-	-	-	-	-	0.22	0.21	0.19	0.20	0.20	0.17	0.20
Basmati rice-wheat-GM	-	-	-	-	-	-	-	0.18	0.18	0.18	0.20	0.20	0.21	0.19
Clusterbean-wheat-summer moong	-	-	-	-	-	-	-	0.22	0.23	0.19	0.19	0.21	0.21	0.21
Soybean -wheat	-	-	-	-	-	-	-	0.23	0.22	0.19	0.19	0.20	0.20	0.21
Mean								0.21	0.21	0.19	0.20	0.20	0.20	

Treatments / Management practice	Bulk density (g/cc)							Soil EC (ds/m)						
	Organic		Inorganic		Integrated (towards organic			Organic		Inorganic		Integrated (towards organic)		
	100% organic	75% organic +innovative organic practices	100% Inorganic	State recommend ation	50% organic + 50% inorganic	75% organic + 25% inorganic	Mean	100% organic	75% organic +innovative organic practices	100% Inorganic	State recommend ation	50% organic + 50% inorganic	75% organic + 25% inorganic	Mean
Pantnagar														
Basmati rice-wheat	-	-	-	-	-	-	-	0.39	0.29	0.50	0.42	0.45	0.35	0.40
Basmati rice -chickpea (4rows+2rows coriander)	-	-	-	-	-	-	-	0.38	0.30	0.60	0.52	0.39	0.45	0.44
Basmati rice -vegetable pea (4 rows vegetable pea +2 rows coriander)	-	-	-	-	-	-	-	0.49	0.35	0.50	0.48	0.42	0.43	0.45
Basmati rice -potato	-	-	-	-	-	-	-	0.30	0.35	0.48	0.56	0.36	0.35	0.40
Mean								0.39	0.32	0.52	0.50	0.41	0.40	
Umiam														
Vegetable-vegetable systems*on raised bed*														
Broccoli -carrot	-	-	-	-	-	-	1.08	-	-	-	-	-	-	-
Broccoli - potato	-	-	-	-	-	-	1.10	-	-	-	-	-	-	-
Broccoli -french bean	-	-	-	-	-	-	1.06	-	-	-	-	-	-	-
Broccoli -tomato	-	-	-	-	-	-	1.13	-	-	-	-	-	-	-
Mean	1.07	1.10	1.14	1.19	1.08	-								
Rice- fallow system on sunken bed														
Megha aromatic 2–fellow	-	-	-	-	-	-	1.1	-	-	-	-	-	-	-
Shasharang–fellow	-	-	-	-	-	-	1.07	-	-	-	-	-	-	-
Ngoba–fellow	-	-	-	-	-	-	1.12	-	-	-	-	-	-	-
Lampnah–fellow	-	-	-	-	-	-	1.09	-	-	-	-	-	-	-
Mean	1.06	1.10	1.13	1.25	1.10									
New centres started from 2015-16														
Narendrapur														
Basmati rice–broccoli –*sesbania* green manure	1.86	1.81	1.88	1.79	1.80	1.83	1.83	0.35	0.21	0.31	0.34	0.37	0.36	0.32
Paddy– mustard– green gram	1.84	1.80	1.92	1.85	1.90	1.67	1.83	0.29	0.30	0.38	0.71	0.25	0.33	0.38
Paddy– capsicum– green gram	1.84	1.81	1.92	1.86	1.90	1.68	1.83	0.26	0.27	0.28	0.28	0.30	0.31	0.28
Paddy –french bean – sesame	1.84	1.80	1.92	1.85	1.90	1.67	1.83	0.29	0.25	0.38	0.71	0.25	0.33	0.37
Mean	1.85	1.81	1.91	1.84	1.88	1.71		0.30	0.26	0.34	0.51	0.29	0.33	
Sardarkrushinagar														
Groundnut- Wheat- Green gram	1.48	1.48	1.5	1.47	1.48	1.48	1.48	0.14	0.14	0.15	0.14	0.14	0.15	0.14
Greengram- Cumin- Vegetable cowpea	1.49	1.47	1.55	1.49	1.48	1.49	1.50	0.14	0.14	0.15	0.15	0.14	0.13	0.14
Greengram-Fennel- Fennel cont.	1.48	1.51	1.51	1.53	1.5	1.5	1.51	0.13	0.14	0.14	0.13	0.14	0.15	0.14
Mean	1.48	1.49	1.52	1.50	1.49	1.49		0.14	0.14	0.15	0.14	0.14	0.14	
Thiruvananthapuram														
Cassava-veg. cowpea	1.03	0.96	0.89	0.92	0.99	0.98	0.96	-	-	-	-	-	-	-
Cassava-groundnut	0.96	1.00	0.96	0.90	0.90	0.90	0.94	-	-	-	-	-	-	-
Taro-black gram	1.02	0.89	0.91	0.87	0.95	0.90	0.92	-	-	-	-	-	-	-
Taro-greengram	0.96	0.92	0.91	0.88	0.92	0.90		-	-	-	-	-	-	-

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

Management practice	pH							Organic carbon						
	Organic		Inorganic		Integrated (towards organic)			Organic		Inorganic		Integrated (towards organic)		
	100% organic	75% organic + innovative organic practices	100% Inorganic	State recommendation	50% organic + 50% inorganic	75% organic + 25% inorganic	Mean	100% organic	75% organic + innovative organic practices	100% Inorganic	State recommendation	50% organic + 50% inorganic	75% organic + 25% inorganic	Mean
Bajura (%)														
Tomato-cauliflower-french bean	7.20	7.20	6.50	6.90	7.20	7.20	7.03	1.48	1.16	0.70	0.97	0.99	1.10	1.07
Fallow-cauliflower-tomato	7.20	7.20	6.50	7.20	7.20	7.40	7.12	1.22	1.15	0.71	0.92	1.05	1.08	1.02
Black gram-cauliflower- Summer squash	7.20	7.10	6.50	7.10	7.30	7.40	7.10	1.28	1.17	0.72	0.95	1.02	1.02	1.03
Lady finger-pea	7.10	7.20	6.30	7.20	7.20	7.30	7.05	1.20	1.18	0.73	0.80	1.04	1.03	1.00
Mean	7.18	7.18	6.45	7.10	7.23	7.33		1.30	1.17	0.72	0.91	1.03	1.06	
Bhopal														
Soybean-durum wheat	7.72	7.72	7.82	7.81	7.76	7.76	7.77	0.97	0.86	0.65	0.60	0.81	0.87	0.79
Soybean- mustard	7.75	7.82	7.84	7.82	7.76	7.78	7.79	0.95	0.92	0.63	0.64	0.77	0.88	0.80
Soybean- chickpea	7.78	7.77	7.82	7.78	7.77	7.77	7.78	0.93	0.91	0.63	0.61	0.81	0.82	0.78
Soybean- linseed	7.77	7.79	7.79	7.75	7.76	7.76	7.78	0.92	0.93	0.61	0.63	0.78	0.77	0.77
Mean	7.75	7.78	7.76	7.77	7.81	7.80		0.94	0.90	0.79	0.83	0.63	0.62	
Calicut (%)														
Ginger -fallow	7.00	7.00	5.50	0.00	5.90	6.20	5.27	2.60	2.50	1.60	0.00	2.10	2.20	1.83
Turmeric-fallow	6.10	6.00	4.90	0.00	5.80	6.10	4.82	1.60	1.50	0.70	0.00	1.40	1.40	1.10
Coimbatore														
Cotton-maize	8.30	8.30	8.60	8.60	8.50	8.60	8.48	0.62	0.60	0.60	0.62	0.62	0.62	0.61
Chilli-sunflower	8.30	8.50	8.40	8.40	8.50	8.50	8.43	0.63	0.61	0.60	0.60	0.62	0.63	0.62
Beetroot-maize	8.40	8.50	8.40	8.40	8.30	8.30	8.38	0.61	0.60	0.60	0.60	0.57	0.60	0.60
Dharwad											(g/kg)			
Cowpea-safflower	7.22	7.21	7.24	7.23	7.22	7.25	7.23	7.48	7.01	6.39	6.99	6.82	6.82	6.92
Pigeon pea (sole)	7.23	7.20	7.27	7.19	7.24	7.24	7.23	7.44	6.94	6.68	6.79	6.94	6.68	6.91
Green gram- sorghum	7.23	7.22	7.25	7.24	7.25	7.24	7.23	7.45	6.97	6.50	6.82	7.14	6.74	6.94
Groundnut + hybrid cotton (2:1)	7.23	7.22	7.24	7.21	7.24	7.24	7.23	7.42	7.03	6.38	7.00	6.92	7.01	6.96
Maize-chickpea	7.19	7.20	7.27	7.22	7.23	7.23	7.22	7.43	7.02	6.49	7.07	6.94	6.74	6.95
Mean	7.22	7.21	7.25	7.22	7.23	7.24		7.44	6.99	6.49	6.93	6.95	6.80	
Jabalpur														
Basmati rice –wheat-green manure	-	-	-	-	-	-	-	8.38	8.29	7.22	7.18	8.16	8.05	7.88
Basmati rice – chickpea - maize (fodder)	-	-	-	-	-	-	-	7.95	7.83	6.72	6.60	7.55	7.52	7.36
Basmati rice – berseem (fodder and seed)	-	-	-	-	-	-	-	7.80	7.78	6.69	6.62	7.66	7.52	7.35
Basmati rice – vegetable pea- sorghum (fodder)	-	-	-	-	-	-	-	8.16	7.97	7.13	6.97	7.75	7.63	7.60
Mean								8.07	7.97	6.94	6.84	7.78	7.68	

Management practice	pH							Organic carbon						
	Organic		Inorganic		Integrated (towards organic)			Organic		Inorganic		Integrated (towards organic)		
	100% organic	75% organic + innovative organic practices	100% Inorganic	State recommendation	50% organic + 50% inorganic	75% organic + 25% inorganic	Mean	100% organic	75% organic + innovative organic practices	100% Inorganic	State recommendation	50% organic + 50% inorganic	75% organic + 25% inorganic	Mean
Karjat														
Rice-Brinjal	-	-	-	-	-	-	6.70	-	-	-	-	-	-	1.51
Rice-Chickpea	-	-	-	-	-	-	6.63	-	-	-	-	-	-	1.28
Rice-Field bean	-	-	-	-	-	-	6.68	-	-	-	-	-	-	1.35
Rice-Onion (White)	-	-	-	-	-	-	6.70	-	-	-	-	-	-	1.47
Mean	6.69	6.65	6.69	6.68	6.59	6.75		1.57	1.55	1.31	1.28	1.37	1.33	
Ludhiana														
Basmati rice-chickpea-GM	7.20	7.10	7.00	7.20	7.20	7.40	7.18	0.52	0.52	0.44	0.45	0.49	0.50	0.49
Basmati rice-wheat-GM	7.20	7.30	7.40	7.20	7.10	7.20	7.23	0.63	0.60	0.43	0.42	0.55	0.59	0.54
Clusterbean-wheat-summer moong	7.10	7.40	7.50	7.20	7.00	7.00	7.20	0.64	0.59	0.42	0.43	0.54	0.55	0.53
Soybean -wheat	7.20	7.00	7.10	7.00	7.00	7.40	7.12	0.56	0.55	0.45	0.46	0.52	0.55	0.52
Mean	7.20	7.20	7.20	7.30	7.10	7.20		0.59	0.57	0.44	0.44	0.53	0.55	
Pantnagar														
Basmati rice-wheat	7.40	6.90	7.40	7.90	6.60	7.30	7.20	1.31	1.19	0.81	0.91	1.10	1.21	1.09
Basmati rice -chickpea (4rows+2rows coriander)	6.80	6.80	7.70	7.90	7.30	7.00	7.20	1.37	1.17	0.78	0.98	1.13	1.22	1.11
Basmati rice -vegetable pea (4 rows vegetable pea +2 rows coriander)	7.30	6.70	7.80	7.50	6.80	7.20	7.20	1.50	1.29	0.82	0.91	1.12	1.19	1.14
Basmati rice -potato	7.40	6.80	7.40	7.40	7.30	6.80	7.20	1.34	1.24	0.71	0.94	1.15	1.15	1.09
Mean	7.23	6.80	7.58	7.68	7.00	7.08		1.38	1.22	0.78	0.94	1.13	1.19	
Raipur														
Soybean-maize	-	-	-	-	-	-	-	0.66	0.67	0.67	0.68	0.68	0.66	0.67
Soybean-pea	-	-	-	-	-	-	-	68.00	0.68	0.67	0.67	0.66	0.66	11.89
Soybean-chilli	-	-	-	-	-	-	-	0.68	0.67	0.66	0.68	0.67	0.66	0.67
Soybean-onion	-	-	-	-	-	-	-	0.68	0.67	0.67	0.67	0.67	0.66	0.67
Mean								17.51	0.67	0.67	0.68	0.67	0.66	
Ranchi														
Rice -wheat	-	-	-	-	-	-	5.97	-	-	-	-	-	-	0.58
Rice-lentil	-	-	-	-	-	-	6.04	-	-	-	-	-	-	0.61
Rice-potato	-	-	-	-	-	-	5.93	-	-	-	-	-	-	0.60
Rice- linseed	-	-	-	-	-	-	5.88	-	-	-	-	-	-	0.55
Mean	6.35	6.31	5.46	5.42	6.07	6.12		0.74	0.71	0.44	0.40	0.60	0.63	
Umiam														
Vegetable-vegetable systems on raised bed														
Broccoli -carrot	-	-	-	-	-	-	5.23	-	-	-	-	-	-	3.12
Broccoli - potato	-	-	-	-	-	-	5.26	-	-	-	-	-	-	3.12
Broccoli -french bean	-	-	-	-	-	-	5.25	-	-	-	-	-	-	3.18
Broccoli -tomato	-	-	-	-	-	-	5.28	-	-	-	-	-	-	3.13
Mean Management practices	5.39	5.18	5.13	0.00	5.32	0.00		3.20	3.31	2.82	0.00	3.22	0.00	
Rice- fallow system on sunken bed														
Megha aromatic 2–fellow	-	-	-	-	-	-	5.40	-	-	-	-	-	-	2.63
Shasharang–fellow	-	-	-	-	-	-	5.58	-	-	-	-	-	-	2.75
Ngoba –fellow	-	-	-	-	-	-	5.33	-	-	-	-	-	-	2.56
Lampnah –fellow	-	-	-	-	-	-	5.43	-	-	-	-	-	-	2.63
Mean Management practices	5.38	5.29	5.39	0.00	5.69	0.00		2.84	2.39	2.52	0.00	2.82	0.00	

Management practice	pH							Organic carbon						
	Organic		Inorganic		Integrated (towards organic)			Organic		Inorganic		Integrated (towards organic)		
	100% organic	75% organic + innovative organic practices	100% Inorganic	State recommendation	50% organic + 50% inorganic	75% organic + 25% inorganic	Mean	100% organic	75% organic + innovative organic practices	100% Inorganic	State recommendation	50% organic + 50% inorganic	75% organic + 25% inorganic	Mean
Narendrapur														
Basmati rice–broccoli – sesbania green manure	6.35	6.24	6.76	6.84	6.34	6.77	6.55	0.89	0.92	0.75	0.75	0.85	0.84	0.83
Paddy– mustard– green gram	6.97	6.09	6.15	6.15	6.12	6.13	6.27	0.87	0.87	0.69	0.70	0.77	0.79	0.78
Paddy– capsicum– green gram	7.07	6.50	6.95	6.40	6.32	6.33	6.60	0.87	0.92	0.77	0.73	0.85	0.86	0.83
Paddy –french bean – sesame	6.97	6.09	6.15	6.15	6.12	6.13	6.27	0.99	0.96	0.63	0.76	0.95	0.80	0.85
Mean	6.84	6.23	6.50	6.39	6.23	6.34		0.90	0.91	0.71	0.74	0.85	0.82	
New centres started from 2015-16														
Ajmer														
Green gram – fennel	-	-	-	-	-	-	-	0.29	0.30	0.29	0.30	0.26	0.27	0.29
Green gram - coriander	-	-	-	-	-	-	-	0.30	0.28	0.28	0.27	0.26	0.28	0.28
Cluster bean - fennel	-	-	-	-	-	-	-	0.29	0.30	0.29	0.30	0.26	0.27	0.29
Cluster bean – coriander	-	-	-	-	-	-	-	0.30	0.28	0.28	0.27	0.26	0.28	0.28
Mean								0.30	0.29	0.29	0.29	0.26	0.28	
Sardarkrushinagar														
Groundnut- wheat- green gram	7.06	7.26	7.25	7.25	7.34	7.18	7.22	0.32	0.31	0.23	0.26	0.28	0.27	0.28
Greengram- cumin- vegetable cowpea	6.97	7.19	7.10	7.22	7.07	6.97	7.09	0.26	0.26	0.22	0.24	0.25	0.23	0.24
Greengram-fennel- fennel cont.	7.13	7.14	7.26	7.02	7.15	6.97	7.11	0.27	0.25	0.22	0.22	0.25	0.25	0.24
Mean	7.05	7.20	7.20	7.16	7.19	7.04		0.28	0.27	0.22	0.24	0.26	0.25	

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

Management practice	Available Nitrogen (kg ha^{-1})							Available Phosphorus (kg ha^{-1})						
	Organic		Inorganic		Integrated (towards organic)			Organic		Inorganic		Integrated (towards organic)		
	100% organic	75% organic + innovative organic practices	100% Inorganic	State recommendation	50% organic + 50% inorganic	75% organic + 25% inorganic	Mean	100% organic	75% organic + innovative organic practices	100% inorganic	State recommendation	50% organic + 50% inorganic	75% organic +25% inorganic	Mean
Bajaura														
Tomato-cauliflower- french bean	255.4	253.0	230.2	245.4	254.9	248.0	247.8	68.2	63.0	38.9	48.0	70.2	65.8	59.0
Fallow-cauliflower-tomato	250.0	251.8	244.3	247.6	234.6	237.5	244.3	70.0	66.2	41.2	45.0	75.0	67.5	60.8
Black gram-cauliflower- summer squash	246.3	240.1	209.7	223.0	263.2	261.2	240.6	69.4	68.0	38.9	43.5	75.4	70.1	60.9
Lady finger-pea	265.2	259.9	228.7	230.5	271.9	268.3	254.1	72.5	71.4	37.9	44.6	72.4	70.8	61.6
Mean	254.2	251.2	228.2	236.6	256.2	253.8		70.0	67.2	39.2	45.3	73.3	68.6	
Bhopal														
Soybean-durum wheat	236.0	205.0	203.0	194.0	211.0	213.0	210.0	103.3	96.6	49.2	47.1	71.0	72.6	73.3
Soybean- mustard	245.0	213.0	180.0	197.0	220.0	207.0	210.0	90.8	89.4	52.4	50.6	72.6	72.2	71.3
Soybean- chickpea	211.0	207.0	197.0	180.0	192.0	194.0	197.0	96.6	91.2	43.9	45.0	73.6	77.3	71.3
Soybean- linseed	197.0	190.0	190.0	192.0	182.0	192.0	191.0	95.6	85.2	39.5	39.0	66.6	71.9	66.3
Mean	222.0	204.0	192.0	191.0	201.0	202.0		96.6	90.6	46.3	45.4	70.9	73.5	
Calicut														
Ginger-fallow	316.0	291.0	182.0	-	229.0	242.0	252.0	87.0	67.0	41.0	-	74.0	66.0	67.0
Turmeric-fallow	184.0	172.0	111.0	-	156.0	164.0	157.4	126.8	121.7	47.4	-	117.0	129.0	108.4
Coimbatore														
Cotton - maize	258.0	256.0	243.0	239.0	255.0	270.0	253.5	10.9	11.6	12.1	13.0	11.6	12.0	11.9
Chillies - sunflower	270.0	271.0	235.0	250.0	357.0	367.0	291.7	11.9	11.7	13.5	13.9	9.6	10.4	11.8
Beetroot - maize	238.0	276.0	313.0	238.0	301.0	276.0	273.7	9.8	9.9	8.9	9.7	10.1	11.3	10.0
Mean	255.3	267.7	263.7	242.3	304.3	304.3		10.9	11.1	11.5	12.2	10.4	11.2	
Dharwad														
Cowpea-safflower	287.0	277.4	263.9	270.8	276.1	272.5	274.6	31.6	27.5	25.9	27.3	29.1	26.9	28.0
Pigeon pea (sole)	317.9	276.4	267.1	271.9	276.4	276.1	281.0	31.8	26.6	26.5	29.6	28.0	27.0	28.3
green gram - sorghum	284.6	275.5	265.7	273.6	278.5	273.9	275.3	30.8	28.7	25.7	29.7	28.9	29.0	28.8
Groundnut + hybrid cotton (2:1)	284.0	275.7	264.6	271.3	272.4	271.1	273.2	28.6	29.9	27.2	27.8	27.9	27.1	28.1
Maize-Chickpea	282.8	271.2	272.8	271.7	273.1	273.1	274.1	28.3	27.6	26.7	27.5	27.2	28.2	27.6
Mean	291.3	275.2	266.8	271.9	275.3	273.3		30.2	28.1	26.4	28.4	28.2	27.6	28.2
Jabalpur														
Basmati rice –wheat (duram)-green manure	290.0	287.0	267.0	266.0	285.0	280.0	279.2	17.4	17.0	16.3	15.0	16.7	16.2	16.4
Basmati rice – chickpea - maize fodder	279.0	276.0	247.0	244.0	271.0	271.0	264.7	17.1	16.7	15.5	13.8	15.7	15.3	15.7
Basmati rice – berseem (fodder and seed)	275.0	274.0	243.0	244.0	273.0	271.0	263.3	16.4	16.1	15.9	15.0	16.5	16.1	16.0
Basmati rice – vegetable pea- sorghum (fodder)	285.0	280.0	265.0	260.0	274.0	272.0	272.7	16.5	16.1	15.1	14.1	16.4	17.0	15.9
Mean	282.3	279.3	255.5	253.5	275.8	273.5		16.8	16.5	15.7	14.5	16.3	16.2	

Management practice	Available Nitrogen (kg ha^{-1})							Available Phosphorus (kg ha^{-1})						
	Organic		Inorganic		Integrated (towards organic)			Organic		Inorganic		Integrated (towards organic)		
	100% organic	75% organic + innovative organic practices	100% Inorganic	State recommendation	50% organic + 50% inorganic	75% organic + 25% inorganic	Mean	100% organic	75% organic + innovative organic practices	100% inorganic	State recommendation	50% organic + 50% inorganic	75% organic +25% inorganic	Mean
Karjat														
Rice-Brinjal	-	-	-	-	-	-	254.8	-	-	-	-	-	-	27.5
Rice-Chickpea	-	-	-	-	-	-	230.1	-	-	-	-	-	-	25.2
Rice-Field bean	-	-	-	-	-	-	240.6	-	-	-	-	-	-	26.0
Rice-Onion (White)	-	-	-	-	-	-	253.1	-	-	-	-	-	-	27.2
Mean	251.9	249.8	239.0	231.0	247.7	248.7		27.4	26.7	25.7	25.2	26.8	26.9	
Ludhiana														
Basmati rice-chickpea-GM	370.7	365.4	288.2	288.2	363.1	363.4	339.8	-	-	-	-	-	-	-
Basmati rice-wheat-GM	350.9	353.1	300.9	302.9	351.7	348.2	334.6	-	-	-	-	-	-	-
Clusterbean-wheat-summer moong	363.4	360.7	302.9	298.2	350.9	325.8	333.7	-	-	-	-	-	-	-
Soybean -wheat	365.4	363.8	303.6	300.2	350.9	350.9	339.1	-	-	-	-	-	-	-
Mean	362.6	360.8	347.1	354.2	298.9	297.4								
Pantnagar												0.0		
Basmati rice-wheat	380.0	325.0	372.0	370.0	397.0	390.0	372.0	70.2	53.9	39.5	46.4	66.2	58.1	55.7
Basmati rice -chickpea (4rows+2rows coriander)	425.0	375.0	358.0	345.0	408.0	407.0	386.0	65.6	59.1	37.8	65.7	68.8	60.3	59.6
Basmati rice -vegetable pea (4 rows vegetable pea +2 rows coriander)	422.0	402.0	368.0	381.0	305.0	392.0	378.0	70.7	60.2	42.6	49.6	64.7	52.4	56.7
Basmati rice -potato	408.0	385.0	302.0	386.0	410.0	382.0	379.0	74.4	63.4	55.7	56.3	71.4	49.8	61.8
Mean	409.0	372.0	350.0	371.0	380.0	393.0		70.2	59.2	43.9	54.5	67.3	55.2	
Raipur														
Soybean-maize	246.7	225.7	239.3	246.7	240.0	238.3	239.4	20.9	21.4	22.7	22.0	21.4	21.5	21.7
Soybean-pea	258.0	234.0	259.0	260.7	251.7	249.3	252.1	23.4	22.9	20.8	21.7	21.8	21.8	22.1
Soybean-chilli	252.0	231.0	249.0	253.0	246.3	242.0	245.6	20.8	21.5	22.5	22.4	21.8	22.6	21.9
Soybean-onion	250.7	228.7	246.7	249.7	241.7	241.0	243.1	22.0	20.6	22.7	23.4	21.8	22.1	22.1
Mean	251.8	229.8	248.5	252.5	244.9	242.7		21.8	21.6	22.2	22.4	21.7	22.0	
Ranchi														
Rice -wheat	-	-	-	-	-	-	284.0	-	-	-	-	-	-	56.9
Rice-lentil	-	-	-	-	-	-	293.6	-	-	-	-	-	-	54.2
Rice-potato	-	-	-	-	-	-	296.4	-	-	-	-	-	-	58.1
Rice- linseed	-	-	-	-	-	-	273.3	-	-	-	-	-	-	55.9
Mean	320.5	309.0	268.7	247.2	279.3	296.3		55.8	54.3	59.9	57.1	55.0	55.5	
Umiam														
Vegetable-vegetable systems on raised bed														
Broccoli -carrot	-	-	-	-	-	-	247.4	-	-	-	-	-	-	20.2
Broccoli - potato	-	-	-	-	-	-	242.5	-	-	-	-	-	-	19.9
Broccoli -french bean	-	-	-	-	-	-	259.1	-	-	-	-	-	-	22.0
Broccoli -tomato	-	-	-	-	-	-	250.3	-	-	-	-	-	-	20.7
Mean	260.2	249.2	241.6		248.2			23.0	20.0	16.8		23.1		

Management practice	Available Nitrogen (kg ha^{-1})							Available Phosphorus (kg ha^{-1})						
	Organic		Inorganic		Integrated (towards organic)			Organic		Inorganic		Integrated (towards organic)		
	100% organic	75% organic + innovative organic practices	100% Inorganic	State recommendation	50% organic + 50% inorganic	75% organic + 25% inorganic	Mean	100% organic	75% organic + innovative organic practices	100% inorganic	State recommendation	50% organic + 50% inorganic	75% organic +25% inorganic	Mean
Rice- fallow system on sunken bed														
Megha aromatic 2–fellow	-	-	-	-	-	-	226.9	-	-	-	-	-	-	19.4
Shasharang–fellow	-	-	-	-	-	-	239.7	-	-	-	-	-	-	19.9
Ngoba–fellow	-	-	-	-	-	-	230.5	-	-	-	-	-	-	19.4
Lampnah–fellow	-	-	-	-	-	-	229.9	-	-	-	-	-	-	19.1
Mean	243.0	220.5	222.5		241.0			21.5	18.1	15.0		23.2		
New centres started from 2015-16														
Ajmer														
Green gram – fennel	140.3	137.8	136.7	134.7	136.1	132.7	136.4	18.2	16.7	16.0	14.3	15.0	13.8	15.7
Green Gram - Coriander	136.5	133.9	131.0	127.5	130.2	126.4	130.9	16.8	16.0	14.1	13.5	13.8	13.0	14.5
Cluster bean - fennel	140.3	137.8	136.7	134.7	136.1	132.7	136.4	18.2	16.7	16.0	14.3	15.0	13.8	15.7
Cluster Bean – Coriander	136.5	133.9	131.0	127.5	130.2	126.4	130.9	16.8	16.0	14.1	13.5	13.8	13.0	14.5
Narendrapur														
Paddy (sohini 2)–broccoli –*sesbania* green manure	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Paddy (satabdi)– mustard– green gram	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Paddy (satabdi)– capsicum– green gram	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Paddy (satabdi)–french bean – sesame	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Mean														
Sardarkrushinagar														
Groundnut- wheat- green gram	151.0	148.0	145.0	146.0	154.0	144.0	148.0	17.7	17.1	16.1	15.9	17.6	16.8	16.8
Greengram- cumin- vegetable cowpea	151.0	151.0	144.0	145.0	150.0	148.0	148.2	15.2	14.0	15.2	15.1	14.5	15.4	14.9
Greengram-fennel- fennel cont.	144.0	143.0	139.0	142.0	142.0	142.0	142.0	15.3	16.8	14.5	13.1	12.6	15.2	14.6
Mean	148.7	147.3	142.7	144.3	148.7	144.7		16.1	16.0	15.2	14.7	14.9	15.8	

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

Management practice	Available Potassium(kg ha^{-1})						
	Organic		Inorganic		Integrated (towards organic)		
	100% organic	75% organic + innovative organic practices	100% inorganic	State recommendation	50% organic + 50% inorganic	75% organic +25% inorganic	Mean
Bajaura							
Tomato-cauliflower- french bean	240.0	248.8	123.9	132.5	241.7	241.9	212.5
Fallow-cauliflower-tomato	240.0	252.5	136.2	143.4	248.6	254.4	212.5
Black gram-cauliflower- summer squash	240.0	246.5	246.5	246.5	246.5	246.5	245.4
Lady finger-pea	240.0	223.6	124.7	132.0	238.7	236.2	199.2
Mean	240.0	242.9	157.8	163.6	243.9	244.8	
Bhopal							
Soybean-durum wheat	530.0	503.0	526.0	510.0	485.0	544.0	516.0
Soybean- mustard	492.0	525.0	524.0	509.0	488.0	490.0	505.0
Soybean- chickpea	490.0	488.0	478.0	503.0	416.0	447.0	470.0
Soybean- linseed	485.0	475.0	489.0	520.0	506.0	539.0	502.0
Mean	499.0	498.0	504.0	511.0	474.0	505.0	
Calicut							
Ginger-fallow	388.0	316.0	247.0	-	275.0	397.0	324.6
Turmeric-fallow	249.0	213.3	365.0	-	336.0	325.7	297.8
Coimbatore							
Cotton - maize	439.0	428.0	419.0	436.0	452.0	455.0	438.2
Chillies - sunflower	473.0	480.0	457.0	477.0	492.0	489.0	478.0
Beetroot - maize	455.0	445.0	465.0	466.0	461.0	472.0	460.7
Mean	455.7	451.0	447.0	459.7	468.3	472.0	
Dharwad							
Cowpea-safflower	387.4	374.8	361.0	371.9	371.7	375.3	373.7
Pigeon pea (sole)	385.7	373.1	366.8	371.9	372.9	375.8	374.4
green gram - sorghum	385.1	373.0	368.7	370.4	373.0	373.8	374.0
Groundnut + hybrid cotton (2:1)	386.0	372.6	364.1	372.9	375.2	371.8	373.8
Maize-Chickpea	380.4	374.5	367.0	373.1	373.0	371.4	373.3
Mean	384.9	373.6	365.6	372.1	373.2	373.6	
Jabalpur							
Basmati rice –wheat (duram)-green manure	297.0	294.0	283.0	282.0	292.0	291.0	289.8
Basmati rice – chickpea - maize fodder	295.0	300.0	279.0	275.0	285.0	284.0	286.3
Basmati rice – berseem (fodder and seed)	293.0	286.0	283.0	274.0	292.0	290.0	286.3
Basmati rice – vegetable pea- sorghum (fodder)	291.0	292.0	265.0	259.0	291.0	282.0	280.0
Mean	294.0	293.0	277.5	272.5	290.0	286.8	
Karjat							
Rice-Brinjal	-	-	-	-	-	-	317.9
Rice-Chickpea	-	-	-	-	-	-	326.5
Rice-Field bean	-	-	-	-	-	-	342.2
Rice-Onion (White)	-	-	-	-	-	-	330.8
Mean	336.0	334.0	313.9	302.7	330.3	332.2	
Ludhiana							
Basmati rice-chickpea-GM	-	-	-	-	-	-	-
Basmati rice-wheat-GM	-	-	-	-	-	-	-
Clusterbean-wheat-summer moong	-	-	-	-	-	-	-
Soybean -wheat	-	-	-	-	-	-	-
Mean							

Management practice	Available Potassium(kg ha^{-1})						
	Organic		Inorganic		Integrated (towards organic)		
	100% organic	75% organic + innovative organic practices	100% inorganic	State recommendation	50% organic + 50% inorganic	75% organic +25% inorganic	Mean
Pantnagar							
Basmati rice-wheat	225.0	247.0	239.0	236.0	253.0	258.0	243.0
Basmati rice -chickpea (4rows+2rows coriander)	251.0	250.0	254.0	290.0	240.0	264.0	258.0
Basmati rice -vegetable pea (4 rows vegetable pea +2 rows coriander)	263.0	244.0	237.0	288.0	282.0	293.0	268.0
Basmati rice -potato	255.0	257.0	242.0	271.0	261.0	256.0	257.0
Mean	249.0	250.0	243.0	271.0	259.0	268.0	
Raipur							
Soybean-maize	372.0	344.3	383.3	387.0	359.3	388.0	372.3
Soybean-pea	373.3	360.7	372.0	387.7	357.3	353.7	367.4
Soybean-chilli	361.7	365.8	373.7	373.8	357.3	357.5	365.0
Soybean-onion	356.0	365.3	377.0	386.3	371.0	363.3	369.8
Mean	365.8	359.0	376.5	383.7	361.2	365.6	
Ranchi							
Rice -wheat	-	-	-	-	-	-	186.4
Rice-lentil	-	-	-	-	-	-	183.2
Rice-potato	-	-	-	-	-	-	173.7
Rice- linseed	-	-	-	-	-	-	193.3
Mean	220.9	216.3	155.9	149.7	178.0	183.8	
Umiam							
Vegetable-vegetable systems *on raised bed*							
Broccoli -carrot	-	-	-	-	-	-	278.7
Broccoli - potato	-	-	-	-	-	-	285.9
Broccoli -french bean	-	-	-	-	-	-	277.0
Broccoli -tomato	-	-	-	-	-	-	280.7
Mean	288.2	273.4	270.6		290.1		
Rice- fallow system on sunken bed							
Megha aromatic 2–fellow	-	-	-	-	-	-	273.2
Shasharang–fellow	-	-	-	-	-	-	288.5
Ngoba–fellow	-	-	-	-	-	-	284.8
Lampnah–fellow	-	-	-	-	-	-	270.0
Mean	284.5	277.5	279.3		275.7		
New centres started from 2015-16							
Ajmer							
Green gram – fennel	324.3	340.7	309.1	302.5	304.8	351.3	322.1
Green Gram - Coriander	353.3	358.6	360.5	362.3	366.2	361.4	360.4
Cluster bean - fennel	324.3	340.7	309.1	302.5	304.8	351.3	322.1
Cluster Bean – Coriander	353.3	358.6	360.5	362.3	366.2	361.4	360.4
Narendrapur							
Paddy (sohini 2)–broccoli –*sesbania* green manure	294.3	287.0	275.3	276.7	342.7	326.0	300.3
Paddy (satabdi)– mustard– green gram	228.9	243.3	252.7	254.8	247.0	231.1	243.0
Paddy (satabdi)– capsicum– green gram	363.7	212.3	267.0	325.7	334.7	257.3	293.4
Paddy (satabdi)–french bean – sesame	227.3	254.7	211.5	211.8	267.0	213.7	231.0
Mean	278.6	249.3	251.6	267.2	297.8	257.0	266.9
Sardarkrushinagar							
Groundnut- wheat- green gram	195.0	190.0	183.0	187.0	190.0	189.0	189.0
Greengram- cumin- vegetable cowpea	183.0	184.0	185.0	184.0	184.0	183.0	183.8
Greengram-fennel- fennel cont.	182.0	182.0	180.0	184.0	183.0	178.0	181.5
Mean	186.7	185.3	182.7	185.0	185.7	183.3	

systems, basmati rice-wheat-green gram system recorded (7.88 g/kg) higher organic carbon whereas, basmati rice–berseem (fodder and seed) recorded least (7.35 g/kg). Available nitrogen, phosphorus and potassium were not influenced due to the cropping system however, organic management practice either 100% or reduce dose of manure up to 25% recorded higher N.P and K.

Ludhiana:

Electrical conductivity, pH, soil organic carbon, available N, P and K were estimated at the end of cropping cycle. Electrical conductivity and pH at the end of cropping cycle did not influenced due to management practice and cropping systems. Among the management practices, soil organic carbon, soil available nitrogen, phosphorus and potassium were higher in organic management with100% nutrient application through manure. Soil organic carbon found to be higher by 34.1% over inorganic but it was on par to integrated management. Available N, P and K were higher under organic management and found to be (N 4.5%), (P 25.7%) and (K 8.6%) than inorganic package respectively. Among the cropping systems, all the systems did not found to be significant to each other for retention of N, P and K as residue in the soil.

Pantnagar:

Electric conductivity, pH, organic carbon, available N,P and K were estimated after completion of crop cycle. Lower EC (0.32 dsm^{-1}) was recorded under organic package with 75% nutrient application through organic manure+25% innovative practice as compared with other packages. Basmati rice-wheat and basmati rice-wheat-potato system recorded lowest EC (0.40dsm^{-1}).pH varied from 6.80 to 7.70among various management options .At the end of cropping cycle, soil organic carbon was influenced by different production management and the maximum value (1.38%) was recorded under 100 % organic followed by 75% organic +innovative technology (1.22%). The difference between organic to inorganic was found to be 76.9%. Among the cropping systems, maximum organic carbon was recorded under basmati rice–vegetable pea (1.14%) followed by basmati rice –chickpea +coriander-*sesbania* (1.11%). Likewise, maximum available N and P (409.0 and 70.2 kg/ha) was recorded under organic management followed by integrated (75% organic + 25% inorganic: 393 kg/ha). Also under organic(75% organic +innovative practices), K and S was higher (249 and 44 kg/ha). Among the cropping systems, maximum availability of N was recorded with rice-chickpea system. Rice–potato recorded higher phosphorus (67.8 kg/ha) and basmati rice -vegetable pea (268 kg/ha) recorded higher K.

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 no variation was found to be for nutrient management practices. However, soil organic carbon content was slightly higher under integrated nutrient management with100% inorganic package. As regards to cropping system no significantly variation in organic carbon was noticed. The residual N, P and K in soil after harvest of the *rabi* crops were found higher under inorganic with state recommendation practice (252.5, 22.4 and 383.7 kg ha^{-1} respectively). Soyabean-pea system recorded significantly higher N in soil after succeeding *rabi* crops over the rest of systems.

Ranchi:

Higher pH, organic carbon, available N & K was recorded with 100% organic package followed by 75% organic + innovative practices of 6.35, 0.74, 320.5 and 220.9 respectively.About 68.2% organic carbon was enhanced with organic practice that of inorganic. Among cropping system, pH, organic carbon and available N was found to be higher in rice-lentil, while,

P in rice-potato and K was higher with rice-linseed system.

Umiam:

End of cropping cycle, physio-chemical properties was estimated. Bulk density in both raised and sunken bed was slightly decreased compared to initial year (1.19 g/cm3 and 1.25 g/cm3 respectively). Among the nutrient management practices, 100% organic resulted in lower bulk density (1.07 mg/m3) whereas among various cropping systems, broccoli-french bean system recorded as lowest (1.06 mg/m3). Soil organic carbon increased over the initial status in all the management practices. Under raised bed and sunken bed condition, 100% organic practice recorded maximum followed by integrated at 30cm depth. Among the cropping systems, broccoli-frenchbean recorded higher organic carbon (2.64%) under raised bed method. Maximum available N and P was found to be higher under 100% organic (260.2 kg/ha and 22.9 kg/ha respectively) whereas, maximum K were found under integrated management (290.1 kg/ha). In case of sunken beds, available N and K were found maximum under organic (243.0 kg/ha and 284.5 kg/ha, respectively) while available P was maximum under integrated (23.2 kg/ha).

Ajmer:

Soil nutrient status after coriander crop was influenced by different management practices and the maximum organic carbon (0.30 %), available N (136.5 kg/ha) and P (16.8 kg/ha) was recorded either by 100% organic or 75% organic + innovative practices while, K was found to be higher (366.2 kg/ha) under integrated (50 % organic + 50% inorganic practices). Similarly, at the end of cropping cycle, the maximum organic carbon (0.29%), available N (140.3 kg/ha) and P (18.2 kg/ha) was recorded under organic practice (100% organic and 75% 0rganic + innovative practices) whereas, available K was higher (351.3 kg/ha) under integrated (75% organic + 25% Inorganic).

Narendrapur:

Bulk density and pH did not influenced by the management practices and recorded ranging from 1.70 to 1.90 (g/cc) and 6.23 to 6.83 respectively across the cropping system. However, soil electrical conductivity and organic carbon did change due to different nutrient management and varied from 0.25 to 0.71dsm^{-1} and 0.69 to 0.99% respectively across the cropping system. Among the management practices, soil organic carbon was recorded higher with 100% organic management (0.91%) followed by integrated (50% organic + 50% inorganic) of 0.85%. Among the copping systems, basmati rice-frenchbean-sesame system recorded higher soil organic carbon (0.85%) but was on par with rice-broccoli-*sesbania* and rice-capsicum- green gram. The soil available phosphoruswas higher in organic package (71.3 and 68.6 kg/ha) followed by integrated towards organic with 75% organic +25% inorganic (64.8 kg/ha)while, K was higher in integrated with 75% organic +25% inorganic through organic and inorganic (297.8 kg/ha).Among the copping systems, Paddy (Satabdi)–capsicum– green gram recorded higher available phosphorus whereas, K was higher in Paddy (sohini 2)–broccoli – sesbania green manure system.

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 (15.43 and 3.64 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 12.1 and 2.90 ppm.

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

Management practice	Soil Available Iron (ppm)							Soil Available Manganese (ppm)						
	Organic		Inorganic		Integrated (towards organic)			Organic		Inorganic		Integrated (towards organic)		
	100% organic	75% organic + innovative organic practices	100% Inorganic	State recommendation	50% organic + 50% inorganic	75% organic + 25% inorganic	Mean	100% organic	75% organic + innovative organic practices	100% Inorganic	State recommendation	50% organic + 50% inorganic	75% organic + 25% inorganic	Mean
Bajura														
Tomato-cauliflower- french bean	14.6	12.3	7.7	9.8	14.2	12.3	11.8	11.2	9.6	7.0	7.7	12.9	10.0	9.7
Fallow-cauliflower-tomato	15.3	12.4	9.1	10.8	13.7	12.6	12.3	11.9	10.0	6.3	8.9	12.9	10.2	10.0
Black gram-cauliflower- summer squash	17.5	13.8	8.4	10.5	16.4	14.5	13.5	11.2	7.9	5.9	7.2	11.1	9.9	8.9
Lady finger-pea	14.3	13.4	8.5	9.8	16.4	14.3	12.8	11.7	10.1	6.4	8.8	11.2	9.9	9.7
Mean	15.4	13.0	8.4	10.2	15.2	13.4		11.5	9.4	6.4	8.2	12.0	10.0	
Calicut														
Ginger - fallow	41.0	37.0	36.0	-	48.0	45.0	41.4	254.0	234.0	45.0	-	205.0	286.0	204.8
Turmeric-fallow	39.0	42.0	42.0	-	39.0	47.0	41.8	15.1	13.9	19.6	-	17.1	24.1	18.0
Dharwad														
Cowpea-safflower	10.7	9.6	9.4	9.5	9.7	10.1	9.8	13.6	13.3	12.5	13.0	13.1	13.1	13.8
Pigeon pea (sole)	10.5	9.3	9.3	9.4	10.1	9.7	9.7	13.7	12.9	12.4	13.3	13.3	12.8	13.1
green gram - sorghum	10.6	10.1	9.1	9.8	9.9	9.4	9.8	14.2	13.1	12.2	13.2	13.1	12.8	13.1
Groundnut + hybrid cotton (2:1)	10.5	9.8	9.2	9.8	9.8	9.7	9.8	14.9	14.2	12.2	13.0	13.2	12.7	13.2
Maize-chickpea	10.5	9.8	9.1	9.8	10.2	9.5	9.8	14.1	12.8	12.2	13.0	13.1	13.0	13.0
Mean	10.6	9.7	9.2	9.7	9.9	9.7		14.1	13.1	12.3	13.1	13.2	12.9	
Pantnagar														
Basmati rice-wheat	75.9	80.5	51.3	39.1	45.6	57.3	58.3	12.7	11.6	9.4	11.1	11.4	11.5	11.3
Basmati rice -chickpea (4rows+2rows coriander)	77.8	80.7	50.5	41.2	46.5	54.4	58.5	14.3	12.5	8.9	9.8	12.6	13.7	12.0
Basmati rice -vegetable pea (4 rows vegetable pea +2 rows coriander)	70.7	80.4	49.8	39.7	49.0	60.7	58.4	17.5	12.5	10.7	8.8	12.3	11.4	12.2
Basmati rice -potato	69.9	81.6	48.6	41.0	46.6	61.9	58.3	14.6	16.1	9.3	10.4	13.7	12.5	12.8
Mean	73.6	80.8	50.1	40.3	46.9	58.6		14.8	13.2	9.6	10.0	12.5	12.3	
Sardarkrushinagar														
Groundnut- Wheat- Green gram	3.7	3.6	3.5	3.4	3.5	3.6	3.5	5.5	5.4	5.0	5.3	5.3	5.4	5.3
Greengram- Cumin- Vegetable cowpea	3.6	3.7	3.4	3.3	3.5	3.4	3.5	6.3	6.2	5.7	5.8	6.0	5.9	6.0
Greengram-Fennel- Fennel cont.	3.8	3.5	3.6	3.4	3.6	3.5	3.6	6.1	5.9	5.6	5.7	5.7	5.7	5.8
Mean	3.7	3.6	3.5	3.4	3.5	3.5		6.0	5.8	5.4	5.6	5.7	5.7	
Thiruvananthapuram														
Cassava-veg. cowpea	34.4	44.5	96.1	26.8	51.9	217.8	78.6	8.4	5.3	16.5	7.2	8.9	32.6	13.1
Cassava-groundnut	16.4	11.0	24.7	13.3	104.5	17.0	31.1	2.6	1.8	2.2	1.7	2.4	2.3	2.2
Taro-black gram	19.3	15.7	19.3	13.1	18.1	26.9	18.7	4.7	3.5	3.4	2.9	3.4	3.4	3.6
Taro-greengram	19.1	11.6	21.7	13.3	13.0	25.8	17.4	2.1	1.9	1.8	1.9	2.4	2.3	2.1
Mean	22.3	20.7	40.5	16.6	46.9	71.9		4.5	3.1	6.0	3.4	4.3	10.1	

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)			Organic		Inorganic		Integrated (towards organic)		
	100% organic	75% organic + innovative organic practices	100% Inorganic	State recommendation	50% organic + 50% inorganic	75% organic + 25% inorganic	Mean	100% organic	75% organic + innovative organic practices	100% Inorganic	State recommendation	50% organic + 50% inorganic	75% organic + 25% inorganic	Mean
Bajura														
Tomato-cauliflower- french bean	3.94	2.85	1.93	1.88	3.09	2.86	2.76	2.16	1.72	0.98	1.45	2.37	1.77	1.74
Fallow-cauliflower-tomato	3.35	2.88	1.74	2.09	3.08	2.89	2.67	3.15	1.85	1.05	1.66	3.73	2.42	2.31
Black gram-cauliflower- summer squash	3.73	3.14	1.85	2.85	2.92	2.75	2.87	1.35	0.98	0.99	0.98	1.65	1.44	1.23
Lady finger-pea	3.55	2.60	1.98	2.38	3.04	2.76	2.72	3.56	2.14	0.96	1.44	3.88	2.46	2.41
Mean	3.64	2.87	1.88	2.30	3.03	2.82		2.56	1.67	1.00	1.38	2.91	2.02	
Calicut														
Ginger - fallow	7.00	5.60	4.10	-	6.80	6.60	6.02	9.20	8.50	7.40	-	6.60	7.90	7.92
Turmeric-fallow	3.50	3.20	0.90	-	1.40	2.00	2.20	6.50	4.30	3.70	-	4.10	5.70	4.86
Dharwad														
Cowpea-safflower	0.81	0.77	0.73	0.75	0.76	0.75	0.76	1.61	1.46	1.37	1.40	1.43	1.41	1.45
Pigeon pea (sole)	0.85	0.79	0.72	0.77	0.80	0.77	0.78	1.56	1.44	1.35	1.42	1.41	1.49	1.45
green gram - sorghum	0.83	0.76	0.74	0.80	0.73	0.73	0.76	1.47	1.43	1.33	1.45	1.47	1.44	1.43
Groundnut + hybrid cotton (2:1)	0.84	0.78	0.72	0.78	0.78	0.74	0.77	1.53	1.49	1.32	1.42	1.41	1.41	1.43
Maize-chickpea	0.82	0.76	0.75	0.78	0.75	0.76	0.77	1.58	1.42	1.38	1.43	1.48	1.42	1.45
Mean	0.83	0.77	0.73	0.78	0.76	0.75		1.55	1.45	1.35	1.42	1.44	1.43	
Pantnagar														
Basmati rice-wheat	1.42	1.54	0.89	0.91	1.36	0.96	1.18	5.45	5.55	4.08	4.10	5.25	5.47	4.98
Basmati rice -chickpea (4rows+2rows coriander)	1.45	1.64	0.88	0.95	1.38	1.12	1.24	5.12	5.70	3.85	4.24	5.32	5.38	4.94
Basmati rice -vegetable pea (4 rows vegetable pea +2 rows coriander)	1.66	1.55	0.92	0.99	1.25	1.20	1.26	4.93	5.47	4.00	4.10	5.23	5.27	4.83
Basmati rice -potato	1.54	1.31	0.89	0.92	1.12	1.15	1.16	5.36	5.54	3.99	4.21	5.33	5.16	4.93
Mean	1.52	1.51	0.90	0.94	1.28	1.11		5.22	5.57	3.98	4.16	5.28	5.32	
Sardarkrushinagar														
Groundnut- wheat- green gram	0.46	0.43	0.27	0.37	0.40	0.41	0.39	0.67	0.58	0.38	0.47	0.57	0.56	0.54
Greengram- cumin- vegetable cowpea	0.44	0.41	0.32	0.37	0.42	0.40	0.39	0.55	0.52	0.35	0.43	0.50	0.48	0.47
Greengram-fennel- fennel cont.	0.38	0.35	0.25	0.29	0.33	0.32	0.32	0.53	0.52	0.38	0.43	0.51	0.46	0.47
Mean	0.43	0.40	0.28	0.34	0.38	0.38		0.58	0.54	0.37	0.44	0.53	0.50	
Thiruvananthapuram														
Cassava-veg. cowpea	5.74	5.80	6.60	6.42	6.74	5.12	6.07	1.92	1.96	2.00	1.92	2.06	1.78	1.94
Cassava-groundnut	4.72	2.92	4.06	4.36	4.56	4.12	4.12	2.04	1.60	1.90	1.78	1.96	1.90	1.86
Taro-black gram	4.84	4.20	5.80	4.86	4.30	4.78	4.80	1.46	1.42	1.58	1.52	1.50	1.42	1.48
Taro-greengram	4.32	3.72	4.84	4.86	1.14	4.20	3.85	1.54	1.52	2.00	2.06	1.70	1.52	1.72
Mean	4.91	4.16	5.33	5.13	4.19	4.56		1.74	1.63	1.87	1.82	1.81	1.66	

Available Fe and Zn was found to be higher (83.0 & 93.6 %) compared to inorganic whereas, Mn and Cu (87.4 & 191.04%) was higher than inorganic management respectively. In terms of cropping system, not much variation recorded with micronutrients. Cropping systems, black gram-cauliflower-summer squash recorded higher available Fe and Zn (13.52 and 2.87 ppm respectively) in the soil. Cauliflower-tomato recorded higher available Mn (10.04 ppm) while, ladyfinger-pea recorded higher copper (2.41 ppm) in the soil.

Calicut:

In ginger crop**,** higher available iron (48.0 ppm) was recorded under inorganic with 50% each organic and inorganic nutrient management whereas; manganese was recorded higher (22.5 ppm) under inorganic nutrient. Higher zinc (7.0 ppm) and copper (9.2 ppm) recorded higher under organic management package. In case of turmeric, higher available iron and manganese (47.0, and 24.1 ppm) were higher under integrated practice with 75% organic +25% inorganic management system whereas zinc and copper was higher under organic nutrient management.

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 9.23, 12.31, 0.73 and 1.35, mg/kg to 10.85, 14.11, 0.83 and 1.55 mg/kg, respectively with 100% organic management practice. Whereas, cropping systems and interactions did not differ significantly.

Pantnagar:

Availability of Zn (1.52 ppm) and Mn (14.8 ppm) in the soil was found higher in 100% organic followed by 75% organic+ innovative practice however; the availability of Cu (5.57 ppm) and Fe (80.8 ppm) was maximum under 75% organic +innovative practices. Among the cropping systems, the availability of Zn was higher in basmati rice- vegetable pea system (1.26 ppm) that of Cu (4.95 ppm) was higher in basmati rice-wheat system and Fe (58.5 ppm) was higher in basmati rice –chickpea system although, availability of Mn (12.8 ppm) was recorded higher in basmati rice-potato system.

S.K. Nagar:

Iron, manganese, zinc and copper were estimated but these are not differ significantly due to the nutrients management practices and cropping systems. The availably of micronutrient in the soil at the end of cropping cycle recorded higher in organic management practice and the variation for Fe and Zn ranging from 3.38-3.87 ppm and 5.45-5.96ppm. Zinc and copper was increased by their initial value with inorganic to organic 0.28-0.43 ppm and 0.37 to 0.58 ppm 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:

The N, P and K uptake among cropping systems was recorded higher in integrated nutrient management consisting of 50% organic+ 50% inorganic while minimum being in 100% inorganic. In tomato-cauliflower- french bean system, the N, P and K uptake ranged from minimum of 392.5 kg/ha, 40.7 kg/ha and 352.4 kg/ha in 100% inorganic to a maximum of 575.4 kg/ha, 70.1 kg/ha and 513.4 kg/ha, respectively in integrated consisting of 50% organic+ 50% inorganic. Similarly, cropping system cauliflower-tomato for N, P and K uptake varied from a minimum of 298.7 kg/ha, 37.3 kg/ha and 279.7 kg/ha under inorganic to a maximum of 451.3kg/ha, 57.6 kg/ha and 422.2 kg/ha, respectively in integrated. The lower value of N (361.7 kg/ha), P (44.3kg/ha) and K uptake (372.8 kg/ha) was recorded in black gram-cauliflower-summer squash under 100% inorganic.

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

Cropping system/management Package	Organic						Inorganic						Integrated (towards organic)					
	100% Organic			75% organic + innovative organic practices			100% inorganic			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	460.2	-	-	474.9	-	-	392.5	-	-	571.7	-	-	575.4	-	-	566.4	-	-
Fallow-cauliflower-tomato	410.7	-	-	418.7	-	-	298.9	-	-	434.4	-	-	451.3	-	-	417.1	-	-
Black gram-cauliflower - summer squash	467.9	-	-	492.8	-	-	361.7	-	-	518.0	-	-	632.9	-	-	632.0	-	-
Lady finger-pea	324.1	-	-	328.5	-	-	247.6	-	-	371.4	-	-	436.3	-	-	395.7	-	-
Calicut																		
Ginger-fallow**(%)**	50.0	-	-	63.0	-	-	33.0	-	-	0.0	-	-	73.0	-	-	84.0	-	-
Turmeric-fallow (kg/ha)	107.1	-	-	89.9	-	-	77.8	-	-	0.0	-	-	104.9	-	-	109.1	-	-
Pantnagar																		
Basmati rice - wheat	85.7	111.4	-	83.5	112.7	-	70.6	116.5	-	73.6	119.2	-	77.7	125.5	-	80.9	128.9	-
Basmati rice–chickpea (4 rows chickpea + 2 rows coriander)	85.7	75.1	-	83.5	76.9	-	70.6	71.3	-	73.6	73.3	-	77.7	75.9	-	80.9	78.0	-
Basmati rice–vegetable pea (4 rows vegetable pea + 2 rows coriander)	85.7	-	-	83.5	-	-	70.6	-	-	73.6	-	-	77.7	-	-	80.9	-	-
Basmati rice – potato	85.7	-	-	83.5	-	-	70.6	-	-	73.6	-	-	77.7	-	-	80.9	-	-
Raipur																		
Mean cropping systems	151.8			159.6		-	137.0		-	141.7			128.8			135.3		
Ranchi																		
Mean cropping system	154.1			153.5			127.1			103.0			143.3			140.7		
New centres included from 2015-16																		
Ajmer																		
Green Gram – Fennel		31.8			30.6			28.4			35.4			31.1			37.9	
Cluster Bean - Fennel		13.7			13.4			14.4			16.7			14.5			17.6	
Sardarkrushinagar																		
Groundnut- wheat- green gram	191.0			193.0			233.0			243.0			223.0			220.0		
Greengram- cumin- vegetable cowpea	70.0			68.0			107.0			109.0			96.0			96.0		
Greengram-fennel- fennel cont.	53.0			52.0			69.0			70.0			64.0			60.0		
Udaipur																		
Maize + blackgram (2:2) – durum wheat – sesbania (GM)	55.8	-	-	57.1	-	-	76.3	-	-	48.9	-	-	83.3	-	-	71.9	-	-
Sweet corn + blackgram (2:2) – chickpea	54.2	-	-	59.8	-	-	86.3	-	-	67.3	-	-	69.0	-	-	61.3	-	-
Blackgram – wheat	19.9	-	-	22.2	-	-	22.6	-	-	16.9	-	-	24.4	-	-	25.5	-	-
Soybean - fenugreek		-	-	29.4	-	-	37.3	-	-	22.3	-	-		-	-	74.4	-	-

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

Cropping system/management Package	Organic						Inorganic						Integrated (towards organic)					
	100% Organic			75% organic + innovative organic practices			100% inorganic			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	55.0	-	-	55.6	-	-	40.7	-	-	66.3	-	-	70.1	-	-	65.6	-	-
Fallow-cauliflower-tomato	52.6	-	-	55.3	-	-	37.3	-	-	57.3	-	-	57.6	-	-	52.2	-	-
Black gram-cauliflower - summer squash	62.9	-	-	67.4	-	-	44.3	-	-	69.2	-	-	83.8	-	-	79.7	-	-
Lady finger-pea	30.4	-	-	30.6	-	-	27.3	-	-	42.4	-	-	51.3	-	-	44.9	-	-
Calicut																		
Ginger-fallow**(%)**	20.0	-	-	26.0	-	-	27.9	-	-	-	-	-	22.0	-	-	24.0	-	-
Turmeric-fallow (kg/ha)	62.5	-	-	56.6	-	-	30.3	-	-	-	-	-	52.7	-	-	57.6	-	-
Pantnagar																		
Basmati rice - wheat	22.1	35.1		23.9	41.6		20.1	43.5		20.3	47.5		21.8	50.6		23.4	52.8	
Basmati rice–chickpea (4 rows chickpea + 2 rows coriander)	22.1	33.6		23.9	30.8		20.1	29.6		20.3	27.9		21.8	33.4		23.4	33.4	
Basmati rice–vegetable pea (4 rows vegetable pea + 2 rows coriander)	22.1	-		23.9	-		20.1	-		20.3	-		21.8	-		23.4	-	
Basmati rice – potato	22.1	-		23.9	-		20.1	-		20.3	-		21.8	-		23.4	-	
Raipur																		
Cropping systems mean	18.8	-	-	19.8	-	-	16.5	-	-	17.6	-	-	15.3	-	-	16.2	-	-
Ranchi																		
Cropping systems mean	40.3	-	-	39.5	-	-	31.5	-	-	24.7	-	-	36.1	-	-	35.7	-	-
New centres included from 2015-16																		
Ajmer																		
Green gram – fennel	-	7.2	-	-	6.8	-	-	6.2	-	-	8.0	-	-	6.5	-	-	8.4	-
Cluster bean – coriander	-	2.7	-	-	3.7	-	-	3.4	-	-	4.0	-	-	3.7	-	-	4.3	-
Sardarkrushinagar																		
Groundnut- wheat- green gram	31.4	-	-	31.3	-	-	37.6	-	-	37.4	-	-	36.2	-	-	34.7	-	-
Greengram- cumin- vegetable cowpea	10.0	-	-	9.3	-	-	16.9	-	-	15.6	-	-	14.2	-	-	13.5	-	-
Greengram-Fennel- Fennel cont.	12.8	-	-	13.2	-	-	17.8	-	-	16.6	-	-	16.1	-	-	15.5	-	-
Udaipur																		
Maize + blackgram (2:2) – durum wheat – sesbania (GM)	11.0	-	-	11.0	-	-	13.2	-	-	8.7	-	-	14.8	-	-	13.6	-	-
Sweet corn + blackgram (2:2) – chickpea	8.5	-	-	9.4	-	-	13.8	-	-	9.9	-	-	11.6	-	-	9.9	-	-
Blackgram – wheat	2.9	-	-	3.2	-	-	3.2	-	-	2.6	-	-	3.6	-	-	3.6	-	-
Soybean - fenugreek		-	-	3.3	-	-	4.2	-	-	2.4	-	-		-	-	8.3	-	-

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

Cropping system/management Package	Organic						Inorganic						Integrated (towards organic)					
	100% Organic			75% organic + innovative organic practices			100% inorganic			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	413.4	-	-	430.8	-	-	352.4	-	-	506.3	-	-	513.4	-	-	504.3	-	-
Fallow-cauliflower-tomato	408.5	-	-	427.4	-	-	279.7	-	-	403.2	-	-	422.2	-	-	389.1	-	-
Black gram-cauliflower - summer squash	473.3	-	-	512.3	-	-	372.8	-	-	518.2	-	-	630.6	-	-	633.1	-	-
Lady finger-pea	190.7	-	-	200.2	-	-	159.4	-	-	218.9	-	-	278.8	-	-	247.3	-	-
Calicut																		
Ginger-fallow(%)	25.0	-	-	25.0	-	-	19.0	-	-	0.0	-	-	38.0	-	-	52.0	-	-
Turmeric-fallow (kg/ha)	120.5	-	-	98.3	-	-	54.2	-	-	0.0	-	-	97.8	-	-	115.8	-	-
Pantnagar																		
Basmati rice - wheat	69.3	100.4	-	68.4	102.0	-	63.7	115.5	-	64.6	110.2	-	68.7	118.6	-	69.7	116.0	-
Basmati rice–chickpea (4 rows chickpea + 2 rows coriander)	69.3	53.8	-	68.4	54.7	-	63.7	53.3	-	64.6	50.1	-	68.7	56.0	-	69.7	57.3	-
Basmati rice–vegetable pea (4 rows vegetable pea + 2 rows coriander)	69.3	0.0	-	68.4	0.0	-	63.7	0.0	-	64.6	0.0	-	68.7	0.0	-	69.7	0.0	-
Basmati rice – potato	69.3	0.0	-	68.4	0.0	-	63.7	0.0	-	64.6	0.0	-	68.7	0.0	-	69.7	0.0	-
Raipur																		
Cropping systems mean	66.5	-	-	71.3	-	-	59.8	-	-	62.5	-	-	55.7	-	-	60.1	-	-
Ranchi																		
Cropping systems mean	149.2	-	-	147.3	-	-	115.2	-	-	94.7	-	-	132.2	-	-	131.7	-	-
New centres included from 2015-16																		
Ajmer																		
Green Gram – Fennel	-	24.7	-	-	22.2	-	-	23.0	-	-	27.7	-	-	23.2	-	-	29.8	-
Cluster Bean – Coriander	-	10.6	-	-	11.7	-	-	10.8	-	-	13.1	-	-	11.6	-	-	14.0	-
Sardarkrushinagar																		
Groundnut- Wheat- Green gram	129.0	-	-	125.0	-	-	144.0	-	-	152.0	-	-	136.0	-	-	128.0	-	-
Greengram-Cumin-Vegetable cowpea	56.0	-	-	54.0	-	-	81.0	-	-	83.0	-	-	76.0	-	-	76.0	-	-
Udaipur																		
Maize + blackgram (2:2) – durum wheat – sesbania (GM)	75.4	-	-	68.6	-	-	75..	-	-	62..3	-	-	92.6	-	-	103.5	-	-
Sweet corn + blackgram (2:2) – chickpea	46.2	-	-	45.7	-	-	62.6	-	-	52.8	-	-	52.5	-	-	53.5	-	-
Blackgram – wheat	10.9	-	-	11.9	-	-	11.5	-	-	10.3	-	-	12.7	-	-	13.2	-	-
Soybean - fenugreek		-	-	16.7	-	-	21.0	-	-	12.9	-	-		-	-	54.3	-	-

Calicut:

Leaf nutrient status in ginger revealed that uptake of nitrogen and potassium were significantly higher in integrated nutrient management practice whereas phosphorous content was higher in inorganic management system. In case of turmeric, nutrient uptake in turmeric rhizome as influenced by different management system was found to be higher in organic management practice for phosphorous and potassium whereas uptake of nitrogen were significantly higher in integrated nutrient management practice either with 50% each organic and inorganic or with 25% more organic manure.

Pantnagar:

During *kharif* in basmati rice, highest uptake of N (85.7 kg/ha) was observed with 100% organic package followed by 75% organic+innovative technology. However, uptake of P (23.9 kg/ha) by basmati rice was higher in 75% organic+ innovative technology under organic followed by towards organic 75% organic + 25% inorganic 23.4 kg/ha. Nitrogen and phosphorus uptake (128.9 and 52.8 kg/ha) in wheat crop was recorded maximum in integrated consisting of 75% organic + 25% chemical whereas potassium uptake (118.6 kg/ha) were recorded maximum in integrated (50% each organic and inorganic nutrients). In case of chickpea crop, nitrogen and potassium (78.0 and 57.3 kg/ha) was found to be higher in 75% organic + 25% inorganic under towards organic, however phosphorus (33.6 kg/ha) was maximum under 100% organic management.

Ajmer:

Uptake of nutrient by coriander showed that highest uptake of N (17.6 kg/ha), P (4.26 kg/ha) and K (14.0 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 (37.89 kg/ha), P (8.42 kg/ha) and K (29.78 kg/ha) were observed in integrated with 75% organic + 25% inorganic followed by state recommendation.

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

Bajaura:

Micronutrients, iron, manganese, zinc and copper uptake among cropping systems was recorded higher in integrated nutrient management consisting of 50% organic+ 50% inorganic while, minimum being in 100% inorganic. Irrespective of different cropping systems and management practices, uptake varied iron from 330 to 1605 g/ha; manganese from 152 to 633 g/ha; zinc from 90 to 520 g/ha and copper from 71 to 276 g/ha, respectively. The highest uptake of iron was observed in tomato-cauliflower- french bean, that of Mn in cauliflower-tomato and Zn in black gram-cauliflower- summer squash under integrated consisting of 50% organic + 50% inorganic nutrient inputs (Table 13).

Calicut:

Leaf nutrient status in ginger among the different management practices for turmeric rhizome was influenced by different management system for iron, manganese, zinc and copper. In case of ginger, significantly higher iron and copper was recorded in organic practice whereas, manganese and zinc found to be higher under inorganic followed by integrated. In turmeric, iron and copper recorded higher in organic with 75% organic +25% innovative organic technology. However, uptake of manganese and zinc was recorded maximum in inorganic management practice (Table 14).

Thiruvanthapuram:

Microbial population in soil as influenced by the different management practices and cropping

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

cropping system/ management Package	Organic						Inorganic						Integrated (towards organic)					
	100% organic			75% organic + innovative organic practices			100% inorganic			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	1349.0	-	-	1397.0	-	-	897.0	-	-	1507.0	-	-	1605.0	-	-	1595.0	-	-
Fallow-cauliflower-tomato	958.0	-	-	954.0	-	-	518.0	-	-	811.0	-	-	972.0	-	-	864.0	-	-
Black gram-cauliflower-summer squash	1190.0	-	-	1183.0	-	-	733.0	-	-	1119.0	-	-	1559.0	-	-	1533.0	-	-
Lady finger-pea	539.0	-	-	520.0	-	-	330.0	-	-	523.0	-	-	709.0	-	-	658.0	-	-
							Manganese (mg/kg)											
Tomato-cauliflower- french bean	416.0	-	-	478.0	-	-	254.0	-	-	451.0	-	-	485.0	-	-	443.0	-	-
Fallow-cauliflower-tomato	407.0	-	-	429.0	-	-	207.0	-	-	383.0	-	-	413.0	-	-	351.0	-	-
Black gram-cauliflower-summer squash	491.0	-	-	498.0	-	-	257.0	-	-	428.0	-	-	633.0	-	-	606.0	-	-
Lady finger-pea	273.0	-	-	243.0	-	-	152.0	-	-	251.0	-	-	372.0	-	-	307.0	-	-
							Zinc (mg/kg)											
Tomato-cauliflower- french bean	447.0	-	-	472.0	-	-	235.0	-	-	408.0	-	-	494.0	-	-	457.0	-	-
Fallow-cauliflower-tomato	358.0	-	-	337.0	-	-	158.0	-	-	283.0	-	-	361.0	-	-	288.0	-	-
Black gram-cauliflower-summer squash	446.0	-	-	217.0	-	-	231.0	-	-	362.0	-	-	520.0	-	-	472.0	-	-
Lady finger-pea	175.0	-	-	156.0	-	-	90.0	-	-	168.0	-	-	218.0	-	-	176.0	-	-
							Copper (mg/kg)											
Tomato-cauliflower- french bean	276.0	-	-	215.0	-	-	103.0	-	-	176.0	-	-	238.0	-	-	208.0	-	-
Fallow-cauliflower-tomato	191.0	-	-	163.0	-	-	84.0	-	-	148.0	-	-	173.0	-	-	152.0	-	-
Black gram-cauliflower-summer squash	214.0	-	-	217.0	-	-	104.0	-	-	166.0	-	-	266.0	-	-	273.0	-	-
Lady finger-pea	163.0	-	-	156.0	-	-	71.0	-	-	149.0	-	-	199.0	-	-	191.0	-	-

Table 14. Effect of different management systems on leaf nutrient status of ginger and turmeric rhizomes at Calicut

Production system		Ginger (ppm)					Turmeric (g/ha)				
		Mg	Fe	Mn	Zn	Cu	Mg	Fe	Mn	Zn	Cu
Organic	100% Organic	0.52	276.00	125.00	30.00	108.00	0.60	143.00	215.00	22.00	10.70
	75% Organic + innovative organic practices	0.54	266.00	138.00	31.00	88.00	0.60	186.00	414.00	29.00	15.30
Inorganic	100% Inorganic	0.58	181.00	618.00	46.00	59.00	0.60	137.00	513.00	35.00	10.30
Integrated	50% Organic+50% inorganic	0.51	217.00	314.00	32.00	34.00	0.50	150.00	511.00	29.00	11.60
	75% Organic+25% Inorganic	0.55	180.00	419.00	36.00	42.00	0.60	148.00	277.00	23.00	9.60
	CD (*P=0.05*)	0.03	28.00	44.00	4.80	14.00	0.02	20.00	31.00	1.60	1.00

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. At the end of cropping cycle, microbial bacteria, fungi and actinomycetes and phosphate solubilizing bacteria were in ranged from 9.5-17.6 log cfu/g, 9.2-13.5 log cfu/g, 8.2-13.5 log cfu/g and 9.4-14.9 log cfu/g respectively in tomato-cauliflower-frenchbean system. Lady finger-pea recorded maximum bacteria, fungi and phosphate solubilizing bacteria of 18.2, 13.8 and 16.2 log cfu/g, respectively under organic practices.

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 39.1 and 23.1%, fungi 35.2 and 23.7%, actinomycetes 46.1 and 23.4% compared to inorganic and integrated (50% each organic and inorganic nutrient) package.

Coimbatore:

Higher bacteria population was recorded under organic nutrient management of 7.00 x10^6cfu/g and it was 49.9% higher with 100% organic compared to inorganic. Similarly, fungi (5.333.x10^6cfu/g) also recorded higher with organic and increased by 33.2% compared to inorganic. Actiniomycetes (5.67 x10^4cfu/g) was increased with organic by 70.3% over inorganic. Among the cropping systems, cotton-maize system recorded higher bacteria and fungi population (7.83 and 5.33 log cfu/g) while actinomycetes was maximum in chilli-sunflower (5.83 log^{4}cfu/g).

Jabalpur:

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 (63.7 & 62.9 log cfu/g) and fungi (55.0 & 54.7 log cfu/g) was increased with organic management from inorganic management bacteria (44.4 & 44.4 logcfu/g) and fungi (36.3 & 35.3 log cfu/g) respectively. Among the cropping systems, basmati-rice- wheat-green manure system registered highest microbial population.

Narendrapur:

Application of organic nutrient reduced dose up to 25% under organic practice +innovative technology resulted higher microbial population in the soil viz. fungi, bacteria and actinomycetes. Population of bacteria (20.75 log cfu/g), fungi (7.80 log cfu/g) and actinomycetes (22.33 log cfu/g) under organic management consisting of 75% organic+innovative practices was increased compared to inorganic management (bacteria 10.16 log cfu/g), (fungi 4.51 log cfu/g) and (actinomycetes 14.16 logcfu/g) respectively. Among the cropping systems, paddy–capsicum– green gram recorded higher bacteria and actinomycetes of 17.33 and 25.27 log cfu/g while, paddy-french-sesame registered highest fungi population (12.83 log cfu/g).

Thiruvanthapuram:

Microbial count in soil such as bacteria and actinomycetes was found to be maximum under 100% organic which was closely followed to 75% organic+25% innovative whereas, fungi found to be higher in inorganic with state recommendation practice. Under organic management, bacteria were increased by 43 and 23.3% and actinomycetes 45.6

Table 15: Rhizosphre microbial population (Bacteria and Fungi micro-organisms) 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 practice	100% Inorganic	State recommendation	50% Organic + 50% inorganic	75% Organic + 25% Inorganic		100% Organic	75% Organic+Innovative Organic practice	100% Inorganic	State recommendation	50% Organic + 50% inorganic	75% Organic + 25% Inorganic	
Bajaura														
Tomato-Cauliflower- French bean	17.6	14.6	9.5	12.8	13.5	14.7	13.8	14.2	13.0	9.2	13.1	12.5	13.5	12.6
Fallow-Cauliflower-Tomato	16.5	14.4	9.4	12.6	14.7	13.0	13.4	14.1	12.8	9.4	12.8	12.5	13.3	12.5
Black gram-Cauliflower- Summer squash	15.4	12.8	9.2	12.6	13.0	13.5	12.8	13.6	12.1	9.3	13.0	13.5	14.1	12.6
Lady finger-Pea	18.2	14.8	9.8	12.9	13.3	14.4	13.9	13.8	12.0	9.5	11.8	13.0	13.8	12.3
Mean	16.9	14.2	9.5	12.7	13.6	13.9		13.9	12.5	9.4	12.7	12.9	13.7	
Bhopal														
Soybean- wheat	42.0	38.0	32.0	32.0	34.0	38.0	36.0	34.0	31.0	28.0	29.0	30.0	33.0	30.8
Soybean- mustard	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Soybean- chickpea	54.0	47.0	37.0	41.0	44.0	49.0	45.3	39.0	32.0	26.0	25.0	29.0	34.0	30.8
Soybean- linseed	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Mean	48.0	42.5	34.5	36.5	39.0	43.5		36.5	31.5	27.0	27.0	29.5	33.5	
Coimbatore														
Cotton - maize	9.0	8.0	7.0	7.0	8.0	8.0	7.8	7.0	6.0	5.0	3.0	5.0	6.0	5.3
Chillies - sunflower	6.0	6.0	4.0	4.0	5.0	6.0	5.2	5.0	4.0	4.0	4.0	4.0	4.0	4.2
Beetroot - maize	6.0	5.0	3.0	3.0	4.0	5.0	4.3	4.0	4.0	3.0	3.0	3.0	4.0	3.5
Mean	7.0	6.3	4.7	4.7	5.7	6.3		5.3	4.7	4.0	3.3	4.0	4.7	
Dharwad														
Cowpea-safflower	1.2	1.2	1.3	1.2	1.2	1.2	1.2	-	-	-	-	-	-	-
Pigeon pea (sole)	1.2	1.2	1.3	1.2	1.2	1.2	1.2	-	-	-	-	-	-	-
Green gram - sorghum	1.2	1.2	1.4	1.2	1.2	1.2	1.2	-	-	-	-	-	-	-
Groundnut +hybrid cotton (2:1)	1.2	1.2	1.3	1.2	1.2	1.2	1.2	-	-	-	-	-	-	-
Maize-chickpea	1.2	1.2	1.4	1.2	1.2	1.2	1.2	-	-	-	-	-	-	-
Mean	1.2	1.2	1.3	1.2	1.2	1.2		-	-	-	-	-	-	
Jabalpur														
Basmati rice – wheat (durum) – green manure	66.2	65.9	46.1	45.4	52.9	53.2	54.9	56.2	55.8	37.9	35.3	49.2	50.1	47.4
Basmati rice – chickpea – maize fodder	62.0	60.6	42.4	43.7	47.1	47.4	50.5	53.8	53.4	35.6	34.2	41.3	42.2	43.4
Basmati rice – berseem (fodder and seed)	61.8	61.4	42.6	42.3	50.5	50.9	51.6	55.3	54.7	35.3	35.1	46.3	46.6	45.6
Basmati rice – vegetable pea– sorghum (fodder)	64.8	63.6	46.5	46.1	51.7	52.4	54.2	54.8	54.7	36.6	36.4	43.7	43.8	45.0
Mean	63.7	62.9	44.4	44.4	50.5	51.0		55.0	54.7	36.3	35.3	45.1	45.7	
New centres started from 2015-16														
Narendrapur														
Basmati rice–broccoli –*sesbania* green manure	22.3	22.7	10.7	12.0	17.3	15.0	16.7	7.5	7.1	4.6	4.6	6.6	5.1	5.9
Paddy– mustard– green gram	14.0	15.7	8.0	7.3	11.7	13.3	11.7	5.4	3.9	2.2	2.4	3.4	3.8	3.5
Paddy– capsicum– green gram	23.3	25.3	10.7	10.3	17.3	17.0	17.3	3.0	3.2	2.6	2.5	2.8	2.9	2.8
Paddy –french bean – sesame	18.0	19.3	11.3	12.3	15.3	13.3	14.9	15.3	16.7	8.7	10.0	12.3	14.0	12.8
Mean	19.4	20.7	10.2	10.5	15.4	14.7		7.8	7.7	4.5	4.9	6.3	6.5	
Thiruvananthapuram														
Cassava-veg. cowpea	29.7	33.7	6.3	9.3	21.0	7.0	17.8	13.0	13.0	52.3	9.7	8.3	5.0	16.9
Cassava-groundnut	8.3	1.3	19.0	11.0	6.0	23.7	11.6	2.3	11.7	14.7	26.0	6.3	18.3	13.2
Taro-black gram	4.3	6.3	9.3	5.3	5.3	10.6	6.9	7.7	6.3	13.7	19.7	10.3	7.3	10.8
Taro-greengram	14.3	11.0	10.0	11.0	11.6	5.0		5.7	5.0	9.3	12.0	7.7	10.3	

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

Cropping systems/	Soil actinomycetes ($x10^4$ cfu/g)							Phosphate solubilizing bacteria ($x10^6$ cfu/g)						
	Organic		Inorganic		Integrated (towards organic)			Organic		Inorganic		Integrated (towards organic)		
management practice	100% organic	75% Organic+ Innovative Organic practice	100% Inorganic	State recommendation	50% Organic + 50% inorganic	75% Organic + 25% Inorganic	Mean	100% organic	75% Organic+ Innovative Organic practice	100% Inorganic	State recommendation	50% Organic + 50% inorganic	75% Organic + 25% Inorganic	Mean
Bajaura														
Tomato-Cauliflower- French bean	13.5	11.0	8.2	10.8	11.0	12.4	11.2	14.9	12.4	9.4	12.1	12.5	13.2	12.4
Fallow-Cauliflower-Tomato	13.5	11.5	8.0	10.2	11.4	12.4	11.2	14.3	11.8	9.8	12.8	12.9	13.2	12.5
Black gram-Cauliflower- Summer squash	14.6	12.9	8.1	11.7	11.8	13.2	12.1	16.4	12.1	10.1	12.0	12.9	13.4	12.8
Lady finger-Pea	12.4	10.0	8.3	11.6	12.2	12.8	11.2	16.2	12.6	10.5	12.1	12.3	13.3	12.8
Mean	13.5	11.4	8.2	11.1	11.6	12.7		15.5	12.2	10.0	12.3	12.7	13.3	
Bhopal														
Soybean- wheat	38.0	36.0	30.0	30.0	32.0	40.0	34.3	-	-	-	-	-	-	-
Soybean- chickpea	57.0	48.0	35.0	33.0	45.0	49.0	44.5	-	-	-	-	-	-	-
Mean	47.5	42.0	32.5	31.5	38.5	44.5		-	-	-	-	-	-	-
Coimbatore														
Cotton - maize	7.0	5.0	3.0	5.0	4.0	5.0	4.8	-	-	-	-	-	-	-
Chillies - sunflower	7.0	6.0	5.0	6.0	5.0	6.0	5.8	-	-	-	-	-	-	-
Beetroot - maize	3.0	3.0	2.0	2.0	2.0	3.0	2.5	-	-	-	-	-	-	-
Mean	5.7	4.7	3.3	4.3	3.7	4.7		-	-	-	-	-	-	-
New centres started from 2015-16														
Narendrapur														
Basmati rice–broccoli –*sesbania* green manure	12.7	17.3	11.7	11.7	15.0	14.7	13.8	-	-	-	-	-	-	-
Paddy– mustard– green gram	15.3	17.0	10.3	10.0	12.7	13.7	13.2	-	-	-	-	-	-	-
Paddy– capsicum– green gram	28.7	31.7	18.7	19.7	26.0	27.0	25.3	-	-	-	-	-	-	-
Paddy –french bean – sesame	21.3	23.3	16.0	14.3	20.3	21.3	19.4	-	-	-	-	-	-	-
Mean	19.5	22.3	14.2	13.9	18.5	19.2	17.9							
Thiruvananthapuram														
Cassava-veg. cowpea	1.7	2.3	3.7	1.7	1.7	1.0	2.0	4.9	1.2	5.5	17.9	2.7	34.9	11.2
Cassava-groundnut	1.3	1.3	9.0	8.3	2.0	4.0	4.3	6.7	4.3	7.9	35.2	1.8	0.9	9.5
Taro-black gram	1.0	6.3	4.0	4.7	1.7	1.0	3.1	7.0	7.6	7.0	2.4	4.6	11.9	6.7
Taro-greengram	5.3	4.3	3.7	3.3	3.3	2.3		5.2	27.3	10.6	11.9	6.4	10.0	

and 60.1% compared to inorganic and integrated (50% each organic and inorganic nutrient) package. Reduction in fungi population was found up to the 52.2 and 35.8% in organic and integrated respectively.

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 estimated under different management practice. Difference in protein content did not observe among the nutrient management for frenchbean, black gram and pea. TSS in tomato was increased by 36.4 and 27.5% in *kharif* and *summer* with organic package while in pea it was higher (30.5%) with integrated (50% each nutrient source through organic and inorganic) but was on par with state recommendation practice. Vitamin C in cauliflower recorded higher by10.0% 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.

Calicut:

In ginger crop**,** oil and oleoresin content was higher under inorganic practice followed by integrated but could not influenced management practice and found to be at par to each other. In turmeric, oil, oleoresin and curcumin content was higher in organic management either by 100% nutrient through organic manure or by reducing dose of organic manure of 25% including innovative practice. Curcumin content was found to be more to the tune of 12.5% with organic package over inorganic.

Coimbatore:

All the quality parameter in cotton did not differ significantly due to nutrient management. Span length was higher under organic practice however, strength, elongation and uniformity ratio was higher under integrated practice with 50% orgaic+50% inorghanic nutrient management.

Ranchi:

Quality of protein in rice was increased in organic production management with 75% organic + 25% innovative practice from 6.60 to 7.00. In case of wheat, reverse was recorded with ranging from 9.7% under organic to 10.0 in inorganic.

Umiam:

Specific gravity (1.27 g/ml), average fruit diameter (52.38 mm), TSS (4.79%), acidity (0.75%), ascorbic acid (29.59 mg/100g), reducing sugar (2.71%), lycopene (18.24 mg/100g) and total sugar (5.04%) of tomato are recorded the highest in 100% organic management followed by integrated. Quality parameters of carrot such as root diameter (mm) was recorded higher under integrated (34.14 mm) treatment, whereas, TSS (%), ascorbic acid (mg/100g), beta carotene (mg/100g), total carotenoids, total sugar and reducing sugar were recorded under 100% organic treatment (8.58%, 41.33mg/100g, 9.09 mg/100g, 75.37 mg/g and 6.18% respectively).

Ajmer:

Quality parameters such as protein% and essential oil (%) in coriander and fennel crops were not influenced by various nutrient management practices and among them,both are observed non- 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.

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

			Organic		Inorganic		Integrated (towards organic)	
Locations	**Crops**	**Quality parameter**	**100% organic**	**75% organic + innovative organic practices**	**100% inorganic**	**State recommendation**	**50% organic + 50% inorganic**	**75% organic + 25% inorganic**
Bajura	French bean		14.00	13.90	13.10	13.20	13.40	13.60
	Black gram	Protein %	14.30	13.60	13.10	13.60	14.00	13.40
	Pea		21.00	20.90	20.40	20.80	21.10	20.90
	Tomato (*Kharif*)		4.50	3.70	3.30	3.50	4.10	3.50
	Tomato (*Summer*)	TSS (0 Brix)	5.10	4.70	4.00	4.50	4.30	4.10
	Pea		16.10	15.10	13.10	17.10	17.10	15.10
	Tomato		34.60	33.90	30.10	31.30	34.90	35.10
	Cauliflower	Vitamin C (mg/100g)	47.33	45.83	42.43	43.53	44.77	44.07
Bhopal		Protein %	34.83	34.49	34.26	34.54	34.21	34.19
	Soybean	Oil (%)	17.96	17.71	17.66	17.88	17.53	17.43
		Methionine (g/16gN)	1.72	1.70	1.66	1.67	1.62	1.63
Calicut	Ginger	Oil content (%)	1.22	1.28	1.37	-	1.44	1.32
		Oleoresin (%)	4.55	4.56	5.06	-	4.81	4.34
	Turmeric	Curcumin (%)	4.50	4.50	4.00	-	4.10	4.30
		Oil content (%)	5.40	5.50	5.20	-	5.30	5.30
		Oleoresin (%)	12.10	12.10	11.00	-	11.60	11.60
	Black pepper	Oil content (%)	2.56	-	2.33	-	2.45	-
		Oleoresin (%)	8.51	-	7.81	-	8.48	-
		Piperine (%)	5.26	-	4.51	-	7.81	-
Coimbatore	Cotton	Micronaire	4.90	4.10	4.00	4.10	4.40	4.90
		2.5% span length	28.60	26.30	27.40	27.20	25.60	28.30
		Strength	17.70	18.00	20.60	19.10	22.50	19.40
		Elongation	6.30	6.40	5.90	6.40	6.50	5.80
		Uniformity ratio	50.90	51.10	49.30	49.00	52.50	50.10
Ranchi	Rice	Protein (%)	6.94	7.00	6.73	6.63	6.84	6.73
		Moisture (%)	14.11	13.45	13.73	14.06	13.56	14.10
	Wheat	Protein (%)	9.76	9.69	9.99	9.88	9.92	9.76
		Moisture (%)	10.21	10.31	10.44	10.37	10.20	10.39
Umiam	Tomato	Specific gravity (g/ml)	1.27	1.17	1.15	-	1.21	-
		Average fruit diameter (mm)	52.38	47.81	42.65	-	51.50	-
		TSS (%)	4.79	4.61	4.15	-	4.43	-
		Acidity (%)	0.75	0.69	0.64	-	0.73	-
		Ascorbic acid	29.59	25.37	24.33	-	27.38	-
		Total sugar (%)	5.04	4.85	4.79	-	4.98	-
		Lycopene	18.24	16.31	15.41	-	17.29	-
	Carrot	Root diameter (mm)	32.69	26.72	28.41	-	34.14	-
		TSS (%)	8.58	8.34	6.78	-	7.90	-
		Ascorbic acid (mg/100g)	41.33	38.91	33.18	-	40.65	-
		Acidity (%)	0.26	0.21	0.17	-	0.22	-
		Beta carotene (mg/100g)	9.09	8.90	6.29	-	8.79	-
		Total carotenoids (mg/g)	75.37	65.11	62.49	-	68.24	-
		Total sugar (%)	4.59	4.36	3.63	-	4.28	-
Ajmer	Coriander	Protein (%)	15.38	13.82	15.73	16.08	14.70	16.21
		Essential oil (%)	0.18	0.19	0.20	0.21	0.20	0.21
	Fennel	Protein (%)	17.19	17.52	16.53	17.73	16.95	18.11
		Essential oil (%)	1.17	1.18	1.18	1.19	1.17	1.20

Influence of organic, inorganic and integrated management packages on economics of different crops and cropping systems Table (18-19)

Bajaura:

Maximum gross return (Rs. 5,27,625/ha), net return (Rs. 330785/ha) and net returns per rupee invested (1.68) was recorded in cauliflower-tomato systems under organic management practice with 75% nutrient through manure + innovative organic practice followed by black gram-cauliflower-summer squash cropping system. Among the cropping systems, tomato-cauliflower cropping system was found to be higher by 19.4, 100.3 and 100.7% than tomato-cauliflower-frenchbean, black gram-cauliflower-summer squash and lady finger-pea respectively in term of net return (Rs.ha). In different management packages, lower cost of cultivation (Rs. 194585/ha) was recorded with 100% inorganic nutrient management while, higher cost of cultivation was recorded under state recommendation of Rs.262360/ha as highest.

Bhopal:

Among the different nutrient management systems, 100% organic management with organic nutrient input through manure recorded higher gross returns (Rs. 103063/ha), net returns (Rs.64637) and benefit cost ratio in term of return per rupee investment (2.68) as compared to inorganic management and it increased 64.9 and 54.8% in respect of net return than the integrated and inorganic management respectively. In case of return per rupees invested, it was increased by 38.6 and 20.2% over integrated and inorganic respectively. Among the cropping systems, soybean-chickpea recorded higher net return and B:C ratio (Rs. 61543, Rs.41051/ha and 3.01 respectively) as compared to other systems. Minimum cost of cultivation of Rs.28255 and 29277/ha was recorded with inorganic practice whereas, higher was with organic management (75% nutrient through manure + innovative organic practice) of Rs.38426 and 40611/ha.

Calicut:

Economics for ginger crop found to be higher for gross return (Rs. 5,62,875/ha), net return (Rs. 4,12,000/ha) and BC ratio (3.73) with integrated nutrient management similarly, turmeric were recorded higher also with integrated towards organic approach consisting of 75% organic nutrient through manure+25% inorganic. The net return/ha under organic cultivation (100%) was found to be 53.1 higher than 100% inorganic practices. Similar trend was found in turmeric crop where maximum net returns was recorded towards organic approach with Rs. 3,62,230\ha\year followed by 100%, Organic production package.

Coimbatore:

Gross return, net return and benefit cost ratio was recorded higher under integrated management consisting of 50% each organic +inorganic or by 75% organic+25% inorganic. In case of net return, Rs.38991 and 13036/ha was obtained more for towards organic under integrated management with 75% organic +25% inorganic than organic and inorganic management. Among the cropping systems, beetroot-maize found more profitable in term of net return for Rs.1,74,593/ha and it is higher by 202.8 and 110.2% than chili-sunflower and cotton-maize system. Lower cost of cultivation (Rs. 70729 /ha) was recorded under inorganic management with state recommendation while higher cost of cultivation (Rs.93267/ha) with organic management.

Dharwad:

Higher gross return of Rs.79826/ha was recorded under organic management with 100% organic manure followed by integrated management.Net monetary return and B:C ratio was recorded maximum

(Rs. 64175 and 64490/ha and 3.47 and 2.86 respectively) with inorganic practice consisting 100% inorganic and state recommendation practice due to lower cost of cultivation (Rs. 21229 and 29904/ha). Reduction in net return due to higher cost of cultivation was found to be 34.4 and 28.6%. Among the cropping systems, groundnut +hybrid cotton (2:1) recorded higher gross return and net return of Rs. 133267 and 88460/ha. Pigeon pea (sole) was the next performing cropping system in term of net return of Rs.58386/ha. Production practices involving recommended rates of inorganic fertilizers and state recommendation recorded higher B:C ratio (3.47 and 2.86, respectively) as compared to organic production system 1.75 to 1.74, respectively. Among the cropping system, pigeon pea (sole) system found more remunerative 3.26 in term of return net rupees invested as compared to other system evaluated.

Jabalpur:

The higher gross return and cost of cultivation was recorded under organic management with 100% organic through manure of Rs. 2,02,814 and Rs.90,465/ha, however, net return (Rs.1,38,592/ha) and benefit cost ratio (2.63) was higher in inorganic management followed by integrated but it found at par with net return 1,31,034/ha and B:C ratio 2.28. Among the cropping systems, basmati rice-berseem (fodder and seed) recorded maximum net return of Rs. 1,59,610/ha and return per rupees invested 2.86 compared to other systems. Basmati rice-berseem (fodder and seed) gave significantly more followed by basmati rice – vegetable pea–sorghum (fodder) and basmati rice – wheat (durum) – green manure. Rice-chickpea recorded significantly lower net return and B:C ratio.

Karjat:

Application of 100% organic package resulted in significantly higher net returns (Rs. 293212 ha^{-1}) as compared to other production systems followed by adoption of 75 per cent organic + innovative organic practices which is statistically on par to integrated management. Though the net returns were higher under 100% organic package, the B:C ratio were significantly higher under 100% inorganic package (2.59) followed by 100% organic and adoption of 75% organic + Innovative organic practices (2.38 and 2.18 respectively). Among the cropping systems, higher net returns (Rs. 435703 and 355482 ha^{-1} respectively) and NRPRI (2.97 and 2.92 respectively) were observed under rice-brinjal and rice-onion system, as compared to other cropping systems.

Ludhina:

Maximum gross return (Rs. 2,30,225/ha), net return (Rs. 1,78,274/ha) and cost benefit ratio (4.43) was recorded in cluster bean-wheat-summer moong systems under organic management practice with 100% application of organic practice followed by 75% nutrient through manure + innovative organic practice. Basmati rice-wheat-green gram cropping system being the next performer system which recorded net return of Rs.136632/ha but soybean-wheat and basmati rice-wheat-green gram being at par among the systems.

Modipuram:

Among the management practices, organic management package with 100% organic application recorded higher net return (Rs.95,015/ha/annum) followed by inorganic (Rs. 94898/ha/annum). In case of cropping system, maize (sweet corn)-mustard system recorded significantly higher return (Rs. 1,50,790/ha/annum) followed by maize (popcorn)-potato-okra (Rs. 83,996/ha/annum) and the difference among both system was found to be 79.5%. Maize (popcorn)-potato-okra system recorded higher monetary return to the tune of 58.8 and 71.9% than basmati rice-wheat-*sesbania* and rice-barley-green gram respectively.

Pantnagar:

Organic management by adoption of 75% organic

Table 18. Influence of organic, inorganic and integrated poduction systems on economics (gross return and cost of cultivation) of different crops in cropping system

	Gross returns (Rs/ha)							Cost of cultivation (Rs/ha)						
	Organic		Inorganic		Integrated (towards organic)			Organic		Inorganic		Integrated (towards organic)		
	100% organic	75% organic + innovative organic practices	100% Inorganic	State recommendation	50% organic + 50% inorganic	75% organic + 25% inorganic	Mean	100% organic	75% organic + innovative organic practices	100% Inorganic	State recommendation	50% organic + 50% inorganic	75% organic + 25% inorganic	Mean
Bajaura														
Tomato-Cauliflower- French bean	420150	443388	284550	405660	398310	397380	391573	288760	278260	247056	321056	269861	280674	280945
Fallow-Cauliflower-Tomato	506250	527625	247200	347535	387360	357930	395650	206090	196840	169565	234565	188594	186539	197032
Black gram-Cauliflower- Summer squash	503075	526113	311210	436000	496190	490610	460533	256385	249035	215913	292413	250328	258872	253824
Lady finger-Pea	309800	321050	196660	278620	337720	306820	291778	160515	156265	145805	201405	161882	166857	165455
Mean production systems	434819	454544	259905	366954	404895	388185		227938	220100	194585	262360	217666	223236	
Bhopal														
Soybean- wheat	-	-	-	-	-	-	85815	-	-	-	-	-	-	34251
Soybean- Mustard	-	-	-	-	-	-	77078	-	-	-	-	-	-	31665
Soybean- Chickpea	-	-	-	-	-	-	92225	-	-	-	-	-	-	30681
Soybean- Linseed	-	-	-	-	-	-	87268	-	-	-	-	-	-	31977
Mean production systems	103063	94987	70008	69868	73162	79542		38426	40611	28255	29277	33977	34426	
Calicut														
Ginger	337250	390450	137750	-	562875	484025	382470	167081	155581	126630	-	150871	161436	152320
Turmeric	525977	449445	223440	-	498180	538973	447203	182081	170581	142802	-	161688	161776	163786
Coimbatore														
Cotton - maize	156181	171051	158083	189938	240415	169648	180886	94261	85295	65029	72621	76600	86110	79986
Chillies - sunflower	117435	125415	124140	46350	119235	138000	111763	73665	68165	64745	46350	53197	62670	61465
Beetroot - maize	268755	263750	250510	266957	279546	324850	275728	111875	101147	83583	93215	95663	106730	98702
Mean production systems	180790	186739	177578	167748	213065	210833		93267	84869	71119	70729	75153	85170	80051
Dharwad														
Cowpea-safflower	29496	28099	28992	32572	32884	29957	30333	68800	61080	24321	33971	51743	59584	49917
Pigeon pea (sole)	54026	49272	51821	51940	44895	72695	54108	37923	34203	13622	19622	29372	34927	28278
Sorghum-green gram	105625	82282	54301	50164	63202	77460	72172	66526	58686	23800	32700	49350	59911	48496
Groundnut +hybrid cotton (2:1)	138873	150090	115325	132440	120686	142190	133267	78770	69490	27922	41247	52796	63490	55619
Maize-Chickpea	71111	56899	77649	58367	73033	65994	67176	52697	46597	16478	21978	32413	36255	34403
Mean production systems	79826	73328	65618	65097	66940	77659		60943	54011	21229	29904	43135	50833	43343
Jabalpur														
Basmati rice – wheat (durum) – green manure	194324	163064	189590	166630	192072	184197	181646	111935	101650	78379	54865	78379	54865	80012
Basmati rice – chickpea – maize fodder	144297	142602	168331	148242	165217	147937	152771	93923	87463	76205	68584	76205	68584	78494
Basmati rice – berseem (fodder and seed)	239885	211565	238050	204560	215017	192772	216975	73600	68075	53293	47963	53293	47963	57365
Basmati rice – vegetable pea–sorghum (fodder)	232750	208197	233700	219900	227130	218290	223328	82400	61800	67425	60682	67425	60682	66736
Mean production systems	202814	181357	207418	184833	199859	185799		90465	79747	68826	58024	68826	58024	

	Gross returns (Rs/ha)							Cost of cultivation (Rs/ha)						
	Organic		Inorganic		Integrated (towards organic)			Organic		Inorganic		Integrated (towards organic)		
	100% organic	75% organic + innovative organic practices	100% Inorganic	State recommendation	50% organic + 50% inorganic	75% organic + 25% inorganic	Mean	100% organic	75% organic + innovative organic practices	100% Inorganic	State recommendation	50% organic + 50% inorganic	75% organic + 25% inorganic	Mean
Karjat														
Rice-Brinjal	-	-	-	-	-	-	88149	-	-	-	-	-	-	222712
Rice-Chickpea	-	-	-	-	-	-	79597	-	-	-	-	-	-	105391
Rice-Field bean	-	-	-	-	-	-	83273	-	-	-	-	-	-	109126
Rice-Onion (White)	-	-	-	-	-	-	86868	-	-	-	-	-	-	186503
Mean production systems	99542	91157	80223	75498	81436	78976		181482	166569	132689	127401	158795	168662	-
Ludhiana														
Basmati rice-chickpea-GM	135185	147897	119484	116682	121996	126221	127911	77945	77789	73817	73867	77785	77464	76445
Basmati rice-wheat-GM	226560	225729	193118	192570	184948	178698	200271	70239	69719	59558	59558	61713	61042	63638
Cluster bean-wheat-summer moong	230225	221457	153770	160888	180185	177418	187324	51951	51431	46865	46915	45618	44970	47958
Soybean -wheat	182511	185342	153590	149458	153138	153080	162853	53939	53044	46168	46218	45556	44850	48296
Mean production systems	193620	195106	154991	154900	160067	158854		63519	62996	56602	56640	57668	57082	
Pantnagar														
Basmati rice-wheat	203046	197915	144138	144409	148159	164410	167013	66425	53520	56032	54982	64577	68637	60696
Basmati rice -chickpea (4rows+2rows coriander)	313068	311335	217091	220459	229005	248520	256580	57805	47882	48425	49475	58814	59492	53649
Basmati rice -vegetable pea (4 rows vegetable pea +2 rows coriander)	314945	316064	233298	231370	254426	248961	266511	66355	56852	59975	61025	67784	68462	63409
Basmati rice -potato	207697	203505	122416	138203	162614	149509	163991	72199	65939	66831	67881	82266	87445	73760
Mean production systems	259689	257205	179236	183610	198551	202850		65696	56048	57816	58341	68360	71009	
Raipur														
Soybean-Maize	345639	375946	273064	277966	244141	239816	292762	87067	84544	71560	77745	82205	84467	81265
Soybean-Pea	226477	236859	176124	191643	186247	150337	194615	70846	68266	58557	64376	65410	69104	66093
Soybean-Chilli	287549	304206	220714	237125	222298	227136	249838	78640	75247	67812	74049	72561	75953	74044
Soybean-Onion	281738	334698	234453	278346	180047	235778	257510	77601	72742	68728	73368	71377	75094	73152
Mean production systems	285351	312927	226089	246270	208183	213267		78539	75200	66664	72385	72888	76155	
Umiam														
Vegetable-vegetable systems *on raised bed*														
Broccoli -carrot	650760	558540	469750	-	541550	-	555150	-	-	-	-	-	-	-
Broccoli - potato	559200	495480	405100	-	462100	-	480470	-	-	-	-	-	-	-
Broccoli -french bean	651960	575040	459750	-	529350	-	554025	-	-	-	-	-	-	-
Broccoli -tomato	693420	617940	492550	-	550400	-	588578	-	-	-	-	-	-	-
Mean production systems	638835	561750	456788	-	520850	-		-	-	-	-	-	-	-

	Gross returns (Rs/ha)							Cost of cultivation (Rs/ha)						
	Organic		Inorganic		Integrated (towards organic)			Organic		Inorganic		Integrated (towards organic)		
	100% organic	75% organic + innovative organic practices	100% Inorganic	State recommendation	50% organic + 50% inorganic	75% organic + 25% inorganic	Mean	100% organic	75% organic + innovative organic practices	100% Inorganic	State recommendation	50% organic + 50% inorganic	75% organic + 25% inorganic	Mean
New centres started from 2015-16														
Ajmer														
Green gram – fennel	-	-	-	-	-	-		59668	49982	27692	37692	43387	51198	44937
Green gram - coriander	-	-	-	-	-	-		45636	39564	26286	36286	35693	40312	37296
Cluster bean - fennel	-	-	-	-	-	-		59668	49982	27692	37692	43387	51198	44937
Cluster bean – coriander	-	-	-	-	-	-		45636	39564	26286	36286	35693	40312	37296
Mean production systems	-	-	-	-	-	-		52652	44773	26989	36989	39540	45755	
Gangtok														
Maize + ginger (1.1)-french Bean	-	-	-	-	-	-	317164	-	-	-	-	-	-	-
Maize + soybean (1:1)-buckwheat	-	-	-	-	-	-	120223	-	-	-	-	-	-	-
Maize +turmeric (1:1)-rajmash	-	-	-	-	-	-	614484	-	-	-	-	-	-	-
Maize+ Pigeon Pea (2:1)	-	-	-	-	-	-	81317	-	-	-	-	-	-	-
Mean production systems	355982	298690	-	220918	265318	-		-	-	-	-	-	-	-
Narendrapur														
Basmati rice – broccoli –*sesbania* green manure	249581	239833	184656	183588	195495	218370	211921	123352	115427	96660	96660	110256	118343	110116
Paddy– mustard– greengram	353827	342302	258290	254763	279163	282165	295085	181644	161765	134810	134810	146838	165011	154146
Paddy– capsicum– greengram	357237	336247	259050	257318	273213	295790	296476	176099	159300	135371	135371	155976	163178	154216
Paddy – french bean – sesame	417175	389656	322359	328623	320579	309472	347977	195254	173280	143494	143494	159233	179311	165678
Mean production systems	344455	327009	267112	276449	256089	256073		169087	152443	127584	127584	143075	156461	
Sardar Krushinagar														
Groundnut- wheat-green gram	231123	238308	223531	242749	219650	216352	228619	132359	121098	96734	141734	114546	123452	121654
Greengram- cumin- vegetable cowpea	214295	207202	250613	289197	237852	243604	240461	100974	95805	86798	131798	93885	97430	101115
Greengram-fennel- fennel cont.	109370	110239	102452	110779	97093	93604	103923	87688	79566	60826	90826	74257	80973	79023
Mean production systems	184929	185250	192199	214242	184865	184520		107007	98823	81453	121453	94229	100618	
Udaipur														
Maize + blackgram (2:2) – durum Wheat –*sesbania* (GM)	191722	209204	263421	263992	267915	242087	239724	104510	91040	48122	61442	76312	90408	78639
Sweet corn + Blackgram (2:2) – Chickpea	178663	205827	256142	249436	200733	167255	209676	71540	64805	44336	50996	57441	64489	58935
Blackgram – wheat (*Triticum aestivum*)	148288	140450	177729	190591	168791	170606	166076	74158	67301	42850	52055	58502	66816	60280
Soybean –fenugreek	40300	52794	67765	61164	45978	76542	57424	20113	41312	34058	39148	18556	40486	32279
Mean production systems	139743	152069	191264	191296	170854	164123		67580	66115	42342	50910	52703	65550	

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

		Net returns (Rs/ha)							Net return per rupee invested (NRPRI)						
		Organic		Inorganic		Integrated (towards organic)		Mean	Organic		Inorganic		Integrated (towards organic)		Mean
		100% organic	75% organic + innovative organic practices	100% Inorganic	State recommendation	50% organic + 50% inorganic	75% organic + 25% inorganic		100% organic	75% organic + innovative organic practices	100% Inorganic	State recommendation	50% organic + 50% inorganic	75% organic + 25% inorganic	
	Bajaura														
	Tomato-cauliflower- french bean	131390	165128	37494	84604	128449	116706	110629	0.46	0.59	0.15	0.26	0.48	0.42	0.39
	Fallow-cauliflower-tomato	300160	330785	77635	112970	198766	171391	198618	1.46	1.68	0.46	0.48	1.05	0.92	1.01
	Black gram-Cauliflower- Summer squash	246690	277078	95297	143587	245862	231738	206709	0.96	1.11	0.44	0.49	0.98	0.90	0.81
	Lady finger-Pea	149285	164785	50855	77215	175838	139963	126324	0.93	1.05	0.35	0.38	1.09	0.84	0.77
	Mean	206881	234444	65320	104594	187229	164950		0.95	1.11	0.35	0.40	0.90	0.77	
	Bhopal														
	Soybean- wheat	-	-	-	-	-	-	51564	-	-	-	-	-	-	2.51
	Soybean- Mustard	-	-	-	-	-	-	45413	-	-	-	-	-	-	2.43
	Soybean- Chickpea	-	-	-	-	-	-	61543	-	-	-	-	-	-	3.01
	Soybean- Linseed	-	-	-	-	-	-	55290	-	-	-	-	-	-	2.73
	Mean production system	64637	54376	41753	40591	39185	45116		2.68	2.34	2.48	2.39	2.15	2.31	
	Calicut														
	Turmeric-Fallow	343990	275260	80640	-	331695	362230	278763	2.89	2.63	1.56	0.00	3.08	3.33	2.25
	Coimbatore														
	Cotton - maize	58920	85756	93054	87317	89790	83538	83063	3.25	4.01	4.85	4.41	4.35	3.91	4.13
	Chillies - sunflower	43770	57250	77560	26060	66038	75330	57668	3.24	3.77	5.35	2.28	4.68	4.38	3.95
	Beetroot - maize	154575	160353	164517	171360	181382	215370	174593	4.50	4.90	5.68	5.36	5.56	5.71	5.29
	Mean production system	85755	101120	111710	94912	112403	124746		3.66	4.23	5.29	4.02	4.86	4.67	
	Dharwad														
	Cowpea-safflower	-12285	-9086	20694	19416	3196	-2739	3199	0.81	0.85	1.70	1.52	1.08	0.97	1.15
	Pigeon pea (sole)	56207	45618	70709	63076	58034	56676	58386	2.63	2.42	4.99	3.78	3.00	2.72	3.26
	Sorghum-green gram	47446	44739	59522	59771	44589	34987	48509	1.82	1.86	3.14	2.66	1.97	1.65	2.18
	Groundnut +hybrid cotton (2:1)	78654	75066	105572	113148	81753	76568	88460	2.14	2.18	4.25	3.59	2.61	2.32	2.85
	Maize-Chickpea	40556	36536	64376	67040	41357	27228	46182	1.36	1.37	3.29	2.74	1.60	1.25	1.93
	Mean production system	42116	38575	64175	64490	45786	38544	48947	1.75	1.74	3.47	2.86	2.05	1.78	
	Jabalpur														
	Basmati rice – wheat (durum)–green manure	82389	61414	111211	111765	-	-	91695	0.74	0.60	1.42	2.04	0.00	0.00	0.80
	Basmati rice – chickpea – maize fodder	50374	55139	92126	79658	-	-	69324	0.54	0.63	1.21	1.16	0.00	0.00	0.59
	Basmati rice – berseem (fodder and seed)	166285	143490	184757	156597	-	-	162782	2.26	2.11	3.47	3.26	0.00	0.00	1.85
	Basmati rice – vegetable pea–sorghum (fodder)	150350	146397	166275	159218	-	-	155560	1.82	2.37	2.47	2.62	0.00	0.00	1.55
	Mean production system	112350	101610	138592	126810	-	-		1.34	1.43	2.14	2.27	0.00	0.00	

	Net returns (Rs/ha)							Net return per rupee invested (NRPRI)						
	Organic		Inorganic		Integrated (towards organic)		Mean	Organic		Inorganic		Integrated (towards organic)		Mean
	100% organic	75% organic + innovative organic practices	100% Inorganic	State recommendation	50% organic + 50% inorganic	75% organic + 25% inorganic		100% organic	75% organic + innovative organic practices	100% Inorganic	State recommendation	50% organic + 50% inorganic	75% organic + 25% inorganic	
Karjat														
Rice-Brinjal	524053	473410	497184	326638	416024	376911	435703	3.02	2.99	3.64	2.79	2.84	2.56	2.97
Rice-Chickpea	75913	66401	58458	52132	59007	53533	60907	1.63	1.60	1.63	1.60	1.54	1.48	1.58
Rice-Field bean	78430	64170	65014	51618	48317	37764	57552	1.63	1.56	1.67	1.56	1.43	1.33	1.53
Rice-Onion (White)	494450	317124	369876	265841	418350	267249	355482	3.22	2.57	3.41	2.80	3.21	2.31	2.92
Mean production system	293212	230276	247633	174057	235425	183864		2.38	2.18	2.59	2.19	2.26	1.92	
Ludhiana														
Basmati rice-chickpea-GM	57240	70107	45667	42815	44211	48757	51466	1.73	1.90	1.62	1.58	1.57	1.63	1.67
Basmati rice-wheat-GM	156321	156010	133560	133013	123234	117655	136632	3.23	3.24	3.24	3.23	3.00	2.93	3.15
Cluster bean-wheat-summer moong	178274	170026	106905	113973	134567	132448	139366	4.43	4.31	3.28	3.43	3.95	3.95	3.89
Soybean -wheat	128572	132298	107423	103240	107582	108230	114558	3.38	3.49	3.33	3.23	3.36	3.41	3.37
Mean production system	130102	132110	98389	98260	102399	101773		3.19	3.24	2.87	2.87	2.97	2.98	
Modipuram														
Basmati rice– wheat -*sesbania* green manure	61617	65223	63473	56888	41023	41023	29040	-	-	-	-	-	-	52877
Rice– barley (*malt*) – green gram	56211	56913	53509	48080	44971	44971	33464	-	-	-	-	-	-	48858
Maize(popcorn)- potato –okra + *sesbania* green manure	97228	89294	103340	87390	72454	72454	54269	-	-	-	-	-	-	83996
Maize(sweet corn)- mustard-*sesbania* green manure	165002	156200	159269	154749	141677	141677	127844	-	-	-	-	-	-	150790
Mean production system	95015	91908	94898	86777	75031	75031	61154	-	-	-	-	-	-	
Pantnagar														
Basmati rice-wheat	136621	144395	88106	89427	83582	95773	106317	2.06	2.70	1.57	1.63	1.29	1.40	1.78
Basmati rice -chickpea (4rows+2rows coriander)	255263	263453	168666	170984	170191	189028	202931	4.42	5.50	3.48	3.46	2.89	3.18	3.82
Basmati rice -vegetable pea (4 rows vegetable pea +2 rows coriander)	248590	259212	173323	170345	186642	180499	203102	3.75	4.56	2.89	2.79	2.75	2.64	3.23
Basmati rice -potato	135498	137566	55585	70322	80348	62064	90231	1.88	2.09	0.83	1.04	0.98	0.71	1.26
Mean production system	193993	201157	121420	125270	130191	131841		3.03	3.71	2.19	2.23	1.98	1.98	
Raipur														
Soybean-Maize	258571	291402	201504	200221	161937	153449	211181	2.97	3.45	2.82	2.58	1.97	1.84	2.61
Soybean- Garden pea	155631	168593	117567	127267	120837	81232	128521	2.20	2.47	2.01	1.98	1.85	1.18	1.95
Soybean-Chilli	208910	228959	152902	163076	149737	151183	175795	2.66	3.04	2.25	2.20	2.06	1.99	2.37
Soybean-Onion	204136	261956	165725	204978	108670	160684	184358	2.63	3.60	2.41	2.79	1.52	2.14	2.52
Mean production system	206812	237728	159425	173886	135295	136637		2.62	3.14	2.37	2.39	1.85	1.79	
Ranchi														
Rice–wheat	-	-	-	-	-	-	68780	-	-	-	-	-	-	1.08
Rice – lentil	-	-	-	-	-	-	51691	-	-	-	-	-	-	1.08
Rice – potato	-	-	-	-	-	-	140220	-	-	-	-	-	-	1.49
Rice– linseed	-	-	-	-	-	-	44543	-	-	-	-	-	-	0.95
Mean production system	109667	113164	61216	44292	66136	63377		1.42	1.63	1.11	0.85	1.01	0.88	

	Net returns (Rs/ha)							Net return per rupee invested (NRPRI)						
	Organic		Inorganic		Integrated (towards organic)		Mean	Organic		Inorganic		Integrated (towards organic)		Mean
	100% organic	75% organic + innovative organic practices	100% Inorganic	State recommendation	50% organic + 50% inorganic	75% organic + 25% inorganic		100% organic	75% organic + innovative organic practices	100% Inorganic	State recommendation	50% organic + 50% inorganic	75% organic + 25% inorganic	
Ajmer														
Green Gram – Fennel	56332	61318	79008	90008	81313	78302	74380	1.94	2.23	3.85	3.39	2.87	2.53	2.80
Green Gram - Coriander	364	22736	26514	27814	22707	20688	20137	1.01	1.57	2.01	1.77	1.64	1.51	1.59
Cluster Bean - Fennel	55632	57118	80108	84408	61213	80902	69897	1.93	2.14	3.89	3.24	2.41	2.58	2.70
Cluster Bean – Coriander	19564	21436	34914	29614	27207	35288	28004	1.43	1.54	2.33	1.82	1.76	1.88	1.79
Mean production system	32973	40652	55136	57961	48110	53795		1.58	1.87	3.02	2.56	2.17	2.13	
Gangtok														
Maize + ginger (1.1)-french Bean							199330							4.17
Maize + soybean (1:1)-buckwheat							33508							1.74
Maize +turmeric (1:1)-rajmash							498368							9.10
Maize+ Pigeon Pea (2:1)							38145							1.89
Mean production system	264747	200949	-	136398	167258	-		5.50	4.15	-	3.69	3.57	-	
Narendrapur														
Basmati rice–broccoli –*sesbania* green manure	126229	124406	87996	86928	85240	100027	101804	2.02	2.08	1.91	1.90	1.77	1.85	1.92
Paddy– mustard– green gram	172183	180537	123480	119953	132325	117154	140938	1.95	2.12	1.92	1.89	1.90	1.71	1.91
Paddy– capsicum– green gram	181138	176948	123679	121947	117237	132612	142260	2.03	2.11	1.91	1.90	1.75	1.81	1.92
Paddy –french bean – sesame	221921	216376	178865	185129	161346	130161	182300	2.14	2.25	2.25	2.29	2.01	1.73	2.11
Mean production system	175368	174567	128505	128489	124037	119989		2.03	2.14	2.00	2.00	1.86	1.77	
Sardar Krushinagar														
Groundnut- Wheat- Green gram	98764	117209	126797	101015	105105	92900	106965	1.75	1.97	2.31	1.71	1.92	1.75	1.90
Greengram- Cumin- Vegetable cowpea	113321	111396	163816	157400	143965	146175	139346	2.12	2.16	2.89	2.19	2.53	2.50	2.40
Greengram-Fennel- Fennel cont.	21682	30672	41626	19953	22835	12631	24900	1.25	1.39	1.68	1.22	1.31	1.16	1.33
Mean production system	77922	86426	110746	92789	90635	83902		1.71	1.84	2.29	1.71	1.92	1.80	
Thiruvananthapuram														
Cassava-veg. cowpea	534624	541289	432472	344642	168411	253766	379201	2.60	2.65	3.28	2.70	1.64	1.75	2.44
Cassava-groundnut	640283	529744	520117	305167	337396	353644	447725	3.80	3.15	3.90	2.65	2.40	2.35	3.04
Mean production system	363092	282678	204238	-22001	353948	307589	248257	1.05	1.35	1.68	0.92	1.93	1.51	1.41
Taro-black gram	60199	123790	127131	-12258	340177	229949	144831	1.91	1.60	1.64	0.95	2.10	1.74	1.66
Taro-greengram	399550	369375	320989	153888	299983	286237		2.34	2.19	2.63	1.81	2.02	1.84	
Mean production system														
Udaipur														
Maize + Blackgram (2:2) – Durum Wheat – Sesbania (GM)	87212	118164	215299	202550	191603	151679		1.83	2.30	5.47	4.30	3.51	2.68	3.35
Sweet corn + Blackgram (2:2) – Chickpea	107123	141022	211806	198440	143292	102766		2.50	3.18	5.78	4.89	3.49	2.59	3.74
Blackgram – Wheat (Triticum aestivum)	74130	73149	134879	138536	110289	103790		2.00	2.09	4.15	3.66	2.89	2.55	2.89
Soybean – Fenugreek	20187	11482	33707	22016	27422	36056		2.00	1.28	1.99	1.56	2.48	1.89	1.87
Mean production system	72163	85954	148923	140386	118152	98573		2.08	2.21	4.35	3.60	3.09	2.43	
Umiam														
Vegetable-vegetable systems on raised bed														
Broccoli -carrot	415860	345942	291684	-	348776	-	350566	1.77	1.63	1.64	-	1.81	-	1.71
Broccoli - potato	288768	248538	189450	-	226017	-	238193	1.07	1.01	0.88	-	0.96	-	0.98
Broccoli -french bean	437472	379452	297933	-	347652	-	365627	2.04	1.94	1.84	-	1.91	-	1.93
Broccoli -tomato	449664	396810	301956	-	341641	-	372518	1.84	1.79	1.58	-	1.64	-	1.71
Mean production system	397941	342686	270256	-	316022	-		1.68	1.59	1.49	-	1.58	-	
New centres started from 2016-17														

+25% innovative organic practices recorded higher net return (Rs.2,01,157/ha) followed by organic (100%) . It increased up to the 65.7 & 54.1% than inorganic and integrated management. Rice-chickpea+coriander +*sesbania* recorded significantly higher net return of Rs. 202931/ha but it was at par with basmati rice - vegetable pea (4 rows vegetable pea among the cropping system.

Raipur:

Among different cropping system, the maximum net return of Rs 2,91,402/ha was obtained in soybean-maize (sweet corn) cropping sequence with 75% organic + foliar spray of vermiwash (10%) nutrient management followed by soybean-onion cropping sequence with 75% organic + foliar spray of vermiwash (10%) of Rs 261956/ha . Similarly, highest B:C ratio (3.60) was also obtained with 75% organic + foliar spray of vermiwash (10%) followed by cow urine (10%) at 20 days interval at 30 DAT and 50 DAT in soybean-onion cropping system followed by soybean-maize (sweet corn) with same nutrient management practices (3.45).

Ranchi:

Among the different management systems, application of 75% organic manure +innovative practices produced higher net return and benefit cost ratio under organic management followed by integrated either by with 50:50% organic and inorganic or towards organic by 75% organic manure +25% inorganic . Application of 75% organic manure +innovative practices recorded of Rs 1,13,164/ha/year followed by 100% organic practice of 1,09,667/ha. It was found to be 84.7 and 65.8% higher than inorganic respectively. Among cropping systems, rice-potato recorded higher net return (Rs. 68780/ha) along with benefit cost ratio of 1.48. Rice-linseed and rice-wheat systems being at par for B:C ratio while, rice-lentil recorded minimum net monetary return.

Umiam:

The economics of broccoli-vegetable based cropping systems under different management practices revealed that with considering of premium price, maximum gross return and net return was recorded in broccoli- tomato cropping system followed by broccoli –frenchbean and broccoli-carrot under organic practices by 100% nutrient supply through organic manure or by supplying 75% organic +25% innovative practices management. Net return per rupee invested being higher in broccoli -frenchbean (2.04) under organic practice cropping system followed by broccoli- tomato (1.84) under organic and 75% organic+ innovative management practices. 47.3% more return was observed with organic over inorganic however, 12.8% more net return per rupee invested was obtained with organic as compared to inorganic.

Ajmer:

Economics for spice based systems among influenced by management practices showed that the net returns (Rs 57961 and 55136/ha) and benefit cost ratio (3.02 and 2.56) recorded higher under inorganic condition with 100% inorganic or by state recommendation practice. Crop green gram and cluster bean grown with fennel found to be more profitable than coriander which obtained highest net returns. Green gram-fennel received 269.4% more return than green gram-coriander similarly, clusterbean- fennel also gave the more return by 149.6% than clusterbean-fennel system. Results indicate that inclusion of fennel in the system either with green gram or clusterbean is more beneficial than coriander.

Gangtok:

Narendrapur:

Among the nutrient managements practices, organic management with 100% nutrient through manure recorded higher gross return (Rs. 2,79,105/ha) and net return (Rs. 1,44,733/ha). It was found to be 39.2 & 21.5% higher than inorganic and integrated

management. Lower cost of cultivation (Rs. 96,271/ha) was recorded under inorganic management with state recommendation. Befit cost ratio was higher under organic with 75% nutrient through manure+ innovative practices (1.03) followed by exclusively 100% organic practice but not significantly differ among the nutrient management. Cropping systems also not to be found differ significantly to each other however, higher net return per rupee invested was recorded with basmati rice–broccoli – *sesbania* green manure system (0.92) than to other system which were at par. Paddy –french bean – sesame system found to be more profitable to other which recorded net return of Rs. 131693/ha/year

Sardarkrushinagar:

Highest gross return (Rs. 2,14,242/ha) recorded under inorganic practices with state recommendation. Other management practices gave lower gross return than inorganic but being on par to each other. Maximum Net return of Rs.1,10,746 was obtained under 100% inorganic followed by state recommendation package whereas minimum was received under organic cultivation. Reduction in organic seems to be by 29.6% over inorganic. Among the cropping systems, greengram- cumin- vegetable cowpea system recorded higher net return of Rs. 139345/ha. Green fennel gave minimum return of Rs. 24,900/ha. Net return per rupee invested was higher under organic management which found to be on par with inorganic. Among the cropping systems, not significant difference was recorded in ranging from 0.87 to 0.92 in term of NRPRI.

Thiruvananthapuram:

With premium price, cassava-groundnut resulted in higher net returns of Rs. 640283/ha and net return per rupees invested (3.55) under organic condition followed by 75% organic+ innovative practices. In the case of taro, 100% organic followed by 75% organic + 25% innovative practices management resulted in higher net returns and benefit cost ratio (Rs. 363092 and 0.92 respectively). Systems, cassava-groundnut was the most remunerative than cassava-vegetable cowpea likewise taro-black gram was the most profitable when computed with or without premium price with taro-green gram.

Udaipur:

Gross return, net return and net return per rupee invested did influenced by the management practice as well as cropping systems. Among nutrient management, higher net return was recorded under inorganic condition however, NRPRI found to be higher in integrated nutrient management either by 50% each nutrients through organic and inorganic or towards organic (75% organic+25% inorganic). Among four cropping systems evaluated, maize + blackgram (2:2) – durum wheat – sesbania (GM) cropping system recorded maximum net return followed by sweet corn + blackgram (2:2) – chickpea. Reverse was found in case of NRPRI, it was higher in sweet corn + blackgram (2:2) – chickpea followed by maize + blackgram (2:2) – durum wheat – sesbania (GM).

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. Almora and Narendrapur not conducted the experiments.

Results

Bajaura

Twelve varieties of tomato including five hybrids in *kharif* and *summer* season, six varieties of okra including two hybrids in *kharif*, three varieties and five hybrids of pea and two varieties and five hybrids of cauliflower in *rabi* season were evaluated for their performance and suitability under organic conditions. (Table 20.1-20.4)

Table 20.1: Yields attributes and yield of tomato in tomato-pea-tomato system under organic management at Bajaura

Varieties/ hybrids	Plant height (cm)		numbers of fruits plant^{-1}	Fruit size (cm^2)		Days taken to flowering		Yield (kg/ha)		TSS (0Brix)	
	kharif	summer	*Kharif*	*Kharif*	Summer	*Kharif*	Summer	*Kharif*	Summer	*Kharif*	Summer
Yash	88.4	101.1	4.5	19.9	29.9	43.0	40.3	1523	10080	4.56	5.0
Naveen 2000	91.0	99.4	4.1	16.8	26.3	40.3	38.3	1020	6770	4.16	4.4
Manisha	92.9	88.0	4.5	21.6	28.4	48.3	46.3	1126	9310	4.50	4.9
Red Gold	92.9	90.1	5.7	22.3	31.3	42.3	40.3	1963	15480	4.30	4.8
Hybrid7730	92.4	98.2	4.7	20.8	25.6	40.0	38.0	1370	10440	3.86	4.2
Roma	87.1	68.1	4.5	21.8	23.8	51.0	49.0	1126	5640	3.83	4.1
Sioux	79.8	86.5	3.3	20.6	23.4	41.3	39.3	880	2410	3.96	4.1
Best of All	94.3	79.1	3.8	21.3	16.6	42.3	40.3	1280	4470	4.40	4.7
Palam Pink	92.0	64.5	5.3	21.1	29.4	41.0	39.0	1086	4600	4.00	4.3
Mar Globe	88.3	92.7	5.2	20.2	36.1	41.7	39.6	1683	2450	3.90	4.1
RK-123	94.8	94.3	5.2	25.2	30.1	43.3	41.3	1870	14890	4.53	4.8
Heem Sohna	93.2	93.7	4.7	16.6	23.2	40.0	38.0	1510	11950	4.56	4.9
CD (P=0.05)	4.87	2.07	NS	0.61	1.69	1.08	1.28	326	892	0.27	0.40

Tomato (Table 20.1):

Significant differences were observed among the tomato varieties/hybrids for all variables except number of fruits/plant. RK 123 and Yash was tallest variety with plant height 94.8 and 101.1 cm respectively, while the lowest plant height among all varieties was achieved by Sioux and Palam pink with length of 79.8 and 64.5 cm in *kharif* and *summer* respectively. Significant fruit yield difference was recorded among the tomato varieties ranged from 880 to 2410 kg/ha and 1963 to 15480 kg/ha during *kharif* and *summer* respectively. Sioux showed lowest yield while Red gold had highest fruit yield with higher number of fruits/plant (5.7) in *kharif*. Significantly higher fruit size was recorded with RK-123 (25.2 cm^2) and Marglobe (36.1 cm^2) during *kharif* and *summer* respectively. TSS (^{0}Brix) in term of quality varied ranging from 3.83 to 4.56 during *kharif* and 4.1 to 5.0 during *summer*.

Okra (Table 20.2): Six varieties of okra were evaluated in okra-cauliflower system for their suitability under organic conditions during *kharif*. Okra varieties showed significant differences for all the parameters. Variety Chameli-015 recorded significantly higher fruit yield (8576 kg/ha) owing to higher number of fruits/plant (25.0), fruit length (11.5 cm) and plant height (173.9 cm) followed by Indranil with yield and fruit length (7683 kg/ha and 11.5 cm) compared to others. Difference for days taken to harvest among the varieties showed least with Chameli-015 (52.3) whereas Perkins long green took maximum number of days (62.3) to get harvest.

Best performing variety of Okra

Table 20.2: Yields attributes and yield of okra in okra-cauliflower system under organic management at Bajaura

Variety	Plant height(cm) /plant	Days taken to Harvest (cm)	No. of fruits	Fruit length	Fruit yield (q/ha)
Perkins Long Green	157.3	62.3	24.3	11.2	6753
Pusa Makhmali	149.2	61.0	22.3	11.1	6603
Palam Komal	136.9	55.6	21.0	10.5	5338
P-8 (check)	154.4	53.6	22.3	10.6	6616
Indranil*	164.3	56.3	23.3	11.5	7683
Chameli-015*	173.9	52.3	25.0	11.5	8576
CD (P=0.05)	10.1	3.2	1.8	0.54	652

**Hybrid*

Pea (Table 20.3)**:** Three varieties and five hybrids of pea were evaluated for their performance under organic conditions during rabi. Significant differences among the pea varieties were observed except plant height and TSS. Difference in pod length among the varieties ranged from 6.8 to 7.6 cm, form 17.3 to 21.3 in number of pods/plant and number of seeds/pod from 4.7 to 7.3. Most of the varieties differed significantly for pod yield. Ten plus gave the highest pod yield (5600 kg/ha) followed by Nirali (5020 kg/ha). Pb 89 produced the lowest yield (3740 kg/ha) with lower number of pods and seeds/plant. Days taken to flowering also more in Tenplus (115.6) followed by NP-20 (114.3 days), Nirali (114.0days), TS-10 (112.6 days), Sommer wood (112.3

Table 20.3: Yields attributes and yield of vegetable pea (rabi) in tomato-cauliflower-pea system under organic management at Bajaura

Varieties	Plant height (cm)	Pod length (cm)	No. of pods plant-1	No. of seeds pod-1	Days taken to flowering	Pod yield (kg/ha)	TSS (0Brix)
Pb-89	50.3	7.3	17.3	4.7	98.0	3740	16.0
Azad-P1	51.9	6.8	19.3	5.3	94.3	3320	15.3
NP-20*	52.4	7.1	18.0	5.3	114.3	2830	15.3
Somer wood*	49.3	7.1	20.3	6.0	112.3	3770	15.3
Nirali*	53.8	7.4	21.3	5.7	114.0	5020	14.6
Ten Plus*	53.7	7.5	20.0	6.7	115.6	5600	15.3
TS-10*	51.2	7.6	20.0	5.0	112.6	4680	14.0
Palam Triloki	52.1	7.3	17.3	7.3	95.3	4590	14.6
CD (P=0.05)	NS	0.38	1.59	1.11	4.85	364	NS

Best performing variety 'Tenplus' of pea at Bajaura

days), but these were found statistically at par to each other.

Cauliflower (Table 20.4)**:**

Two varieties and five hybrids of cauliflower were evaluated. Significant differences were observed among the varieties/hybrids for the different traits. Though higher curds size was obtained in KT-25 (200.4 cm2) but significantly higher marketable curd was obtained in US-178 (92.1%) along with higher curd weight (470.6 g) resulted in higher curd yield (10270 kg/ha) as compared to other varieties followed by Chandramukhi (8830 kg/ha). Variety KT-25 recorded lower yield (6560 kg/ha) resulting in lower number of marketable curd (77.1%) and curd weight (299.6 g).

Table 20.4. Yields attributes and yield of cauliflower (rabi) in okra-cauliflower system under organic management at Bajaura

Variety/hybrid	Marketable curd (%)	Curd weight (g)	Curd size (cm^2)	Curd yield (kg/ha)	Biomass/(kg/ha)
US-178*	92.1	470.6	197.6	10270	13450
Chamdramukhi*	88.7	438.6	194.1	8830	12150
Madhuri*	87.6	419.0	171.7	8060	12000
Sonaxi*	90.3	412.3	165.2	7620	11340
71No.*	85.5	402.3	161.4	7370	11120
PSBK-1	80.2	395.0	157.3	7210	11260
KT 25	77.1	299.6	200.4	6560	10470
CD (P=0.05)	0.34	26.3	12.18	963	9210

**Hybrid*

Bhopal

Response of different varieties/hybrids of crops in soybean-wheat and maize-chickpea system at Bhopal. Twelve varieties of each soybean and maize in *kharif* and wheat and chickpea in rabi season including two major varieties grown by the farmers in the region were evaluated in soybean-wheat and maize-chickpea cropping systems (Table 21.1-21.4).

Soybean (Table 21.1):

Among the soybean varieties, NRC 37 was the tallest variety (65.9 cm) but statistically on par with JS 97-52 whereas variety JS 20-34 recorded shortest plant (34.3 cm). Soybean variety, RVS-2002-4 resulted in significantly higher seed yield (1290 kg/ha) owing to higher pods/plant (47.7) and biomass (4735 kg/ha) while, JS 93-05 recorded lower soybean yield (680 kg/ha) with least pods/plant (31.1), seeds/pod (2.6) and biomass (2323 kg/ha).

In term of quality, significant variation was also observed for oil and protein content among the soybean varieties. The percentage of protein and oil content from different varieties of soybean seeds was found to be in the range of 36.21 – 37.43% and 18.67–20.09% respectively. 7.6% more oil was recorded in RVS 2002-7 compared to JS 97-52. Significantly higher protein (37.43%) was recorded with JS-93-05 followed by JS 20-29 (37.36%) but statistically at par with all other varieties except JS-20-34 and RVS-2002-6.

Table 21.1. Yield attributes, yields and quality of soybean 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	48.3	43.5	3.3	1080	4083	26.4	36.8	19.4
JS-93-05	46.3	31.1	2.6	680	2323	29.3	37.4	19.3
JS-95-60	42.2	39.2	3.1	940	2670	35.2	36.8	19.0
JS-20-41	54.7	47.2	3.5	1147	4050	28.3	36.6	19.5
NRC-7	47.0	43.2	3.3	1057	3880	27.2	36.5	18.8
NRC-37	65.9	40.3	2.7	977	3570	27.4	37.1	18.8
JS-20-29	55.7	42.5	3.2	1057	3833	27.6	37.4	19.8
RVS-2002-4	50.7	47.7	3.4	1290	4735	27.2	36.3	19.7
RVS-2002-6	54.7	45.9	2.7	1097	4157	26.4	36.2	19.9
RVS-2002-7	54.9	41.7	2.7	1043	4053	25.7	36.5	20.1
JS-97-52	65.0	46.0	3.4	1110	4027	27.6	36.4	18.7
JS-20-34	34.3	35.9	2.9	875	3253	26.9	36.2	18.2
CD (P=0.05)	8.8	NS	0.49	142	675		1.13	0.06

Maize (Table 21.3): Most of the varieties differed significantly for seed and biomass yield. Kanchan was the leading variety in plant height (158 cm), cobs/plant (1.4), rows/cob (12.6), seed/row (20.8) and seed and biomass yield (2907 and 6393 kg/ha respectively) but statistically similar with Proagro 4412 and Pratap-6. Sweet corn produced lower number of cobs/plant (1.0), row/cob (9.8), seeds/row (14.1) and grain yield of (983 kg/ha). Among all the quality parameters assessed, Proagro-4412 recorded more protein and tryptophan (10.04% and 0.91 g/16gN respectively). The variation for protein ranged from 9.24 to 9.98%, ash 1.39 to1.60% and tryptophan ranging from 0.69-0.89 g/16gN.

Table 21.2. Yield indices, yield and quality of different maize varieties/hybrids 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	158	1.4	12.6	20.8	2907	6393	45.5	9.74	1.62	0.89
Pratap 5	124	1.0	11.7	16.5	1730	3880	44.6	9.64	1.49	0.84
Arawali	118	1.1	11.9	18.5	2047	4413	46.4	9.88	1.45	0.77
Sona 222	137	1.1	11.8	18.7	2140	4613	46.4	9.66	1.56	0.84
Pratap 6	131	1.2	12.3	19.9	2670	5740	46.5	9.60	1.53	0.79
JM 216	153	1.1	11.9	18.1	2343	5250	44.6	9.84	1.48	0.75
Popcorn 1	128	1.0	10.1	15.4	1173	2910	40.3	9.24	1.48	0.69
JM 8	114	1.2	11.9	17.6	1950	4270	45.7	9.74	1.51	0.88
JM 12	122	1.2	11.5	17.4	1767	3820	46.2	9.44	1.50	0.81
Proagro 4412	121	1.3	12.5	20.5	2847	6163	46.2	10.04	1.60	0.91
Sweet Corn	132	1.0	9.8	14.1	983	2250	43.7	9.37	1.39	0.71
CPBG 4202	123	1.1	12.0	19.4	2327	5253	44.3	9.98	1.45	0.87
CD (P=0.05)	NS	NS	1.5	NS	495	998		0.03	0.046	0.025

Wheat (Table 21.3):

Among the wheat varieties, GW-366 recorded significantly higher number of spikes/meter row length (100), seeds/spike (76.7) resulted in higher grain and biomass yield (3356 and 6985 kg/ha) and harvest index (48.0%) followed by HI-8498 and Malwa shakti in term of yield. C-306 produced lower yield (2067 kg/ha) with total biomass (4974 kg/ha). GW 366 produced 62.4% higher yield compared to C306 which was lowest in yield.

Chick pea (Table 21.4):

Among the varieties, JG 130 recorded higher seed yield (2154 kg/ha), correspondingly higher biomass yield of 5217 kg/ha, seeds/pod (2.1) and pod/plant

Table 21.3. 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	66	60.7	2067	4974	42
HI-8663	88	68.7	2764	6624	42
HI-1544	87	66.0	2618	6026	43
Malwashakti	95	70.3	2929	6219	47
GW-322	93	68.7	2802	6100	46
GW-366	100	76.7	3356	6985	48
HI-1531	80	61.7	2419	5526	44
HI-8498	98	74.3	3007	6563	46
HI-1500	76	62.7	2333	5619	42
1202	87	67.7	2742	6604	42
HD-932	95	71.3	2681	6459	42
LOK-1	71	62.3	2196	5115	42.9
CD (P=0.05)	10	8.4	239	337	70.9

Table 21.4. Yield indices and yield of different chickpea varieties/hybrids under organic management at Bhopal

Treatment	Pods/plant	Seed/pod	Grain yield (Kg/ha)	Biological yield (Kg/ha)	HI %
RVG-202	90	2.0	1806	4277	38
JG-16	93	1.7	1817	4799	34
JGK-3	90	1.6	1283	3269	33
RVG-203	92	2.1	2077	4891	39
JG-11	88	1.6	1777	4617	34
JG-6	87	1.7	1726	4054	38
JG-130	95	2.1	2154	5217	38
JG-315	87	2.0	1617	4188	34
JG-63	68	1.5	1551	4036	33
JG-74	72	1.7	1570	4099	33
VIRAT	96	1.5	1477	3803	33
UJJWALA	97	1.4	1399	3449	35
CD (P=0.05)	2.2	0.4	180	390	

(95) followed by RVG 203 (2077 kg/ha) and JG 16 (1817 kg/ha) in term of yield. Rest of varieties were ranged from 1283 to 1806 kg/ha on yield basis.

Calicut

Evaluation of different varieties of turmeric under organic farming at Calicut (Table 22): Among the 11 varieties of turmeric evaluated under organic and inorganic situation, maximum yield was recorded by Suguna (41800 kg/ha) followed by Sudarshana (39900 kg/ha) which was statistically on par. Variation in other turmeric varieties was recorded in range from 18900 kg/ha (Prathibha) to 34000 kg/ha (Sobha). the average yield of turmeric found to be higher by 37.9% in organic compared to inorganic production system. In term of quality of turmeric, Sobha recorded maximum oil

Table 22. Response of different management systems on yield and quality of turmeric under organic conditions at Calicut

Varieties	Yield (kg/ha)		Oil content (%)		Oleoresin content (%)		Curcumin (%)	
	Organic	Inorganic	Organic	Inorganic	Organic	Inorganic	Organic	Inorganic
Prathibha	18900	17900	4.8	4.9	11.8	12.1	5.1	5.1
AlleppeySupreme	22400	18300	4.8	4.9	12.7	13.0	6.2	5.6
Varna	28300	23200	5.8	5.9	11.9	9.9	3.6	2.6
Sobha	34000	21700	6.0	5.6	10.7	9.3	3.3	3.0
Sona	29100	22600	5.9	5.1	10.6	9.0	3.3	2.6
Kanthi	33900	21400	5.8	5.1	10.4	8.8	3.0	2.4
Suvarna	31900	18600	5.8	5.9	10.8	10.5	2.8	2.3
Suguna	41800	28500	5.1	4.9	14.3	12.6	5.9	5.7
Sudarsana	39900	25300	4.7	5.0	12.3	11.9	5.5	5.2
Kedaram	19500	17600	5.2	4.5	14.1	12.1	5.7	5.2
Prabha	20800	16900	5.4	5.1	13.1	12.1	5.1	4.9
Mean	29100	21100	5.4	5.2	12.1	11.0	4.5	4.0
(CD=0.05)	1010		0.07		0.14		0.06	

content (6.0%) which was on par with Sona (5.9%), Varna, Kanthi, Suvarna (5.8%) and Prabha (5.4) and the least oil content was noticed in Prathibha and Aleppey Supreme. Suguna and Kedaram recorded maximum oleoresin 14.3 and 14.1% while, Aleppey supreme recorded maximum curcumin content (6.2%) followed by Suguna (5.9%).

Coimbatore

Evaluation of rice varieties suitable for organic farming at Coimbatore (Table 23.1-23.4)

Rice (Table 23.1)

Rice varieties reflected significant differences for all the traits studied. Variation in plant height recorded in ranged between 58cm to 105.6cm and productive tillers/hill was in range from 11.6 to 19.0. Kitchili Samba was the tallest variety with higher number of productive tillers/hill (19) while, IR 20 recorded shortest plant height (58cm). Thousand grains weight among the varieties varied from 12.2 to 24.1 g. Least thousand grains weight (12.2 g) was observed for Jeeraga Samba while heaviest grains (21.1 g) was produced by variety Mapillai Samba. Significant grain yield difference was observed among the rice varieties. Data revealed that the difference in grain yield among the varieties ranged from 2710 to 5500 kg/ha. KDML 105 showed lowest grain yield (2710 kg/ha) while CB05022 had highest grain yield (5500 kg/ha). Harvest index values were calculated in different varieties, however, CO(R)48 gave the highest harvest index (0.38) followed by CO(R)51. The lowest harvest index was determined in Mappillai Samba (0.25) which was due to higher straw yields (13960 kg/ha).

Variety wise economic returns were worked out and presented in Table 24.2. Among the different varieties of rice, Mappillai Samba fetched maximum gross return (Rs. 119765/ha), net return (Rs. 79175/ha) and net returns per rupee invested (2.95) followed by Kitchidi Samba and IW Ponni, while, KDML105 gave minimum net return of Rs.25050/ha with net return rupee per invested (1.50).

Table 23.1: Evaluation of rice varieties suitable for organic condition at Coimbatore

Treatments	Plant height at 75 DAT (cm)	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	80.0	12.9	124.0	22.3	4330	7900	0.35
White Ponni	72.4	13.0	161.0	15.8	4440	8570	0.34
Mappillai Samba	91.2	15.4	163.3	24.1	4710	13960	0.25
Kitchili Samba	105.6	19.0	151.3	18.4	4310	10110	0.3
IR 20	58.0	12.8	161.0	18.1	4030	8070	0.33
CO 43	75.0	13.5	183.3	19.9	3950	8110	0.33
CO® 48	67.0	14.9	147.8	19.1	5180	8500	0.38
CO® 51	84.6	14.2	166.0	16.9	4230	7130	0.37
CB 05022	78.3	14.0	197.3	18.8	5500	10100	0.35
KDML 105	89.7	11.6	69.8	23.6	2710	4100	0.31
Red Kavuni	91.8	14.6	188.8	23.3	3650	9960	0.27
Jeeraga Samba	90.6	14.2	163.2	12.2	3420	9030	0.27
CD (P=0.05)	6.82	3.02	19.49	1.55	0.39	1.73	

Table 23.2. Economics of rice under organic cultivation at Coimbatore

Treatments	Gross return (Rs/ha)	Cost of cultivation (Rs/ha)	Net return (Rs/ha)	NRPRI
Mappillai samba	119765	40590	79175	2.95
Kitchidi samba	104265	40590	63675	2.57
IW Ponni	103720	40545	63175	2.56
CB 05022	99950	40590	59360	2.46
CO® 48	92110	40545	51565	2.27
Red kavuni	91095	40590	50505	2.24
Jeeragasamba	84750	40590	44160	2.09
Bhavani	78585	40545	38040	1.94
CO 51	75595	40545	35050	1.86
IR 20	66515	40545	25970	1.64
CO 43	65595	40545	25050	1.62
KDML	61045	40590	20455	1.50

Table 23.3: Physical parameters of rice varieties under organic farming at Coimbatore

Treatments	Hulling(%)	Milling(%)	Before cooking		After cooking	
			Length of kernel (mm)	Breadth of kernel (mm)	Length of kernel (mm)	Breadth of kernel (mm)
Bhavani	78.5	84.4	5.4	1.8	9.2	2.1
IW Ponni	73.2	78.6	5.2	1.8	8.5	2.4
Mappillai samba	80.3	73.2	5.5	2.5	10.2	2.6
Kitchili samba	78.9	81.1	5.2	1.9	10	2.5
IR 20	79.1	78.3	5.1	1.8	8.2	1.6
CO 43	80.9	72.9	4.8	2.1	8.5	1.8
CO® 48	78.7	79.2	4.9	1.8	8.1	2.7
CO 51	82.1	75.7	4.6	1.6	8.6	2.8
CB 05022	78.5	82	5.4	2.1	7.8	2.5
KDML	70.6	85.6	6.2	2	10.2	2.6
Red kavuni	74.3	81.7	4.8	2	8	2.6
Jeeraga samba	72	86.6	3.7	1.6	6.5	2.1

Physical quality parameter such as kernel length, kernel breadth, length breadth ratio, hulling percentage and milling percentage were estimated at post-harvest stage and given in Table 24.3-24.4. Among the varieties, CO 51 obtained higher hulling percentage (82.1%) while Jeeraga samba registered lower hulling percentage (72%) though milling (86.6%) was higher in Jeeraga samba. KDML 105 followed by Mapillai Samba obtained higher kernel length of 6.2 & 5.5 mm respectively as long size category while, Jeeraga samba recorded 3.70mm kernel length as short category before and after cooking. The variety CO(R)51 recorded higher kernel breadth (2.8) followed by CO (R) 48 (2.7), Mappillai samba, KDML105 and Red kavuni (2.6 mm) while, IR 20 found to be lower in breadth 1.6 mm after cooking.

The gelatinization temperature of the endosperm starch a useful test of cooking quality refers to the

Table 23.4: Cooking parameters of rice varieties under organic farming at Coimbatore

Treatments	Gelatinization temperature (GT)	Gel consistency (GC)	Linear elongation ratio (LER)	Volume expansion ratio	Breadth wise expansion ratio
Bhavani	3	Medium	1.7	4.7	1.33
IW Ponni	3	Medium	1.63	4.6	1.5
Mappillai samba	3	Medium	1.85	3.9	1.44
Kitchili samba	7	Medium	1.92	3.9	1.32
IR 20	2	Medium	1.61	4.6	1.33
CO 43	7	Medium	1.77	3.7	1.24
CO® 48	2	Soft	1.65	3.9	1.61
CO 51	2	Medium	1.87	3.7	1.75
CB 05022	3	Medium	1.44	3.7	1.24
KDML	7	Soft	1.65	3.9	1.3
Red kavuni	6	Medium	1.67	3.3	1.65
Jeeragasamba	2	Soft	1.76	3.7	1.69

cooking temperature at which water is absorbed and the starch granules well irreversibly in hot water with a simultaneous loss of crystallinity and birefringence. The time required for cooking is determined by the gelatinization temperature (GT). The varieties IR 20, COR 48, CO(R) 51and Jeeraga Samba were recorded lower as kernel not affected/swollen and come under rating 2. The varieties Bhavani, IW Ponni, Mappillai samba and CB 05022 are grouped in the rating 3. The variety CO 43 and KDML 105 has high alkali digestion value and grouped under 7th category describes kernel completely dispersed. In term of gel consistency, varieties CO(R) 48, KDML 105 and Jeeraga Samba were classified as soft rice. Linear elongation ratio among the varieties varied from 1.44 to 1.92. Maximum linear elongation ratio (1.92) was noted for Kitchili samba followed by CO 51and Mappillai samba while least LER was observed for CB05020. With regard to breadth wise expansion ratio, the variation aws found to be from 1.24 to 1.75 where, CO51 obtained higher BER of 1.75 followed by Jeeraga Samba (1.69), Red kavuni (1.65) andCOR 48 (1.61) . The culture CB 05022 obtained least breadth wise expansion ratio as 1.24. In regard of volume expansion ratio during cooking, the rice kernels absorb water and increase in volume through increase in length or breadth, length wise increase without increase in girth is desirable characteristics in high quality of premium rice. Variety Bhavani produced higher volume expansion ratio of 4.7 compared to other varieties. It was followed by IW Ponni and IR 20 (4.6). The lesser volume expansion was noticed in Red kavuni (3.3).

Dharwad

Evaluation of response of different varieties of chickpea and wheat for organic farming under rainfed farming situation during rabi season (Table 24.1-24.5)

Chickpea (Table 24.1 & 2): The production management did not differ significantly for all the traits except nos. of pod/plant and seed weight/plant. Variety MACB 27 recorded taller plants (40.4 cm), while BGD-103 gave higher number of pods/plant (46.1), seed weight/plant (22.17g) and 1000-grains weight (357.5 g) under organically grown chickpea varieties. Organic production practice produced higher seed yield of chickpea (3172 kg/ha) as compared to inorganic (application of recommended rates of fertilizers along with farmyard) (3098 kg/ha). Among the varieties, A1 recorded maximum yield of

3653 kg/ha with higher stover yield and harvest index whereas, JAKI 9218 produced lower yield of 2806 kg/ha under organic condition. The difference from the lower and higher yielder variety found to be 30.2%.

Wheat (Table 24.3): Production practices involving the application of organic sources, Bijaga yellow recorded tallest variety with higher nos. of 1000-grains weight (55.1 cm and 44.94g respectively) however, higher grain yield of wheat (2380 kg/ha) was recorded with

Table 24.1: Yield attributes of chickpea cultivars as influenced by different production systems under rainfed farming situation at Dharwad

Sorghum cultivars	Plant height (cm)			No. of pods/plant			Seed weight (g/plant)			1000 grains weight (g)		
	Organic	In organic	Mean	Organic	In organic	Mean	Organic	In organic	Mean	Organic	In organic	Mean
A 1	33.1	32.2	32.6	28.0	20.7	24.4	9.78	6.39	8.09	254.0	260.9	257.4
MABC 27	40.4	35.9	38.1	42.0	28.1	35.0	20.20	8.84	14.5	315.8	325.8	320.8
MABC 37	38.7	38.4	38.6	32.3	33.1	32.7	11.97	9.41	10.7	298.5	293.2	295.9
BGD 103	37.5	42.5	40.0	46.1	41.8	44.0	22.17	16.72	19.4	357.5	362.4	360.0
JAKI 9218	32.9	34.7	33.8	23.9	22.4	23.2	7.44	6.83	7.1	266.8	262.8	264.8
Mean	36.5	36.7		34.5	29.2		14.31	9.64		298.5	301.0	
CD (P=0.05)												
Production System (PS)		NS			3.14			2.92			NS	
Cultivars (cv.)		5.38			5.67			2.96			14.07	
cv at same PS		NS			8.01			4.18			NS	

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

Table 24.2: 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
A 1	3653	3558	3605	2414	2259	2337	0.60	0.61	0.61
MABC 27	3006	3112	3059	2181	2112	2147	0.58	0.59	0.59
MABC 37	3508	3229	3369	2357	2382	2370	0.56	0.57	0.59
BGD 103	2889	2383	2636	2370	2077	2224	0.55	0.53	0.54
JAKI 9218	2806	3207	3006	2148	2198	2173	0.57	0.59	0.58
Mean	3172	3098	3135	2294	2206	2250	0.58	0.58	0.58
CD (P=0.05)									
Production System (PS)		NS			NS			NS	
Chickpea Cultivars (cv.)		391.68			NS			NS	
cv at same PS		452.10			NS			NS	

UAS 347 while, minimum was noted with DWR 2006. Cultivar UAS 347 produced 21.8, 28.41, 34.8 and 71.3% higher seed yield over cultivars UAS 456 (1954 kg/ha), Bijaga yellow (1853 kg/ha), NIAW 1415 (1765 kg/ha) and DWR 2006 (1389 kg/ha) respectively.

Changes in soil chemical properties (Table 24.4 & 5)

The results revealed that soil pH and electrical conductivity did not differ significantly either due to different production systems or due to varieties or

Table 24.3: Yield attributes and yields of wheat cultivars as influenced by different production systems under rainfed farming situation at Dharwad

Sorghum cultivars	Plant height (cm)			1000 grains weight (g)			Grain yield (kg/ha)			Straw yield (kg/ha)			Harvest Index		
	Organic	In-org-anic	Mean	Organic	In-org-anic	Mean	Organic	In-org-anic	Mean	Organic	In-org-anic	Mean	Organic	In-org anic	Mean
BIJAGA YELLOW	55.1	52.9	54.0	44.94	40.75	42.85	1853	1695	1774	4307	4636	4471	0.302	0.272	0.287
UAS 446	47.5	51.4	49.4	36.29	35.43	35.86	1954	1738	1846	3670	4019	3844	0.347	0.306	0.327
DWR 2006	54.9	58.1	56.5	44.41	42.50	43.46	1389	1653	1521	3888	3811	3850	0.265	0.302	0.283
UAS 347	50.0	51.7	50.9	31.78	34.95	33.36	2380	2178	2279	4504	5130	4817	0.348	0.298	0.323
NIAW 1415	36.3	39.6	37.9	27.54	31.45	29.50	1765	2131	1948	4898	4731	4815	0.267	0.310	0.289
Mean	48.8	50.7		36.99	37.02		1868	1879		4253	4465		0.306	0.298	
CD (P=0.05)															
Production System (PS)		NS			NS			NS			NS			NS	
Wheat Cultivars (cv.)		NS			3.651			338.52			438.2			0.039	
cv at same PS		6.22			5.170			NS			NS			0.056	

Table 24.4: Soil pH, electrical conductivity (d Sm^{-1})) and organic carbon (g kg^{-1}) as influenced by different production systems under rainfed farming situation at Dharwad

Sorghum cultivars	Soil pH			Electrical conductivity (d Sm^{-1})			Organic carbon (g kg^{-1})		
	Organic	Inorganic	Mean	Organic	Inorganic	Mean	Organic	Inorganic	Mean
A 1	7.34	7.24	7.29	0.21	0.22	0.22	6.38	5.74	6.06
MABC 27	7.37	7.33	7.35	0.22	0.21	0.22	6.33	5.33	5.83
MABC 37	7.30	7.27	7.29	0.22	0.22	0.22	6.46	5.14	5.80
BGD 103	7.25	7.29	7.27	0.20	0.21	0.21	6.40	5.32	5.86
JAKI 9218	7.32	7.31	7.32	0.23	0.23	0.23	6.40	5.25	5.83
Mean	7.32	7.29		0.22	0.22		6.40	5.36	
CD (P=0.05)									
Production system (PS)		NS			NS			0.07	
Chickpea cultivars (cv.)		NS			NS			NS	
cv at same PS		NS			NS			NS	

Table 24.5: Available nitrogen, Available phosphorus and available potassium as influenced by different production systems under rainfed farming situation at Dharwad

Sorghum cultivars	Available nitrogen, N (kg ha^{-1})			Available phosphorus, P_2O_5 (kg ha^{-1})			Available Potassium K_2O (kg ha^{-1})		
	Organic	Inorganic	Mean	Organic	Inorganic	Mean	Organic	Inorganic	Mean
A 1	359.9	305.7	332.8	42.74	39.12	40.93	313.04	297.53	305.3
MABC 27	332.9	301.0	317.0	41.44	38.44	39.94	312.50	292.96	302.7
MABC 37	360.2	309.2	334.7	41.28	38.15	39.72	313.51	287.25	300.4
BGD 103	350.0	307.5	328.8	41.02	38.52	39.77	313.33	290.46	301.9
JAKI 9218	350.8	312.9	331.9	40.70	39.12	39.91	313.20	290.10	301.7
Mean	350.8	307.3		41.44	38.67		313.1	291.7	
CD (P=0.05)									
Production system (PS)		25.0			4.14			8.39	
Chickpea cultivars (cv.)		NS			NS			NS	
cv at same PS		NS			NS			NS	

interactions. Soil organic carbon increased significantly with organic farming (6.40 g kg^{-1}) than conventional farming with the use of inorganic fertilizers and farmyard manure (5.36 g kg^{-1}). Similarly, the major available nutrients N, $P2O_5$ and K2O also increased significantly from 307.3, 38.67 and 291.7 kg ha^{-1} with conventional farming to 350.8, 41.44 and 313.1 kg ha^{-1} respectively with organic farming and did not vary significantly due to varieties.

Jabalpur

Evaluation of response of different varieties of rice and wheat crop in rice wheat system for organic farming (Table 25.1-25.5)

Best performing variety of wheat (UAS 347) at Dharwad

Rice (Table 25.1): Significant difference among the varieties for yield and yield attributing parameters were recorded except effective tillers/hill, 1000-grains weight and straw yield. PS-3 and PS-5 was the leading varieties in all the traits but statistically on par with each other however, significantly different from rest of verities. Plant height among the varieties ranged between 64.6 and 81.2 cm. Least plant height (64.6 cm) was noted for IR 36 while highest height was recorded for PS-3, PS-5 and IR 64 (81.2, 76.7 and 75.0 respectively). Difference for panicle length among the varieties ranged from 19.0 as least (IR-64) to 26.6 cm as highest (PS-3). Among the varieties, maximum grain yield was recorded with PS-3 (5800 kg/ha) followed by PS-5 (5490 kg/ha) due to higher number of effective tillers/m^2 (14.3 and 14.0), grains/panicle (69.4 & 69.6) respectively. The lowest yield was recorded in BVD-109 (3780 kg/ha) owing to lower effective tillers/m^2 (9.1), grains/panicle (60.5) and harvest index 31.1%.

Wheat (Table 25.2)**:**

Among the varieties, all the parameters showed non-significant differences except grain yield. Plant height ranged from 80.0 cm to 83.1 cm whereas tallest plant was recorded for HI 1418 and smallest was for JW 17. Number of grains/spike and test weight recorded superior in HW 2004 (54.3 nos. and 50.6 g respectively) followed by HI-1500 (52.9 nos. and 49.2 g respectively) among the wheat varieties. Significantly higher wheat yield was recorded with HI 1500 (5180 kg/ha) and found to be on par with HI 1418 (5157 kg/ha), C-306 (5058 kg) and HD 2987. These varieties are significantly superior over JW 3173 (4318 kg/ha), HI 1531 (4256 kg/ha), HD-4672 (4155 kg/ha), HW 2004 (4108 kg/ha). JW 3020 recorded minimum grain and straw yield of wheat (3941 and 5895 kg/ha).

Rice equivalent yield and economics of different varieties of rice and wheat in rice-wheat system (Table 25.3):

The system productivity of rice-wheat cropping systems under organic management in term of rice equivalent yield (REY) recorded maximum with rice (PS-3) – wheat (HI-1418) of 11376 kg/ha followed by rice (PS-5) - wheat (JW 17) of 10644 kg/ha and rice (Madhuri) – wheat (HI 1500) of 10374 kg/ha. Shehdri(rice)-JW 3020(wheat) recorded minimum equivalent yield of 8772 kg/ha. The higher gross return (Rs. 2,84,414/ha/year), net return (Rs. 1,82,479/ha/year) and B:C ratio of 1.79 were recorded with the variety PS-3 and HI-1418 followed by PS-5 and JW 17 (gross return Rs.2,66,116/ha, net return Rs. 1,64,181/ha and B:C ratio 1.61) in the system. The lowest gross return, net return and B:C ratio was recorded by the variety Shehdri and JW 3020 with Rs.2,19,305, Rs.11,7,370/ha and 1.15 respectively.

Effect of different varieties of rice and wheat on soil chemical and microbial properties (Table 25.4 & 25.5):

Response on soil properties was observed over their initial status under all the treatment in rice-wheat system. The difference among the varieties in respect of physical and chemical properties found to be non-significant. Maximum organic carbon content (7.73 g/kg) in the soil was found to be with rice (PS-4)-wheat (JW-3173), JR 201 - JW 3288 and PS 3 – HI 1418 in the system and lowest was with PS5 – JW 17 of 7.31 g/kg in the system. Available N, P and K follow the same trend as organic carbon. Among the varieties grown in kharif and rabi in rice-wheat system, higher fungi (40.39 x104/g cfu) and azotobacter (30.24 x106/g cfu) was recorded in rice (IR 64)-wheat (HI 2987), followed by JR-201-JW-3288 39.84 (x104/g cfu) and 29.69 (x106/g cfu). System PS4-JW-3173 recorded lowest population of fungi and azotobacter. Bacteria and phosphate solubilizing bacteria was found to be higher in rice (PS-5) - wheat (JW 17) of 53.29 and 18.81 x106/g cfu). Cropping system rice (MTU-1010) - wheat (HW-2004) retained higher actinomycets (25.75 106/g cfu) while lower was with rice (Shehdri)-wheat (JW 3020) system (17.88 x106/g cfu).

Table 25.1: Yield attributes and yield of rice varieties under organic farming at Jabalpur

Rice varieties	Plant height (cm)	Effective tillers /hill	Panicle length (cm)	Grains/ panicle	1000-grains weight (g)	sterility (%)	Grain yield (kg/ha)	Straw yield (kg/ha)	Harvest index (%)
PS 5	76.7	14.0	23.7	69.6	23.2	13.5	5490	9820	35.8
Shehdri	71.5	9.8	22.9	62.0	27.4	19.2	4520	9800	31.6
PS 4	69.1	12.7	20.4	64.7	23.4	17.2	4980	9590	34.2
BVD 109	72.2	9.1	21.1	60.5	25.7	20.5	3780	8430	31.1
JR-201	74.7	12.7	23.7	62.3	27.0	17.8	4290	8720	32.9
Dhanteshwari	71.6	12.4	24.7	68.2	27.1	13.3	4730	9770	32.6
Madhuri	68.3	11.0	23.3	67.3	24.4	14.0	5010	9350	34.9
IR 36	64.6	9.4	19.6	66.9	27.0	15.1	5070	9240	35.4
MTU 1010	70.2	9.9	21.2	65.5	26.6	16.2	4680	9360	33.3
IR 64	75.0	9.6	19.0	64.4	27.2	17.9	5040	9490	34.7
Pusa basmati 1	68.5	11.5	25.2	61.4	24.8	19.2	4820	9310	34.1
PS 3	81.2	14.3	26.6	69.4	24.8	13.4	5800	9960	36.8
CD (P=0.5 %)	7.4	N.S.	3.6	5.6	N.S.	-	692.7	N.S.	3.1

Table 25.2: Yield attributes and yield of wheat varieties under organic farming at Jabalpur

Wheat varieties	Plant height (cm)	Effective tillers /m^2	Spike length (cm)	Grains/spike	Test weight (g)	Grain yield (kg/ha)	Straw yield (kg/ha)	Harvest index
JW 17	80.0	578.0	11.1	49.9	49.6	4774	7855	38.2
JW 3020	82.4	564.0	9.6	48.1	49.5	3941	5895	40.0
JW 3173	81.6	562.0	11.0	43.0	46.6	4318	8701	33.1
JW 3269	81.3	554.0	9.3	42.7	48.1	4799	8824	35.4
JW 3288	80.8	558.0	10.7	45.2	49.3	4910	7500	39.5
HI 1531	81.5	586.0	12.0	46.0	46.7	4256	7255	37.3
HI 1500	82.1	566.0	10.6	52.9	49.2	5180	7022	42.3
C 306	80.6	565.0	12.2	49.8	47.4	5058	6863	42.8
HW 2004	82.0	575.0	11.6	54.3	50.6	4108	6458	39.8
HD 2987	81.5	558.0	9.8	46.0	46.5	5009	7157	41.0
HD 4672	80.7	550.0	10.0	46.9	49.3	4155	7132	36.8
HI 1418	83.1	556.0	11.0	45.9	48.4	5157	8762	37.0
CD (P=0.5)	NS	NS	NS	NS	NS	328.1	NS	NS

Table 25.3: Rice equivalent yield and economics of rice - wheat systems under organic farming at Jabalpur

Rice *(Kharif)*	Wheat *(Rabi)*	REY (Rs/ha/)	Gross Return (Rs/ha)	Cost of Cultivation (Rs/ha)	Net Return (Rs/ha)	B:C Ratio
PS 5	JW 17	10644	266116	101935	164181	1.61
Shehdri	JW 3020	8772	219305	101935	117370	1.15
PS 4	JW-3173	9858	246474	101935	144539	1.42
BVD 109	JW 3269	9012	225311	101935	123376	1.21
JR – 201	JW 3288	9463	236594	101935	134659	1.32
Dhanteshwari	HI 1531	9400	235005	101935	133070	1.31
Madhuri	HI 1500	10374	259361	101935	157426	1.54
IR 36	C 306	10304	257615	101935	155680	1.53
MTU 1010	HW 2004	9111	227791	101935	125856	1.23
IR 64	HI 2987	10285	257136	101935	155201	1.52
Pusa 1	HD 4672	9367	234178	101935	132243	1.30
PS 3	HI 1418	11376	284414	101935	182479	1.79

Table 25.4: 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 (%)	Available nutrients (kg/ha)		
					N	P	K
PS 5	JW 17	7.26	0.36	7.31	274.0	12.8	313.0
Shehdri	JW 3020	7.25	0.35	7.42	274.0	13.6	314.0
PS 4	JW 3173	7.30	0.37	7.73	278.1	14.1	317.0
BVD 109	JW 3269	7.30	0.35	7.62	276.0	13.5	316.0
JR – 201	JW 3288	7.28	0.35	7.73	278.1	13.7	317.0
Dhanteshwari	HI 1531	7.32	0.36	7.62	277.1	13.5	317.0
Madhuri	HI 1500	7.26	0.36	7.42	274.0	13.2	315.0
IR 36	C 306	7.38	0.37	7.52	275.0	13.3	315.0
MTU 1010	HW 2004	7.29	0.35	7.52	275.0	13.1	315.0
IR 64	HI 2987	7.28	0.37	7.52	275.0	13.4	317.0
Pusa 1	HD 4672	7.29	0.37	7.62	276.0	13.5	316.0
PS 3	HI 1418	7.26	0.37	7.73	278.1	13.8	317.0
CD (P=0.5)		NS	NS	NS	NS	NS	NS

Table 25.5: Effect of microbial changes in soil under different varieties of rice and wheat at Jabalpur

Rice *(Kharif)*	Wheat *(Rabi)*	Fungi (104/g)	Bacteria(106/g)	AZB (106/g)	PSB (106/g)	ACT (106/g)
PS 5	JW 17	39.02	53.29	27.25	18.81	19.09
Shehdri	JW 3020	36.60	50.19	28.91	17.99	17.88
PS 4	JW 3173	35.72	52.16	29.14	18.69	18.73
BVD 109	JW 3269	38.07	53.15	26.73	17.99	20.03
JR – 201	JW 3288	39.84	51.38	29.69	18.66	19.16
Dhanteshwari	HI 1531	37.08	50.37	27.69	18.24	18.50
Madhuri	HI 1500	37.97	51.95	28.55	17.40	18.50
IR 36	C 306	39.29	51.49	28.34	18.07	18.78
MTU 1010	HW 2004	37.76	51.20	28.78	17.03	25.75
IR 64	HI 2987	40.39	51.94	30.24	18.22	19.04
Pusa 1	HD 4672	36.15	49.21	28.32	18.14	18.70
PS 3	HI 1418	36.38	51.44	27.98	17.53	18.38
CD (P=0.5)		NS	NS	NS	NS	NS

Karjat

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 (Table 26.1-26.4).

Rice (Table 26.1): Among the rice varieties grouped in four categories, rice variety Sahyadri-5, Sahyadri-3, Sahyadri-4 and Jaya which is popularly among farmers recorded significantly higher grain yield over rest of varieties (6841, 6786 6597 and 6114 kg/ha respectively) but these are statistically on par to each other. Karjat 4 recorded lowest yielded variety among the rice varieties.

Ground nut (Table 26.2):

Significantly higher pods yield (3172 kg/ha) of groundnut recorded in TG 26 followed by Konkan Gaurav TAG 24, Phule 6021 but these are statistically at par to each other. The range other varieties of groundnut recorded from 2215 to 2903 kg/ha. Kopergaon-1 produced lower yield (2015 kg/ha) among the varieties. Haulm weight (4248 kg/ha) was recorded higher in TG-6 over rest of the varieties.

System equivalent yield and economics (Table 26.3):

Cropping system variety Karjat-3 (rice) in kharif and TG-26 (groundnut) in rabi recorded significantly higher system equivalent yield (REY 31989 kg/ha), net return (Rs. 3,07,901/ha) and benefit cost ratio (2.90) compared to other varieties evaluated in the system and were statistically on par with Jaya - Konkan gaurav. Lowest system equivalent yield and net return was recorded in rice (palghar-1) -

Table 26.1: Evaluation of response for different varieties of rice on yields in rice-groundnut system under organic management at Karjat

Duration	Rice varieties / hybrids	Grain Yield (kg ha^{-1})	Straw Yield (kg ha^{-1})
Early	Karjat - 4	4013	4692
	Karjat-7	5039	5646
	Ratnagiri-1	4779	4776
	Sahyadri-4	6597	7062
Mid-late	Karjat-5	6148	7561
	Karjat-6	4602	5800
	Palghar-1	4767	6908
	Sahyadri-3	6786	7231
Late	Ratnagiri-2	5547	5885
	Ratnagiri-3	5707	6553
	Karjat-8	4970	6532
	Sahyadri-5	6841	7218
Grown by farmers	Karjat-3	5911	6482
	Jaya	6114	7253
	Karjat-2	5342	6226
	CD(P=0.05)	519	599

Table 26.2. Response of different varieties of groundnut on yield in rice-groundnut system under organic management at Karjat

Groundnut varieties/hybrids	Yield dry pods (kg/ha)	Haulm weight (kg/ha)
Phule-6021	3057	4174
SB XI	2260	3336
Western-44	2428	3469
Western-66	2754	3586
TAG-24	3081	3954
TKG-Bold	2485	3601
Kopergaon-1	2215	3248
Phule Pragati (JL-24)	2303	3512
JL-220	2277	3453
JL-776	2903	3851
JL-501	2726	3718
TG-37 A	2546	3807
TG-26	3348	4248
Konkan Gaurav	3197	4115
RHRG-6083	2638	3454
CD(P=0.05)	203	489

groundnut (kopergaon-1) of 22916 kg/ha and Rs. 1,74,524/ha respectively

Soil chemical properties (Table 26.3) **:**

The soil chemical properties measured after completion of rice - groundnut system. Soil pH and EC were not influenced significantly due to varietal sequences of rice and groundnut. Significantly higher organic carbon content (1.40 %), available N (282.15 Kg ha^{-1}), available P_2O_5 (23.74 Kg ha^{-1}) and available K_2O (416.19 Kg ha^{-1}) were observed with 'Jaya – Konkan Gaurav' varietal sequence as compared to other sequences followed by 'Karjat-3 –TG 26' sequences, both are statistically at par to each

Table 26.3. 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's 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	27457	403616	162335	241281	2.49
Karjat-7	SB XI	23376	343629	162335	181294	2.12
Ratnagiri-1	Western-44	23893	351230	162335	188895	2.16
Sahyadri-4	Western-66	29019	426573	162335	264238	2.63
Karjat-5	TAG-24	30601	449831	162335	287496	2.77
Karjat-6	TKG-Bold	24413	358864	162335	196529	2.21
Palghar-1	Kopergaon-1	22916	336859	162335	174524	2.08
Sahyadri-3	Phule Pragati (JL-24)	26207	385249	162335	222914	2.37
Ratnagiri-2	JL-220	24009	352939	162335	190604	2.17
Ratnagiri-3	JL-776	28649	421139	162335	258804	2.59
Karjat-8	JL-501	26672	392076	162335	229741	2.42
Sahyadri-5	TG-37 A	27974	411224	162335	248889	2.53
Karjat-3	TG-26	31989	470236	162335	307901	2.90
Jaya	Konkan Gaurav	31323	460441	162335	298106	2.84
Karjat-2	RHRG-6083	26451	388824	162335	226489	2.40
CD (P=0.05)		1747	25681		25681	0.16

Table 24.4. Response of 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-60 21	6.96	0.40	1.35	259.16	20.91	376.77
Karjat-7	SB XI	6.95	0.41	1.33	254.98	20.65	374.53
Ratnagiri-1	Western-44	6.81	0.41	1.30	248.71	20.13	369.15
Sahyadri-4	Western-66	6.86	0.41	1.31	252.89	20.39	370.94
Karjat-5	TAG-24	6.83	0.40	1.29	250.80	19.87	361.98
Karjat-6	TKG-Bold	6.86	0.41	1.26	244.53	19.36	357.06
Palghar-1	Kopergaon-1	6.70	0.42	1.24	240.35	19.10	352.58
Sahyadri-3	Phule Pragati (JL-24)	6.81	0.41	1.38	263.34	21.42	392.90
Ratnagiri-2	JL-220	6.81	0.40	1.37	261.25	21.16	387.52
Ratnagiri-3	JL-776	6.90	0.40	1.38	275.88	22.97	408.13
Karjat-8	JL-501	6.92	0.41	1.26	246.62	19.62	360.19
Sahyadri-5	TG-37 A	6.84	0.41	1.35	271.70	21.68	392.00
Karjat-3	TG-26	6.77	0.42	1.39	280.06	23.49	411.26
Jaya	Konkan Gaurav	6.83	0.42	1.40	282.15	23.74	416.19
Karjat-2	RHRG-6083	6.77	0.41	1.38	277.97	23.23	405.44
CD (P=0.05)		NS	NS	0.05	7.52	1.13	8.85

other. Cropping system 'Palghar-1- Kopergaon-1' was observed as lowest in organic carbon (%), available N, P and K.

Ludhiana

Evaluation of response of different varieties of rice and wheat under rice-wheat system:

Twelve varieties of rice and 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 (Table 27.1-27.2).

Basmati rice (Table 27.1):

Significant difference was noticed among the rice varieties for all the traits except grains/panicle. Among the varieties, AVT 1 BT 2502 was the tallest variety with plant length 131.3 cm followed by Pusa basmati-2 (110.3 cm). The lowest plant length among all varieties was achieved by RYT 3382 (102.5 cm). Significant variation among the varieties for panicle length recorded from 22.6cm as least in RYT 3390 to maximum 28.7cm in AVT 1 BT 2507. Thousand grains weight among the varieties varied from 25.5 to 33.3 g. Lower thousand grains weight (25.5 g) was observed for PB-2 while higher grains weight (33.3 g) was produced by variety AVT 1 BT 2502. Basmati rice yield significantly varied from 3200 – 5353 kg/ha with a variation of 67%. Number of effective tillers/m^2 and grain yield (388 and 5353 kg/ha respectively) recorded significantly higher with PPB 1509 as compared to other varieties but statistically on par with RYT 3404, E1, E 2 and RYT 3390. The lowest grain yield was given by Punjab basmati-2 (3203 kg/ha).

Wheat (Table 27.2): Significant differences were found among the varieties for all the parameters except number of effective tillers/m^2. The variation for plant height was noted from 82.4 cm to 100.1cm, variety PBW 677 attained tallest plant while PBW-590 been smallest. Differences in spike length were observed significantly between 5.3 cm and 8.2 cm for PBW 291 and PBW 761 respectively. The variation for number of effective tillers $meter^{-2}$ was observed from 321 as lowest and 387 as highest and found to be non-significant. Variation in thousand-grain weight $spike^{-1}$ was recorded in range from 35.5 (g) in PBW 590 to 52.3 g in WHD 943 and differ significantly. The wheat grain yield varied from 3430kg -4673 kg/ha among different varieties and the variation was of 36.2%. Significantly higher grain yield of wheat (4673 kg/ha) was observed in HD 3086 than the other varieties of wheat which were statistically at par with all other varieties PBW 590, HD 2967, PBW 658, PBW 660 and HPBW 01 . The

Table 27.1: 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	73.9	325	27.0	75.3	25.9	4183	5467	43.4
Punjab Basmati 2	110.3	300	27.1	68.6	25.5	3203	4197	43.3
Punjab Basmati 3	90.1	354	26.2	66.4	26.3	3903	5483	41.6
RYT 3390	77.7	361	22.6	72.2	27.9	4660	6293	42.5
Ent 6001	88.2	356	23.9	70.7	27.2	4403	5740	43.4
Punjab Basmati 1121	85.3	357	26.8	68.5	28.0	4450	5717	43.8
PPB 1509	79.3	388	25.6	71.7	26.1	5353	7117	42.9
RYT 3404	85.0	383	23.2	67.2	28.2	5057	5857	46.3
AVT 1 BT 2502	131.3	308	25.9	68.2	33.3	4320	5707	43.1
AVT 1 BT 2507	96.3	332	28.7	70.9	31.3	4143	5940	41.1
E1	89.4	380	24.2	67.0	28.9	5000	6647	42.9
E 2	92.1	383	25.8	70.9	26.9	4807	6433	42.8
CD (P=0.05)	14.0	2.05	37.9	NS	2.85	792.6	840.0	-

Table 27.2: 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 grains weight (g)	Grain yield (kg/ha)	Straw yield (kg/ha)	Harvest index (%)
PBW 725	96.1	359	6.8	39.7	40.5	4270	5567	43.4
WHD 943	89.1	321	5.4	36.5	52.3	4553	6300	42.0
PDW 291	84.6	335	5.3	36.2	48.8	4280	5167	45.3
PBW 590	82.4	373	7.4	37.3	35.5	3433	4733	42.0
PBW 658	88.5	357	7.6	34.7	43.6	3903	5400	42.0
HD 2967	91.4	374	6.7	34.0	39.1	3437	4767	41.9
PBW 677	100.1	354	7.3	34.0	48.4	4240	5733	42.5
WH 1105	95.3	336	7.4	43.0	41.0	4463	5967	42.8
HD 3086	94.3	387	7.1	38.1	42.3	4673	6000	43.8
PBW 761	84.7	340	8.2	42.3	42.3	4533	6267	42.0
HPBW 01	97.3	326	8.0	42.6	42.3	4113	5733	41.8
PBW 660	97.9	378	6.6	35.7	40.4	3977	4933	44.6
CD (P=0.05)	3.7	0.88	5.31	NS	3.9	566.0	838.0	

lowest grain yield was recorded with PBW 590 (3433 kg/ha). Highest straw yield recorded in WHD 943 (6300 kg/ha) whereas harvest index (45.3%) was found to be higher in PBW 291 followed by PBW 660 and HD 3076, however, lower straw yield was produced by PBW 590 (4733 kg/ha).

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 (Table 28.1 & 28.2).

Maize (Table 28.1):

Cob yield of maize was significantly varied among the varieties of maize from 4620-6340 kg/ha and higher grain yield was found to be in PMH-3 (6340 kg/ha) followed by seed tech. (5950 kg/ha) while lowest yield recorded in HQPM-1 39 (4620 kg/ha). Cost of cultivation for all the varieties was same however, PMH-3 gave the maximum net returns and NRPRI of Rs. 62,260/ ha/annum and 1.50 respectively followed by seed tech.

Mustard (Table28.2):

Among the mustard varieties, significantly higher seed yield was recorded with RGN-229 (1970 kg/ha)

Table 28.1: Yield and economics of different of maize varieties under organic farming at Modipuram

Maize varieties/ hybrids	Cob yield(kg/ha)	Cost of cultivation (Rs/ha/annum)	Net Returns (Rs/ha/annum)	B:C ratio
Prakash	5900	41425	48665	1.17
Seed tech. 2324	5950	41425	54070	1.31
PMH-1	5630	41425	45880	1.11
PMH-3	6340	41425	62260	1.50
PMH-4	5730	41425	51450	1.24
PMH-5	5640	41425	48829	1.18
HQPM-5	4970	41425	43260	1.04
HQPM-1	4620	41425	32449	0.78
Bio-9681	4860	41425	35070	0.85
Bio-9637	5320	41425	48665	1.17
Vivek hybrid-9	4690	41425	26880	0.65
Vivek QPM-9	4710	41425	21310	0.51

Table28.2: Yield and economics of mustard varieties under organic farming at Modipuram

Variety	Seed yield(kg/ha)	Cost of Cultivation (Rs/ha)	Net return (Rs/ha)	NRPRI
DRMRIJ-31	1530	18876	37734	2.00
NRCDR-02	1750	18876	45874	2.43
NRCHB-101	1650	18876	42174	2.23
NRCHB-506	1910	18876	51794	2.74
Pusa mustard 25 (NPJ-112)	1650	18876	42174	2.23
Pusa mustard 25 (NP-J113)	1670	18876	42914	2.27
PusaTarak	1570	18876	39214	2.08
RH-0406	1950	18876	53274	2.82
RGN-229	1970	18876	54014	2.86
RGN-48	1830	18876	48834	2.59
Urvashi	1910	18876	51794	2.74
Pusa Bold	1870	18876	50314	2.67

and it was statistically at par with RH 0406, Urvashi and NRCHB-506. Variety DRMRIJ-31 gave minimum yield of 1530 kg/ha. The yield difference from highest yielded variety to lowest was found to be 28.76%. Cost of cultivation was found equal for all the varieties of mustard. Maximum net return and NRPRI was recorded with RGN-229 (Rs. 54,014 and 2.86 respectively) followed by RH-0406 with Rs 53,274 and 2.82 respectively.

Pantnagar

Evaluation/screening of rice (basmati and non-basmati) and wheat varieties under organic cultivation: 14 varieties of rice including seven fine grain basmati rice and seven coarse grain varieties during *kharif* and fourteen varieties of wheat in *rabi* were evaluated under similar organic nutrient inputs and doses (Tables 29.1-29.4).

Rice (Table29.1): Significant difference was observed among the rice varieties for all the traits. Plant height of different coarse grain rice varieties ranged from 102 to 114 cm and fine grain rice varieties ranged from 101 to 150 cm. Tallest varieties among coarse grain & fine grain rice were PD-18 and Taraori, respectively. Among

Table 29.1. Response for yield attributes and yield of rice varieties in rice-wheat system under organic management at Pantnagar

Rice varieties/hybrids	Plant height (cm)	Effective tillers/m2	Grain weight / panicle(g)	1000-grains weight(g)	Grain yield (kg/ha)	Straw yield (kg/ha)	Harvest Index
Coarse grain							
Pant dhan-4	104	268	2.56	30.2	4861	5078	48.9
IR-64	105	261	2.56	28.5	5014	5067	49.7
Pusa-44	102	253	2.53	28.7	4706	4965	48.7
Pant dhan-18	114	266	2.57	29.9	4958	5188	48.9
Pant dhan-19	106	262	2.54	29.8	5056	5243	49.1
NDR-359	106	264	2.65	30.1	5181	5312	49.4
UPR-3425-11-1-1	105	265	2.61	30.6	4750	4995	48.8
Fine grain (basmati)							
Taraori	150	252	1.88	20.6	3189	5361	37.6
Pusa-1509	107	256	1.84	20.8	4192	4807	46.7
Pusa Basmati-1	113	262	1.99	21.2	4035	4706	46.2
Pusa-1121	123	258	1.99	21.4	4343	5123	45.8
Pant Basmati-1	110	260	2.06	21.9	4599	5062	47.7
Pant Sugandha-27	101	254	1.92	22.0	4693	5147	47.5
UPR-3506-7-1-1	129	250	1.81	20.6	3925	4753	45.3
CD (P=0.05)	4.79	4.7	0.08	0.77	332	216	2.02

coarse grain varieties, highest number of effective tillers/m^2 was in PD-4 (268) whereas fine grain rice varieties, Pusa Basmati-1 produced higher effective tiller/m^2 (262). Among different coarse and fine grain varieties grain weight/panicle ranged from 2.53 to 2.65g and 1.81 to 2.06g, respectively. Significantly higher grain weight/panicle among coarse grain rice varieties was observed in NDR-359 (2.65g) being at par with PD-18, while significantly higher grain weight/panicle among fine grain rice varieties was observed in Pant Basmati-1(2.06g) which was at par with Pusa Basmati-1 and Pusa-1121. Test weight i.e. 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 28.5 to 30.6g and the fine grain rice varieties ranged from 20.6 to 22.0g. Significantly higher test weight of coarse grain rice varieties was found in UPR-3425-11-1-1 (30.6g) which was at par with PD-4 (30.2 g) and NDR-359 (30.1) while, in fine grain rice varieties *viz.* Pusa-1121 (21.4g), Pant basmati-1(21.9g) and Pusa-basmati-1 (21.2g) were at par with each other, significantly higher being observed in UPR-3488621 (22.0g). Grain yield of coarse grain rice varieties ranged from 4706 to 5181 kg/ha while fine grain rice varieties recorded range from 3189 to 4693 kg/ha. Among coarse grain rice varieties, significantly higher grain yield was observed in NDR-359 (5181 kg/ha) which was at *par* with PD-19 (5056 kg/ha), PD-18 (4958 kg/ha, PD-4 (4861 kg/ha) and IR-64 (5014 kg/ha). Significantly higher grain yield among fine grain rice varieties was observed in Pant basmati-1(4599 kg/ha) which was at par with Pusa-1121 (4343 kg/ha) & UPR-3488621 (4693 kg/ha).

Nutrient Uptake by Paddy (Table 29.2): Significant differences in N, P, K and S uptake were observed among different rice varieties under organic cultivation. Nitrogen uptake among coarse grain rice varieties was found to be higher in IR-64 (94.4 kg/ha) which was at par with PD-4 (92.3 kg/ha) and NDR-359 (90.6 kg/ha), while, N-uptake among fine grain rice varieties was significantly higher in Pant Basmati-1 (93.0 kg/ha). P uptake among coarse grain rice varieties was significantly higher in NDR-359 (28.3 kg/ha) which was at par with all other varieties except Pusa-44 and UPR-3425-11-1-1 whereas, phosphorus

Table 29.2: Total N, P, K and S uptake in different varieties of rice under organic mode of cultivation.

Treatments	N uptake (kg/ha)	P uptake (kg/ha)	K uptake (kg/ha)	S uptake (kg/ha)
Coarse grain				
PD-4	92.3	26.9	82.2	18.1
IR-64	94.4	26.6	84.0	18.9
PUSA-44	89.4	24.8	82.9	17.9
PD-18	87.1	26.6	83.4	20.9
PD-19	87.3	26.9	85.4	20.0
NDR-359	90.6	28.3	87.5	20.8
UPR-3425-11-1-1	82.0	25.3	82.7	18.0
Fine grain				
Taraori	67.3	21.1	78.1	14.2
Type-3	85.0	22.6	75.7	16.5
Pusa Basmati-1	79.9	22.0	76.0	16.6
Pusa-1121	88.0	25.7	83.2	17.7
Pant Basmati-1	93.0	27.7	82.3	17.8
UPR-3488621	90.0	26.3	84.3	17.4
UPR-3506-7-1-1	82.6	22.6	76.8	15.0
CD(P=0.05)	4.94	2.45	4.16	2.66

among the fine grain rice varieties was found to be higher in Pant Basmati-1 (27.7 kg/ha) over all other rice variety except Pusa-1121 (25.7 kg/ha). NDR-359, a coarse grain rice variety resulted in highest K-uptake (87.5 kg/ha). K- uptake among fine grain rice varieties was found to be significantly higher in UPR-3488621 (84.3 kg/ha) except Pusa-1121 and Pant Basmati-1. Sulphur uptake among the coarse grain rice varieties was found to be significantly higher in PD-18 (20.9 kg/ha) which was at par with PD-19, NDR-359 and IR-64, while among the fine grain rice varieties Pant Basmati-1 (17.8 kg/ha) recorded the highest S-uptake which was at par with all other fine grain rice varieties except Taraori and UPR-3506-7-1-1.

Wheat: Yield and yield attributes of wheat varieties under organic cultivation (Table 29.3): Significant variation among the wheat varieties were observed for all parameters studied. Plant height of different wheat varieties ranged from 83 to 103 cm, highest being in UP-1109, (103 cm) followed by UP- 2841 (94 cm) and lowest was recorded inDBW-17 (83cm). Significant differences in spikes/m2 of wheat

Table 29.3: Response for yield attributes and yields of wheat varieties in rice-wheat system under organic management at Pantnagar

Wheat varieties /hybrids	Plant height (cm)	spikes/m2	No. of grains / spike (g)	grain wt. / spike(g)	1000-grain wt. (g)	Grain yield (kg/ha)	Straw yield (kg/ha)	Harvest Index
WH-1105	87	274	39	1.55	42.0	3760	3993	48.5
PBW-550	89	267	40	1.61	41.5	3362	3604	48.2
UP-2628	89	287	37	1.61	43.0	3514	3706	48.6
UP-1109	103	289	36	1.48	42.0	3816	4047	48.5
UP-2425	89	259	32	1.59	53.3	3618	3817	48.6
UP-2843	85	301	35	1.41	41.4	4033	4212	49.1
UP-2841	94	319	35	1.45	41.1	3829	3812	50.1
UP-2572	91	298	37	1.67	45.3	4518	4803	48.5
DPW-62150	88	313	40	1.76	43.0	4313	4936	48.5
UP-2565	89	321	38	1.79	46.3	4622	5108	47.5
HD-2967	91	314	46	2.05	42.0	4733	5440	46.4
UP-2684	93	297	43	1.69	41.4	3889	4130	48.4
DBW-17	83	319	40	1.60	40.4	4642	4891	48.7
UP-2784	87	288	30	1.67	42.4	3471	3656	48.7
CD (P=0.05)	4.65	22.2	3.90	0.11	3.7	497	631	NS

Table 29.4: Total N, P, K and S uptake in different wheat varieties under organic mode of cultivation at Pantnagar

Treatments	N uptake (kg/ha)	P uptake (kg/ha)	K uptake (kg/ha)	S uptake (kg/ha)
WH-1105	70.5	17.9	57.7	24.2
PBW-550	61.2	16.2	51.7	20.0
UP-2628	63.8	15.5	51.4	17.4
UP-1109	68.6	17.0	55.5	22.5
UP-2425	65.6	15.0	55.2	20.2
UP-2843	72.8	19.5	61.1	24.8
UP-2841	68.1	17.8	54.7	24.2
UP-2572	83.3	21.6	66.4	29.5
DPW-62150	81.7	19.0	67.7	28.3
UP-2565	85.8	20.0	71.6	27.8
HD-2967	89.0	20.6	76.1	33.6
UP-2684	72.0	17.0	58.7	25.3
DPW-17	84.6	20.7	68.3	31.8
UP-2784	63.8	15.7	53.0	22.2
CD(p=0.05)	8.8	3.06	8.3	4.3

varieties were in range from 259 to 321 and were found to be higher in UP-2565 (321) which was at par with UP-2843 (301), UP-2841 (319), HD-2967(321) and DPW-17 (319) while found lower in UP 2425 (259). Number of grains/spike ranged between 30.0 to 46.0 among wheat varieties and recorded higher number in HD-2967 (46) being at par with and UP-2684 (43). Test weight of different wheat varieties ranged from 40.4 to 46.30 g. Significantly highest test weight among the wheat varieties was found in UP–2425 (53.3g) which was significantly higher with UP-2628, UP-2425, UP-2572 and DPW-62150 whereas, these were at par to each other. Grain yield of different wheat varieties ranged from 3362 to 4733 kg/ha. Significantly highest grain yield was noticed in HD-2967 (4733 kg/ha) which was at par with UP-2572, DPW- 62150, UP- 2565 (4622 kg/ha) and DPW-17(4642 kg/ha). Lowest yielded variety was PBW-550 under organic farming situation.

Nutrients uptake by wheat crop (Table 29.4): Among different wheat varieties, significantly higher uptake of nitrogen, potassium and sulphur was observed in HD-2967 (89.0, 76.1 and 33.6 kg/ha, respectively), while the phosphorus uptake was higher in UP- 2572 (21.6 kg/ha). N-uptake in HD-2967 variety was at par with UP-2572(83.3 kg/ha), DPW-621-50 (81.7 kg/ha), UP-2565 (85.8 kg/ha) and DPW-17 (84.6 kg/ha). P uptake in UP-2572 was at par with HD-2967 (20.61 kg/ha), UP-2843 (19.5 kg/ha), DPW-62150 (19.0 kg/ha), UP-2565 (20.0 kg/ha) and DPW-17 (20.7 kg/ha). K uptake in HD-2967 (76.1 kg/ha) was at par with UP-2565 (71.6 kg/ha) and DPW-17 (68.3 kg/ha). However, S uptake in HD-2967 wheat variety was found at par with UP-2572 (29.5 kg/ha) and DPW-17 (31.8 kg/ha).

Raipur

Response of different traditional and improved scented rice and chickpea varieties under organic farming in rice-chickpea cropping system (Table 30.1 - 30.4):

Fifteen traditional /improved scented rice varieties and 15 popular chickpea varieties in the region were evaluated for their performance under organic management in rice-chickpea cropping system.

Table 30.1: 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	No. of filled grains/panicle	Panicle length (cm)	Test weight (g)	Grain yield (kg/ha)	Straw yield (kg/ha)	Harvest Index
Badshah Bhog Sel.01	155.9	7.1	158.0	23.4	14.8	3500	10759	24.6
Gopapl Bhog	144.7	7.0	123.0	30.8	22.7	3978	10167	28.3
Vishanu Bhog Sel.01	143.1	7.9	141.0	22.8	16.3	4000	10537	27.6
C.G. Sugandhit Bhog	138.9	9.3	144.0	20.9	21.9	4578	8241	35.7
Shyamajeera	142.1	6.9	138.0	26.4	18.8	3000	9981	23.1
IndiraSugandhit dhan	126.5	8.2	182.0	26.2	23.3	4169	7537	36.0
Kubri mohar	146.9	8.1	138.0	25.3	19.6	3315	11222	22.8
Dubraj Sel.01	145.8	8.2	119.0	22.7	21.7	4043	10361	28.2
Lohandi	136.0	8.3	173.0	26.4	19.0	3574	10454	26.0
Gangabaru	162.4	7.7	240.0	31.0	16.4	3259	11092	22.7
Karigilas	149.2	7.3	90.0	25.6	41.6	3380	9194	28.4
Lalu 14	91.5	6.8	65.0	18.9	18.5	2352	8481	22.0
Tarun bhog Sel.01	131.3	7.8	132.0	20.2	17.7	3833	12407	23.7
Sugandhmati	133.6	8.3	155.0	28.6	23.8	3528	7315	32.5
CR Sugandha dhan 907	150.5	8.8	137.0	23.4	20.7	4326	10704	28.9
CD (P=0.05)	8.82	1.33	17	4.49	1.74	503	2525	6.1

Table: 30.2 Available nutrients 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	0.69	255	20.71	324
Gopalbhog	0.68	257	19.66	330
Vishnubhog	0.68	250	20.57	330
Bisni	0.68	255	21.52	325
Shyamajeera	0.69	253	21.03	330
Jeeraphool	0.68	255	22.56	332
Kubri Mohar	0.68	254	22.04	325
Tulsi Manjari	0.68	256	21.66	320
Jaygundi	0.68	252	21.65	332
Gagabaru	0.68	256	21.88	333
Sugandhmati	0.69	258	21.75	332
Lalu 14	0.69	255	21.51	321
Dujai	0.68	253	20.16	328
Dubraj	0.69	252	21.79	327
CR Sugandha Dhan 907	0.67	258	22.04	324
CD (P=0.05)	NS	NS	NS	NS

Rice (Table 30.1)**:** Among the different varieties of rice, significant variation for plant height was recorded in range from 92 - 162cm, variety Gangabaru recorded as a tall followed by Badshahbhog 907 (156cm) which was on par, while Lalu 14 recorded as smallest (92 cm). Number of filled grains penicle^{-1} and panicle length was recorded between range of 69-240 and 18.9 - 31cm respectively. Variety Gangabaru was the leading variety which was significantly superior over rest of the rice varieties, however variety, Indira sugandhit dhan and Lohandi was next in order and produced 182 and 173 filled grain panicle^{-1}, however, Gopalbhog

Table: 30.3 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
Vaibhav	39.8	3.81	40.3	45.2	24.9	1486	1876	44.2	52110	2.17
JG-226	47.6	4.28	33.5	36.5	24.7	1407	1895	42.5	48195	2.00
Jaki	45.4	5.33	46.4	52.9	25.9	1726	1954	46.9	64187	2.67
RG2009-01	35.5	4.22	35.3	39.5	23.1	1171	1546	43.2	36046	1.50
RG2009-16	41.5	4.61	40.9	45.9	23.5	1593	2037	43.9	57659	2.40
RG2003-28	38.8	3.97	25.8	36.7	29.2	1508	1953	43.6	53320	2.22
Vishal	45.4	5.36	47.9	45.2	27.7	1652	2312	41.7	60862	2.53
JG-16	40.6	5.66	49.9	50.7	29.1	1685	2286	42.5	62480	2.60
Vijay	40.5	3.50	38.0	40.1	21.3	1207	1619	42.7	37919	1.58
JG-11	37.7	4.64	43.4	34.3	26.4	1364	1708	44.4	45878	1.91
JG-14	36.1	3.14	42.0	33.4	23.9	1466	1773	45.3	51012	2.12
BGD-128	41.4	3.94	42.2	37.0	28.1	1511	1955	43.7	53466	2.22
Daftari-21	42.1	4.39	41.2	38.6	28.5	1470	1930	43.2	51380	2.14
PKV Kabuli	41.4	3.50	35.3	41.2	24.1	1372	1772	43.6	46305	1.93
JG-130	41.6	3.92	44.1	51.3	27.1	1546	1967	44.2	55211	2.30
CD (P=0.05)	2.9	0.68	5.3	6.2	2.4	195	248	2.7	9930	0.41

Table: 30.4 Available nutrients status after harvest of different improved varieties of chickpea under organic production system at Raipur.

Variety	Organic Carbon (%)	Available N (Kg ha^{-1})	Available P (Kg ha^{-1})	Available K (Kg ha^{-1})
Vaibhav	0.67	266	23.3	338
JG-226	0.68	267	23.4	335
Jaki	0.68	264	22.8	330
RG2009-01	0.67	265	23.0	330
RG2009-16	0.68	264	23.1	344
RG2003-28	0.67	262	22.2	332
Vishal	0.69	261	22.7	340
JG-16	0.66	264	23.2	340
Vijay	0.69	260	23.3	335
JG-11	0.69	262	22.4	339
JG-14	0.69	263	22.1	345
BGD-128	0.69	267	22.9	344
Daftari-21	0.67	262	22.8	338
PKV Kabuli	0.69	266	23.1	342
JG-130	0.69	263	22.6	341
CD (P=0.05)	NS	NS	NS	NS

recorded 30.8 cm panicle length as next performed variety. The number of tillers hill^{-1} was significantly higher in C.G. Sugandhitbhog (9.3 hill^{-1}) which was comparable with CR Sugandhadhan 907 (8.8), Lohandi and Sugandhamati (8.3 tillers hill^{-1}) whereas, the lowest panicle length was recorded in Lalu 14 (6.8 hill^{-1}). As regards to test weight highest test weight was achieved by Karigilias (41.6 g) while the lowest test weight was in Badshahbhog sel 01 (14.08 g). Significant grain yield difference was observed among the rice varieties. The difference in grain yield among the varieties ranged from 2532 to 4578 kg/ha. C.G. Sugandhit Bhog (4578 kg/ha)n was the highest yielded variety which was significantly superior over rest of the varieties except CR Sugandha dhan 907 Indirasugandhit dhan which produced 4326, and 4169 kg/ha respectively.

Soil Nutrient Status (Table 30.2)**:** Soil organic carbon available nitrogen, phosphorus and potash in soil after harvest of rice revealed that the varieties did not influence significantly on availability of these nutrients in soil and all varieties behaved almost similar. The ranged for organic carbon was found to be between 0.66 to 0.69%, whereas, available N ranged from 250-258 kg/ha, available P and K were in range from 19.66-22.56 kg/ha and 320-333 kg/ha respectively.

Chickpea (Table 30.3 & 4)**:** All the growth and yield parameters of different desi and kabuli chickpea varieties were influenced significantly due to the organic farming. Plant height of chickpea was significantly higher in JG226 (47.6 cm) followed by Jaki and Vishal which were statistically on par to each other while, lower plant height was recorded in RG 2009-01 (35.5 cm). Number of branches plant^{-1} at harvest and number of pods/plant was recorded higher in JG-16 (4.66) followed by Vishal, and Jaki which were found to be statistically on par to each other. Lowest Number of branches and pods plant^{-1} was recorded with JG-14 and RG-2003-28. As regards the number of nodules plant^{-1} at 60 DAS, higher number of nodules plant^{-1} was in Jaki (52.9) and found significantly superior over rest of varieties except JG-130, JG-16 and RG-2009-16 which is at par. 100 seeds weight was higher in RG 2003-28 (29.2 g) followed by JG-16, Daftari-21, BGD-128 and Vishal. Minimum test weight of chickpea was observed in in Vijay (21.3 g). Seed yield of chickpea was also varied among varieties and the difference in seed yield ranged from 1171 to 1726 kg/ha. Higher seed yield was obtained from Jaki (1726 kg/ha) which was

significantly higher over other varieties JG-16, Vishal, RG2009-16 and JG-130 (1685, 1652, 1593 and 1546 kg/ha respectively) whereas RG-2009-01 been the lowest yielded variety. The harvest index, net return and benefit cost ratio was also higher with Jaki (46.9, Rs. 64187/ha and 2.67 respectively). JG -16 (Rs. 62480 and 2.6) and Vishal (Rs.60862/ha and 2.53) followed the net return and B:C ratio.

Soil Nutrient Status: Soil organic carbon, available nitrogen, phosphorus and potash in soil after harvest of chick pea crop did not influence significantly on availability of these nutrients in soil. The ranged for organic carbon was found to be between 0.66 to 0.69%, whereas, the ranged for available N been from 260-266 kg/ha, whereas, available P and K were in range from 22.1-23.5 and 330-345 kg/ha respectively.

Ranchi

Twelve varieties of rice and wheat were evaluated for their suitability under organic farming in the system mode with same level and sources of nutrients (Table 31.1-31.4).

Rice (Table 31.1): Significant difference among the rice varieties were observed for all agronomic traits. Variation for plant height among the rice varieties ranged from 83.1 to 118.7 cm. Tallest plant (118.7cm) was noted in B.V.D-110 over all varieties except Anjli, Birsa Vikas Dhan 203, Lalat and Sahbhagi. M.T.U 10 attains the smallest height (83.1cm). The panicle length and was higher (24.5 cm) with Akhchhai, and statistically at par with Anjali and Lalat, however, number of grains/panicle was in ranged between 85 - 107. Lalat produced higher grains/panicle (107) while, BVD-110 recorded as least in term of grains/panilcle. 1000-grains weight, grain yield and straw yield also varied significant among the rice varieties. The variation for 1000-grains weight and grain yield were in range between 21.3-24.2g and 3289 and 4511 kg/ha. The maximum 1000-grains weight and grain yield of rice (24.2g and 4511 kg/ha) was obtained with MTU-10 followed by Birsa dhan 201 and Akhchhai for test wt. (23.2 and 23.1g) and Lalat (4400 kg/ha), Birsamati (4267 kg/ha), Naveen (4156 kg/ha) and Pusa Sugandha (3978 kg/ha) for grain yield. Lower seed yield recorded with BVD-110 of 3244 kg/ha.

Wheat (Table 31.2):

Variation for yield attributes and yield were found to be significant. The range of plant height was noted from 78.0 to 96.0cm. K-9107 recorded tallest plant

Table 31.1: Yield and yield attributing characters of rice varieties under organic management practices at Ranchi

Cropping System	Plant height (cm)	Panicle length (cm)	Grain/panicle	1000 grain weight (g)	Effective tillers/m2	Grain yield (q/ha)	Straw yield (q/ha)
Birsa Vikas Dhan 203	99.3	21.7	92	22.33	295	3911	6519
Birsa Dhan 201	115.6	21.9	96	23.17	257	3867	5963
Birsa Vikas Sugandha 1	110.1	20.7	97	21.26	272	3789	5894
B.V.D110	118.7	21.2	85	22.50	247	3244	6204
Sahbhagi	86.9	21.9	87	22.63	277	3689	5787
Birsamati	109.6	22.8	100	21.59	293	4267	6898
Anjli	102.8	24.0	97	22.34	223	3289	5420
Lalat	91.7	23.4	107	22.88	265	4400	6452
M.T.U 10	83.1	22.5	95	24.23	295	4511	6762
Akhchhai	111.2	24.4	102	23.07	215	3622	5926
Pusa Sugandha	110.5	22.7	107	22.22	260	3978	6204
Naveen	108.5	23.0	103	21.78	282	4156	6346
CD (P=0.05)	11.0	1.6	12.8	1.24	27.7	539	698

Table 31.2: Yields and yield attributing characters of wheat varieties under organic management practices at Ranchi

Cropping System	Plant height (cm)	Number of tillers/m2	Spike length (cm)	No. of grains / spike	1000 grain weight (g)	Grain yield (q/ha)	Straw Yield (q/ha)
Raj 4250	88.9	271	7.3	30	42.77	2311	4056
GW 366	87.5	318	8.9	33	42.37	3038	4631
NW 2036	87.1	291	8.0	30	45.33	2631	4287
K0307	91.6	348	9.9	34	42.35	3258	4869
K9107	96.0	305	8.2	32	42.82	2754	4418
HI 1563	91.2	274	7.5	29	46.33	2396	4122
Raj 4229	81.5	330	9.5	32	44.37	3116	4718
DBW 14	78.0	286	7.8	30	44.58	2540	4173
WR 544	92.0	281	7.7	28	47.72	2507	4142
BG 3	84.6	302	8.4	31	47.22	2912	4522
HD 2733	79.6	267	6.8	29	44.87	2262	4020
DBW 39)	83.4	304	8.7	32	45.82	3004	4578
CD (P=0.05)	7.8	29.3	0.67	2.7	2.05	394	616

while, DBW 14 been smallest in plant height. Number of tiller m-2 was in ranged between 267- 348, Spike length been in range from 6.8-9.9cm, number of grains/spike was in range between 29 to 34 and the variation in 1000-grains weight of the wheat ranged from 42.3g (K0307) to 47.7g (WR-544). K-0307 recorded significantly higher number of tiller m-2, spike length, number of grains/spike and grain yield of 3258 kg/ha which was statistically at par with Raj 4229 (3116 kg/ha), GW 366 (3038 kg/ha), DBW 39 (3004 kg/ha) and BG-3 (2912kg/ha).

Soil nutrient status at the end of cropping cycle (Table 31.3):

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 (6.38) in rice (B.V.D203)–wheat (Raj 4250) system of their initial value of 5.5. After completion of cropping cycle, higher organic carbon (0.71%) was found in rice (Pusa Sugandha) - wheat (HD 2733) system and it was increased by 69% to their initial value of 0.42. Significantly higher availability of N, P and K in the soil was found in rice (Pusa sugandha) – wheat HD 2733) of 266.25, 42.41 and 221.96 kg/ha respectively at the end of cropping cycle. Among rice varieties, MTU-10 recorded the highest N (101.30 Kg/ha) uptake while in rabi, wheat variety K0307 recorded maximum N (82.37 kg/ha) and P (14.93 kg/ha) uptake. Among cropping sequence, Naveen – DBW-39 registered the highest N (171.65 kg/ha) uptake as well total NPK uptake (326.36 kg/ha) of the system. The cropping sequence Birsa vikash Dhan 203 (83.64 kg/ha) – K-307 (49.78 kg/ha) recorded the maximum K uptake.

Systems productivity, economics of system and weed dry matter (Table 31.4 & 5): In terms of system productivity of rice-wheat system, rice (Naveen) – wheat (DBW-39) sequence gave significantly higher system productivity (7315 kg/ha) than MTU-10-WR-544 and Birsa Dhan 201-GW366 but not varied with rest of the cropping sequence. Rice (Birsa Vikas Dhan 203) - wheat (Raj 4250) gave minimum system equivalent yield of 6342 kg/ha. In term of economics, rice variety MTU-10 resulted in significantly higher net return (Rs. 59309/ha) and B:C ratio (1.60) over other varieties but it remains at par with Birsamati (Rs.57474/ha), Lalat (Rs. 56575/ha), Naveen (Rs. 52003/ha), Pusa Sugandha (Rs. 50502/ha), Birsa Vikash Sugandha-1 (Rs. 448125/ha), Birsa Vikash sugandha-1

Table 31.3: 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)	6.38	0.70	264.4	42.4	218.9	158.2	33.6	125.8
Rice (Birsa Dhan 201) – Wheat (GW 366)	6.35	0.65	252.4	38.7	204.2	170.2	35.7	118.1
Rice (Birsa Vikas Sugandha 1) -Wheat (NW 2036)	6.20	0.68	257.0	41.2	213.8	159.2	34.1	113.9
Rice (B.V.D110) – Wheat (K0307)	6.16	0.63	250.7	37.6	200.8	164.8	34.8	114.0
Rice (Sahbhagi) – Wheat (K9107)	6.34	0.68	256.8	40.5	207.0	157.6	34.4	114.2
Rice (Birsamati) – Wheat (HI 1563)	6.18	0.70	263.7	42.1	218.2	162.7	36.7	120.5
Rice (Anjli) – Wheat (Raj 4229)	6.10	0.64	251.2	38.4	203.8	157.6	34.0	114.8
Rice (Lalat) – Wheat (DBW 14)	6.18	0.69	257.9	41.3	216.9	166.0	36.4	113.5
Rice (M.T.U 10) – Wheat (WR 544)	6.23	0.70	261.4	41.4	217.4	167.8	35.9	120.2
Rice (Akhchhai) – Wheat (BG 3)	6.13	0.68	255.9	40.3	206.3	162.2	34.8	118.8
Rice (Pusa Sugandha) –Wheat (HD 2733)	5.82	0.71	266.3	42.4	222.0	155.7	32.3	104.1
Rice (Naveen) – Wheat (DBW 39)	6.06	0.66	253.1	40.2	205.5	171.7	36.0	118.7
CD (P=0.05)	0.20	0.06	19.90	5.78	22.77	13.18	3.13	13.90
Initial	5.5	0.42	230	32.25	162			

Table 31.4: Systems productivity and economics of different varieties of rice and wheat crop under organic management practices at Ranchi

Treatment Cropping system	System productivity (Kg/ha)	Kharif Net Returns (Rs/ha)	B : C ratio	Net Returns (Rs./ha)	Rabi B:C ratio	Net Returns (Rs./ha)	System B:C ratio
Rice (Birsa Vikas Dhan 203) - Wheat (Raj 4250)	6342	48125	1.30	10116	0.26	58241	0.76
Rice (Birsa Dhan 201) – Wheat (GW 366)	7062	45953	1.24	23212	0.59	69165	0.90
Rice(Birsa Vikas Sugandha 1) -Wheat (NW 2036)	6556	46305	1.25	15805	0.40	62110	0.81
Rice (B.V.D110) – Wheat (K0307)	6671	35588	0.96	27399	0.70	62987	0.82
Rice (Sahbhagi) – Wheat (K9107)	6586	42380	1.14	18145	0.46	60524	0.79
Rice (Birsamati) – Wheat (HI 1563)	6786	57474	1.55	11637	0.30	69111	0.90
Rice (Anjli) – Wheat (Raj 4229)	6566	34413	0.93	24701	0.63	59114	0.77
Rice (Lalat) – Wheat (DBW 14)	7071	56575	1.52	14019	0.36	70594	0.92
Rice (M.T.U 10) – Wheat (WR 544)	7147	59309	1.60	13401	0.34	72711	0.95
Rice (Akhchhai) – Wheat (BG 3)	6685	41552	1.12	20916	0.53	62468	0.82
Rice (Pusa Sugandha) –Wheat (HD 2733)	6357	50502	1.36	9246	0.24	59748	0.78
Rice (Naveen) – Wheat (DBW 39)	7315	52003	1.40	22517	0.57	74520	0.98
CD (P=0.05)	**578**	**10670**	**0.29**	**10670**	**0.19**	**11587**	**0.15**

(Rs. 46305/ha) and Birsa Dhan-201 (Rs. 45953/ha). In rabi, wheat variety K-0307 registered significantly more net returns (Rs.27399/ha) and benefit: cost ratio (0.70) than rest of the varieties, but remains statistically at par with Raj-4229 (Rs.24701/ha), GW-366 (Rs.23212/ha), DBW-39 (Rs. 22517/ha) and BG-3 (Rs. 20916/ha).

Dry matter accumulation of weed per unit area was minimum in Rice (Lalat) – wheat (DBW 14) cropping sequence during kharif at 25 & 40 DAT/ DAS, while in rabi, minimum dry matter accumulation of weeds was recorded with the cropping sequence rice (Shahbhagi) – wheat (K-9107) at 25 & 40 DAT/ DAS. The highest dry matter accumulation was recorded with Birsa Vikas sughanda -1 and NW- 2036 system during kharif season at 25 & 40 DAT/ DAS.

Table 31.5: Dry matter accumulation of weeds (g/m2) in rice – wheat cropping sequence organic management at Ranchi.

Cropping system	Rice (Kharif)		Wheat (Rabi)	
	Weed dry Wt. (g/m^2) 25 DAT	Weed dry Wt. (g/m^2) 40 DAT	Weed dry Wt. (g/m^2) 25 DAS	Weed dry Wt. (g/m^2) 40 DAS
Rice (Birsa Vikas Dhan 203) - Wheat (Raj 4250)	19.74	26.02	11.27	22.72
Rice (Birsa Dhan 201) – Wheat (GW 366)	20.30	26.57	10.22	17.34
Rice(Birsa Vikas Sugandha 1) -Wheat (NW 2036)	27.16	34.29	11.28	21.53
Rice (B.V.D110) – Wheat (K0307)	26.14	33.88	10.06	14.69
Rice (Sahbhagi) – Wheat (K9107)	23.46	28.12	11.05	19.00
Rice (Birsamati) – Wheat (HI 1563)	24.67	29.30	13.78	22.54
Rice (Anjli) – Wheat (Raj 4229)	25.69	33.31	10.13	17.05
Rice (Lalat) – Wheat (DBW 14)	18.73	24.78	10.29	22.48
Rice (M.T.U 10) – Wheat (WR 544)	24.39	28.58	12.48	23.02
Rice (Akhchhai) – Wheat (BG 3)	25.33	32.10	11.25	18.12
Rice (Pusa Sugandha) –Wheat (HD 2733)	24.72	30.46	12.08	23.46
Rice (Naveen) – Wheat (DBW 39)	22.75	27.47	10.51	17.82
CD (P=0.05)	2.15	1.66	1.41	1.54

Umiam

The experiment consisted of three major crops viz., maize, frenchbean and tomato. In Maize, 11 varieties were screened among which 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 screened in the experiment (Table 32.1-32.6).

Maize (Table 32.1-32.3)**:** Significant variation was observed among the maize varieties for all the traits. Among the varieties, plant height was maximum in RCM 75 (252.8 cm) followed by RCM 1-3 (249.2 cm) and Hemant (247.1 cm) whereas, Hybrid (JKMH) recorded the shortest plant (210.8 cm). Variation in chlorophyll content across the growth stages were also noticed among the maize line/varieties. Significantly higher chlorophyll index (CI) at 30 and 60 DAS was recorded in DA 61 A (42.7 and 49.1) followed by RCM 1-3 (41.5 and 47.6) while, minimum chlorophyll index was recorded in variety RCM 1-1 (43.5) at 60 DAS. Yield attributes and yields of different variety of maize were significantly differed. Difference among the varieties for cob length ranged from (11.7-14.9 cm), cob weight (165.2-224.3 g), green cob yield (4200-6000 kg/ha), kernel yield (3100-3700 kg/ha) and stover yield (5300-8400 kg/ha). Maximum cob length, cob weight, green cob yield and kernel yield were recorded with variety DA 61-A (14.9cm 224.3g, 6000 kg/ha and 3700 kg/ha respectively) and found to be on par with RCM-75 and RCM-76 whereas, minimum cob length and cob weight was recorded in the variety local white (11.7cm and 165.2g respectively). However, lower green cob yield and kernel yield was recorded in the Vijay composite (3900 and 2200 kg/ha respectively).

Fodder quality: RCM-1-2 and RCM-1-3 were recorded the higher crude protein and content among the maize varieties was found to be higher under RCM-1-3 while lower was recorded with DA-16-A and RCM1-1. In respect to ether extract ether, Vijay composite were recorded higher of 1.70% while lower was with RCM-75. Where reverse was observed in case of ash wherein RCM-75 noted highest. Local white recorded maximum Nitrogen free extract of 53.1%.

Stem borer infestation: Among the 11 varieties of maize, RCM-1-1 and Local yellow exhibited higher stem borer infestation and leaf injury and found to be high susceptible to the resistance reaction. RCM-1-2

Table 32.1: Plant height and chlorophyll index of different varieties of maize under organic production system at Umiam.

Varieties	Plant height (cm)	Chlorophyll index (CI) 30 DAS	60 DAS	Cob Length (cm)	Cob weight (g)	Green cob yield (t/ha)	Kernel yield (t/ha)	Stover yield (t/ha)
RCM-1-1	246.8	37.03	43.5	13.3	210.6	5400	3400	7600
RCM-1-2	234.0	37.93	45.7	13.0	202.5	5200	3100	7000
RCM-1-3	249.2	41.53	47.6	13.6	212.6	5700	3500	8300
RCM-75	252.8	40.67	46.4	14.1	220.1	5700	3600	8400
RCM-76	243.9	39.47	45.9	14.0	212.0	5500	3500	8300
Vijay composite	234.9	36.93	45.9	13.5	197.1	3900	2200	5300
Hemant	247.1	35.50	44.2	13.0	191.6	4900	3300	7700
DA 61 A	223.9	42.73	49.1	14.9	224.3	6000	3700	8300
Hybrid (JKMH)	210.8	35.30	46.2	13.2	196.8	4900	3300	7800
Local Yellow	224.9	37.73	44.6	13.9	180.0	4500	2900	7100
Local White	234.8	39.43	45.1	11.7	165.2	4200	3100	7500
CD(P=0.05)	4.55	3.88	3.22	1.12	4.79	920	430	990

Table 32.2: Fodder quality of different varieties of maize under organic production systems at 90 DAS at Umiam

Varieties	Crude protein (%)	Crude fiber (%)	E.E (%)	Ash (%)	NFE (%)
RCM-1-1	10.9	24.2	1.32	12.5	50.9
RCM-1-2	12.5	24.8	1.43	11.4	50.7
RCM-1-3	12.8	29.5	1.64	11.3	46.8
RCM-75	11.8	26.7	1.25	14.4	47.3
RCM-76	11.6	26.6	1.28	10.3	51.5
Vijay composite	10.7	25.5	1.70	11.7	51.5
Hemant	12.1	25.3	1.52	10.8	50.8
DA 61 A	10.6	26.5	1.53	11.4	51.6
Hybrid (JKMH-501)	11.4	24.6	1.59	10.2	52.4
Local Yellow	11.0	28.5	1.30	9.8	50.2
Local White	11.8	24.8	1.46	10.3	53.1
CD (=0.05)	0.49	0.47	0.06	0.19	0.21

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

found to be resistant to insect-pest due to lower infestation%, leaf injury and resistance reaction.

Tomato (Table 32.4): Significant variation among different varieties for yield attributes and yield were observed. Plant height at 60 DAS for different tomato varieties ranged from 35.2 to 112.5 cm. O-17 was the tallest variety Arka vikas was the smallest. In case of chlorophyll index, highest chlorophyll was found in MT 2 (43.8 60 DAS) followed by Rocky, O-17, and MT11XMT2 being on par and varied significantly over rest of varieties. Primary branches, secondary branches and fruit yield also showed significant variation. Primary branches and secondary branches of different tomato varieties ranged from 5.8 – 7.8 and 4.0 – 6.8 at 60 DAS. Maximum primary branches and secondary branches were observed with MT2. The range of fruit yield of tomato were from 7600 to 21790 kg/ha among the different varieties. Tomato cultivars MT-2 produce higher fruit yield (21790 kg/ha) compared to other cultivars due to the less pod borer incidence and being at par with 0-17, MT11XMT2 and Pant T10. The lowest yield of tomato was recorded in the cultivar Rocky (7600 kg/ha) due to the less secondary branches and heavy pod borer incidence. Less fruit borer infection (9.1%) was observed in MT-2

Table 32.3: Screening of maize varieties against stem borer, (*Chilopartellus Swinhoe*) at Umiam

Varieties	Stem borer infestation (%)		Leaf Injury	Resistance
	Plant Infestation (%)	Dead Heart (%)	Rating (LIR)	reaction
RCM-1-1	77.3	7.8	8.5	HS
RCM-1-2	11.6	2.7	2.6	R
RCM-1-3	38.0	6.5	6.0	MS
RCM-76	57.4	6.9	6.7	HS
DA-61-A	39.2	5.4	6.2	HS
RCM-75	54.8	7.3	6.6	HS
Hybrid	40.9	5.3	6.3	HS
Local White	31.9	5.0	6.8	HS
Hemant	57.7	6.0	6.5	HS
Vijay Composite	39.4	6.0	7.6	HS
Local Yellow	67.0	11.0	8.1	HS
CD (P=0.05)	2.54	0.66		

LIR>3 or <6 = moderately susceptible (MS); LIR > 6 = Highly susceptible (HS); LIR ≤ 3 Resistance (R)

Table 32.4: Growth, yield and their insect pests (pod borer) of different tomato varieties under organic production system at Umiam

Cultivars	Plant height (cm)		Chlorophyll Index		Primary branches		Secondary branches		Pod borer	Yield
	30 DAT	60 DAT	30 DAT	60 DAT	30 DAT	60 DAT	30 DAT	60 DAT	incidence (%)	(Kg/ha)
0-17	44.0	112.5	44.8	43.2	6.5	7.5	1.4	6.2	9.8	21670
Sel-1	30.7	38.9	43.3	36.6	6.3	6.4	1.3	4.7	14.7	12850
Sel-9A	30.4	38.1	39.4	31.7	5.2	5.8	0.5	4.0	18.4	13420
Vikash	22.0	35.2	42.3	38.5	4.8	6.5	0.3	5.1	14.7	10440
TMC-5	22.3	35.5	42.3	38.9	4.7	6.7	0.4	5.1	16.0	11170
Pant-T 10	29.7	47.5	44.6	37.5	4.9	6.1	0.4	5.0	14.4	18810
DMT-5	29.1	43.4	42.9	38.4	5.3	6.0	1.1	5.4	15.1	13990
Rocky	29.9	58.1	43.5	43.4	3.5	4.4	0.9	4.1	18.1	7600
MCTR-4	31.3	49.9	44.2	38.7	6.2	6.4	0.9	5.5	15.3	14080
MT 11 X MT 2	35.2	65.1	46.3	42.8	6.4	7.4	1.5	6.6	13.9	19580
MT 1 X MT 2	36.2	49.5	44.7	38.7	6.4	6.6	1.4	6.5	10.6	16470
INDET-IET	34.0	49.2	40.4	38.0	5.9	5.8	1.1	6.1	12.6	15540
MT 2	36.9	67.5	47.4	43.8	6.9	7.8	1.7	6.8	9.1	21790
NS-812	35.0	50.3	43.0	39.0	6.2	7.5	1.2	6.7	13.5	16310
CD (P=0.05)	2.73	2.92	3.07	2.73	0.53	0.55	0.32	0.68	3.48	3260

compared to the other cultivars. Other less infested cultivars were 0-17 (9.8%), MT1XMT2 (10.6%) and INDET-IET (12.67%). Among the cultivars highly infested cultivars was Sel 9A (18.4%).

French bean (Table 32.5)**:**

In French bean, plant height has recorded highest in Naga Local (239.70 cm) followed by RCM-FB-18 (225.7 cm) and RCM-FB-80 (224.0 cm). The lowest plant height was recorded in Maram (48 cm). In case of pod length of different varieties, Naga local (16.30 cm) recorded the longest followed by RCM-FB-18 (16.10 cm) and RCM-FB-19 (15.20 cm) while shortest pod length was recorded also in Maram (13.20 cm). Average pod weight was higher in Naga local (11.50 g) followed by RCM-FB-18 (10.30 g) and RCM-FB-19 (7.60 g) while lowest average pod weight was recorded also in Maram (4.00 g). Among the frenchbean varieties,

Table 32.5: Evaluation of different varieties of french bean 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	225.7	16.1	10.3	8000	3800	6500
RCM FB-19	189.6	15.2	7.6	5800	3200	5700
RCM FB-37	220.0	14.9	7.2	5500	2400	5300
RCM FB 61	158.3	14.2	6.4	3700	2300	4900
RCM FB-62	217.3	13.5	6.5	5700	2500	5300
RCM FB-80	224.0	15.1	7.3	5800	2900	4900
Nagaland local 1	197.7	13.4	4.5	2200	1600	3300
Nagaland local 3	148.7	14.7	5.9	5200	3000	6400
Maram	48.0	13.2	4.0	1100	800	1500
Naga local	239.7	16.3	11.5	9200	4300	7800
CD (P=0.05)	10.96	0.84	0.87	850	600	750

Table 32.6: Soil physical and chemical properties after different varieties of maize under organic production system at 0-15 cm soil depth at Umiam.

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	2.17	1.13	214.7	20.2	204.4
RCM-75	4.99	2.16	1.17	199.8	19.2	203.3
RCM-76	5.13	2.14	1.18	203.5	18.4	197.8
Vijay composite	5.09	2.13	1.20	206.2	18.9	195.5
Hemant	4.96	2.11	1.20	201.1	18.1	189.8
DA 61 A	5.04	2.18	1.15	203.2	19.3	201.7
Hybrid (JKMH-501)	5.10	2.11	1.20	199.8	15.7	194.6
Local Yellow	5.14	2.15	1.14	217.3	20.1	202.9
Local White	4.98	2.12	1.15	213.3	20.2	198.8
CD(p=0.05)	NS	0.07	0.09	7.99	2.51	NS

highest green pod yield was recorded in Naga local (9200 kg/ha) followed by RCM-FB-18 (8000 kg/ha) RCM-FB-19 and RCM-FB-80 (5800 kg/ha). Lowest green yield was recorded in Maram (1100 kg/ha). Seed yield also shown the similar trend as in green pod which had recorded highest in Naga local (4230 kg/ha) and lowest in Maram (800 kg/ha).

Soil chemical and physical properties:

Among the varieties/lines of maize, significantly higher soil organic carbon was recoded with both the variety DA 61A (2.18%) followed by RCM 1-3, RCM-75 and Local yellow but found on par to each other. Highest bulk density was recorded under Hemant and Vijay composite and Hybrid (JKMH-501) while, lowest was with RCM-1-3. The available N and P status in soil after among the varieties were also varied significantly with ranged for N 199.8-217.3 kg/ha, P from 15.7-20.2 kg/ha and for K it was between 189.8 to 204.4 kg/ha. Maximum soil available N (217.30 kg/ha) and P (20.2 kg/ha) was recorded under Local Yellow whereas, maximum K was recorded under RCM 1-3 (204.40 kg/ha).

Ajmer:

Seed spice crops including different varieties of coriander and fennel in rabi season and green gram and cluster bean in kharif were evaluated/screened for organic farming. The total eight varieties each of coriander, fennel, green gram and cluster were evaluated. The coriander data are presented in Table 33.1-33.5.

Green gram (Table 33.1):

There were significant difference in its performance in terms of growth and seed yield of green gram. Green gram variety Mum-2 performed significantly better in term of plant height, number of primary branches, number of nods/plant, number of seeds/pod, also for seed yield and biomass yield. It recorded 984.4 kg/ha seed yield and being at par to rest of varieties except SML 668 and MSG 118 which produced lower yield of 721.8 and 658.3 kg/ha respectively.

Cluster bean (Table 33.2)**:**

Results revealed that significant variation for all the traits was recorded. Difference for plant height among the varieties ranged from 91.9 to95.8 cm 169 days. Tallest variety was RGC-1038 and smallest is RGC-12-1 whereas, variation for primary branch/plant (5.6-12.3), pods/plant (43.3-68.9), seeds/pod (8.1-8.5) were recorded. Variety RGC-1038 recorded maximum primary branches (12.3), number of pods per plant (68.9), number of seeds per pod (8.5), seed yield per hectare (1485.8 kg/ha) and biomass yield per hectare (6141.7 kg) and it was found at par with RGC-1055. Lowest performance in terms of primary branches (12.3), number of pods per plant (21.3), numbers of seeds per pod (35.1), seed yield per hectare (1475.8 kg)

Table 33.1: Performance of green gram varieties under organic management practices during Kharif at Ajmer

Treatment	Plant height at harvest (cm)	No. of primary branches Plant-1	No. of pods /plant	No. of seeds pod-1	Seed yield (kg/ha)	Biomass yield (kg/ha)
RMG-975	69.3	5.9	28.4	11.4	975.7	3750
RMG-62	68.3	5.6	21.3	10.8	861.5	3307
MSG-118	52.8	5.7	28.3	10.7	658.3	2152
RMG-492	50.0	5.4	24.8	10.9	920.2	3587
SML-668	42.2	5.1	20.1	9.9	721.8	2362
GANGA-1	66.3	5.4	25.9	10.3	905.5	2962
IPM-02-3	51.9	5.8	24.1	11.3	907.3	3029
MUM-2	71.0	6.2	29.5	11.5	984.2	3868
CD(P=0.05)	10.8	0.6	4.8	1.0	196.1	334

Table 33.2: Performance of cluster bean varieties under organic management practices during Kharif at Ajmer

Treatment	Plant height at harvest (cm)	No. of primary branches Plant-1	No. of pods /plant	No. of seeds pod-1	Seed yield (kg/ha)	Biomass yield (kg/ha)
RGC-936	91.9	10.0	54.3	8.2	999.7	4638
RGC-1001	86.0	11.7	57.1	8.1	1051.0	4955
RGC-1003	91.4	9.6	43.3	8.3	1162.5	4758
RGC-1038	95.8	12.3	68.9	8.5	1485.8	6142
RGC-986	91.3	10.6	53.0	8.3	1111.8	5105
RGC-1055	93.1	12.0	65.5	8.4	1185.7	5620
RGC-1066	92.4	5.7	46.4	8.4	1083.0	3970
RGC-12-1	85.3	9.5	43.9	8.4	1158.5	4348
CD(P=0.05)	6.1	1.7	9.1	NS	215.6	736

and biomass yield per hectare (1475.8 kg) was observed in variety RGC-12-1.

Coriander (Table 33.3): Significantly higher plant height (99.7 cm) was recorded with ACr-1 while lower was with RCr-436 (69.6 cm). Primary branches (7.7 and secondary branches (26.9), number of umbels (44.0), number of umbellets (6.1) and seed yield (1703 kg/ha) was found to be higher in Azad dhania-1 followed by ACr-1 and Hissar Anand while lowest was recorded in RCr- 446 with number of primary branches/plant (5.8), numbers of secondary branches /plant (20.6), number of umbel/plant (35.1), number of umbellate/umbel (3.8) and seed yield (1220 kg/ha). RCr-446 took minimum days for 50% flowering (35.1 days). It is clearly indicated that in coriander crop Azad dhania-1, Hissar Anand and ACr-1 performed better under organic management (table 34.3).

Fennel (Table 33.4): In fennel crop, plant height at harvest was significantly higher (161.1 cm) in GF-12 which is at par with GF-2, AF-1, Co-1 and Rajendra saurabha, whereas lowest plant height was recorded in RF281. Another parameters such as primary branches (10.2), secondary branches 21.3), umbels per plant (35.1), umbellates per umbel (26.1) and seed yield (1476 kg/ha) was also found significantly higher in GF-2, while lowest performance in terms of seed yield (1149 kg/ha) was observed in variety RF-101. GF 1-12 also took the minimum days (96.3)for flowering (50%) while, 100 days was taken by Co-1 for 50% flowering (table 34.4).

Nutrient Uptake by coriander and fennel (Table 33.5):

Significant difference in N, P and K uptake were observed among different coriander varieties under organic system. Among coriander varieties,

Table 33.3: Performance of coriander varieties under organic management practices during *rabi* at Ajmer

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	99.7	7.6	25.4	74.7	41.8	6.0	1623.5
Azad Dhania-1	86.8	7.7	26.9	69.7	44.0	6.1	1702.8
RCr-435	77.3	6.4	23.1	56.3	37.6	4.9	1217.8
RCr-436	69.6	7.0	20.9	55.3	35.2	4.5	1223.8
RCr-446	75.8	5.8	20.6	54.3	35.1	3.8	1220.3
RCr-684	79.2	6.0	22.9	60.3	37.1	4.5	1287.7
Hissar Sugandha	78.7	5.8	22.0	60.7	36.2	4.1	1274.5
Hissar Anand	81.2	7.1	24.1	57.0	39.5	4.9	1381.3
CD(P=0.05)	5.5	0.7	2.0	2.3	2.6	0.4	308.0

Table 33.4: Performance of fennel varieties under organic management practices during *rabi* at Ajmer

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	158.9	9.9	20.1	97.0	33.1	25.0	1466.7
RF-101	148.5	6.7	15.7	99.3	27.9	19.2	1148.7
Co-1	156.4	6.6	17.4	100.0	29.2	21.7	1158.2
Rajendra Saurabha	150.6	6.9	17.9	99.0	28.3	22.5	1229.7
GF-12	161.1	10.2	21.3	96.3	35.1	26.1	1475.8
RF-281	135.8	6.5	18.9	98.3	29.0	18.6	1310.7
RF-125	148.5	7.2	16.5	97.7	28.4	23.4	1438.7
GF-2	158.9	7.1	16.1	99.0	26.1	22.9	1428.5
CD(P=0.05)	13.5	0.7	2.7	1.7	5.0	3.4	219.9

Table 33.5: Total N, P, K uptake in different varieties of coriander and fennel under organic production system at Ajmer

Treatment	N uptake (kg/ha)	P uptake (kg/ha)	K uptake (kg/ha)
Coriander			
ACr-1	45.5	9.8	68.6
Azad Dhania-1	44.1	9.3	71.4
RCr-435	30.2	7.6	50.3
RCr-436	32.2	7.4	50.8
RCr-446	32.7	7.7	48.4
RCr-684	29.3	7.3	52.4
Hissar Sugandha	31.8	7.6	52.2
Hissar Anand	33.7	7.6	56.7
CD(P=0.05)	7.2	1.6	9.2
Fennel			
AF-1	44.0	9.4	64.3
RF-101	33.1	7.1	50.2
Co-1	33.0	6.9	48.2
Rajendra Saurabha	33.7	7.8	54.1
GF-12	42.8	9.3	63.9
RF-281	38.4	8.3	59.6
RF-125	40.0	8.7	62.9
GF-02	39.8	8.7	62.0
CD(P=0.05)	10.9	2.1	14.4

nitrogen and phosphorus uptake found to be significantly higher in ACr-1 (45.5 and 9.8 kg/ha) which was statistically on par with Azad dhania-1 (44.1 and 9.3 kg/ha) while lower uptake of nutrients of N and P was recorded with RCr-684 of 29.3 and 7.3 kg/ha respectively. K uptake was significantly higher in Azad dhania-1 (71.3 kg/ha) followed by ACr-1 (68.6 kg/ha) which was at with Hissar anand while lowest uptake was in RCr-646 (48.4 kg/ha). Among different fennel varieties, N, P and K uptake was found to be significantly higher in AF-1 (44.0, 9.4 and 64.3 kg/ha respectively) which was statistically on par with GF-12 been (42.8, 9.3 and 63.9), RF-125 (40.0, 8.7 and 62.9 kg/ha respectively) and GF-02 (39.8, 8.7 and 62.0 kg/ha respectively). Minimum uptake of nutrients was recorded with Co-1 among the fennel varieties.

Gangtok

Varietal evaluation of maize and buckwheat under organic management under maize-buckwheat cropping system (Table 34.1- 34.3)

Maize (Table 34.1 & 2): 12 varieties of maize composite were evaluated under organic management: Variation for tasseling (50%), plant height and cob length found to be significant. The range for tasseling between 61.0-72.7 days, for plant height 138 cm to 308 cm and for cob length, ranged was 11.3-16.7 cm. Seti makkai attained the maximum height 305 cm and took more days for flowering up to 50%. RCm1-1 recorded maximum cob length (16.7 cm) while, Vivek sankul-37 recorded shortest cob length (11.3 cm). Vivek sankul -35 performed better in term of grain yield (2940 kg/ha) which were on par with Vivek sankul -31, Sethe Makkai and RCM -75 while lowest yield was recorded in Satheya (1361 kg/ha). Seti Makkai took more time in days (134) for maturity up to 75% while vivek sankul -

Table 34.1: Evaluation of maize composite under organic management at Gantok

ENTRIES	Days to 50% tasseling	Plant height (cm)	Cob length (cm)	Cob diameter (cm)	No. of rows/cob	No. of grains /row	Grain yield (q/ha)	Days to maturity (75%)	Disease Incidence (%)
Seti Makkai	72.7	305	16.0	11.4	11.47	31.0	27.2	134.0	23.87
Pahenlo Makkai	68.0	237	14.9	11.6	11.33	33.7	17.5	124.0	27.27
Rato Makkai	71.0	277	16.1	11.3	11.07	36.6	14.2	120.0	3.94
Baiguni Makkai	71.0	296	15.4	11.2	11.53	30.4	16.1	119.0	14.60
Kalo Makkai	67.3	258	14.0	10.4	8.67	36.8	14.1	120.0	12.97
Satheya	63.0	264	13.4	10.6	9.07	28.0	13.6	109.3	38.83
RCM 1-1	65.8	219	16.7	10.4	10.60	29.4	23.3	113.0	35.67
RCM 1-3	68.0	225	15.2	11.6	11.33	27.1	22.5	115.0	39.73
RCM 75	67.7	231	15.3	11.7	11.60	32.2	25.0	110.7	12.73
Vivek Sankul-31	62.0	149	13.4	13.4	11.60	34.5	27.8	103.3	45.73
Vivek Sankul-37	62.0	157	11.3	12.0	12.41	30.4	23.9	101.3	61.01
Vivek Sankul-35	61.0	138	12.2	13.2	12.99	30.7	29.4	103.3	61.07
SEm ±	0.93	9.71	0.42	0.56	0.68	1.05	1.70	1.44	16.94
CD 0.5%	2.66	27.89	1.20	1.60	1.96	3.02	4.89	4.12	49.69

Table 34.2: Economics of varietal maize cultivation under organic management condition at Gantok

Treatments	Gross return(Rs. ha^{-1})	Net return (Rs. ha^{-1})	Return rupee^{-1} invested
Seti Makkai	108890	67348.9	2.62
Pahenlo Makkai	70000	28460.0	1.69
Rato Makkai	56670	15126.7	1.36
Baiguni Makkai	64440	22904.4	1.55
Kalo Makkai	56220	14682.2	1.35
Satheya	54440	12904.4	1.31
RCM 1-1	93330	51793.3	2.25
RCM 1-3	90000	48460.0	2.17
RCM 75	100000	58460.0	2.41
Vivek Sankul makka-31	111110	69571.1	2.67
Vivek Sankul makka-37	95555	54015.6	2.30
Vivek Sankul makka-35	117770	76237.8	2.84

Table 34.3: Evaluation of varietal buckwheat under organic management at Gantok

ENTRIES	Days to maturity	Plant height (cm)	No. of leaves/ plant	Chlorophyll content	Spike length (cm)	Yield (kg/ha)	Gross return (Rs ha-1)	Net return (Rs ha 1)	Return rupee-1 invested
Local Meethay	112	57.00	20.00	22.02	1.57	1830	40833	12133	1.42
Local Teethay	109	52.00	21.67	20.48	1.18	1780	73119	44419	2.55
IC 104727	113	55.73	12.00	23.53	1.16	1940	64000	35300	2.23
IC 36805	112	49.97	11.67	15.03	1.50	1670	76667	47967	2.67
IC 109729	113	41.83	16.00	16.82	1.17	1110	33000	4300	1.15
IC 15393	113	49.97	15.00	28.36	1.16	1560	42214	13514	1.47
IC 109433	112	58.33	11.00	14.85	1.23	2440	70238	41538	2.45
IC 49671	113	36.67	9.67	16.06	1.22	2780	31350	2650	1.09
IC 2018742	109	49.07	12.00	15.65	1.23	1720	43881	15181	1.53
PRB-1	113	68.33	11.33	15.52	1.13	1500	67619	38919	2.36
VL-ugal	112	57.27	18.67	14.65	1.19	670	30524	1824	1.06
Sangla B-1	113	62.17	13.67	18.77	1.15	1280	35607	6907	1.24
CD P=0.05	-	7.81	5.66	6.09	0.26	1018			

31 and 37 mature early and took 101.3 days. Among the maize composite varieties, evaluated against the natural infection of turcicum leaf blight disease, the lowest disease incidence was observed in Rato makai (3.94) followed by RCM-75 (12.73), Kalo makai (12.97) and Seti makai (23.87) whereas Vivek Sankul makka-35 (61.07) recorded severe incidence of disease. Vivek sankul makka-35 observed the most profitable variety which gave highest net return of Rs. 76238/ha and return per rupees invested (2.84)

Buckwheat (Table 34.3): Among the buckwheat varieties, PRB-1 recorded as tallest (68.3 cm) whereas, IC 49671 recorded as smallest. IC 15393 accumulate higher chorophyll content (38.4) whereas, VL-ugal recorded least (14.6). Significant differences among the buckwheat varieties for yield ranged 670-2780 kg/ha. IC 49671 was the highest yield variety and Vl ugal aws the lowest yieldded variety. In terom of economics, gross return, net return and return per rupees invested was higher in IC 36805. Local teethay was next higher variety for net rurn. IC 49671 gave minimum retrun per rupees invested of 1.09

Sardarkrushinagar

Eight verities of each crop of groundnut-wheat-green gram system were grown under organic management (Table 35.1-35.6).

Groundnut (Table 35.1): Yield and economics of different varieties showed significant variations among groundnut varieties. Significant higher

Table 35.1: Yields attributes and yield of different groundnut varieties under organic farming at SK Nagar

Varieties	Number of nodules/ plant at 50 DAS	Plant height (cm) at harvest	Number of branches/plant	Number of pods/plant	Pod yield (kg/ha)	Haulm yield (kg/ha)
GG- 2G	79.20	55.43	4.00	19.20	2089	3170
GJG-17	102.47	51.27	3.73	23.27	2044	3156
TG-37	91.13	60.13	3.93	23.13	1896	2889
GJG-HPS-1	70.47	53.43	3.27	19.27	1748	2844
KDG-123	73.20	57.67	3.33	18.33	1719	2726
GJG-9	80.60	67.73	3.67	18.87	1674	2770
GG-7	78.53	68.40	3.40	20.67	1630	2667
GG-5	96.00	63.73	3.67	17.80	1452	2415
CD (P=0.05)	5.29	9.28	7.52	18.5	319	433

number of nodules/plant was observed in GJG 17 (102.5) whereas lower nos. of nodule was in GJG HPS-1 (70.5). Tall variety was noted GJ-7 however, GJG-17 recorded smallest plant. Number of branches/plant pod yield and haulm weight among the varieties, ranged from 3.27-4.0, 1748-2089 and 2415-3170 kg/ha respectively. Significantly higher pod yield was found in variety GG- 2G (2089 kg/ha) which is at par with GJG-17 (2044 kg/ha) and TG-37 (1896 kg/ha). Haulm yield of different varieties also followed the same pattern.

Wheat (Table 35.2)**:** Grain yield, test weight and plant height showed significant variation among the wheat varieties. Difference for the plant height ranged in 70.8-88.8 cm. GW 451 recorded smallest in height whereas, GW 273 noted highest. Ear head length was also recorded higher in GW 273 of 11.6 nos. Grain and straw yield showed significant variations among different wheat varieties. Grain yield of different varieties varies from 3256 kg/ha to 3971 kg/ha. Significantly higher yield was found in variety GW-496 (3971 kg/ha) which is significantly higher than other varieties but was on par with GW 451, GW-273 and GDW-1255. Straw yield of different varieties also followed the same pattern.

Green gram (Table 35.3)**:** Yield of different green gram varieties showed significant variations among varieties evaluated. Seed yield varied from 485 kg/ha to 566 kg/ha. Higher seed yield was found in variety GM 4 (566 kg/ha) which is at par to THE other except K851 (4705 kg/ha), PDM 139 (485 kg/ha) and IPM-410-3 it resulted lower yield.

Economics of groundnut-wheat-green gram system: Highest groundnut equivalent yield, gross return, net return and B: C ratio was obtained in GG 20 (SS) - GW 366 - Meha cropping system of 4779 kg/ha, Rs. 238934/ha, Rs. 107166 and 2.79 respectively which is closely followed by GJG 17 (S) - GW1139 - PKVAKM 4

Table 35.2: Yield attributes and yield of different wheat varieties during rabi at SK Nagar

Treatments	Plant height at harvest (cm)	Effective tiller /meter row length	Ear head length (cm)	No. of grain /ear head	Test weight (gm)	Grain yield	Straw yield
GW496	81.1	2.2	10.2	30.3	34.0	3971	5182
GW 451	70.8	2.5	7.2	27.0	34.0	3882	4949
GW 273	88.8	2.4	11.6	28.7	34.0	3678	4764
GDW 1255	71.7	2.1	7.3	29.0	35.0	3663	4678
GW1139	71.9	2.7	7.7	29.7	34.0	3601	4900
GW 366	78.7	1.7	8.0	28.7	33.0	3458	4564
HI 8498	73.8	2.7	7.9	31.3	34.0	3324	4513
GW 322	75.7	2.4	10.1	28.3	36.0	3256	4539
CD (P=0.05)	2.68	NS	1.64	NS	NS	389	386

Table 35.3: Yield attributes and yield of different green gram varieties during summer at SK Nagar

Treatments	Plant Height (cm) at harvest	Number of Branches/ Plant	Number of Pods/Plant	Number of Seeds Pod-1	1000 seed weight (g)	Seed yield (kg/ha)	Stover yield (kg/ha)
GM 4	40.2	6.3	28.2	10.3	35.0	566	1191
GM 5	40.2	6.1	27.8	10.0	33.0	534	1147
Meha	38.5	5.9	27.8	9.9	36.0	532	1113
PKVAKM 4	38.4	4.7	25.8	8.7	33.0	506	1033
BGS 9	37.3	4.9	25.5	8.5	32.3	503	1025
K 851	37.9	5.9	27.8	8.3	34.3	501	1061
PDM 139	41.0	6.2	26.7	8.6	33.7	485	1000
IPM 410-3	40.4	6.0	26.5	7.7	32.7	458	1030
CD (P=0.05)	NS	NS	NS	0.95	NS	60.0	115.0

(4769 kg/ha, Rs. 238450/ha, 106681/ha and 2.72 respectively) and GJG HPS-1(S) - GW 451 - GM 4 system which produced 4665 kg/ha of GEY, Rs. 233257/ha of gross return, Rs. 101489/ha of net return and 2.55 of B:C ratio. Lowest ground nut equivalent yield, net profit and B: C ratio of 4159 kg/ha, Rs. 76,143/ha and 1.94) was found with GG 7 (B) - GW 322 - K 851 system. (Table 35.4 & 35.5)

Nutrient Uptake (Table 35.6)**:** Data indicated that maximum total uptake of N, P and K was observed in cropping system GG 20 (SS) - GW 366 - Meha (212, 33.4, and 129 kg/ha) followed by GJG 17 (S) - GW1139 - PKVAKM 4. KDG 123 (B - HI 8498- BGS 9 system

Table 35.4: Economics of groundnut- wheat- green gram cropping system at SK Nagar

Varieties	System equivalent yield (kg/ha)	Gross return (₹/ha)	Net return (₹/ha)	NRPRI
GJG HPS-1(S) - GW 451 - GM 4	4665	233257	101489	2.55
GG 20 (SS) - GW 366 - Meha	4779	238934	107166	2.79
GG 7 (B) - GW 322 - K 851	4159	207911	76143	1.98
TG 37 (A) (B) - GW 273 - PDM 139	4595	229737	97969	2.46
GJG 9 (B)- GW496- IPM 410-3	4467	223381	91612	2.18
GG 5 (B1)- GDW 1255 - GM 5	4189	209437	77668	1.94
GJG 17 (S)- GW1139 - PKVAKM 4	4769	238450	106681	2.72
KDG 123 (B - HI 8498- BGS 9	4279	213910	82141	2.14

Table: 35.5: 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**
GJG HPS-1(S) - GW 451 - GM 4	91.0	11.7	45.0	95.0	16.8	71.0	25.0	3.8	10.0	210.0	32.2	127.0
GG 20 (SS) - GW 366 - Meha	103.0	14.5	52.0	86.0	15.7	67.0	23.0	3.2	10.0	212.0	33.4	129.0
GG 7 (B) - GW 322 - K 851	86.0	12.1	44.0	82.0	14.2	64.0	23.0	3.9	10.0	191.0	30.1	117.0
TG 37 (A) (B) - GW 273 - PDM 139	91.0	11.8	48.0	90.0	14.8	66.0	21.0	3.1	9.0	202.0	29.7	122.0
GJG 9 (B)- GW496- IPM 410-3	87.0	12.4	45.0	97.0	17.3	73.0	22.0	3.5	9.0	205.0	33.2	127.0
GG 5 (B1)- GDW 1255 - GM 5	74.0	10.9	39.0	90.0	15.1	61.0	24.0	3.7	10.0	188.0	29.7	110.0
GJG 17 (S)- GW1139 - PKVAKM 4	100.0	14.0	52.0	90.0	15.6	69.0	21.0	3.0	9.0	211.0	32.7	129.0
KDG 123 (B - HI 8498- BGS 9	83.0	10.9	45.0	80.0	14.2	63.0	20.0	2.8	9.0	183.0	27.9	116.0

Table 35.6: Soil physical and chemical properties after completion of crop sequence at SK Nagar

Treatments	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)
GJG HPS-1(S) - GW 451 - GM 4	0.24	170	14.45	171	3.36	7.29	0.33	0.36	0.08	7.11	31.53	1.41
GG 20 (SS) - GW 366 - Meha	0.23	172	15.59	177	2.96	7.05	0.37	0.33	0.08	7.24	32.66	1.44
GG 7 (B) - GW 322 - K 851	0.21	177	14.90	179	2.86	6.47	0.39	0.37	0.08	7.07	31.22	1.40
TG 37 (A) (B) - GW 273 - PDM 139	0.25	165	14.13	174	3.02	7.92	0.35	0.40	0.08	6.97	29.74	1.39
GJG 9 (B)- GW496- IPM 410-3	0.24	172	14.54	168	3.28	7.42	0.28	0.34	0.09	7.15	28.17	1.37
GG 5 (B1)- GDW 1255 - GM 5	0.25	163	14.32	177	3.29	7.45	0.26	0.31	0.08	6.87	21.27	1.36
GJG 17 (S)- GW1139 - PKVAKM 4	0.25	162	14.06	174	3.11	5.77	0.35	0.30	0.09	7.02	30.18	1.42
KDG 123 (B - HI 8498- BGS 9	0.25	176	14.95	171	3.03	7.03	0.38	0.33	0.09	7.13	29.41	1.52
INITIAL	0.19	147	10.92	140	2.62	5.70	0.25	0.24	0.09	7.14	26.62	1.48

removed minimum N, P and K. Soil organic carbon was found to be higher in TG 37 (A) (B) - GW 273 - PDM 139 (0.25%) being at par with all other than GG 20 (SS) - GW 366 – Meha and GG 7 (B) - GW 322 - K 851 (0.23 and 0.21%) and it was increased 31.6% to their initial value. Residual N, P and K was available in the soil ranged N from 162-177 kg/ha, P ranged from 14.9-15.6 kg/ha and K range was from 168-179 kg/ha. Soil physiological characters did not differ among the varieties in the system to their initial value after completion of cropping cycle.

Thiruvananthapuram

Evaluation of response of different varieties of cassava for suitability under organic farming (Table 36.1-36.3): 12 varieties of cassava were grown under organic management using the organic production technology developed by ICAR-CTCRI, i.e., FYM @ 12.5 t ha^{-1}, in-situ green manuring (normally produces green matter 10-15 t ha^{-1}), crop residue incorporation (generates dry biomass @ 3 t ha^{-1}), Azospirullum @ 3 kg ha^{-1}, phosphobacteria @ 3 kg ha-1 and K solubilizer @ 3 kg ha-1. Cassava varieties varied significantly in plant height at 6 MAP, Sree Athulya was the tallest (167.1 cm), but remained on par with H-165, Sree Visakham, M-4, H-226 and Kalpana. Sree Pavithra was the smallest variety (114.9 cm). Response of different varieties of cassava to organic farming indicated that the varieties varied significantly in tuber yield, tuber girth, total dry matter production and harvest index. Among the 12 varieties, H-226 produced the highest yield (46.7 t ha-1), but on par with CR-24-4 (45.8 t ha-1), Sree Athulya (36.3 t ha-1) and Sree Pavithra (33.4 t ha-1). Kalpaka produced the lower yield (8.9t/ha). Among the varieties evaluated, cultivation of H-226 and CR-24-4 under organic practice was profitable as these varieties generated higher profit (Rs. 5,32,229 ha-1 and Rs. 5,18,855 ha-1 respectively) and B: C ratio (4.16 and 4.08). Sree Athulya and Sree Pavithra were the next good performers (net returns of Rs. 3,76,022 and Rs. 3,33,182 ha-1; B:C ratio of 3.23 and 2.98 respectively) (Fig.).

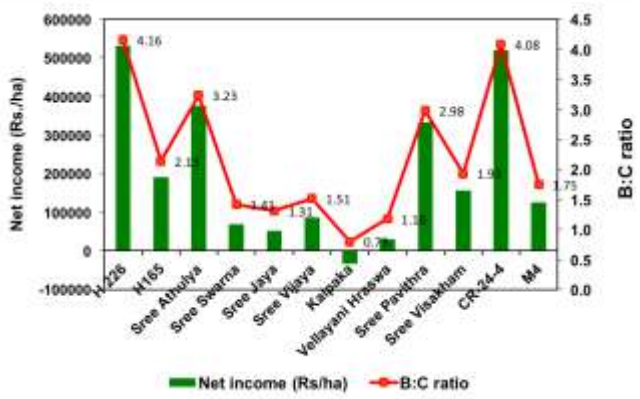


Fig. 6. Economics of cultivation of cassava varieties under organic practice

Table 36.1: Response for yield and yield attributes of cassava varieties under organic management at Thiruvananthapuram

Varieties	Plant height (cm) at 6 MAP	Leaf	Stem girth (cm)	Tuber length(cm)	Tuber girth(cm)	Tuber yield (t ha^{-1})	Dry matter production (t ha-1)	Harvest index production
H-226	146.3	162	6.7	28.3	17.1	46.7	17.4	0.73
CR-24-4	131.0	123	6.0	29.6	18.8	45.8	16.7	0.61
Sree Athulya	167.1	86	8.0	24.8	18.9	36.3	16.6	0.67
Sree Pavithra	114.9	123	7.0	31.1	17.6	33.4	13.0	0.64
H-165	159.6	154	7.3	26.5	21.0	23.9	11.1	0.55
Sree Visakham	156.7	156	7.3	28.2	16.7	21.6	11.6	0.50
M-4	153.0	146	6.3	24.0	15.0	19.6	10.5	0.57
Sree Vijaya	137.9	140	6.3	28.2	15.2	17.0	8.2	0.55
Sree Swarna	134.4	182	10.3	30.0	15.1	15.8	7.5	0.55
Sree Jaya	134.8	171	6.7	31.2	16.6	14.7	8.8	0.64
Vellayani Hraswa	120.2	169	6.7	29.4	16.4	13.2	7.9	0.62
Kalpaka	144.0	154	8.0	26.9	14.3	8.9	4.8	0.48
CD (0.05)	27.7	NS	2.3	NS	3.8	16.9	7.7	0.109

Table 36.2: Biochemical composition of tubers of cassava varieties under organic management at Thiruvananthapuram

Varieties	Dry matter (%)	Cyanogenic glucoside (µg g-1) (FW)	Starch(% FW)	Crude protein (% FW)	Total sugars (% FW)
H-226	23.3	126.2	13.1	1.80	0.59
H-165	25.5	85.1	15.9	1.91	0.78
Sree Athulya	30.5	149.6	27.9	2.03	0.90
Sree Swarna	40.3	42.4	21.7	2.96	1.62
Sree Jaya	33.8	28.1	22.6	2.51	1.14
Sree Vijaya	32.0	33.9	22.9	2.42	1.44
Kalpaka	31.1	41.6	18.6	2.58	1.55
Vellayani Hraswa	38.0	40.2	26.3	2.48	1.76
Sree Pavithra	24.8	42.9	17.9	1.73	1.14
Sree Visakham	26.5	80.5	16.0	2.38	1.41
CR-24-4	21.6	67.7	13.6	2.22	0.58
M-4	30.3	34.3	19.1	2.28	2.06
CD (0.05)	5.6	21.6	4.5	NS	0.485

Cassava varieties varied significantly for dry matter, cyanogenic glucoside, starch and total sugar contents under organic practice (Table 36.3). Sree Swarna had highest dry matter content in tubers on par with Vellayani Hraswa. All the domestic varieties, Sree Jaya, Sree Vijaya, Kalpaka, Vellayani Hraswa, Sree Swarna, Sree Pavithra and M4, had significantly lower cyanogenic glucoside content (28-43 µg g-1). The starch content of Sree Athulya and Vellayani Hraswa were higher and equal. The total sugar content of M4 was the highest on par with Sree Swarna and Vellayani Hraswa. Crude protein content of the varieties tested was not significantly different. The varieties had similar mineral contents in tubers, except Fe content (Table 17). The high yielders, H-165 and Sree Athulya, under organic mode, also had higher Fe content in tubers.

Soil properties (Table 36.3): Available K was significantly influenced under the impact of the varieties under organic practice (Table 18). In plots were the short-duration varieties, Kalpaka, Sree Vijaya, Vellayani Hraswa and Sree Swarna were planted, due to their early harvest and probably lesser uptake, showed higher available K status after harvest. All the other major, secondary and micro nutrients were unaffected (Tables 18 & 19). The soil enzyme activity too was not significantly affected.

Table 36.3. Response for chemical properties of soil under cassava varieties in organic condition

Varieties	pH	EC	Organic C(%)	Available N (kg ha^{-1})	Available P (kg ha^{-1})	Available K (kg ha^{-1})
H-226	4.47	0.039	1.28	76.30	99.92	65
H-165	4.41	0.058	1.43	110.30	88.19	74
Sree Athulya	4.88	0.049	1.26	70.00	82.99	63
Sree Swarna	4.68	0.124	1.39	59.60	92.91	182
Sree Jaya	4.74	0.171	1.60	76.80	178.97	124
Sree Vijaya	4.63	0.125	1.64	70.60	81.26	277
Kalpaka	4.53	0.136	1.69	70.00	53.78	301
Vellayani Hraswa	4.33	0.214	1.72	82.10	68.66	253
Sree Pavithra	4.71	0.144	1.67	90.40	101.49	98
Sree Visakham	5.02	0.058	1.57	78.40	93.93	95
CR-24-4	4.80	0.091	1.44	85.20	74.72	146
M-4	4.63	0.079	1.53	118.60	91.96	95
CD (0.05)	NS	NS	NS	NS	NS	124.30

Udaipur

Evaluation of response of different varieties of maize and wheat grown in maize wheat system under organic farming (Table 37.1-37.4)

Yield attributes of maize (Table 37.1): Yield attributes of maize varieties showed that variety, Pratap Hybrid Maize-3 recorded higher number of grains row/cob, grains weight/cob and test weight among maize varieties grown for grain purpose. Among sweet corn varieties, Sugar 75 produced higher yield attributes whereas, VL Amber popcorn varieties registered higher nos. of grains/row, grains weight/cob, test weight and number of cobs/plant for popcorn purpose. Navjot in local varieties showed comparative better performance of yield attributes for different types of maize and Farmers' selection in local varieties showed comparative better performance for yield and attributes.

Yield and economics of different varieties of maize (Table 37.2): Among the different maize varieties, Sugar -75 recorded significantly higher maize equivalent yield (6348 kg/ha) as compared to other varieties. In case of hybrid varieties, PHM-3 recorded significantly higher maize equivalent yield (6296 kg/ha) as compared to PQPM-1 (5833 kg/ha) and PM-9 (4462 kg/ha). Among sweet corn varieties, sugar-75 gave significantly higher maize equivalent yield (6348 kg/ha) as compared to Misthy (5972 kg/ha) and Madhula variety (5621kg/ha). In case of baby corn varieties, PM-3 recorded higher maize equivalent yield (5183 kg/ha) as compared to PM-5 variety (3887 kg/ha). Among popcorn varieties, VL- Amber observed significantly higher maize equivalent yield (2926 kg/ha) as compared to Amber popcorn (1633kg/ha).

Among different maize varieties, Pratap Hybrid Maize-3 recorded significantly higher gross return (Rs.140335/ha) and net return (Rs. 84465/ha) as compared to other varieties. In case of hybrid varieties, PHM-3 recorded significantly higher gross and net return (Rs. 140335 and Rs.84465/ha, respectively) as compared to PM-9 but it was at par with PQPM-1 (Rs. 126556 and Rs.70686/ha). Among the sweet corn, sugar-75 recorded significantly higher gross and net return (Rs.124013 and Rs.45193/ha). In case of baby

Table No. 37.1: Evaluation of response of different varieties of maize on yield attributes and yield at Udaipur

Varieties	Number of cobs per plant	Number of grain rows per cob	Number of grains per cob	Weight of grain per cob (g)	Test weight (g)	Economic yield (kg/ha)	Fodder yield (kg/ha)
Maize (Grain)							
Pratap QPM Hybrid – 1	2.0	14.0	470.7	87.8	186.7	5831	7659
PM – 9	1.7	12.7	368.7	66.6	181.0	4462	6800
Pratap Hybrid Maize – 3	1.7	14.7	354.0	94.5	266.7	6296	9000
Sweet corn							
Sugar 75	2.0	15.3	406.7	37.2	91.7	4333	5647
Madhula	1.7	13.3	287.3	14.1	49.0	3833	3687
Misty	1.0	14.0	375.3	23.6	62.7	4072	4693
Baby corn							
PM- 3	2.33	NA	NA	NA	NA	1851	2662
PM- 5	1.33	NA	NA	NA	NA	1388	2412
Pop corn							
VL Amber	1.7	13.3	427.3	61.5	148.7	2926	3777
Amber	1.0	11.3	320.3	23.0	72.0	1633	3367
Local varieties							
Navjot	1.3	12.0	288.0	52.9	183.3	3518	6667
Farmers selection	2.0	13.3	403.3	80.0	198.3	5425	7733
CD at 5 %	0.7	2.1	47.5	9.7	8.8	736	835

Table 37.2: maize equivalent yield and economics of different varieties of maize grown under organic farming at Udaipur

Varieties	Maize equivalent yield (kg/ha)	Gross return (Rs/ha)	Net return (Rs/ha)	B:C ratio
Maize (Grain)				
Pratap QPM Hybrid – 1	5833	126556	70686	2.27
PM – 9	4462	101615	45745	1.82
Pratap Hybrid Maize – 3	6296	140335	84465	2.51
Sweet corn				
Sugar 75	6348	124013	45193	1.57
Madhula	5621	103112	24292	1.31
Misty	5972	113511	34691	1.44
Baby corn				
PM-3	5183	91326	35706	1.64
PM-5	3.87	70601	14981	1.27
Pop corn				
VL Amber	2926	63146	8086	1.15
Amber	1633	41670	-13390	0.76
Local varieties				
Navjot	3518	86770	31450	1.57
Farmers selection	5425	120820	65500	2.18
CD at 5 %	887	12932	129.32	0.226

corn varieties, PM-3 recorded significantly higher gross and net return (Rs.91326 and Rs.35706/ha) and was at par with PM-5 (Rs.70601 and Rs.14981/ha, respectively). In case of popcorn, VL-Amber gave significantly higher gross and net return (Rs.63146 and Rs.8086/ha) as compared to Amber popcorn.

Yield attributes and yield of wheat (Table 37.3): In organic management practices, 12 wheat varieties were grown. Among them, variety HI- 8713 recorded significantly higher number of grains/ear (54.7) and number of spikelet/ear (19.7) as compared to other wheat varieties but it was at par with HI-8627, HI-8663,

Table 37.3: Yield attributes of wheat varieties grown under organic farming at Udaipur

Varieties	Number of spikelets / ear	Ear length (cm)	Number of grains/ear	Test weight (g)	Grain yield (q/ha)	Straw yield (q/ha)	Harvest index (%)
			Triticum aestivum				
HI-1531	19.3	7.4	48.3	47.3	4296	8481	0.34
MP-3288	17.3	10.4	52.3	45.8	4815	6852	0.42
Raj-3765	19.0	9.2	46.0	48.5	4111	7556	0.37
Raj-4037	13.7	7.3	35.3	52.3	4407	8000	0.36
Raj-4120	13.3	8.4	42.0	50.0	3741	8111	0.32
			Triticum durum				
HI-8627	17.0	7.4	50.7	57.3	4648	9056	0.36
HI-8663	18.0	6.7	48.3	51.0	5185	8148	0.39
HI-8713	19.7	7.3	54.7	57.7	6796	10426	0.40
MPO-1215	16.3	7.0	41.7	58.7	4500	6611	0.41
HI-1500	16.7	8.1	40.0	45.7	3537	7574	0.32
			Wheat (Local)				
Lok-1	13.7	7.6	31.7	43.7	3704	7037	0.37
C-306	15.3	10.0	44.3	49.3	4278	7981	0.36
CD at 5 %	3.1	0.2	6.8	3.4	1316	3569	0.149

Table 37.4: Yield and economics of wheat varieties under organic farming at Udaipur

Varieties	Gross return (Rs ha^{-1})	Net return (Rs ha^{-1})	B:C Ratio
		Triticum aestivum	
HI-1531	163552	117816	2.58
MP-3288	169759	124023	2.71
Raj-3765	153644	107908	2.36
Raj-4037	164207	118471	2.59
Raj-4120	146107	100371	2.19
		Triticum duram	
HI-8627	185628	139892	3.06
HI-8663	197111	151375	3.31
HI-8713	257061	211325	4.62
MPO-1215	168717	122981	2.69
HI-1500	144739	99003	2.16
		Wheat (Local)	
Lok-1	139593	93857	2.05
C-306	160483	114747	2.51
SEm ±	10683	10682	0.234
CD at 5 %	31331	31331	0.685
C.V	6.02	8.21	8.21

HI-1531 and MP-3288. In case of Triticum aestivum varieties, significantly higher number of grains/ear and ear length was recorded in MP-3288 (52.3 and 10.4 cm, respectively) as compared to Raj-4037 and Raj-4120 but it was at par with HI-1531 (48.3 and 7.4 cm, respectively). In case of Triticum durum, HI-8713 recorded significantly higher number of grains/ear and number of spikelet/ear (54.7 and 19.7) as compared to MPO-1215 and HI-1500 and it was at par with HI-8627 (50.7 and 17.0, respectively). Among local wheat varieties, C-306 recorded significantly higher number of grains/ear and ear length (44.3 and 15.3 cm, respectively) as compared to Lok-1 (31.7 and 13.7 cm, respectively).

Among wheat varieties, HI-8713 recorded significantly higher grain yield (6796 kg/ha) and net return (Rs. 211325 ha-1) as compared to other varieties. Among Triticum aestivum varieties, variety MP-3288 recorded significantly higher grain yield (4815 kg/ha) and net return (Rs. 124023 ha-1) as compared to other wheat varieties In case of Triticum durum varieties, variety HI-8713 gave significantly higher grain yield (6796 kg/ha) and net return (Rs. 211325 ha-1) as compared to HI- 1500 (35.37 q/ha) and MPO- 1215 (4500 kg/ha) but the yield of HI-8713 was at par with HI-8663 (5185 kg/ha). In local wheat varieties, variety C-306 recorded significantly higher grain yield (4278 kg/ha) as compared to Lok-1 (3704 kg/ha).

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 (Table 38.1-38.6)

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

Four systems namely soybean-wheat, groundnut +cotton (2:1), green gram-sorghum and soybean + pigeon pea (2:1) 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 crops as influenced by land configuration and crop residue management (Table 38.1&2).

Soybean yield (1590 kg/ha) was higher in broad bed and furrow planting method with crop residue which is increased by 10.8% than conventional flat bed with residue. Groundnut and green gram during *khrif* and cotton, sorghum and pigeon pea during *rabi* recorded higher yield in conventional method of planting with crop residue of 1374, 452, 1065, 1353 and 990 kg/ha respectively. Conventional planting method produced 15.9, 11.5, 16.1 and 5.1% higher yield for groundnut, cotton, pigeon pea and green gram respectively. The wheat crop was not sown because of moisture shortage at the time of sowing after harvesting of soybean. Conventional flatbed method of planting with crop residue produced higher gross return and net monetary returns of Rs. 1,49,934 and Rs. 70,561/ha respectively) in groundnut + cotton (2:1) intercropping system followed by broad-bed and furrow (BBF) method of planting with crop residues (Rs. 1,30,832 and Rs. 48,459/ha respectively). Whereas, benefit cost ratio was found to be higher (2.18) in soybean + pigeonpea (2:1) intercropping with conventional flat method of planting with crop residue.

Physical and chemical properties of soil as influenced by land configuration and crop residue management (Table 38.3-38.5)**.**

Broad bed and furrow (BBF) method of planting with crop residues decreased bulk density to 1.18 g/cm^3 from conventional flatbed (FB) method of planting without crop residue (1.31 g/cm^3). Improvement in bulk density was found to be 11.0%. 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 furrow method of planting without

38.1: 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 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	
Soybean-wheat	1590	1053	1435	1016	1274	0	0	0	0	0000	1590	1053	1435	1016	1274
Groundnut + cotton (2:1)	1131	1041	1374	1185	1183	972	945	1065	955	984	1771	1679	2034	1791	1819
Green gram-sorghum	358	329	452	430	392	1118	1097	1353	1123	1173	1585	1526	1943	1683	1684
Soybean + pigeon pea (2:1)	1066	813	1004	727	903	872	658	990	853	843	2435	1845	2556	2065	2225

Table 38.2: 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	52839	35366	47813	34145	42541	42087	42087	39087	39087	40587	10752	-6721	8726	-4942	1954	1.26	0.84	1.22	0.87	1.05
Groundnut+ Cotton (2:1)	130832	123963	149934	132086	134204	82373	82373	79373	79373	80873	48459	41591	70561	52713	53331	1.59	1.50	1.89	1.66	1.66
Green gram-Sorghum	61595	59574	74742	65356	65317	61976	61976	55976	55976	58976	-381	-2401	18766	9380	6341	0.99	0.96	1.34	1.17	1.12
Soybean + pigeon pea (2:1)	84849	64412	89452	72842	77889	44067	44067	41067	41067	42567	40782	20345	48385	31775	35322	1.93	1.46	2.18	1.77	1.84

Table 38.3: Soil physical and chemical properties as influenced by land configuration and crop residues management

	Bulk density (g/cc)					pH					Electrical conductivity (dS/m)					Organic carbon (g/kg)				
	Broad bed and furrow		Conventional flatbed			Broad bed and furrow		Conventional flatbed			Broad bed and furrow		Conventional flatbed			Broad bed and furrow		Conventional flatbed		
	with crop residues	without crop residues	with crop residues	without crop residues	Mean	with crop residues	without crop residues	with crop residues	without crop residues	Mean	with crop residues	without crop residues	with crop residues	without crop residues	Mean	with crop residues	without crop residues	with crop residues	without crop residues	Mean
Soybean-Wheat	1.16	1.27	1.20	1.31	1.24	7.21	7.14	7.19	7.18	7.18	0.22	0.20	0.21	0.18	0.20	7.20	6.47	7.07	6.30	6.76
Groundnut+ Cotton (2:1)	1.17	1.25	1.22	1.33	1.24	7.19	7.18	7.19	7.16	7.19	0.22	0.22	0.21	0.19	0.21	7.07	6.43	6.93	6.33	6.69
Green gram-Sorghum	1.18	1.28	1.23	1.30	1.25	7.20	7.15	7.19	7.16	7.18	0.20	0.20	0.20	0.17	0.19	7.10	6.53	6.90	6.23	6.69
Soybean + pigeon pea (2:1)	1.19	1.29	1.21	1.28	1.24	7.18	7.15	7.17	7.17	7.17	0.22	0.19	0.20	0.19	0.20	7.13	6.50	6.80	6.37	6.70
Mean	1.18	1.27	1.21	1.31	1.24	7.20	7.19	7.16	7.17	7.18	0.22	0.20	0.21	0.18	0.20	7.13	6.48	6.93	6.31	6.71
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 0.20	CS NS	LCRM NS	X CS	

Table 38.4: 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 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	
Soybean-wheat	300.3	284.1	291.6	273.6	287.4	31.3	29.4	31.5	28.0	30.0	396.1	392.5	387.4	386.4	390.6
Groundnut +cotton (2:1)	299.3	282.5	293.0	270.8	286.4	32.2	28.8	31.8	27.9	30.2	396.7	393.7	395.6	387.3	393.4
Green gram-sorghum	295.6	282.7	293.3	247.0	286.4	32.0	29.7	30.5	26.6	29.7	399.7	387.1	390.9	389.4	391.8
Soybean +pigeon pea (2:1)	293.9	279.4	289.0	277.8	285.0	32.9	29.0	31.2	28.4	30.3	396.7	387.1	394.0	396.2	392.5
Mean	297.3	282.2	291.7	274.1	286.3	32.1	29.2	31.2	27.7	30.1	397.3	390.1	392.0	389.8	392.3
CD (P=0.05)	LCRM	CS	LCRM	X CS		LCRM	CS	LCRM	X CS		LCRM	CS	LCRM	X CS	
	3.76	NS	NS			2.60	NS	NS			6.96	NS	NS		

Table 38.5: 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	1.68	1.52	1.58	1.49	1.57	14.31	12.96	13.40	12.37	13.26	9.91	9.58	10.00	9.30	9.70	0.96	0.86	0.95	0.75	0.88
Groundnut+ Cotton (2:1)	1.70	1.56	1.61	1.48	1.58	13.97	12.85	13.22	11.76	12.95	10.18	9.62	9.91	9.49	9.80	1.00	0.95	0.93	0.76	0.91
Green gram -Sorghum	1.73	1.55	1.56	1.52	1.59	14.14	12.77	13.40	11.05	12.84	10.38	9.69	9.66	9.44	9.79	1.01	0.83	0.91	0.77	0.88
Soybean + pigeon pea (2:1)	1.71	1.54	1.53	1.53	1.58	14.46	12.67	13.51	12.08	13.18	10.30	9.42	9.58	9.49	9.43	0.94	0.82	0.97	0.78	0.89
Mean	1.71	1.54	1.57	1.51	1.58	14.22	12.81	13.38	11.82	13.06	10.19	9.58	9.79	9.43	9.75					
CD (P=0.05)	LCRM 0.05	CS NS	LCRM NS	X CS		LCRM 055	CS NS	LCRM NS	X CS		LCRM 0.35	CS NS	LCRM NS	X CS		LCRM 0.06	CS NS	LCRM NS	X CS	

Table 38.6: 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	107.6	68.0	68.9	50.3	73.7	6.2	8.2	4.0	8.7	6.8	42.7	41.9	38.7	23.0	36.6	37.1	12.0	27.6	12.7	22.3
Groundnut+ Cotton (2:1)	68.2	50.8	77.5	63.7	65.0	7.8	7.4	7.1	4.9	6.8	54.8	32.7	43.1	37.7	42.1	28.9	9.4	13.7	25.4	19.4
Green gram -Sorghum	60.8	54.3	52.2	44.5	52.9	10.5	9.7	5.7	6.3	8.0	42.8	34.9	36.2	29.9	35.9	26.2	18.7	27.2	23.7	23.9
Soybean + pigeon pea (2:1)	76.2	58.5	47.0	37.4	54.8	13.5	5.3	7.2	8.0	7.0	45.2	28.2	34.5	23.8	32.9	12.9	17.5	29.1	22.0	20.4
Mean	78.2	57.9	61.4	49.0		9.5	7.7	6.0	7.0		46.4	34.4	38.4	28.6		26.3	14.4	24.4	20.9	

crop residue (6.47 g/kg) to broad bed furrow method of planting with crop residue (7.20 g/kg). The available N, and P_2O_5 increased significantly from 277.79 and 27.97 kg/ha with conventional flatbed method of planting without crop residue to 300.27 and 32.86 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 (300.27 kg/ha). All these nutrients were unaffected by cropping system. The available micronutrients namely, Cu, Mn, Fe and Zn increased significantly higher from 1.73, 14.46, 10.38 and 1.01 mg/kg with broad bad and furrow method of planting Without crop residue to 1.56, 12.96, 9.69 and 0.95 mg/kg, respectively with conventional flatbed method of planting with crop residue. The cropping systems were not affected significantly.

Microbial population as influenced by land configuration and crop residue management (Table 38.6).

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 (73.70 $x10^6$ cfu/g), fungal population (8.03 $x10^4$ cfu/g), population of actinomycetes (42.05$x10^3$ cfu/g) and P-solubilizing microorganism (23.94 $x10^6$ cfu/g), activity as compared to other land configurations. The differences in population of microorganisms and microbial activity between cropping systems were marginal.

Pantnagar

Resource conservation techniques in different crops and cropping systems under organic cultivation (Table 39.1-39.6)

Yield, yield attributes and harvest index of paddy (Table 39.1): 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 (104 cm) was attained in SRI-wheat –*sesbania* cropping system, and was found *at par* with basmati rice-wheat-sesbania in raised bed system. Significantly higher number of effective tillers/m2 and grain wt./panicle (263 & 2.02g, respectively) were recorded under basmati rice-wheat-sesbania compared to all other resource conservation technologies, however, number of effective tillers in basmati rice-wheat-sesbania was at par with DSR-wheat-moong on broad bed and furrow system and grain weight per panicle in Basmati rice-wheat-sesbania was at par with SRI-wheat-sesbania system. 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. Basmati rice-wheat-sesbania system recorded significantly higher basmati rice grain yield (4107 kg/ha) over all other resource conservation treatments, and was at par with SRI-wheat-sesbania treatment.

Straw yield was also significantly higher under basmati rice-wheat-sesbania (4525 kg/ha) and was at par with DSR- wheat (ZT)- sesbania and DSR + Soybean-vegetable pea + mustard resource conservation treatments. Higher harvest index (53.3) was obtained with DSR + soybean-vegetable Pea + mustard on furrow in raised bed system over all other resource conservation treatments.

Nutrient uptake in rice crop (Table 39.2): Significantly higher nitrogen uptake (76.3 kg/ha) was recorded in DSR- wheat (ZT) –Sesbania which was at par with Basmati rice-Wheat-Sesbania, Significantly higher phosphorus (20.10 kg/ha), potassium uptake (65.4 kg/ha) and sulphur uptake (28.8 kg/ha) in basmati rice was recorded with Basmati rice-wheat – Sesbania. However, N uptake (76.3 kg/ha) was significantly higher in DSR- wheat (ZT) –Sesbania which was at par with Basmati rice-Wheat-Sesbania. Phosphorus and potassium uptake in Basmati rice-

Table 39.1: Yield attributes and yield of rice as influenced by different resource conservation practice

Treatments	Plant height (cm)	Effective tillers /m2	1000 -grains wt. (g)	Grain yield (kg/ha)	Straw yield (kg/ha)	Harvest Index
Basmati rice-wheat-*sesbania*	98	263	21.8	4107	4525	52.4
SRI-wheat- *sesbania*	104	255	21.8	3798	4204	52.5
DSR-wheat(Zero tillage) –*sesbania*	97	255	21.6	3759	3996	51.3
DSR-wheat-moong on broad bed and furrow	89	257	22.2	2828	2963	51.1
DSR-vegetable pea -cowpea on broad bed and furrow	91	255	21.1	3086	3153	50.5
DSR-chickpea–moong on broad bed and furrow	90	251	21.4	3126	3335	51.6
FIRB: DSR+ soybean -vegetable pea+ mustard	91	251	21.3	3456	4000	53.3
FIRB: rice +pigeon pea-cowpea +okra	88	253	21.5	3072	3247	51.4
CD(P=0.05)	3.79	6.49	0.53	321	671	NS

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

Table 39.2: 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	75.6	20.1	65.4	28.8
SRI-wheat- sesbania	70.1	18.3	57.8	26.9
DSR-wheat(Zero tillage) –sesbania	76.3	17.8	55.9	28.3
DSR-wheat-moong on broad bed and furrow	49.2	12.6	41.6	19.0
DSR-vegetable pea -cowpea on broad bed and furrow	52.8	14.1	42.0	21.6
DSR-chickpea–moong on broad bed and furrow	55.4	14.2	45.6	21.2
FIRB: DSR+ soybean -vegetable pea+ mustard	61.8	15.8	51.3	24.9
FIRB: rice +pigeon pea-cowpea +okra	54.5	13.6	43.8	20.1
CD(P=0.05)	5.74	1.93	7.59	2.99

DSR wheat (ZT)-sesbania

DSR + soybean + vegetable pea + mustard

Table 39.3: 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 weight of wheat and 100 seeds weight of veg. pea and cowpea
Basmati rice-wheat-sesbania	92.0	273	38.0	47.0
SRI-wheat- sesbania	90.0	225	36.4	46.1
DSR-wheat(Zero tillage) –sesbania	91.0	246	33.0	46.6
DSR-wheat-moong on broad bed and furrow	89.0	237	37.7	46.5
DSR-vegetable pea -cowpea on broad bed and furrow	79.0	19	6.1	50.7
DSR-chickpea–moong on broad bed and furrow	90.0	47	2.0	30.6
FIRB: DSR+ soybean -vegetable pea+ mustard	77.0	20	6.0	53.3
FIRB: rice +pigeon pea-cowpea +okra	-	-	-	-
CD(P=0.05)	-			

wheat- Sesbania was at par with SRI- wheat- Sesbania resource conservation treatments. While S uptake by basmati rice under Basmati rice- wheat –Sesbania was at par with SRI-wheat-Sesbania and DSR-Wheat (ZT)-Sesbania resource conservation treatments.

Yield and Yield attributes of *rabi* crops (Table 39.3 & 4): Maximum plant height (92.0 cm), spikes/m^2 (273), no. of pod/plant (38) and test weight (47.0 g) was attained under basmati rice-wheat-sesbania DSR-wheat (ZT)-*sesbania* resource conservation practices. Maximum grain yield of wheat (3953 kg/ha) was recorded in Basmati rice- wheat- *sesbania* while lowest grain yield (3245 kg/ha) was observed in DSR-wheat-(ZT)–*sesbania*. Green pod yield of vegetable pea was found to be higher (7748 kg/ha) in DSR+ soybean-vegetable pea+ mustard system as compared to in DSR-vegetable pea-cowpea on broad bed and furrow (7304 kg/ha). Chickpea yield recorded under DSR-chickpea-moong on broad-bed and furrow system (1662 kg/ha). Higher grain yield coriander (422 kg/ha) was recorded under DSR-vegetable pea-cowpea on broad bed and furrow which was at par with DSR-chickpea-moong on broad-bed and furrow system (386 kg/ha). Mustard grain yield (222 kg/ha).

System productivity and economics (Table 39.5): Maximum net returns (Rs.17,55,283 /ha) and system productivity (9098 kg/ha) was recorded in (FIRB) Rice + pigeon pea-cowpea + okra 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. 69,194 /ha) and B: C ratio (1.0), 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 (9098 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 (8944 kg/ha).

Soil nutrient status (Table 39.6): Nutritional status of soil after completion of one crop cycle in terms of organic carbon, available N, P, K and S were significantly influenced by resource conservation practices. Significantly higher organic carbon was analyzed in DSR-wheat-moong on broad bed and furrow system which was at par with that of under DSR-vegetable pea-cow pea on broad bed and furrow

Table 39.4: 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	3953	-	-	-	-
SRI-wheat- sesbania	3803	-	-	-	-
DSR-wheat(Zero tillage) –sesbania	3245	-	-	-	-
DSR-wheat-moong on broad bed and furrow	3557	-	-	-	-
DSR-vegetable pea -cowpea on broad bed and furrow	-	7304	-	422	-
DSR-chickpea–moong on broad bed and furrow	-	-	1662	386	-
FIRB: DSR+ soybean -vegetable pea+ mustard	-	7748	-	-	222
FIRB: rice +pigeon pea-cowpea +okra	1107	-	-	-	-

Table 39.5: 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	7120	66425	111577	1.68
SRI-wheat- sesbania	6697	62195	105229	1.69
DSR-wheat (zero tillage) –sesbania	6233	53745	102062	1.90
DSR-wheat-moong on broad bed and furrow	5539	69290	69194	1.00
DSR-veg. pea -cowpea on broad bed and furrow	7469	66480	120247	1.81
DSR-chickpea–moong on broad bed and furrow	8944	52225	171380	3.28
FIRB:DSR+ soybean-vegetable pea+ mustard	9098	52175	175283	3.36
FIRB: rice +pigeon pea-cowpea +okra	5519	24860	113117	4.55
CD (P=0.05)	379.4			

Table 39.6: 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	1.22	349	35.1	201	22.5
SRI-wheat- sesbania	1.20	370	31.7	225	37.2
DSR-wheat (Zero tillage) –sesbania	1.31	360	42.8	236	27.2
DSR-wheat-moong on broad bed and furrow	1.39	358	32.0	210	34.3
DSR-veg. pea -cowpea on broad bed and furrow	1.33	370	30.5	250	31.0
DSR-chickpea–moong on broad bed and furrow	1.32	382	33.3	258	25.9
FIRB:DSR+ soybean-vegetable pea+ mustard	1.20	332	28.8	220	28.0
FIRB: rice +pigeon pea-cowpea +okra	1.11	340	37.0	260	25.5
CD (P=0.05)	0.06	28.4	3.76	14.03	5.4

system. However, available N ranged from 332 to 382 kg/ha, significantly higher available N being observed in DSR-chickpea-moong on broad –bed and furrow system which was at par with SRI-wheat-sesbania, dsr-wheat(ZT)-sesbania, DSR-wheat-moong on broad bed and furrow system and DSR-vegetable pea-cowpea on broad bed and furrow system resource conservation practices. Available phosphorus after completion of one crop cycle ranged from 31.7 to 42.8 kg/ha, maximum availability being observed in DSR-wheat (zero tillage) - sesbania. Availability of K, however, was significantly higher (260 kg/ha) under DSR-wheat (ZT)-sesbania which was at par with DSR-vegetable pea - cowpea on BBF System and DSR-chickpea– moong on BBF resource conservation treatments. However, Availability of sulphur was significantly higher in SRI-wheat- sesbania which was at par with DSR-wheat-moong on BBF system resource conservation practices.

Umiam: (Table 40.1-40.3)

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.

Growth parameters and yield of rice on sunken bed (Table 40.1): Among the rice varieties, the highest plant height was recorded in Vivek-Dhan-82 (95.20 cm) which was followed by Shahsarang-1 (81.2 cm) and IR 64 (75.9 cm) while variety Lampnah (74.6 cm) recorded the shortest plants. Tillers per square meter was recorded maximum in Shahsarang-1 (327) followed by Lampnah (251) and IR 64 (255). The lowest numbers of tillers were recorded in Vivek Dhan-82 (233). 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 3700 to 4700 kg/ha under different sequences with mean productivity of 4170 kg/ha and 4060 kg/ha under rice-lentil and rice-

Harvested potato crop on raised bed

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

Table: 40.1: Growth parameters and yield (kg/ha) *Kharif* and *rabi* crops on sunken beds

Cropping sequence	*Kharif*		*Rabi*			REY (kg/ha)
	Plant height (cm)	Tiller/m2 nos.	Panicle/m2 nos.	Rice yield	Lentil &Pea yield	
Rice (IR-64) - lentil	75.9	255	241	3960	1130	7630
Rice (VD-82) -lentil	95.2	233	216	3700	1200	7560
Rice (Shahsarang-1) -lentil	82.1	327	275	4700	1140	8530
Rice (Lampnah)-lentil	74.6	251	249	4330	1070	8030
Mean	81.93	266.50	245.50	4170	1130	7940
Rice (IR-64) - Pea	75.40	261.33	234.00	3740	4520	12740
Rice (VD-82) -Pea	97.60	218.00	209.00	3480	4840	13180
Rice (Shahsarang-1) -pea	83.33	314.33	310.33	4680	4270	13140
Rice (Lampnah) -pea	76.00	254.33	241.33	4350	4270	13310
Mean	83.08	262.00	248.67	4060	4520	13090

Table 40.2: 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	18200	8900	27300
French bean- okra	12100	9900	29300
Carrot- okra	22700	8800	30700
Mean	17600	9200	29100

pea cropping system, respectively. Among the rice varieties, Shahsarang-1 recorded the highest grain yield (4700 kg/ha) under rice-lentil cropping sequence. Higher yield of lentil was recorded with rice variety (Vivek dhan-82) of 1200 kg/ha among rice-lentil system whereas, pea yield (4840 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 (13310 kg/ha) followed by rice (VD-82) –pea 13180 kg/ha. Among rice lentil system, rice (Shahsarang-1)–lentil system recorded highest rice equivalent yield of 8530 kg/ha.

Yield of vegetables on raised-bed: Potato, French bean and carrot recorded yield on raised bed of 18200, 12100 and 22700 kg/ha respectively. The yield of okra during *kharif* season ranged from 8800 to 9900 kg/ha and was higher with frenchbean (9900 kg/ha) in the system whereas, rice equivalent yield was recorded higher under carrot–okra cropping system (30700 kg/ha).

Physico-chemical properties of soil: French bean-okra cropping sequence recorded higher soil pH (5.22), soil organic carbon (2.41%), available nitrogen (275.5 kg/ha), phosphorus (26.1 kg/ha) and potassium (266.6 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 (5.20), OC (2.80%), available nitrogen (273.8 kg/ha), phosphorus (26.9 kg/ha) and (271.2 kg/ha) whereas, among cropping system, rice-pea system, rice (Shahsarang-1)-pea cropping sequence also recorded maximum pH, OC, N, P and K of 5.19, 2.80%, 274.7,26.2 and 270.1 kg/ha respectively.

Table 40.3: 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	5.18	2.25	256.8	22.6	263.5
French bean- Okra	5.22	2.41	275.5	26.1	266.6
Carrot- Okra	5.17	2.27	270.0	23.4	263.6
Mean	5.19	2.3	267.5	24.0	264.6
Sunken bed					
Rice (IR-64) - Lentil	5.17	2.74	267.3	25.2	268.9
Rice (VD-82) -Lentil	5.21	2.78	268.5	26.3	269.4
Rice (Shahsarang-1) -Lentil	5.22	2.85	283.6	28.3	273.9
Rice (Lampnah) -Lentil	5.21	2.82	275.7	28.0	272.4
Mean	5.20	2.8	273.8	26.9	271.2
Rice (IR-64) - Pea	5.13	2.75	267.9	24.3	266.9
Rice (VD-82) -Pea	5.14	2.83	270.9	25.5	269.2
Rice (Shahsarang-1) -Pea	5.25	2.85	284.1	27.6	272.5
Rice (Lampnah) -Pea	5.24	2.82	275.8	27.5	271.8
Mean	5.19	2.8	274.7	26.2	270.1

7.5: Development of Integrated Organic Farming System models

Objectives

- 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 plot with spices, fodder and vegetables combination was established at Chelavoor farm. The crops pepper, turmeric, fodder grasses (congo signal grass, CO-3, CO-4), tapioca, banana, cowpea and pineapple were planted and established .Two cows and their calves are maintaining at IISR farm. Fodder grasses 700 kg; Tapioca 50 kg and vegetable cowpea 12 kg were harvested. Fodder grass fed to the cows that are maintained at IISR farm. A profit of Rs 1.08 lakhs was received from one acre integrated farming system model. The highest contribution towards the total net return by milk component of the model is 85%.

Details of income generated from IOFS model (1 acre) at Calicut

Component	Quantity (kg or L)	Price (Rs/kg or L)	Total
Turmeric	100	60	6000
Milk	3701	60	2,22,060
Vegetable cow pea	12	50	600
Tapioca	50	25	1250
Banana	60	25	1500
Cow dung	12000	2.5	30,000
Total			261410
Expenditure			
Bed making	20	60	1200
Intercropping		3000	3000
Cattle feed	7200	20	144000
Total			153000
Profit			**108410**

Coimbatore

Composition of organic farming system model (0.40 ha)

Components	Treatments/ Remarks
Crop component	
Cropping Systems:	1. Green manure - Bhendi - Maize (0.12 ha)
	2. Green manure - cotton - Redgram (0.12 ha)
	3. Fodder grass (Cumbu-Napier Co5) and desmanthus (0.10 ha)
Agro forestry	Azardhiracta indica, Melia dubia, Sesbania grandiflora, Pongamia pinnata, Gmelina arborea, Ailanthus excelsa (500 m2)
Dairy	Milch animal: 2 cows and female calves
Manure pit	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	Threshing floor, pest repellent cafetaria etc.
Border plants	Desmanthus, Banana, Coconut, Glyricidia sp.

Performance of Green manure-okra (Bhendi) - maize system:

Okra plant attained the maximum height of 68.4 cm with 1755 kg/ha of dry matter production. Fruit length of okra was 11.2 cm, numbers of fruits/plant 38.3 with yield 12,229 kg/ha was recorded in okra variety COBh 1 grown with green manure (*Daincha*) + maize system. Net return of Rs. 58,740/ha was obtained through okra under integrated organic farming model. Availability of nutrients such as nitrogen, phosphorus and potassium in soil was 238, 10.4 and 488 kg/ha at the end of cropping cycle.

Maize variety COH (M) 6 was sown in the system gave 4700 kg/ha of grain yield with 4733 kg/ha of straw yield. Organic carbon of 0.50% was recorded in maize plot along with residual nutrient availability of

Table 41.1. Plant height, dry matter, soil fertility status and yield and economics of okra under IOFS

Particulars (at harvest)	Okra
Plant growth parameters	
Plant height (cm)	68.4
DMP (kg/ha)	1755
Soil nutrient status	
Organic carbon (%)	0.57
N (kg/ha)	238
P (kg/ha)	10.4
K (kg/ha)	488
Yield parameters	
Fruit length (cm)	11.2
Fruit girth (cm)	4.5
No. of fruits plant-1	38.3
Fruit weight (g fruit-1)	14.5
Fruit yield ((kg/ha))	12229

Table 41.2. Plant height, dry matter, soil fertility, yield of maize under IOFS

Particulars (at harvest)	Maize
Plant growth parameters	
Plant height (cm)	263
DMP (kg ha-1)	7610
Soil nutrient status	
Organic carbon (%)	0.5
N (kg/ha)	265
P (kg/ha)	11.4
K (kg/ha)	480
Yield parameters	
No. of rows cob-1	13.5
No. of grains row-1	34.2
100 Seed wt. (g)	27.1
Grain yield ((kg/ha))	4700
Straw yield ((kg/ha))	4733

Table 41.3. Plant height, dry matter, soil fertility, yield and economics of cotton under IOFS

Particulars	Cotton
Plant growth parameters	
Plant height (cm)	73.3
DMP (kg ha-1)	3622
Soil nutrient status	
Organic carbon (%)	0.6
N (kg/ha)	268
P (kg/ha)	10.2
K (kg/ha)	475
Yield parameters	
No of sympodial branches	15.6
No of bolls per plant	7.43
Seed cotton yield (kg/ha)	1385

nitrogen, phosphorus and potassium of 265.0, 11.2 and 480 kg/ha respectively. Maize recorded the net income of Rs. 41,370/ ha under integrated organic farming model.

Performance of green manure - cotton – red gram (0.12 ha)

Cotton recorded 3622 kg/ha of dry matter production at the stage of harvest with maximum height of 73.3 cm. Number of sympodial branches recorded in cotton of 15.6 with 7.43 bolls/plant resulted 1385 kg/ha Seed cotton yield. Net return of Rs. 27,475/ha was recorded in the model.

IOFS model is comprised of different components viz., Crops (0.24 ha), green fodder crops (0.15 ha), boundary plantation, dairy and vermi-compost (0.01 ha).

Total net profit of ₹14098 was received by crop

Table 41.4. Economics 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)
1. Geen manure-Bhendi -Maize	0.12	Green manure	250t/ha /year (5 cuttings)			
		Bhendi	12,229	63,550	1,22,290	58,740
		Maize	4700	31,480	70,500	41,370
2. Green manure - Cotton - Redgram	0.12	Green manure	250 t/ha/year			
		Cotton Redgram	1385	34,850	62,325	27,475
3. Fodder grass	0.10	Cumbu napier and desmathus	45t/ha/year (4 cuttings)	Used as feed for dairy unit		
4.Dairy unit		Malik yield (Lt/year)	2805.35			

Sardarkrushinagar:

Composition of integrated organic farming systems model

Farming system components	Net Area (ha)
Crops: Groundnut-Potato-Pearlmillet	0.24
Green Fodder : F.Bajara- F. Maize+F.Oat- F.Bajara	0.15
Livestock + Vermicompost	0.01
Boundary Plantation	-
Total	0.40

component from 0.24 ha area and ₹12141 was received by fodder unit (0.15 ha.). Construction of animal shed and purchases of animals is under process. Ardusa, napier grass and lemon grass have been planted around the border and bunds. Total net profit from all the components of IOFS Model during 2016-17 was ₹ 26,239 from 0.4 ha area.

Table 42: Yield (kg/ha) and economics (Rs./ha) of integrated organic farming systems model (0.04 ha) at Sardarkrushinagar

S.N.	Farming system components	Total Area (ha)	Ground nut Equivalent Yield (kg)	Gross Return (₹)	Cost(₹)	Net Returns (₹)
1	Crops: Groundnut-Wheat-Green gram	0.24	1328	53115	39017	14098
2	Green Fodder : F. Bajra- F. Maize + Oat- F. Bajra	0.15	1170	46800	34659	12141
3	Livestock + Vermicompost	0.01	Construction of animal shed and purchases of animals is awaited due to unavailability of grant			
4	Boundary Plantation	-	-	-	-	-
Total	0.40	1328	99915	73676	26239	

Udaipur

Development of integrated Organic Farming System Model for Southern Rajasthan: An integrated 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 + cowpea during kharif and berseem in rabi and sesbania green manuring during zaid), vegetables in 0.10 ha (tomato and cowpea), fruit crop in 0.04 ha (guava) and compost unit in 0.01 ha were evaluated during 2016-17. The total maize equivalent yield of 4213 kg/ha and a net return of Rs. 20539 /ha was obtained from the farming system model during 2016-17.

Sweet corn variety Sugar- 75

Experimental site

Table 43.1: Yield and economics of different components of IOFS at Udaipur

Farming System components	Total area (ha)	Actual yield (kg)	Maize equivalent yield (kg)	Cost of cultivation (Rs)	Gross return (Rs)	Net return (Rs/ha)	Net return per rupee invested
Crops							
Sweet corn + black gram (*kharif*)	0.25	392.5	1377 (49.5)**	12322	20655	8433	0.40
Wheat (*rabi*)		661	1256	8650	18840	10190	1.18
Fodder							
Fodder maize + Cowpea (*kharif*)	0.05	1580	1580 (243)	6142	8058	1916	0.31
Berseem (*rabi*)		-	-	-	-	-	-
Sesbania (*zayad*)		1610	Used as green manuring				
Vegetables							
Tomato (*kharif*)	0.10	-	-	-	-	-	-
Cowpea (*zayad*)		-	-	-	-	-	-
Fruits							
Papaya	0.04	N. A.	N. A.	N. A.	N. A.	N. A.	N. A.
Compost Unit							
NADEP compost	0.01	4000	-	-	-	-	-
Vermi-compost		1900	-	-	-	-	-
Compost		7000	-	-	-	-	-
Vermi-wash		400	-	-	-	-	-
BD 500		700 g	-	-	-	-	-
BD 501		800 g	-	-	-	-	-
Earthworms		22	-	-	-	-	-
Total		19065.5	4213	27114	47553	20539	1.89

***Figure in parenthesis indicate actual yield of intercrop.*
N.A.: Not applicable as papaya growth was stunted due to soil factors

Table 43.2 :Productivity & net return from IOFS model at Udaipur

Farming System components		**Maize equivalent yield (kg)**			**Net returns (Rs/ha)**			
Crops	2015-16	2016-17	Mean	2015-16	2016-17	Mean		
Kharif	Sweet corn + Blackgram	906.73						
(61.5)*	1377							
(49.5)	1141.86	8568.25	8433	8500.62				
Rabi	Wheat	1562	1256	1409	17851	10190	14020.5	
Fodder								
Kharif	Fodder Maize + Cowpea	1350						
(250)	1580							
(243)	1465	1693	1916	1804.5				
Rabi	Berseem	704	N.A.	704	6910	N.A.	6910	
Zaid	Sesbania			Used as green manuring				
Vegetable								
Kharif	Tomato	590	N.A.	590	6950	N.A.	6950	
Zaid	Cowpea	42	N.A.	42	1230	N.A.	1230	
Fruits	Papaya, Guava	N.A.						
Compost unit								
	Output (kg)							
	2015	2016						
NADEP compost	4000	5000	N.A.	N.A.	N.A.	N.A.	N.A.	N.A.
Vermicompost	543	1900	N.A.	N.A.	N.A.	N.A.	N.A.	N.A.
Enriched Compost	645	950	N.A.	N.A.	N.A.	N.A.	N.A.	N.A.
Vermiwash	400 lit.	550 lit	N.A.	N.A.	N.A.	N.A.	N.A.	N.A.
BD 500	0.700	1.2	N.A.	N.A.	N.A.	N.A.	N.A.	N.A.
BD 501	0.520	1.1	N.A.	N.A.	N.A.	N.A.	N.A.	N.A.
Earthworms	34	22	N.A.	N.A.	N.A.	N.A.	N.A.	N.A.
Total	5623	8424	5155	4213	4684	43202	20539	31871

** Data in parenthesis indicate the actual yield of crop.*

T. aestivum variety Raj-4120

Green manure crop (*Sesbania rostrata*)

Sweet corn + blackgram (2:2)

Aestivum variety Raj-4120

Crops components in IOFS model at Udaipur

Panchgavya

Vermiwash production

Beejamrut

Jeevamrut

Earthworm Production

Different types of compost

Components of integrated farming system model under NPOF at Udaipur

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 m2 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 of Rs. 57,588/- per year under the IOFS model with an area of 0.43 ha. Maximum expenditure was incurred in crop component of the model with 47.21% of the total cost of cultivation. Dairy unit with one adult cow and one calf registered 37.09 % of the total cost of cultivation, while fishery component recorded 8.52 % of the total cost of cultivation. For maintaining vermicomposting unit of 72 m2 area and other important operations like hedgerow planting, residue recycling, rock phosphate application and liming, the expenditure was incurred of Rs. 4120/- which account to 7.15 % of the total cost. A total net return of Rs. 73,005/- 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 (66.84%) followed by dairy (23.37%) and fishery component (15.91%). The fish production was 136 kg.

For 0.43 ha area, the total nutrient requirement for organic crop production has been estimated at nitrogen (N)-65.44 kg, phosphorus (P_2O_5)- 23.37 kg and potassium (K_2O)-54.42 kg. On farm nutrient recycling in IFOS could produce an amount of 62.41 kg N, 19.19 kg $P_2O_5$and 54.05 K_2O. Hence, 95.4% of the total N requirement, 82.1% of the total P_2O_5 requirement and total K_2O requirement could be met within the model itself and only 4.6% of the total N requirement, 17.9 % 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.

Table 45: Economics of the IOFS model (area=0.43 ha)

Farming System components	Total area(ha)	Rice Equivalent Yield (t/ha)	Cost (Rs)	Net returns (Rs)	Net return (Rs/ha)
Crops (Cereals, pulses, oilseeds, vegetables, fruits and fodder crops)	0.3745	5.08	27193	48800	-
Dairy (1 milch cow + 1 calf)	0.0036	2.56	21365	17065	-
Fishery (Composite)	0.046	1.05	4910	11090	-
Nutrient cycling (Vermicompost/FYM/ Hedgerow planting/ Residue recycling/ Rock phosphate application/Liming)	0.0070	-	4120	-3950	-
Total	0.4311	8.69	57,588	73,005	1,69,346
Net income/day	-	-	-	200	463

Different vegetables and Vermicompost unit under IOFS model at Umiam

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: Modipuram 2014-15, Almora and Dharwad, 2015-16

Only Almora and Modipuram centre reported the results

Almora:

Results:

Farm wastes have been composted with different proportion of raw materials and inoculation of different microbes and earthworm. The compost yield was more than the weight of waste materials in all treatments but vermicomposting provided the highest compost yield. The composting with Pleurotus sajorcarju, Trichoderma harzianum, Aspergillus niger, biomineralizer of P and Zn, Azotobacter and PGPR enhanced 11, 32 and 119% C, N and P compared to control, respectively. Vermicomposting enhanced 6, 19 and 61% C, N and P compared to control, respectively. Addition of legume residue enhanced the nutrient composition of composts from farm waste with different technologies.

Table 45. Properties of composts from farm waste

Treatment details	Weight of waste (before composting)	Compost yield (kg)	C (%)	N (%)	P (%)
Control (CR:CDS µ) = 4:1	30 kg	52.3	28.2	1.05	0.30
Vermicompost (CR:CDS = 4:1)	30 kg	54.9	29.9	1.70	0.35
Vermicompost (CR:CDS:LR = 3:1:1)	30 kg	53.2	30.2	2.15	0.39
CR:CDS = 4:1 + *Pleurotos sajorcaju* + *Trichoderma harzianum*	30 kg	52.0	30.7	2.08	0.37
CR:CDS:LR = 3:1:1 + *P. sajorcaju* + *T. harzianum*	30 kg	48.7	31.7	2.34	0.41
CR:CDS = 4:1 + *P. sajorcaju* + *T. harzianum* + **Biomineralizer* + *Aspergillus niger* + *Azotobacter spp.*	30 kg	49.3	31.5	2.31	0.39
CR:CDS:LR = 3:1:1 + *P. sajorcaju* + *T. harzianum* + *Biomineralizer* + *Aspergillus niger* + *Azotobacter spp.*	30 kg	48.0	32.3	2.46	0.44

µCR - Cereal residue; CDS - Cattle dung slurry; LR - Legume residue; *Biomineralizer = Microbial consortia of P & Zn solubilizer and PGPR

Modipuram:

Treatment details is given below

Treatments	Description
T1	Maize stover+ rice straw (3:1 ratio) + Soil+ cow dung/urine (C:N ratio 30:1)
T2	Maize stover+ rice straw (3:1 ratio) + Soil + legume/*Leucaenabiomass* + cow dung/urine (C:N ratio 30:1)
T3	Maize stover+ rice straw (3:1 ratio) pre-treated with *Trichoderma* (15 days in advance)+ Soil+ legume/*Leucaenabiomass* + cow dung/urine (C:N ratio 30:1)

T4	Maize stover+ rice straw (3:1 ratio) + Soil +cow dung/urine + TNAU *Biomineralizer*@2kg/ton residue (C:N ratio 30:1)
T5	Maize stover+ rice straw (3:1 ratio) + Soil +other farm residues + cow dung (Vermicomposting) in 2 feet high piles
T6	Maize stover+ rice straw (3:1 ratio) + Soil +legume/Leucaenabiomass + cow dung/urine + bio-enrichment at curing phase with Azotobacter, PSB, Trichodermaetc. (C:N ratio 30:1)
T7	Maize stover+ rice straw (3:1 ratio) in piles as Control

Results

Treatment maize stover+ rice straw (3:1 ratio) pre-treated with Trichoderma (15 days in advance)+ Soil+ legume/Leucaenabiomass + cow dung/urine (C:N ratio 30:1)] showed fastest decomposition within 60 days with final volume of 0.530 M3 against 0.970 M3 in control. The constant temperature (250C) near to ambient was also noticed in case of treatment 3. Least rate of decomposition was found with control (total volume of 0.970 M3 at 60 days) with higher temperature (420C) which shows the continuation of the active decomposition phase.

Table 46: Effect of different treatments on nutrient content of different residues

Treatment details	Weight of waste (before composting)	Compost yield (kg)	Cost of inputs (Rs)	N content (%)	P2O5 (%) content	K2O (%)
Maize stover + rice straw (3:1 ratio) + Soil+ cow dung/urine (C:N ratio 30:1)	3 Qtl.	1.76 Qtl.	350	0.35	0.21	0.38
Maize stover+ rice straw (3:1 ratio) + Soil + legume/Leucaena biomass + cow dung/urine (C:N ratio 30:1)	3 Qtl.	1.54 Qtl	375	0.56	0.28	0.36
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)	3 Qtl.	1.50 Qtl.	400	0.59	0.30	0.41
Maize stover+ rice straw (3:1 ratio) + Soil +cow dung/urine + TNAU Biomineralizer @2kg/ton residue (C:N ratio 30:1)	3 Qtl.	1.46 Qtl.	410	0.58	0.18	0.35
Maize stover+ rice straw (3:1 ratio) + Soil +other farm residues + cow dung (Vermicomposting) in 2 feet high piles,	3 Qtl.	1.58 Qtl.	430	0.53	0.23	0.34
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)	3 Qtl.	1.62 Qtl.	450	0.60	0.19	0.51
Maize stover+ rice straw (3:1 ratio) in piles as Control	1.5 Qtl	0.97 Qtl.	300	0.32	0.21	0.35

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 butter milk, cow urine in equal ratio and one copper wire and put it in earthen pot for one week to proper fermentation. Then after 20% solution prepared and spray on fenugreek, coriander, mustered and vegetables to manage sucking pests.
- Use of elephant dung smoke to avoid blight disease on crops.
- Use of dried leaves of Azadirachta indica in two to three layer for safe storage of grains/ pulses for at least one.
- Dusting of cow dung ash on vegetables, coriander, fenugreek and other field crops for the management of powdery mildew disease.
- Farmers are using head of died cow or ox for the management of rats in wheat and chick pea field.

Gangtok

(a) ITK: Farmers are using well decomposed cow dung extract (10%) and keeping it for 3-4 days then filtering the extract with a cotton cloth before applying to improve the production and productivity of vegetable crops.

Validation: Treatments to validate the ITK : T1: Cow dung extract (5%); T2: Cow dung extract (10%) Farmer's Practice; T3: Cow dung extract (15%) and T4: Control (only water spray).

Results: The experiments were conducted on cabbage and radish crop growing under low cost plastic tunnels and red cherry pepper growing under low cost plastic rain shelters. It was observed that all the treatments have significantly improved the yield of cabbage, Red cherry pepper and radish as compared to control. There was no significant difference observed between farmer's practice and higher doses applied, however, lower dose (T1) yield was significantly less than the farmer's practice (T2).

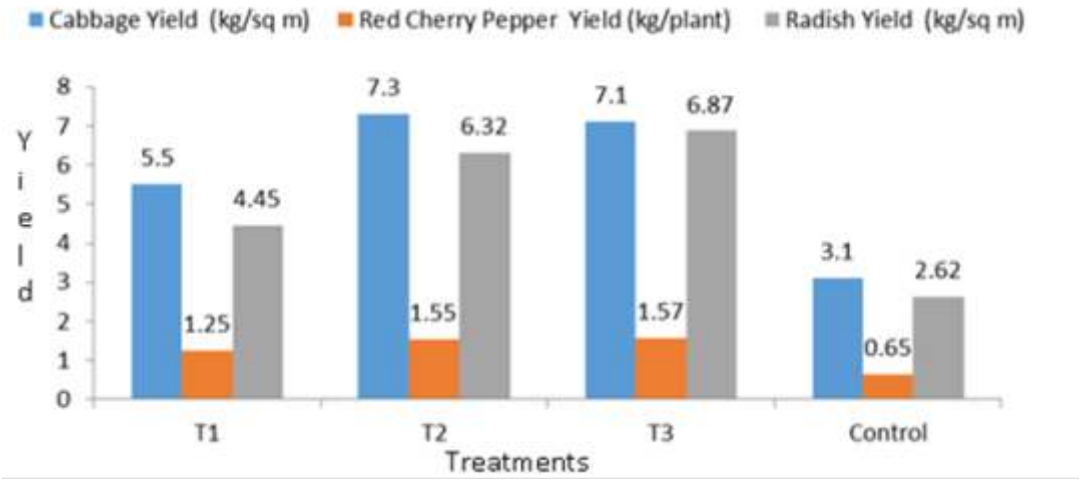


Fig. 7: Effect of treatment on yield of crops at Gantok

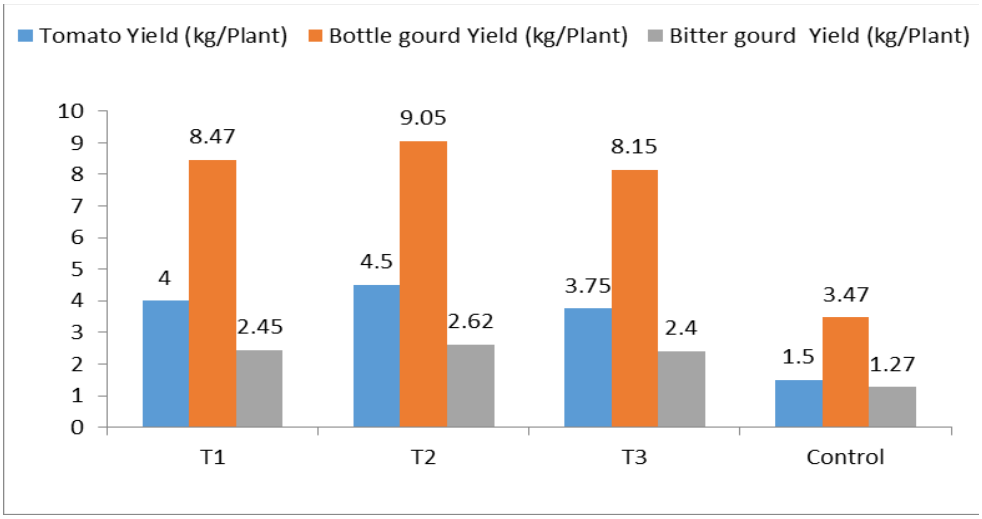


Fig. 8: Effect of treatment on yield at Gantok

(b) ITK: Farmers are using cow urine @ 10% for improving the yield of tomato and cucurbitaceous vegetables.

Validation: Treatments to validate the ITK : T1**:** Cow urine (5%); T2: Cow urine (10%) Farmer's Practice; T3: Cow urine (15%) and T4: Control (only water spray).

Results: The experiments were conducted on tomato, bitter gourd and bottle gourd growing under low cost plastic rain shelters. It was observed that all the treatments have significantly improved the yield of tomato, bottle gourd and bitter gourd as compared to control. There was no significant difference observed between farmer's practice (T2) and lower (T1) or higher doses (T3) applied.

(c) ITK : Farmers are managing aphids and fruit borer by spraying 0.2% solution of a mixture of 10% agave extract + 5% cow urine + 2.5% grinded chilly. Before spraying all the ingredients were mixed properly in plastic container and kept in shade for 3 days and then from this mixture 0.2% solution is prepared for spray in vegetable crops.

Validation: Treatments to validate the ITK and its effect on the yield of vegetables : T1: 0.1% solution spray; T2: 0.2% solution spray (Farmer's Practice); T3: 0.5% solution spray and T4: Control (only water spray).

Results: The experiments were conducted on tomato and French bean growing under low cost plastic rain shelters and broccoli growing under low cost plastic tunnels. It was observed that all the treatments have significantly improved the yield of tomato, French bean and Broccoli as compared to control. The significant increase in yield of tomato and broccoli was observed in between the farmer's practice (T2) and the higher doses applied (T3), however, French bean yield was highest in farmer's practice (T2).The graphical representation revealed that T3 was recorded maximum number of aphid population decrease over control in all the crops viz, tomato (80.4%), French bean (79.8%) and broccoli (83.7%) followed by T1 and T2 respectively. Similarly, the maximum number of borer population decrease over control in tomato (75%) and broccoli similarly.

Udaipur

- ITKs documentation, collection and validation: An experiment on evaluation of indigenous biopesticides (ITK) for organic management of Chilli anthracnose was conducted during 2016-17.

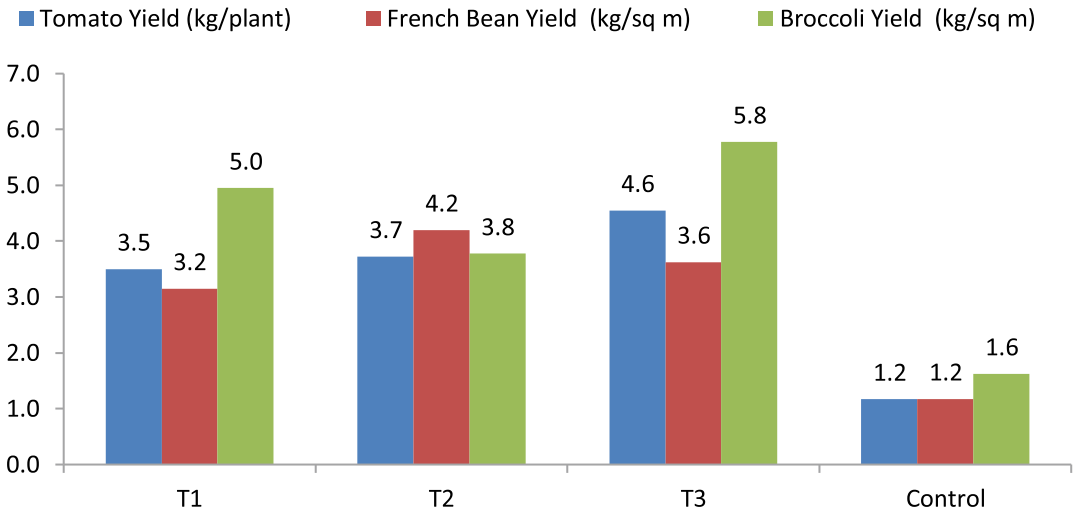
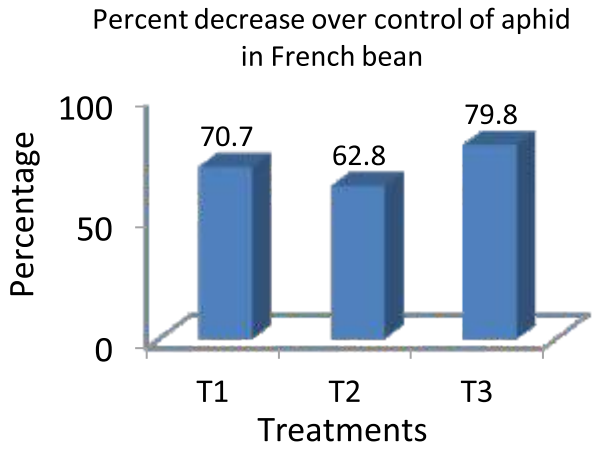
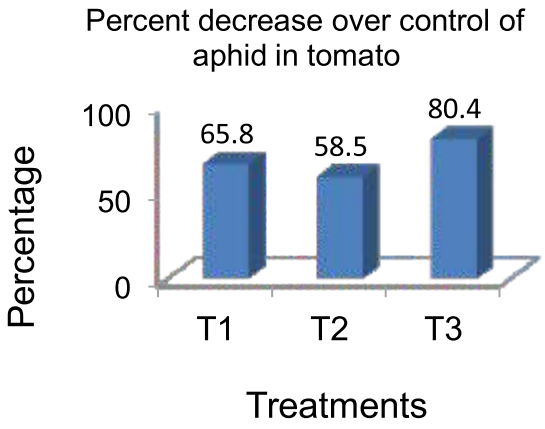
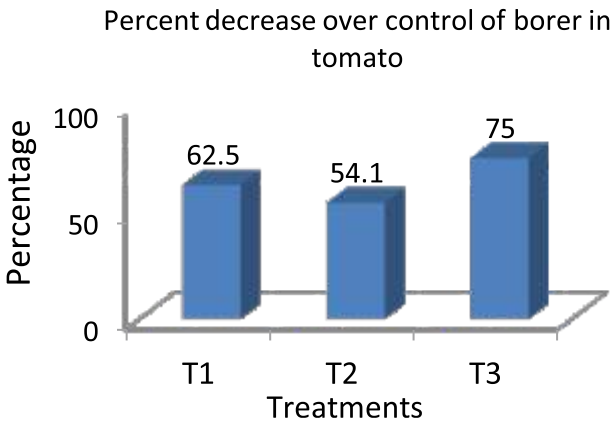


Fig. 9: Effect of treatments on yield at Gantok







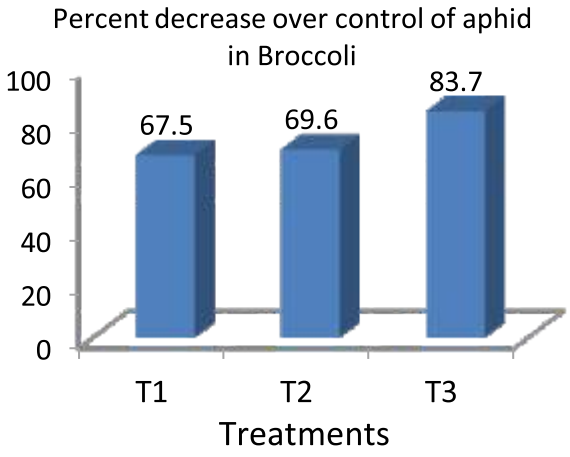


Fig. 10 : Effect of treatment on aphid and borer infestation at Gantok

1. Objective: To evaluate and ITKs for suppression of the anthracnose of chilli in organic pot culture.
2. Treatment details

a. Neem oil - 0.5%

b. Garlic bulb extract - 2%

c. Indian aloe - 2%

d. BD -501 - (1g/ 13L)

e. Indigenous fungicides (ITK)

f. Untreated control.

ITK Used (indigenous fungicide): Cow milk -5 lit, black pepper powder – 200g, water – 200 lit

3. Experimental details

Experimental design	**:**	**CRD**
Number of replications	:	Five
Number of treatments	:	Six
Number of pots	:	30
Season	:	Kharif - 2016
Crop and variety	:	Chilli - Pusa Jwala Selection

Methodology

The experiment was conducted in pots (30 cm) in completely randomized design with five replications in the cage house. The pots were filled by Soil: FYM (3:1) mixture from organic field where organic farming is practiced for past six years. Chilli plants of variety Pusa Jwala Selection were raised by transplanting. For each treatment group, five pots were maintained. Inoculations were made with a spore suspension of inoculum concentration of 1×104 conidia ml-1 for Capsicum capsici.

Indigenous fungicide was prepared by cow milk-5L, black pepper powder – 200g, and water – 200 L. These constituents were mixed in required quantity for spray in 1 acre area.

Neem oil sold by Shree Aushadh Pratisthan, Udaipur, for commercial purpose was used.

Preparation of 2 percent Garlic extract: 50 g of cleaned garlic bulbs were washed and crushed in 2.5 litres of water. The crushed product was tied in muslin cloth and filtrate was collected.

Preparation of 2 percent Indian Aloe: 50 g of cleaned Aloe leaves were washed and crushed in 2.5 litres of water. The crushed product was tied in muslin cloth and filtrate was collected.

BD-501: It was prepared at the NPOF unit, Udaipur. BD 501 is "cow horn silica" and is made from quartz crystals ground to alum power consistency, stuffed into a cow horn, buried during spring equinox, and taken out during autumn equinox. The material is stored in glass bottle and exposed to the sun by the windowsill. Spray solution was prepared by dissolving 2.5g BD-501 in 40 L of water per ha, agitated with a clean wooden stick clockwise and anticlockwise for one hour and was sprayed as a fine mist on the foliage in the morning (before 9.00 AM). The application dates corresponded to days when moon ascending in the biodynamic calendar.

The first spray of treatments (Neem oil (0.5% v/v), garlic bulb extract (2%), Indian aloe (2%), BD-501(2.5g/40L) and Indigenous fungicides) was applied on the initiation of symptoms and subsequent second spray repeated at 10 day intervals by hand atomizer.

Results

Results reveal that application of indigenous biopesticides significantly suppressed the anthracnose in chilli over un-treated inoculated control. The maximum PDI (76.6) was observed in the un-treated inoculated control. (Table 43.1 & Fig). The lowest disease with PDI 28.9 was recorded in foliar spray of neem oil (0.5%), which was found significantly superior as compared to all the other treatments followed, by garlic bulb extract (2%) with PDI 36.2. The other organic inputs were found to exhibit weak efficacy against anthracnose of chilli. The percent disease index for BD-501 was 52.4, for Indigenous fungicide (ITK) was 55.5 and for Indian aloe (2%) it was

Table 47: Effect of organic inputs for suppression of anthracnose disease of chilli in organic pot culture

S.No.	Treatments	Per cent disease Index (PDI)*	Per cent efficacy of disease control (PEDC)**
1.	Neem oil 0.5%	28.9 (32.5)	62.2 (52.1)
2.	Garlic extract 2%	36.2 (36.9)	52.7 (46.5)
3.	Indian aloe 2%	64.2 (53.2)	16.1 (23.5)
4.	BD-501	52.4 (46.3)	31.5 (34.1)
5.	Indigenous fungicide (ITK)	55.5 (48.1)	27.5 (31.6)
6.	Untreated Control	76.6 (61.0)	-
	CD at 5%	2.578	3.366

** Mean of five replications*
Figures in parentheses are arcsine % angular transformed values

64.2.

Maximum percent efficacy of disease control (PEDC) for management of anthracnose of chilli was observed in foliar spray of neem oil (0.5%) with PEDC 62.2. Foliar application of neem oil resulted in significantly higher PEDC as compared to other treatments. The remaining treatments, foliar spray with garlic bulb extract (2%) resulted in PEDC of 52.7, BD-501 resulted in PEDC of 31.5, Indigenous fungicide (ITK) resulted in PEDC of 27.5 and with Indian aloe (2%), it was 16.1. The least percent efficacy of disease control was observed in spray of Indian aloe (2%) with PEDC 16.1 as compared to all other treatments.

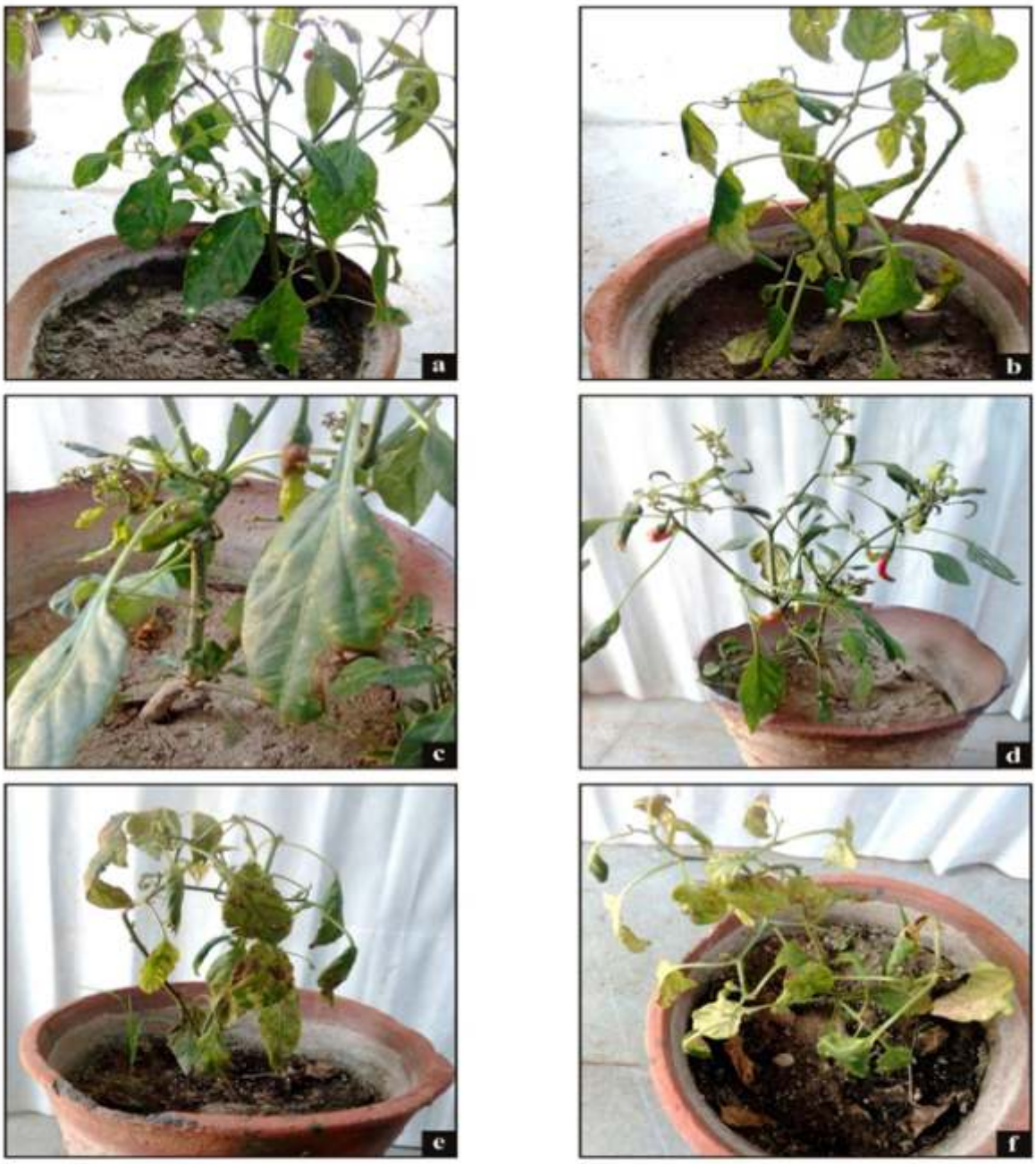


Plate 4. Suppression of anthracnose disease of chilli through organic practices in pot culture.
a. Neem oil - 0.5%
b. BD -501
c. Indian aloe - 2%
d. Garlic bulb extract - 2%
e. ITK
f. Untreated control.

Fig. 11: Suppression of anthracnose disease of chilli through organic practices in pot culture at Udipur

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 IPM Modules against aphid infesting coriander and fennel

A field experiment was conducted to evaluate the relative efficacy of six organic based IPM modules (including control) against aphid on coriander and fennel. Observations were recorded from randomly selected five tagged plants per plot right from pests' initiation on crop to harvesting. Result showed that all IPM modules were found significantly superior over untreated check. The maximum percent reduction in aphid population was recorded in module M-3 (garlic extract 10 ml/lit + azadirachtin 0.03% EC @ 5ml/lit + tumba fruit extract 10ml/lit.), which was 67.10% on coriander and 66.40% on fennel followed by M-2 (field sanitation + NSKE 5ml/lit + Ker extract 10 ml/li.), where population reduction were 65.78 and 65.13%, both on coriander and fennel respectively.

Evaluation of IPM Modules against thrips infesting coriander and fennel

A similar field experiment was also conducted to evaluate the relative efficacy of six organic based IPM modules (including control) against thrips on coriander and fennel. Observations were recorded from randomly selected five tagged plants per plot right from pests' initiation on crop to harvesting. The results showed that all IPM modules were found significantly superior over control. The maximum percent reduction in thrips population was recorded under IPM module M-3 (garlic extract 10 ml/lit + azadirachtin 0.03% EC @ 5ml/lit + tumba fruit extract 10ml/lit.), which was 63.84% on coriander and 62.37% on fennel followed by M-2 (field sanitation + NSKE 5ml/lit + Ker extract 10 ml/li.), where population reduction were 62.55 and 61.00 percent, both on coriander and fennel respectively.

Almora

Field evaluation of botanicals and bio-agents against toria aphids

A field evaluation of botanicals and bio-agents was carried out during *rabi* 2016-17. Spray of botanicals

Table 48.1. Field testing of botanicals and bio-agents on toria aphids

Treatment	Percent infestation		Percent reduction
	Before treatment	After treatment*	
Melia extract 5%	60.33	53.33	11.65 [cd†] (19.35)[µ]
Artemisia leaf extract 5%	63.00	56.67	10.05[d] (18.23)
Pine leaf extract 5%	53.33	46.67	12.49[c] (20.27)
Nimbecidine 3 mL/L	50.00	43.33	13.34[c] (21.23)
Metarhizium 3 g/L	56.67	43.33	23.54[b] (28.62)
Beauveria 3 g/L	60.33	56.67	6.07[e] (14.34)
Acetamiprid 0.25 g/l	56.67	3.75	93.38[a] (74.16)
Control	60.00	63.33	-5.55[e] (13.02)

*Mean of 2, 4, 6 and 8 days after treatment µFigures in the parentheses are arc sign transformed values
†Means in the same column with different letters are significantly (P < 0.05) different

and bio-agents were made at the time of peak incidence of aphids which coincided with late flowering of the crop. The pretreatment aphid infestation in panicles ranged from 50 to 63% in different plots. None of the bio-agents or botanicals was found effective against *toria* aphids except *Metarrhizium anisopliae*, which gave 24% reduction in aphid infestation. Nimbicidine 3 mL/L registered a reduction of 13% and pine leaf 5% extract gave 12% reduction in aphid infestation. However, insecticide acetamiprid was found effective in managing the aphids by causing a reduction of 93%.

Laboratory experiments on predatory potential of *coccinellids* on toria aphids

A laboratory experiment was conducted to find out the predatory potential of different coccinellid adults i.e. *Coccinella septempuctata* and *Harmonia dimidiata*. The coccinellids fed on aphids voraciously and a single *H. dimidiata* and *C. septempunctata* fed as many as 53 and 34 aphids per day, respectively.

Laboratory testing of botanicals and bio-agents on amaranth webber

Amaranth leaf webber, *Hymenia recurvalis* was reared in laboratory and tested for its susceptibility to botanicals and bio-agents through leaf dip bioassay. *Melia azedarach* extract was found to be superior in causing mortality to the larva up to 73% which is at par with VL Bt 6 2g/L (70%) and followed by commercial *Bacillus thuringiensis* (63.33%) at 10 days after treatment.

Table 48.2 : Laboratory testing of botanicals and bio-agents on amaranth webber

Pest control agents	Per cent mortality	
	5 DATµ	10 DAT
Melia azedarach fruit extract 5%	33.3[a]	73.3[a]
Lantana camara leaf extract 5%	13.3[bc]	16.7[d]
Bt (Biovit®) 2 g/ L	30.0[ab]	63.3[ab]
VL Bt 6 2 g/L	26.7[ab]	70.0[a]
Artemisia sp. leaf extract 5%	10.0[c]	30.0[cd]
Parthenium hysterophorus leaf extract 5%	16.7[abc]	46.7[bc]
Pinus sp. leaf extract 5%	23.3[ab]	40.0[c]

µDAT = Days after treatment; †Means in the same column with different letters are significantly (P < 0.05) different

Field evaluation of organic pest management options for amaranth leaf webber

A field trial with eight treatments including control was laid out to evaluate the organic pest management options for amaranth leaf webber. The incidence of amaranth leaf webber was only 0.34, 1.21 and 1.47 per 10 panicles during August, September and October months, respectively. The incidence of amaranth leaf webber was very low and the experiment could not be conducted.

Pest incidence in organic production system

The overall pest incidence during *kharif* 2016 was low. Low incidence of sucking bug, *Chauliops chopra* in soybean during August month and very low incidence of aphids in finger millet were recorded in organic farming areas. Amaranth was found to be infested with leaf webber, *Spoladea = Hymenia recurvalis* (Low incidence) during August-September, sucking bug, *Cletus* sp. and *Lygus* sp. from August to October (medium incidence) and *Spodoptera litura* from September to October (low incidence).

In the organic and inorganic production system experiment, the overall incidence of sucking bug was in the range of 1.12 to 1.97 per panicle. After the application of cartap hydrochloride @ 1g/L in 100% inorganic and 50% organic plots, the incidence was reduced to 0.03 to 0.12 per panicle.

During *rabi* season, in the organic and inorganic production system experiment, *toria* was found to be infested with aphids to a tune of 10-22% which was found to increase up to 22-38% during the second fortnight of February. After spray with acetamiprid @ 0.3 g/L the aphid infestation reduced to 3.6 and 3.0% in 100% inorganic and 50% inorganic plots, respectively. The incidence of coccinellids was 0.6 to 1.8 per 10 panicles of *toria* irrespective of treatments, whereas the incidence of syrphid grubs was low (0.3 to 1.0 per 10 panicles).

Gangtok

Organic insect pest management in large cardamom

Objective: To study the Evaluation of some new biopesticides and organically permitted insecticides against insect pests of large cardamom

(Second Year study-2016)

Survey for various insect pests in large cardamom (Second Year study-2016)

Result: The roving survey was conducted to know the per cent incidence (PI) of different insect pests in large cardamom fields of all four districts of Sikkim and the PI of different insect pests was recorded. As per last year, shoot fly, leaf eating caterpillar and stem borer were found everywhere. Additionally, high infestation of mealy bug was observed in the root zone of large cardamom infected with foorkey diseases. The higher infestation of Tea mosquito bug was recorded in this year.

(Third year study-2017)

The experiment was conducted to evaluate the efficacy of 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 insect pests of large cardamom viz., stem borer, shoot fly, leaf eating caterpillar and tea mosquito bug. All the treatments showed effective results to control insect pests over the control. However, spinosad 45 SC @ 0.3 ml/l was found to be the most effective to control all the

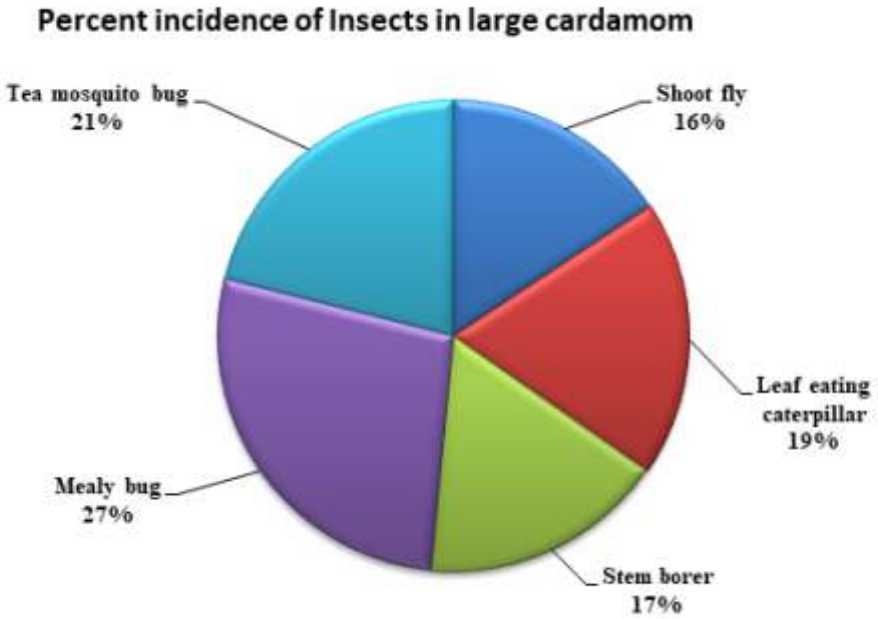


Fig.12. Percent incidence of Insects in large cardamom

Tea mosquito bug infestation

Mealy bug infestation

pests (69.91 to 81.32% reduction of infestation over control) followed by neem oil (1500 ppm) @ 4 ml/l (61.32 to 67.64% reduction of infestation over control) and petroleum agrospray @ 10 ml/l (52.22 to 59.47% reduction of infestation over control)

Insect pest and disease management in maize-based cropping system

Objectives

Surveys for insect pests and natural enemies in maize based cropping system to determine the incidence of different insect pests and to find out occurrence of any new pests and natural enemies.

Results

The experiment was carried out to evaluate the

Semi looper

Army Worm

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 (65.23 to 86.55% reduction of infestation over control) followed by neem oil based formulation (1500 ppm) @ 4 ml/l (58.43 to 63.74% reduction of infestation over control).

7.9 Evaluation of organic management practice for diseases in crops

Objectives:

- 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

Location: Ajmer and Gangtok

Ajmer

Management of *Sclerotium* rot of coriander

Five different treatments were evaluated including Soil Solarization (21 days), Trichoderma, neem cake (0.5t/ha), caster cake (0.5t/ha) and control. The experiment was designed in a manner which having four replications for each treatment. The plot size of the experimental plots was kept 3x3 metres. Soil solarization was conducted in the plots in summer (May-June) for 21 days by covering 100µm polyethylene sheets on ploughed, well plained and moist soil. Trichoderma @ 2kg /ha, neem cake (0.5t/ha), caster cake (0.5t/ha) were mixed with soil before sowing the coriander crop. Statistically the experiment was designed according to RBD (Randomized block design). The disease measurement was done throughout the cropping span by counting the diseased plants and healthy plants and then percent disease index (PDI) was calculated. Among the treatments soil solarization was found most effective (PDI 1.2) followed by Trichoderma & neem cake (PDI 4.2) and (PDI 4.3) while the disease was recorded maximum (PDI 8.6) in control. Total number of weeds /m2 area was counted after fifteen days of sowing and soil solarization was found most effect and only 5.2 weeds/m2 were recorded while number of weed in control were 55.5. The results of the experiment have been illustrated.

Effect of Soil Solarization on coriander crop

Table 49: Influence of different treatments on Sclerotium rot disease of coriander at Ajmer

Treaments	Sclerotium Rot (PDI)	No.Weeds /M2	Yield q/ha
Soil solarization (21 days)	1.2	5.2	8.7
Trichoderma (Soil & Seed App)	4.2	56.5	7.2
Neem cake (0.5 T/ha)	4.3	44.5	7.4
Caster cake (0.5 T/ha)	5.8	47.6	6.8
Control	8.6	55.5	6.0
SEm±	0.10	0.75	0.04
CD at 0.05%	0.31	2.33	0.11

Table 49.1: Effect of botanical on Ramularia blight of fennel at Ajmer

Treaments	No. Weeds /M2	Yield q/ha	Ramularia blight (PDI)
Neem oil (0.5%)	50.5	21.2	6.81
Castor oil (0.5%)	47.5	20.0	9.6
Garlic extract (0.5%)	46.1	22.9	5.2
Onion extracts (0.5%)	54.8	22.0	6.80
Control	49.2	18.0	14.0
SEm±	0.12	0.07	0.13
CD at 0.05%	0.38	0.22	0.44

Management of Ramularia blight of fennel (Foeniculum vulgare)

Organically in fennel an experiment was conducted comprising five different treatments including arial spray of neem oil (0.5%), castor oil (0.5%), garlic extract (0.5%), onion extract (0.5%) and control. The experiment was designed with four replications of each treatment. The plot size of the experimental plots kept 3x3 metres. Statistically the experiment was designed in RBD (Randomized block design). The spray schedule of different botanicals was adopted on initiation of the disease. Among the five treatments garlic extract (0.5%) was found most effective (PDI 5.2) followed by Onion extracts (0.5%) with (PDI 6.80) and Neem oil (0.5%) (PDI 6.81) while the disease was recorded maximum (PDI 8.6) in control. Total number of weeds /m2 area was counted after fifteen days of sowing. The results of the experiment have been illustrated.

Gangtok

Organic disease management in large cardamom

An experiment was conducted to study the evaluation of locally available botanicals, commercially available bio control agents and organically permitted fungicides against blight of large cardamom.

Result: Blight is one of the important diseases in large cardamom which is caused by Colletotrichum gloeosporioides. Different organic treatments like botanical (Garlic, Artimesia, Chilaune, neem oil), biocontrol agents (Trichoderma viride and Pseudomonas flourescens) 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)

7.10: Development of scientific organic package for large cardamom

Objectives:

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

Year of start: 2015-16

Location: Gangtok

Results

An experiment was conducted during two consecutive years (2015-16 and 2016-17) to standardize organic nutrient management package for large cardamom. Large cardamom cultivar Sawney was evaluated with different organic nutrient treatment. The study consisted RBD having 10 treatments viz., T1=FYM @ 5 kg/clump + bio-fertilizers; T2=FYM @7.5 kg/clump + bio-fertilizers; T3=FYM @ 10 kg/clump + bio-fertilizers; T4=FYM @ 5 kg + vermin-compost @ 2.5 kg/clump + bio-fertilizers; T5=FYM @7.5 kg + vermin-compost @2.5 kg/clump + bio-fertilizers; T6=FYM @10 kg + vermi-compost @2.5 kg/clump + bio-fertilizers; T7=vermin-compost@ 5.0 kg/clump + bio-fertilizers; T8=vermin-compost @7.5 kg/clump + bio-fertilizers; T9=vermin-compost @10 kg/clump + bio-fertilizers and control. The two year pooled data showed that vermin-compost @ 10 kg/ha + bio-fertilizers significantly increased maximum number of plant height (cm), average number of spikes/clump, average number of capsule/ spike, fresh weight/ clump, dry weight of capsule/ clump and productivity as compared to control treatment.

*(**Biofertilizers @25 kg/ha: Mixer of N fixer, P solubilizer and K mobilize)*

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

Result: An experiment was conducted to standardize response of large cardamom (growth and yield parameters) to soil and foliar application of micronutrients. The study consisted RBD with 3 replication having 7 treatments viz., T1-1.0, 2.0 and 3.0 kg/ha for B; T2-10, 15 and 20 kg/ha for Zn; T3-50, 75 and100 g/ha for Mo; T4-0.1%, 0.2% and 0.3% for B; T5-0.1%, 0.25% and 0.5% for Zn; T6-0.05%, 0.1% and 0.2% for Mo; T7- control. Foliar application was more effective than soil application for Zn, B and Mo. The

Table 50. Effect of treatments on growth and yield of large cardamom at Gangtok.

Treatments	Plant height (cm)	Av. no. Spikes /clump	Av. no. of capsules / spike	Fresh weight of capsule/clump (g)	Dry wt.of capsules/clump (g)	Productivity (kg/ha)
T1	152.31	4.43	25.17	71.46	14.29	312
T2	157.36	4.49	25.86	75.61	15.12	320
T3	150.51	4.53	25.97	80.37	16.07	343
T4	153.85	4.67	26.11	81.61	16.32	376
T5	157.61	4.71	26.61	84.61	16.92	399
T6	152.61	4.91	29.17	91.59	18.31	413
T7	150.36	4.79	28.61	85.64	17.12	406
T8	156.27	5.23	30.51	94.37	18.87	423
T9	164.15	5.71	32.45	98.64	19.72	453
T10	130.67	2.19	13.04	31.27	6.25	121
CD (5%)	6.67	10.35	4.92	9.02	14.73	9.12



Foliar application of boron 0.3% resulted maximum values of mature tillers

best soil treatment that increased the yield of large cardamom significantly is 3.0 kg/ha boron, 15 kg/ha zinc and 100 g/ha molybdenum compared to control. On the other hand, among the foliar application 0.3% boron, 0.25% zinc 0.2% molybdenum application significantly increased the maximum number of plant height (cm), immature tiller, mature tiller and vegetative buds as compared to control treatment.

Table 50.1. Effect of soil and foliar application of micronutrients in response of large cardamom (growth and yield parameters) at Gangtok.

Treatments	Dose	Immature tiller	Mature tiller	Vegetative buds
T1	1.0 kg/ha	3.16	3.09	2.41
	2.0 kg/ha	3.21	3.18	2.46
	3.0 kg/ha	3.35	3.29	2.57
T2	10 kg/ha	2.95	2.97	2.37
	15 kg/ha	3.15	3.08	2.48
	20 kg/ha	3.04	3.01	2.41
T3	50 kg/ha	2.76	3.01	2.29
	75 kg/ha	2.89	3.12	2.34
	100 kg/ha	3.07	3.18	2.41
T4	0.1 %	3.61	3.41	2.71
	0.2 %	3.75	3.49	2.76
	0.3 %	3.98	3.57	2.81
T5	0.1 %	3.61	3.23	2.62
	0.25 %	3.89	3.43	2.72
	0.5 %	3.73	3.35	2.67
T6	0.05 %	1.98	3.13	2.54
	0.1 %	2.09	3.08	2.61
	0.2 %	2.19	3.17	2.67
T7	Control	1.16	1.09	0.89
CD (5 %)	0.48	0.43	0.35	

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

Objectives:

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

Year of start: 2015-16

Location: Narendrapur

Narendrapur

Morphological and Biochemical Characterization as well as validation of ITK's- Sashyagavya

1. Determination of pH:

*pH of Shasyagavya of 16 and 26 days of incubated samples were determined with 3 replicates. Y-axis denotes the value of pH with standard error of mean (SEM). Multiple t-tests with Bonferroni-Dunn correction method were performed to determine the statistical significance. Here, **** denotes p <0.0001.*

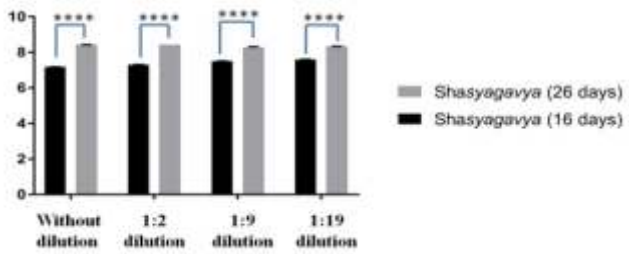


Fig. pH of Shasyagavya increases with days of incubation.

2. Determination of Electrical Conductivity (EC):

*EC of both 16 and 26 days samples were estimated with 3 replicates with standard error of mean (SEM). The y-axis represents value of EC in milli-siemens per centimeter. Multiple t-test with Bonferroni-Dunn correction method was performed to determine the statistical significance. Here, **** denotes p <0.0001 and ns is not significant*

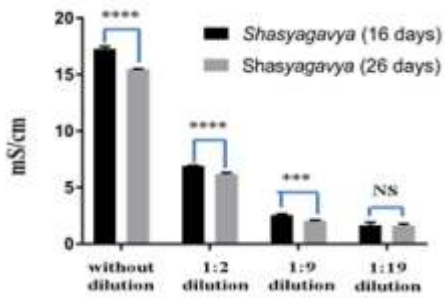


Fig: Determination of electrical conductivity (EC) of Shasyagavya

3. Determination of organic carbon, total nitrogen, available nitrogen and available phosphorus:

*(A). Organic carbon, total nitrogen and available nitrogen were estimated from 16 and 26 days incubated samples with 3 replicates and the value is shown here as standard error of mean (SEM). y-axis denotes the concentration in percentage. Multiple t-test with Bonferroni-Dunn correction method was performed to determine the statistical significance. Here, **** and ns denote p <0.0001 and not significant respectively. (B) Available phosphorus was determined by Olsen's extractant method and value is shown here as standard error of mean (SEM) from 3 replicates. y-axis represent the value in ppm. Pair t-test was performed to determine the statistical significance and ** denotes as p <0.01.*

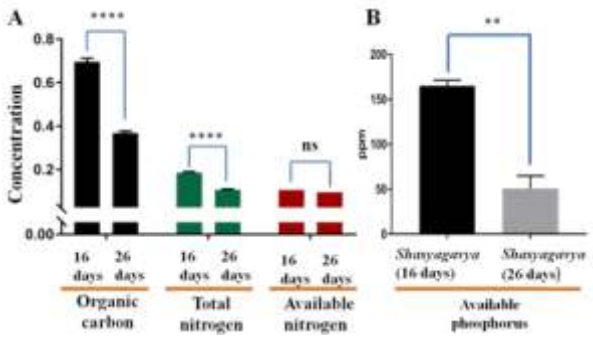


Fig. Status of organic carbon, total nitrogen, available nitrogen and available phosphorus in *Shasyagavya.*

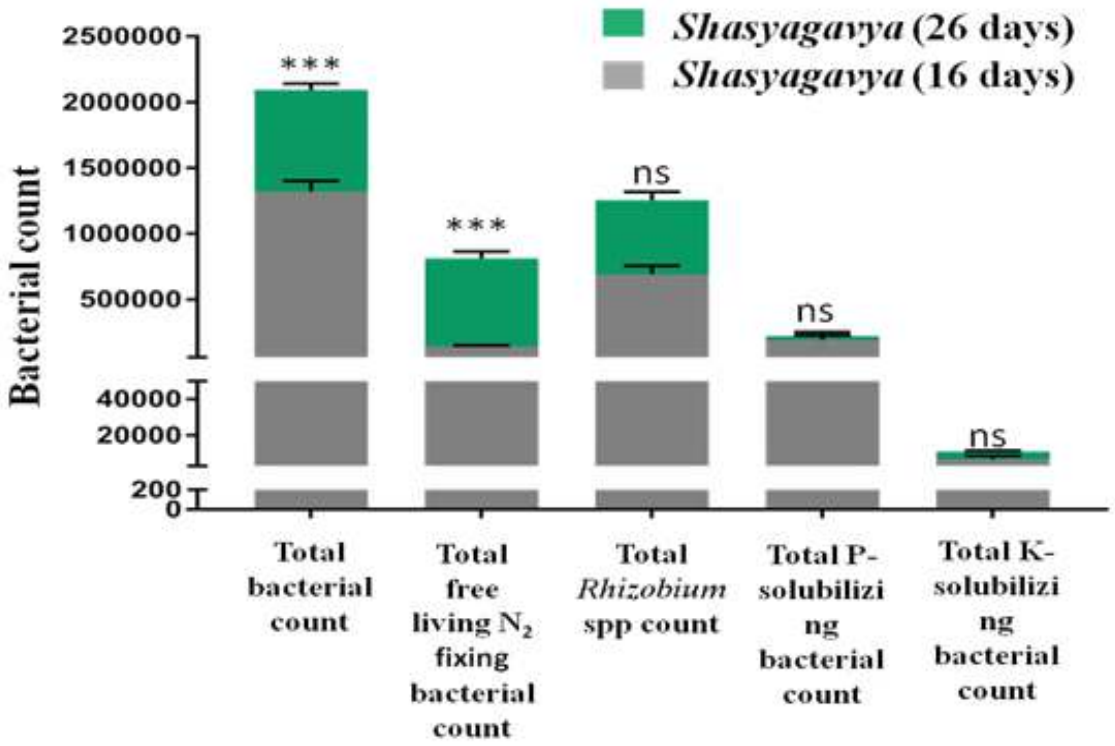


Fig: Bacterial dynamics and diversity in Shasyagavya.

4. Studies on microbial diversity :

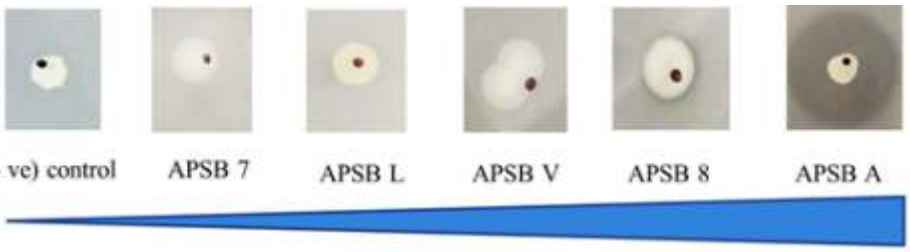
*Bacterial colonies were counted from three different replicates and mean with standard error (SEM) has been shown. Y-axis denotes bacterial count; ns and *** represent not significant and p <0.001 respectively. Multiple t-tests with Bonferroni-Dunn correction method was performed to determine the statistical significance.*

5.Selection of free living nitrogen fixers :

Name of the bacterial isolates	Size of the colony	Margin/ edge	Surface texture	Elevation	Pigmentation
AN 1	Small	Rough	Smooth	Thin	White
AN 3	Large	Smooth	Smooth	Thin	Orange
AN 4	Large	Smooth	Smooth	Thin	White
AN 6	Large	Rough	Wrinkled	Thin	White
AN 7	Large	Smooth	Smooth	Thin	White

Distinct colony morphology of different bacterial isolates from Shasyagavya nitrogen fixing bacteria screened on Jensen's medium and purified further.

6. Selection of free living nitrogen fixers :



Name of the organism	Diameter of the colony (in mm)	Diameter of the solubilizing zone (in mm)	% solubilizing efficacy
(-ve) control	0.4	0	0
APSB 7	0.5	0.7	40
APSB L	0.6	0.9	50
APSB V	0.4	0.6	50
APSB 8	0.8	1.3	62.5
APSB A	0.4	1.6	300

Fig: An assay to determine the phosphate solubilizing efficiency of bacterial isolates.

The colony pictures show the soluble zone of phosphorus as halo and the value is mentioned in tabulated form.

7. Indole acetic acid production assay:

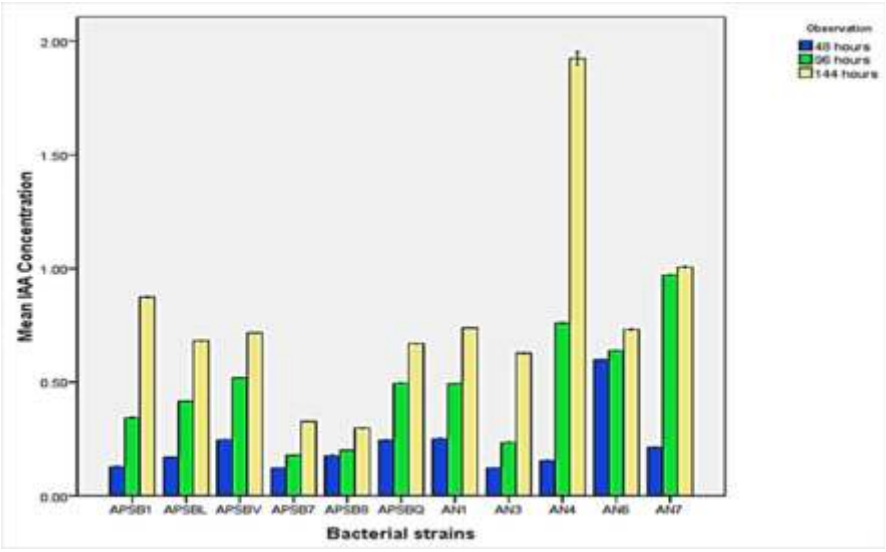


Fig: IAA production of selected bacterial isolates from Shasyagavya.

IAA concentration has been estimated as described in Ramachandran et al. (2002).
Y-axis represents mean value with standard error from three replicates.

1. Morphological characterization of Plant growth promoting bacterial isolates:

Name of bacterial isolates	Gram's reaction	Size and shape
APSB A	+ve	Short, rod
APSB L	+ve	Medium, rod
APSB V	+ve	Short, rod
APSB 7	+ve	Short, rod
APSB 8	+ve	Short, rod
AN 1	+ve	Short, rod
AN 3	-ve	Short, rod
AN 4	-ve	Long, rod
AN 6	-ve	Short, rod
AN 7	+ve	Long, rod

Morphological characterization of plant beneficial bacterial isolates isolated from Shasyagavya.

The bacterial isolates were isolated from Shasyagavya after 26 days of incubation and further, purified on different nutrient media before morphological studies.

9. Biochemical characterization of Plant growth promoting bacterial isolates:

BIOCHEMICAL TESTS	APSB A	APSB L	APSB V	APSB 7	APSB 8	AN 1	AN 3	AN 4	AN 6	AN 7
CARBOHYDRATE UTILIZATION										
DEXTROSE	+	-	+	+	+	+	+	+	+	+
FRUCTOSE	+	+	+	+	+	-	+	+	+	-
SUCROSE	+	+	+	+	+	+	+	+	+	+
MALTOSE	+	+	+	+	+	+	+	+	-	-
LACTOSE	-	-	+	+	+	-	-	-	-	+
AMINO ACID UTILIZATION										
DECARBOXYLATION	-	-	-	-	-	-	-	+	-	-
DEAMINATION	+	-	+	-	-	+	-	-	-	+
ENZYMATIC AVAILABILITY										
OXIDASE	-	+	+	-	+	+	+	+	+	-
NITRATE REDUCTASE	+	+	+	+	+	-	+	+	-	-
CATALASE	+	+	+	+	+	+	+	+	+	+
UREASE	-	-	-	-	-	+	+	+	-	-

STARCH HYDROLASE	+	-	-	-	-	+	-	-	+	-
CASEIN HYDROLASE	-	-	-	-	-	-	+	-	+	+
LIPASE	+	+	+	+	+	+	-	+	+	+
GELATINASE	+	+	+	+	+	-	-	-	-	+
IDENTIFICATION TEST										
INDOLE	-	-	-	+	-	-	-	-	-	-
METHYL RED	+	+	+	+	+	+	+	+	+	+
VOGES–PROSKAUER	+	+	+	+	+	-	+	-	-	+
CITRATE	+	-	-	-	-	+	-	-	+	-
H2S PRODUCTION	-	+	-	+	-	-	-	-	-	-
MOTILITY	+	+	-	+	+	-	-	-	-	-

Biochemical characterization of selected plant-beneficial bacterial isolates from Shasyagavya

10. Morphological and biochemical attributes based identification of Plant growth promoting bacterial isolates:

Name of the isolates	Probable identification	% of match
APSBA	Paenibacillus polymyxa	86%
APSBL	Bacillus niacini	81%
APSBV	Bacillus niacini	81%
APSB7	Brevibacillus laterosporus	75%
APSB8	Bacillus sporothermodurans	88%
AN1	Paenibacillus sputi	86%
AN3	Bacillus decolorationis	86%
AN4	Bacillus decolorationis	83%
AN6	Bacillus muralis	72%
AN7	Bacillus pumilus	78%

Identification based on biochemical attributes through "ABIS online.

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 organized on 13th May 2013, 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, French bean and some vegetables seeds were distributed to the farmers. The formal Memorandum of Understanding (MOU) between ICAR and the village was made. 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 cow dung would be used for vermicomposting, FYM preparation etc. for crop production and organic milk may be sold as comparatively higher price.

Community vermin-compost 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 vermin-compost for organic agriculture. The villagers may also earn from

Selling vermin-compost and earthworm for their livelihood. The additional organic manure may be procured by the Institute for various programme.

Green manuring for crop production: Green maturing (GM) would be practiced wherever possible. GM crops such as crotolaria, dhaincha, rice bean, 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), Erythrinaindica, Samaneasaman (Acacia), *Delonixregia* (Gulmohar), *Pongamiaglabra* (Pogamia) and *Azadirachtaindica* (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 Multipurpose 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 lifesaving 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, napieretc) to supply green fodder to the dairy unit. Beside, cultivation of fodder in hill slopes would rehabilitate degraded land by reducing soil loss.

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.

Progress mode during 2013-16:

A. Development of farm pond for adding value to various farming activities:

In addition, to the existing ponds constructed, one more pond was constructed in the farmer's land of Mynsain village. The ponds were constructed for adding value to other farming activities in which water from ponds can serve as domestic and livestock water supplies as well as irrigation for high-value crops and vegetables during lean period. Application of lime (2t/ha) and FYM (10t/ha) was performed after the pond was constructed for enhancing the soil fertility. An amount of Rs.50, 000 was incurred for the construction of the pond. Apart from the new pond, three existing ponds were also renovated in farmer's

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	

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

Species	Weight (g)	Total Length (cm)	Girth (cm)
Catla	899.0 ± 120.2	35.21 ± 2.36	15.35 ± 1.17
Grass Carp	783.8 ± 164.2	33.62 ± 1.98	9.65 ± 0.92
Common Carp	1450.8 ± 301.1	37.45 ± 2.16	16.21 ± 1.45

field in which the farmer's themselves actively participated for achieving diversification of their farm enterprises. During the year 2016, a total quantity of 50kgfingerlings were distributed to the farmers for developing IFS models. The list of beneficiary farmers, village and the geographical coordinates of the demonstration sites have been provided in table below:

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 (899.0 ± 120.2) and length (35.21 ± 2.36) whereas minimum weight and length was found in grass carp (783.8 ± 164.2) and length of (33.62 ± 1.98).

B. Jalkund: Interventions were taken up to popularize low- cost rainwater harvesting structures 'Jalkund' (5x4x1.5 m) with silpaulin lining having a storage capacity of 30,000 liters for harvesting rainwater in farmer's fields of Mynsain village. These structures were constructed to enable the farmers to harvest rainwater during the rainy season and subsequently use the water during dry periods as well as to provide critical irrigation to high value winter crop. Jalkunds were constructed at higher elevations, for easy diversion and collection of rainwater in

thejalkund that will roughly store adequate amounts 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 muddy 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 of Mynsain village are storingthe rain water directly in the jalkunds during the rainy season and later they utilize it to provide protective irrigation to the crops for successful cultivation during dry periods. Also the stored water is utilized for rearing of livestock, piggery and poultry. Farmers grow tomato, capsicum, curcubits, cabbage, cauliflower, bottle gourd and pumpkin all along the periphery of the jalkund to increase farm income as a whole. The stored water also helps the farmers of this village to raise 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 2016.

C. Vermicomposting unit:

Earthworms are often referred to as farmer's friend and nature's ploughmen. Degradation of organic waste by earthworms is one of the recent developments in biological sciences. Vermicomposting is a simple biotechnological process of composting, in which certain species of earthworms are used to enhance the process of waste conversion and produce a better end product. It is one of the easiest methods to recycle agricultural wastes to produce quality compost. Earthworms being voracious eaters consume the biodegradable matter and give out a part of the matter as excreta or vermi-castings. The vermi-casting containing nutrients is a rich manure for the plants. Vermicompost, apart from supplying nutrients and growth enhancing hormones to plants, improves the soil structure leading to increase in water and nutrient

holding capacities of soil.

Based on this method a community vermicomposting unit (size 6m x 8m x2.6m) has been constructed in Mynsain village with an objective to recycle on-farm biomass to increase the fertility of the soil with the existing eight composting tanks (size 2m x 1.5m x 0.75m) two more units were recently constructed. Vermicomposting unit were constructed using cement brick tanks for greater efficiency. The tanks are filled with organic wastes and composting is taken up. The community collects the biomass from farmer's field and use it for vermicomposting. During the year 2016, the farmer's harvested about8tonnes of vermicompost.

D. Vermi-beds

Vermi Beds are unique and latest technology 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, which can produce about 1200kgs to 1500kgs of vermicompost. Vermi-beds can be done on a small scale by farmers with household organic wastes. Crop residues and agricultural wastes are collected by the farmers and filled in the vermin beds for decomposition processes.

E. Improved farm yard manure storage tank

Five numbers of improved fym storage tank (pit and shed) have been constructed in five farmer's field. pit size of 4m x 3m x 1m was dug and covered with either grass or plastics for protection of the pits from rainfall. Residues from field were collected and placed inside the pits along with cow dung for decomposing. This method helped the farmers to get easy on- farm manure for crop cultivation.

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, consisting of beds which are more or less levelled and have rising walls or bunds. It is easy to grow crops on the terraces being fairly levelled. For efficiency, bench terraces must be well maintained. In Mynsain village, the risers were planted with grass, and repairing was done when required. The use of conservation agriculture on the beds helped in soil conservation, increased water infiltration and maintenance of soil fertility. The newly prepared terraces were incorporated with lime (2t/ha), FYM (15t/ha) and biomass to develop soil fertility. The vegetables like groundnut, rice bean, green gram, soybean etc were planned for cultivation in the first year for developing soil fertility. At present, five bench terraces were constructed in different farmer's field of Mynsain village under TSP-NPOF.

2. Raised and Sunken beds:

Raised and sunken beds were developed after rice harvest in lowland for cultivation of vegetables. The

Temporary raised and sunken bed developed by farmers in Mynsain Village

dimensions of the raised bed were 0.75-1m in breadth, 10m in length and 0.3-0.5m in height and the drainage channel (sunken bed) varied from 0.2-0.5m.A total of 23784.70m2 area had 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. kufrimegha) carrot (var. new kuroda), brocolli (var. green magic) lettuce etc were grown by the farmers on raised beds.

G. Fruit trees plantation

During the year 2016, 200 nos. of sweet orange saplings 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 5x5 m apart which were then 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 was about 85%.

H. Pineapple plantation

A farmer of Mynsain village having an area of about 1 acre was given three thousand numbers of pineapple suckers (var. kew) for planting during monsoon of the year 2016. The plantation was carried out 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 varieties viz. DA-61A @150kg, RCM-1-3@50 kg were distributed to the farmers for comparison with the available local variety

From the findings above, it was found that a total number of 30 farmers were provided with maize seeds of different varieties i.e. DA 61 A and RCM 1-3 for comparison with the locally available maize variety. According to the farmer's practices, it was found that the average production was higher in DA-61- A (65.80 ± 14.45) as compared to RCM 1-3 (41.20 ± 12.27) and the local variety had the least production (12.42 ± 75.34).

J. Fodder cultivation

Cultivation of fodder crops in degraded land was done with an objective for supplying green fodder as a feed to mulch animals, thereby providing required nutrients for milk production and health of dairy animals. The cultivation of fodder in hill slopes also helps in rehabilitating the degraded land by reducing soil loss. Fodder cultivation was done in two farmer's field (Mrs. Divine Cherish and Mrs. Rosemary Rani)

Pineapple and plantation in Mynsain village

Name of beneficiaries, area, production and productivity of maize in farmers field

Sl.No.	Name of beneficiary	Area (m2)	Production (kg)	Yield (kg/ m2)	Yield (t/ha)
	DA-61-A				
1	Mrs. Elisha Rynghang	300	96	0.35	3.52
2	Mr Never Rynghang	160	44	0.29	2.91
3	Mr. Tiol Nongkharai	210	76	0.39	3.90
4	Mr. Ribet Lyngdoh	79	87	0.25	2.50
5	Mrs. Biolin Shadap	109	80	0.33	3.32
6	Mrs. Bibi Rynghang	169	64	0.38	3.79
7	Mrs.Philimon Rani	259	94	0.42	4.22
8	Mr. Markynsai Makdoh	93	50	0.33	3.30
9	Mr. Damut Rynghang	249	62	0.65	6.47
10	Mrs. Serinda Lyngdoh	165	70	0.43	4.30
11	Mrs. Aitilin Lapang	153	75	0.47	4.69
12	Mrs. Balensar Makhroh	245	88	0.69	6.90
13	Mrs. Dapbiang Makhroh	120	53	0.53	5.33
14	Mrs. Paleisha Rani	175	85	0.58	5.78
15	Mrs. Dwianca Thabah	136	63	0.44	4.41
16	Mrs. Mercyful Shadap	134	62	0.48	4.83
17	Mr. Jril Makhroh	129	57	0.47	4.69
18	Mr. Debinus Nongsiej	96	68	0.63	6.32
19	Mrs. Maiden Lapang	69	39	0.46	4.59
20	Mrs. Ibapdianghun	136	59	0.77	7.70
21	Mrs. Ebela Nongrang	155	68	0.47	4.71
22	Mrs. Bentina Diengdoh	70	35	0.32	3.24
23	Mrs. Perila Rynghang	145	75	0.50	5.00
24	Mrs. Elis Lapang	120	55	0.51	5.13
25	Mrs. Sorida Rynghang	89	40	0.49	4.89

	Mean	150.6 ± 61.44	65.80 ± 14.45	0.46 ± 0.12	4.65 ± 1.27
			RCM-1-3		
26	Mrs. Rosemary Rani	130	50	0.213	2.130
27	Mrs. Thial Shabong	110	35	0.135	1.351
28	Mr. Daniel Jyrwa	75	24	0.224	2.240
29	Mr. Jeris Nongbsap	90	55	0.342	3.420
30	Mr. Kyrshan Nongbri	85	42	0.553	5.53
	Mean	98 ± 21.96	41.2 ± 12.27	0.31 ± 0.16	3.20 ± 1.58
			Local		
	Mean	65.13 ± 25.64	12.42 ± 75.34	0.15 ± 0.06	1.74 ± 0.5

Maize variety DA 61 A

Beneficiaries benefitted from poultry rearing at Mynsain Village

covering an area of 1 acre. Two varieties of fodder viz; setaria and co-4 (200 nos. each) were planted at a spacing of 50 x 50 cm along with multipurpose trees at 5 meter distance in mrs. divine cherishes field. FYM @ 250g/pit was also applied at the time of planting. A total number of 500 slips of Napier, Congo signal and guinea grass were supplied to mrs. rosemary rani during the year 2016.

K. Poultry

During the year 2016, 2500 nos. poultry chicks (breed-vanaraja & gramapriya) and 5 bags poultry feed were

Var.Bhalum-1

Var. Shahsarang 1

distributed to 6 beneficiaries in order to increase the socio-economic condition of the villages. An average of 18-20 eggs were being produced each poultry bird per month. The average weight of the poultry birds were 3 kg. The farmers could also sell the poultry birds for meat purpose at an average price Rs. 300 per kg.

L. Introduction of Improved Pig Variety

Farmers of Mynsain village received12 nos. of improved breeds of pigs (75% Hampshire and 25% mixed local which gave higher productivity and income. Seven units (one male and one female) of improved cross breed piglets were provided to each beneficiary farmer of the village. Two units of local piglets were also included in farming system for comparisons. After one year, 5 pigs with an average weight 60 kg had 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 intervals across the slope (10 to 20 m depending upon the slope).The hedge row species were also grown around the farm which served as a purpose of fencing, soil and water conservation and supply of nutrient rich green leaf manure. The interspaces would be used for growing crops thereby increasing the production.

N. Improved Rice production

Improved rice production technology had been introduced to the farmers

Variety: Shahsarang 1, Bhalum-1

Cultivation method: Integrated crop management

Spacing: 20 x 20 cm

Ground nut on raised bed in Mynsain village

Area and production of groundnut in farmers' field

Sl no.	Farmer's Name	Area (m2)	Production (kg)	Production (kg/m2)	Production (t/ha)
1	Mr. Markyndsai Rynghang	150	20	0.130	1.320
2	Mrs. Shimti Nongsiej	70	7.85	0.087	0.871
3	Mr. Bony Matlang	100	15.5	0.125	1.250
4	Mr. Teilang Makhroh	85	10.98	0.125	1.250
5	Mr. Damut Makhroh	120.5	12.54	0.090	0.903
6	Mr. Abius Matlang	75	9.62	0.110	1.150
7	Mrs. Merinda Marbaniang	50	4.57	0.086	0.828
8	Mr. Sanbot Thangkhiew	80	6.69	0.085	0.855
9	Mrs. Larihun Mawlong	110	8.5	0.120	1.205
10	Mrs. Sankilda Lapang	135	18.7	0.097	0.971
Mean	73.94 ± 46.87	11.44 ± 5.25	0.24 ± 0.27	2.49 ± 2.75	

Seedlings age: 20 days

No. of seedlings/hill:2

Organic Vegetables and Crop Production:

1) Leguminous crops

Crops like groundnut, soybean etc. were cultivated in newly constructed terraces to enhance the soil fertility. Groundnut (Var. ICGS 76 @ 50 kg) and Soybean (Var.JS-81@50 kg) were cultivated as trials in farmer's field at various locations and it was found that 750 kg of groundnut could be produced from an area of 3000 square meter.

2) Turmeric Plantation

Turmeric is one of the major spices of the north-eastern region, however turmeric has not occupied a significant area in this region. Although, there are no processing industries however some farmers of the village have started growing turmeric. About 500 kg of turmeric rhizomes (var. megha turmeric-1) were distributed to farmers. Most of the turmeric was

List of beneficiary for Turmeric plantation and their Production

Sl. No.	Name of beneficiary	Area (m2)	Production (kg)	Yield(kg/ m2)	Yield (t/ha)
1	Mrs. Ribet Lyngdoh	290	606.9	2.16	21.60
2	Mr. Wellington Rymbai	301	599.43	2.96	29.60
3	Mrs. Merinda Lyngdoh	260	365	2.01	20.12
4	Mr. Bantei Rynhang	305	635	2.75	27.52
5	Mr Bakutlang Lyngdoh	287	615.04	2.26	22.60
6	Mr Teilang Rynhang	195	311.2	1.94	19.40
7	Mrs. Palei Lyngdoh	147	125.5	1.06	10.62
8	Mr. Jopthiaw Makhroh	196	224.53	1.86	18.64
9	Mrs. Kyntiew Lyngdoh	195	210.22	1.60	16.01
10	Mrs. Dority Mawlong	140	145.82	2.57	25.71
11	Mr. Banker Mawlong	183	190.95	1.18	11.80
12	Mr. Boxes Lapang	166	164.64	1.95	19.50
	Mean	222.08 ± 62.20	349.51 ± 206.36	2.02 ± 0.57	20.26 ± 5.74

List of beneficiaries, area and production of french beans in mynsain village

		French bean (Var. Naga Local)			
Sl.No	**Name of Famers**	**Area (m2)**	**Production (kg)**	**Yield (kg/ m2)**	**Yield (t/ha)**
1	Mrs. Bala Rympei	150	30	0.30	3.00
2	Mrs. Melis Rymbai	70	25	0.25	2.50
3	Mrs. Nola Rymphang	250	90	0.38	3.80
4	Mr. Trias Lapang	120	32	0.24	2.40
5	Mrs. Aitimon Lapang	160	34	0.31	3.10
6	Mr. Banker Matlang	115	29	0.23	2.30
7	Mr. Sumar Lyngdoh	120	35	0.27	2.70
8	Mrs. Rophila Jala	180	40	0.29	2.90
9	Mr. Sirbon Lapang	190	55	0.17	1.70
10	Mrs. Merrily Mawlong	300	65.5	0.34	3.40
11	Mrs. Wanroi Kharbudon	190	20	0.17	1.70
12	Mrs. Biloris Nongrang	140	18	0.18	1.80
13	Mrs. Bibibiancy Shadap	290	60	0.20	2.00
14	Mr. Piar Lyngdoh	160	40	0.11	1.10
15	Mr. Fleming Lyngdoh	140	25	0.15	1.50
Mean		171.66 ± 64.90	39.9 ± 19.73	0.23 ± 0.07	2.39 ± 0.76

planted in raised bed (bun system) at a spacing of 30 x 30cm and fym was applied @ 2kg/m2.

3) French bean:

A total of 100 kg french-bean seeds (var. naga local) were distributed to fifteen numbers of beneficiaries in mynsain village for crop diversification and increasing the income. The seeds were planted at a spacing of 30 x 15 cm and fym was incorporated @ 10 t/ha. The average production was found to be (2.39 ± 0.76t/ha).

4) Potato:

350kg of potato tubers (Var. Kufrimegha) was distributed to fifteen farmers of Mynsain village. The sprouted tubers were planted in temporary raised beds made by the farmers in their paddy fields after rice harvesting. The tubers were planted in furrows at the spacing of 50 x 30cm and FYM @ 10-15 t/ha was applied in the opened furrows before planting. The Average yield was (7.22 ± 2.84 t/ha).

5) Bitter gourd:

100g of bitter gourd seeds (var. malay 101) was distributed to five farmers of mynsain village. The field was thoroughly ploughed (3-4 times) before planting by digging with the help of spades and well rotten fym @ 15 t/ha was incorporated at the time of plugging. The seeds were 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 (7.32 ± 1.66 t/ha).

6) Cucumber:

200g of cucumber seeds (var. malini) were distributed to ten farmers of mynsain village. Before planting the soil was thoroughly ploughed (3-4 times) by digging through spades and well rotten FYM @ 15 t/ha was mixed at the time of plugging. The seeds were planted at a spacing of 1.5 to 2.5m (row to row) x 60 to 90cm (plant to plant). The average yield was found to be (8.12 ± 1.45/ha).

List of beneficiaries, area and production of french beans in mynsain village

Potato (var. kufri megha)					
Sl.No	**Name of Famers**	**Area (m2)**	**Production (kg)**	**Yield (kg/ m2)**	**Yield (t/ha)**
1	Mrs. Sorianda Lyngdoh	10.2	12	1.56	15.60
2	Mrs. Pynjanai Nongsiej	25.19	16.5	0.87	8.70
3	Mr. Hor Nomngkharai	18.51	12.4	0.67	6.70
4	Mr. Revulut Nongsiej	7.82	6	0.66	6.66
5	Mr. Krion Kyrshan	6.83	4.5	0.50	5.00
6	Mr. Tista Lapang	20.54	16.5	0.87	8.70
7	Mr. Bensimai Nongsiej	15.81	8.25	0.79	7.90
8	Mrs. Debora Kurbah	20.23	8.55	0.71	7.10
9	Mrs. Marvellyngdoh	16.42	7.98	0.62	6.20
10	Mrs. Anjela Kharai	5.99	3.54	0.56	5.60
11	Mrs. Dwian Lapang	8	6.20	0.35	3.50
12	Mrs. Lilda Lapang	14.78	7.84	0.55	5.50
13	Mrs. Philmon Rani	21.35	17.50	0.69	6.90
14	Mr. General rynghang	26.64	20.13	0.96	9.60
15	Mrs. Balisha Rynghang	11	9.56	0.47	4.70
Mean		15.28 ± 6.75	10.49 ± 5.11	0.72 ± 0.28	7.22 ± 2.84

Name of beneficiaries, area, production and productivity of bitter gourd at Mynsain village

Bitter Gourd (Var. Malay 101)					
Sl.No	**Name of Famers**	**Area (m2)**	**Production(kg)**	**Yield(kg/ m2)**	**Yield (t/ha)**
1	Mr. Sharai Kyrsain	130	90	0.88	8.80
2	Mr. Kenny Nongsiej	60	42	0.73	7.30
3	Mr. RoneyDondor	75	36	0.78	7.80
4	Mrs. M Pasi	80	45	0.82	8.20
5	Mr.Jajan Nongsiej	58	36	0.45	4.50
	Mean	80.6 ± 29.18	49.80 ± 22.80	0.73 ± 0.16	7.32 ± 1.66

Name of beneficiaries, area, production and productivity of cucumber at Mynsain village

Cucumber (var. malini)					
Sl.No	**Name of Famers**	**Area (m2)**	**Production(kg)**	**Yield(kg/ m2)**	**Yield (t/ha)**
1	Mrs. Baiamon Matlang	89	73	0.83	8.30
2	Mr. Los Kurbah	110	82	0.98	9.80
3	Mrs. Shai Rynghang	87	65	0.73	7.30
4	Mr David Myrboh	115	89	0.94	9.40
5	Mrs. Sophimon Rynghang	90	66	0.86	8.60
6	Mrs. Shimti Rynghang	120	79	0.96	9.60
7	Mrs. Shalita Lyngdoh	74	54	0.59	5.90
8	Mrs Judy Myrboh	125	115	0.93	9.30
9	Mr. Rophin Kurbah	75	52	0.66	6.60
10	Mrs.Rilin Makdoh	89	66	0.64	6.40
	Mean	**97.4± 18.54**	**74.1 ± 18.52**	**0.81 ± 0.14**	**8.12 ± 1.45**

7) Lettuce:

300g of lettuce seeds (Var. Iceberg Cabbage TYP) were distributed to eight numbers farmers. The nursery was temporarily prepared on raised beds in paddy fields after rice harvesting. The seedlings were then transplanted at a spacing of 45 x 30 cm and FYM @ 10t/ha was applied at the time of planting. The average yield was found to be (5.63 ± 2.24 t/ha).

8) Tomato:

500g of tomato seeds (var. avinash and rocky) was also distributed to 25 farmers. Seedlings were raised temporarily on raised beds after rice harvesting and later were transplanted at a spacing of 60 x 45 cm and FYM was incorporated @ 20t/ha at the time of planting. The average yield was found to be higher in rocky (22.11 ± 5.76 t/ha) than in avinash (2.03 ± 7.22).

Name of beneficiaries, area, production and productivity of lettuce at Mynsain village

		Lettuce (Iceberg Cabbage TYP)			
Sl.No	**Name of Famers**	**Area (m2)**	**Production(kg)**	**Yield(kg/ m2)**	**Yield (t/ha)**
1	Mr Niewkor Rympei	80	20	0.60	6.00
2	Mr. Shemphang Rympei	130	55	0.88	8.88
3	Mrs.Lophina Rynghang	75	29	0.56	5.60
4	Mrs. Sankilda Lapang	86	35	0.64	6.40
5	Mrs. Ladei Nongsiej	122	50	0.82	8.20
6	Mrs. Smin Rynghang	60	19	0.26	2.60
7	Mrs Rachel nongrum	84	24	0.43	4.30
8	Mrs Pynrkhie Matlang	68	19	0.31	3.10
	Mean	**88.12 ± 24.94**	**31.37 ± 14.21**	**0.56 ± 0.22**	**5.63 ± 2.24**

9) Sweet potato:

600 numbers of sweet potato cuttings (var. kokrajhar) were planted in fields of four farmers at a spacing of 50 x 50 cm on raised beds. At 30 DAT, inter cultural operations (weeding and earthling up) were performed by the farmers and FYM @ 10-15 t/ha was also incorporated. The average yield was found to be (27 ± 9.62 t/ha).

Community Nursery:

One community nursery was formed in the village (Mynsain) during the year 2016 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:

300g of cabbage seeds (var. fiesta) was distributed to ten farmers in Mynsain village, Nursery preparation and other inter cultural practices was carried out before transplanting. Seedlings were transplanted at the 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 (3.64 ± 1.73 t/ha).

12) Broccoli

150g of broccoli seeds (var. green magic) were distributed to 10 farmers.Nursery preparation and other inter cultural practices was carried out and the seedlings were transplanted at a recommended spacing of 45 x 30 cm. FYM@10-15 t/ha was incorporated before transplanting of the seedlings. The average yield was found to be (3.92 ± 2.22 t/ha).

13) Chilli

200g of chilli seeds (var. Telwa BSS) were distributed to five farmers. Nursery preparation and other inter cultural practices was carried out and the seedlings were transplanted at a recommended spacing of 45 x

Name of beneficiaries, area, production and productivity of tomato at Mynsain village

Tomato (var. avinash)					
Sl.No	**Name of Famers**	**Area (m2)**	**Production (kg)**	**Yield (kg/ m2)**	**Yield (t/ha)**
1	Mr. Omweltariang	31	20	2.45	24.50
2	Mrs. Jiaryngkhat Nongsiej	100.45	110	1.98	19.80
3	Mr. Chester Nongsiej	56.31	120	3.12	31.20
4	Mrs.Airisha Kurbah	75.69	210	1.92	19.20
5	Mr. Rophin Kurbah	54.05	80	1.02	10.20
6	Mrs. Melis Rympei	86.22	160	1.66	16.60
7	Mr. Victor Rympei	56.48	90	0.98	9.8
8	Mr. Shlur Makhroh	496.7	900	2.14	21.40
9	Mr.Jopthiaw Makdoh	122.9	280	2.76	27.60
	Mean	**119.9 ± 143.94**	**218.88 ± 266.52**	**2.00 ± 0.72**	**20.03 ± 7.22**
		(var.rocky)			
10	Mrs. Banrihun Rani	197.9	400	3.01	30.10
11	Mrs. Lilda Lyngdoh	124.05	165	1.95	19.50
12	Mr. Phlan Sting	230.81	850	2.82	28.20
13	Mr. Rongdondor Makhroh	329.3	810	2.73	27.30
14	Mr. Rias Makhroh	275.32	380	1.99	19.90
15	Mr. Morning Lapang	79.56	90	1.63	16.30
16	Mr. Debinus Nongsiej	136.2	270	2.35	23.50
17	Mrs. Bethel Lyngdoh	145.85	280	1.78	17.80
18	Mr. Jetwis Sohkhra	89.45	135	2.31	23.10
19	Mrs. Diamond Nongkharai	66.89	95	1.54	15.40
	Mean	**167.53 ± 88.20**	**347.5 ± 276.74**	**2.21 ± 0.51**	**22.11 ± 5.16**

Name of beneficiaries, area, production and productivity of sweet potato at Mynsain village

Sweet potato cuttings (var. kokrajhar)					
Sl.No	**Name of Famers**	**Area (m2)**	**Production(kg)**	**Yield(kg/ m2)**	**Yield (t/ha)**
1	Mr.SkolaLapang	16	27.6	1.60	16
2	Mr. Junior Lyngdoh	18	28.4	2.20	22
3	Mrs. Shalita Lyngdoh	22	33.7	2.87	29
4	Mr. Bianglut Rympei	29	30.3	3.94	39
	Mean	**21 ± 5.73**	**30 ± 2.71**	**2.65 ± 1.00**	**27 ± 9.62**

30 cm. FYM@10-15 t/ha was incorporated before transplanting of the seedlings. The average yield was found to be (4.10 ± 2.23 t/ha).

14) Carrot:

150g of carrot seeds were distributed to five farmers. Nursery preparation and other inter cultural practices was carried out and the seedlings were transplanted at a recommended spacing of 30 x 30 cm. FYM@10-15 t/ha was incorporated before transplanting of the seedlings. The average yield was found to be (4.22 ± 2.94 t/ha).

One of the community nursery at Mynsain village

Name of beneficiaries, area, production and productivity of sweet potato at Mynsain village

Cabbage (var. fiesta)					
Sl.No	**Name of Famers**	**Area (m2)**	**Production(kg)**	**Yield(kg/ m2)**	**Yield (t/ha)**
1	Mr. Brilang Kurbah	120	55	0.60	6.00
2	Mrs. Medal Shylla	150	72	0.39	3.90
3	Mrs. Melis Rympei	50	26	0.54	5.40
4	Mr. Hynniew Rynghang	60	16	0.28	2.80
5	Mrs. Pynsan Rynghang	9	5	0.42	4.20
6	Mr. Iashemlang Lapang	20	12	0.22	2.20
7	Ms Dahunshisha Lyngdoh	50	18	0.34	3.40
8	Ms.Korphila Lapang	110	50	0.58	5.80
9	Mrs.Iadei Nongsiej	10	5	0.12	1.20
10	Mr.Trias Makdoh	15	8	0.15	1.50
	Mean	59.40 ± 50.68	26.70 ± 23.79	0.36 ± 0.17	3.64 ± 1.73

Brocolli seeds (var. green magic)					
Sl.No	**Name of Famers**	**Area (m2)**	**Production(kg)**	**Yield(kg/ m2)**	**Yield (t/ha)**
1	Mr. Phrang Lyngdoh	50	20	0.35	3.50
2	Mr Pynhun Rymbai	80	50	0.78	7.80
3	Mrs. Linda Rympei	50	25	0.34	3.40
4	Mr. Bansan Maring	25	15	0.24	2.40
5	Mrs. Bina Rynghang	30	22	0.25	2.50
	Mean	**47 ± 21.67**	**26.40 ± 13.68**	**0.39 ± 0.22**	**3.92 ± 2.22**

Name of beneficiaries, area, production and productivity of cabbage at Mynsain village

Chilli seeds (var. Telwa BSS)					
Sl.No	**Name of Famers**	**Area (m2)**	**Production(kg)**	**Yield(kg/ m2)**	**Yield (t/ha)**
1	Mr.Sunny Lyngdoh	80	50	0.56	5.60
2	Mrs.MerishalMallai	120	80	0.89	8.90
3	Mrs.MelisRympei	40	25	0.34	3.40
4	Mr.PhrangRynghang	20	15	0.23	2.30
5	Mrs.BalaRynghang	15	7	0.20	2.00
	Mean	**55 ± 44.44**	**35.40 ± 29.72**	**0.41 ± 0.22**	**4.10 ± 2.23**

Carrot seeds (var.Kuroda New)					
Sl.No	**Name of Famers**	**Area (m2)**	**Production(kg)**	**Yield(kg/ m2)**	**Yield (t/ha)**
1	Mr.Banker Lyngdoh	50	20	0.52	5.20
2	Mr Jril Makdoh	100	80	0.89	8.90
3	Mr.PhrangRynghang	30	25	0.32	3.20
4	Mrs Palei Rymbai	25	15	0.20	2.00
5	Mrs.Janai Rynghang	10	7	0.18	1.80
	Mean	**43 ± 34.92**	**29.40 ± 29.05**	**0.42 ± 0.29**	**4.22 ± 2.94**

15) Pea:

200kg of pea seeds were distributed to twenty farmers. Nursery preparation and other inter cultural practices was carried out and the seedlings were transplanted at a recommended spacing of 30 x 30 cm. FYM@10-15 t/ha was incorporated before transplanting of the seedlings. The average yield was found to be (2.69 ± 0.93 t/ha).

Pea (var. arkel & vikash)					
Sl.No	**Name of Famers**	**Area (m2)**	**Production(kg)**	**Yield(kg/ m2)**	**Yield (t/ha)**
1	Mr Will Lyngdoh	150.4	75	3.45	34.50
2	Mr Pynkhraw Rymbai	100.45	50	2.98	29.80
3	Mrs Merisha Mallai	70.2	45	2.12	21.20
4	Mrs.Belinda Kurbah	75.00	42	2.92	29.20
5	Mr Rang Kurbah	50.81	23	1.42	14.20
6	Mrs.Balari Rympei	80.42	58	1.66	16.60

7	Mr. Victor Kurbah	60.50	59	1.98	19.80
8	Mr. ShlurMakhroh	250.3	120	4.01	40.13
9	Mr Jril Makdoh	130.7	97	2.76	27.61
10	Mrs.Banrihun Rani	240.2	125	3.98	39.81
11	Mrs.Lucy Lyngdoh	150.40	70	2.95	29.55
12	Mrs. Lisa Syiem	258.3	130	3.98	39.80
13	Mr. RongdondorMakhroh	300.25	145	4.58	45.82
14	Mr Khraw Makhroh	50.78	25	1.69	16.94
15	Mr. Lastly Lapang	79.56	47	1.89	18.90
16	Mr. Lung Sun	130.2	65	2.39	23.93
17	Mrs.Bethel Lyngdoh	145.00	200	2.78	27.79
18	Mrs Phira Syiem	90.00	58	2.01	20.15
19	Mrs Susan Suchiang	65.90	42	1.54	15.40
20	Mr Revi Kharbudon	80.57	62	2.86	28.61
	Mean	**127.99 ± 76.44**	**76.90 ± 45.48**	**2.69 ± 0.93**	**26.98 ± 9.31**

PUBLICATIONS/HUMAN REOURCE DEVELOPMENT AND WORKSHOPS /MEETINGS

08

8.1 Publications

8.1.1 Research Papers

- A.M. Patel, P.K. Patel, A.K. Saini and K.M. Patel (2016). Sustainability of farm and farmers through eco-friendly IFS approach. Indian Agriculturist, vol. 60 (1and2), pp. 15-19.
- A.M. Patel, P.K. Patel, A.K. Saini and K.M. Patel (2017). Long term integrated nutrient management in pearlmillet – wheat cropping system under North Gujarat Agro-Climatic Region. Trends in Biosciences 10(24), pp. 5155-5157,
- A.M. Patel, P.K. Patel, A.K. Saini and K.M. Patel (2017). Management of cropping systems for resource conservation. Green Farming Vol. 8 (4): 962-965.
- B. L.Yadav, A. M. Patel, B. S. Patel, Shaukat Ali and Jitendra Singh (2016) Quality and soil fertility as influenced by different row spacing and intercropping systems in Rabi fennel (Foeniculum vulgare Mill.) Adv. Res. J. Crop Improv; 8(1) pp. 75-79.
- Choudhary, Roshan, Sharma, S. K. and Choudhary, R. S. 2017. Effect of Bio Herbal Growth Promoter on Growth and Yield of Wheat Grown under Organic Management Chemical Science Review and Letters 6 (22): 1022-1026.
- C.K.Desai, B.S.Rathore and A.M.Patel (2016). Effect of weed control treatment on weed dynamics and yield of mustard [Brassica juncea (L.) Czern and Coss.] Research on Crops vol. 17(3):489-492.
- D. K. Parmar and D.R. Thakur (2017). Improvement in soil physical, chemical and microbiological properties during cropping cycles under different nutrient managements in Western Himalayas. International Journal of Current Microbiological and Applied Sciences, 6 (6):487-496.
- D.K. Singh, Shilpi Gupta, Gangadhar Nanda, Y. Sharma, V. V. Singh 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.
- Hari SIngh, S.S., Burark, S.K. SHarma, D.K. Jajoria and R.P. Sharma 2017. Economic Evaluation of Farming Systems for Agricultural Production in SOurthern Rajasthan. Economic Affairs 62 (1): 1-7.
- Jitendra Singh, A.M. Patel, B.S. Rathore, Shaukat Ali and B.L. Yadav (2017) Nutrient uptake and physico-chemical properties of soil as influenced by Bt cotton (Gossypium hirsutum L.) based cropping systems under different spacings. Adv. Res. J. Crop Improv. 7(2) pp. 180-186.
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- Kanwar H., Trivedi A., Chandrawat B.S. and Sharma S.K. 2016. Progression of Powdery mildew, Alternaria Blight and Bacterial Leaf Blight of Cluster Bean in Relation to Weather Parameters.

Journal Pure and Applied Microbiology, 10 (2): 1285-1292.

- K.D. Ameta, S.K. Shrma, R. B. Dubey and R.A. Kaushik 2017. Effect of Humic Acid and Micro Nutrients on Growth and Yield of Poly House Grown Cucumber (Cucumis sativus L.). Chemical Science Review and Letters 6 (21), 88-93.
- Kumar, N., Sharma, S. K., Yadav, S. K., Choudhary, R and Choudhary, R. S. 2016. Nutrient content, uptake and economics of sweet corn [Zea mays (L.) spp. saccharata] grown under organic management practices. Crop Research 51 (1, 2 & 3): 38-44.
- Kumar, N., Sharma, S. K., Yadav, S. K., Choudhary, R. S. and Choudhary, R. 2016. Growth and yield of sweet corn grown under organic management practices. Annals of Plant and Soil Research.18 (4): 328-332.
- Lenka S, Lenka N K, Singh A B, Singh B and Raghuwanshi Jyothi (2016). Global warming potential and greenhouse gas emission under different soil nutrient management practices in soybean-wheat system of central India. Environmental Science and pollution Research, DOI 10.1007/s11356-016-8189-5.
- Sandhya Bhatt, R L Lal, K.K.Misra and D.K.Singh. 2017. Response of organic formulations on fruiting and yield of litchi (Litchi chinensis Sonn.) cv. Rose Scented. Journal of Pharmacognosy and Phytochemistry. 6(6): 2092-2095.
- Sharma, S. K., Choudhary, Roshan, Trivedi, A., Choudhary, R. S. and Yadav, Sharvan K. 2017. Response of Organic Nutrient Management Practices on Soil Properties and Productivity of Chickpea (Cicer arietinum L.) International Journal of Bio-resource and Stress Management 8 (2): 196-200.
- Sharma, R. K., Sharma, S.K. and Yadav, C.M. 2016. Impact analysis of front line demonsrations on horsegram in Bhilwara district of Rajasthan (India) under rainfed condition. Legume Research 39 (I): 145-148.
- Srinivasan V, Thankamani CK, Dinesh R, Kandiannan K, Zacharia TJ, Leela NK, Hamza S, Shajina O and Ansha O. 2016. Nutrient management system in turmeric: Effect on soil quality, rhizome yield and quality. Industrial Crops and Products. 85, 241-250
- 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. In: Proceedings of International Conference on Environment and Agriculture in the U. N Sustainable Development Goals held during December, 17-19, 2016 at Noor-us-Sabha, Bhopal.
- Thankamani CK, Kandiannan K, Hamza S & Saji K V. 2016. Effect of mulches on weed suppression and yield of ginger (*Zingiber officinale* Roscoe). Scientia Horticulturae. 207, 125–130
- Thankamani C.K, Srnivasan V, Hamza S, Dinesh R and Praveena R.2017.Cultivation of Organic Turmeric Plants. Indian Journal of Arecanut, Spices & Medicinal Plants. 19(3)10-15
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- Yadav, S. K., Babalad, H. B., Sharma, S. K. and Choudhary, R. K. 2016. Studies on Nutrient Management through Organics in Summer Mungbean (Vigna radiata L. Wilczk). The bioscany, 11 (4): 2345-2347.
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Attributes and Yield of Summer Mungbean. International Journal of Bio-resource and Stress Management, 7 (5): 1136-1139.

8.1.2 Popular article/folders/ Palmphlet

- A.M. Patel, P.K. Patel, A.K. Saini and K.M. Patel (2016). Khetima vadhare napho meravava sanklit kheti padhdhati (IFS) Model. Krushima yantrikaran booklet published by RE and EE College, SDAU, S.K.Nagar pp.15.
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- Rashidpervez, S.Prasannakumari, Srinivasan V, Thankamani. C.K, Hamza, T.John Zachariah, R.Dinesh, R.Praveena.2017. Masalomka gaivik ulpadan. Kalimirch, Adarak, haldhi. ICAR-IISR, Kozhikode. P38
- 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) pp 16-23.
- Srinivasan V, Thankamani CK, Hamza S, John Zacharia T, Dinesh R and Praveena R. 2017. Organic spices production. ICAR-IISR, Kozhikode. 44 P.
- Singh, A. B, K Ramesh, Brij Lal Lakaria, S. Ramana and J. K. Thakur (2016). Utpadakta Evam Mridha Swasthya ke liye Jaivik Verdan Krishi PranaliVaigyanik Patrika, July-December, 2016 pp 20-24.
- Singh, A. B, Manna M C, Tripathi A K and Patra A K (2017). Vermicopmosting- carbonic upshit padharthon se jaivik khad banane ki takneek.Mridha Swasthya Aalok Patrika. ICAR-IISS, Bhopal, pp 127-134.
- Singh, A. B, Manna M C, Tripathi A K and Patra A K (2017). Jaivik kheti Tecau Utpadakta Evam Mridha Swasthya ke liye Verdan.Mridha Swasthya Aalok Patrika. ICAR-IISS, Bhopal, pp 135-142.
- Thankamani CK, Hamza S, Srinivasan V, Dinesh R, John Zacharia T and Praveena R. 2017. *Jaiva kurumulagu* (Malayalam). ICAR-IISR, Kozhikode. 28 p.
- Thankamani CK, Hamza S, Srinivasan V, Dinesh R, John Zacharia T and Praveena R. 2017. *Jaiva manjal* (Malayalam). ICAR-IISR, Kozhikode. 16 p.
- Thankamani CK, Hamza S, Srinivasan V, Dinesh R, John Zacharia T and Praveena R. 2017. *Jaiva inchi* (Malayalam). ICAR-IISR, Kozhikode. 16 p.

- डॉ. एस. के. शर्मा, 2017 जैविक कृशिः उद्धेश्य, विशेषताऐं एवं सिद्धान्त जैविक कृषि प्रशिक्षण प्रस्तिका, उन्नत भारत अभियान, भारतीय कृषि अनुसंधान परिषद, नई दिल्ली पेज नं. 1.18
- डॉ. एस. के. शर्मा 2017 जैविक प्रमाणीकरण जैविक कृषि प्रशिक्षण पुस्तिकाए उन्नत भारत अभियानए भारतीय कृषि अनुसंधान परिषद, नई दिल्ली पेज नं. 19—25
- डॉ. एस. के. शर्मा 2017 जैविक कृषि में उद्यमिता विकास एंव रोजगार के अवसर जैविक कृषि प्रशिक्षण पुस्तिकाए उन्नत भारत अभियान भारतीय कृषि अनुसंधान परिषद, नई दिल्ली पेज नं. 146.156.
- डॉ. एस. के. शर्मा, डॉ. रोशन चौधरी एवं डॉ. अमित त्रिवेदी 2016 जैविक कृषि में उद्यमिता विकास एंव रोजगार के अवसर, कृषि में नवाचार समृद्धि की ओर बढते कद पेज नं. 6.11.
- डॉ. रोशन चौधरी डॉ. एस. के. शर्मा, डॉ. डी. के. जाजोरिया एवं श्रवण कुमार यादव 2016 जैविक खेती में खरपतवारों का पुनर्चक्रण द्वारा पोषक तत्व प्रबंधन, कृषि भारती जयपुर पेज नं. 25—24

- डॉ. एस. के. शर्मा एवं डॉ. रोशन चौधरी 2016 जैविक आदान उत्पादन की तकनीके नवम्बर कृषि में नवाचार – समृद्धि की ओर बढ़ते कदम। पेज नं. 61–66

- डॉ. रोशन चौधरी डॉ. एस. के. शर्मा, श्रवण कुमार यादव एवं रवीन्द्र जैन 2016 जैविक फसलों में पोशक तत्व प्रबन्धन कृषि में नवाचार समृद्धि कृषि में नवाचार – समृद्धि की ओर बढ़ते कदम। पेज नं. 81–86

- डॉ. रोशन चौधरी 2017 बायोडायनेमिक एंव जीरो बजट खेती जैविक कृषि प्रशिक्षण पुस्तिकाए उन्नत भारत अभियानए भारतीय कृषि अनुसंधान परिषद, नई दिल्ली पेज नं. 26–37.

- डॉ. रोशन चौधरी 2017 जैविक खेती में पंचगव्य का महत्व एंव उपयोग जैविक कृषि प्रशिक्षण पुस्तिकाए उन्नत भारत अभियान, भारतीय कृषि अनुसंधान परिषद, नई दिल्ली पेज नं. 52–56.

- डॉ. रोशन चौधरी 2017 जैविक खेती में खरपतवार प्रबंधन के सिद्वान्त एंव विधियाँ जैविक कृषि प्रशिक्षण पुस्तिकाएँ उन्नत भारत अभियान, भारतीय कृषि अनुसंधान परिषद, नई दिल्ली पेज नं. 52–56

- डॉ. अमित त्रिवेदी 2017 जैविक खेती में रोग प्रबंधन के सिद्वान्त एवं विधियाँ जैविक कृषि प्रशिक्षण पुस्तिकाएँ उन्नत भारत अभियान, भारतीय कृषि अनुसंधान परिषद, नई दिल्ली पेज नं. 84–96

- डॉ. अमित त्रिवेदी 2017 विभिन्न फसलों में जैविक खेती की तकनीके जैविक कृषि प्रशिक्षण पुस्तिकाएँ उन्नत भारत अभियान, भारतीय कृषि अनुसंधान परिषद, नई दिल्ली पेज नं. 104–115

- डॉ. गजानन्द जाट 2017 जैविक खेती में पोषक तत्व प्रबन्धन जैविक कृषि प्रशिक्षण पुस्तिकाए उन्नत भारत अभियान, भारतीय कृषि अनुसंधान परिषद, नई दिल्ली पेज नं. 38–51

- डॉ. हेमन्त स्वामी 2017 जैविक खेती में कीट प्रबंधन जैविक कृषि प्रशिक्षण पुस्तिकाएँ उन्नत भारत अभियान, भारतीय कृषि अनुसंधान परिषद, नई दिल्ली पेज नं. 76–83

8.1.3 Books/ Book Chapter/ Bulletins/Mannual

- Concise Agriculture" book 3rd Revised Edition published by New Vishal Publications, New Delhi (2016)

- D.K. Singh, K.P. Raverkar, Chandra Bhushan and Shilpi Gupta (2017). Organic Package of Practices for Uttarakhand. In Organic Farming (Crop Production Guide) (N. Ravishankar, A.S. Panwar, Kamta Prasad, Vipin Kumar, S. Bhaskar Eds.). Today and Tomorrow Printer and Publishers, New Delhi p 51-72.

- D.K. Singh, Shilpi Gupta and Yogesh Sharma (2017). Nutrient Management in Organic Farming: Principal and Practices. In Organic Farming (Crop Production Guide) (N. Ravishankar, A.S. Panwar, Kamta Prasad, Vipin Kumar, S. Bhaskar Edts.). Today and Tomorrow Printer and Publishers, New Delhi p 18-32.

- Manna, MC, Sahu Asha, Singh A B, Sudeshna Bhattacharjya, Ashok K Patra, Chaudhari S K , Subba Rao A and Khanna S S (2017). Quality compost production from solid waste for enhancing crop productivity and soil health. Bulletin No: 02/IISS/2017, ICAR-IISS, Bhopal, pp1-63.

- N. Ravishankar, S.K. Sharma, D.K. Singh, A.S. Panwar and Vipin Kumar (2017). O rganic Farming in India: Production Issues and Strategies In Organic Farming (Crop Production Guide) (N. Ravishankar, A.S. Panwar, Kamta Prasad, Vipin Kumar, S. Bhaskar

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- Singh, A B and A. Subba Rao (2016). Recycling of Organic Wastes by different Composting Techniques for Sustainable Agriculture. In: Improving Productivity of Drylands by Sustainable Resource Utilization and Management. Editors: Devi Dayal et al CAZRIRR, Station Kukum Bhuj,Publisher, New India Publishing Agency, New Delhi, India,pp115-126.
- Srinivasan V, Thankamani CK, Hamza S and John Zachariah .2016. Western Coastal Plains and Ghats: Kerala. In: Organic Farming: Technologies and Strategies (Eds.) B. Gangwar and N. K. Jat. Today & Tomorrow's Printes and Publishers, New Delhi, India. 327-345
- Thankamani CK, Srinivasan V, Hamza S. 2017. Organic farming in spices. In *Organic Farming in Plantation Crops*, Krishnakumar V and Chowdappa P (Eds.). Daya Publishing House, Astral International Pvt Ltd, New Delhi. 215-248.
- Tripathi A K , Ramana S, Singh A B , Manna M C and Ashok K Patra (2017). Mridha Swasthya Aalok Patrika. ICAR-IISS, Bhopal, pp1-174.

8.1.4 Participation in Conferences/ Paper presented/AbstractsMeeting/ Seminar/ Symposium/ /Workshop

- A.M. Patel, P.K. Patel, A.K. Saini and K.M. Patel (2016). Potential integrated farming system model under north Gujarat agro climatic situations. 4th International Agronomy Congress, organized by ISA, New Delhi, India Extended Summaries Vol. 1. pp. 223.
- Actively participated in Chart preparation for Krushimahotsav -2016-17 organized by Government of Gujarat at Sardarkrushinagar (Banaskantha).
- Choudhary, R., Sharma, S. K. and Choudhary, R. S. 2017. Use of Neem based Indigenous Technical Knowledge (ITK) in Organic Farming and Research Needs. National Symposium on 'The Role of Vrikshayurveda and Traditional Practices in Organic Agriculture', MPUA&T, Udaipur, India during 6-8 March, 2017 pp 08.
- Choudhary, G. L., Sharma, S. K., Kaushik, M. K. and Singh, K. P. 2017. Effect of Panchagavya on Growth, Yield and Quality of Organic Black gram (Vigna mungo). National Symposium on 'The Role of Vrikshayurveda and Traditional Practices in Organic Agriculture', MPUA&T, Udaipur, India during 6-8 March, 2017 pp 20.
- D.K.Singh, Shilpi Gupta, Yogesh Sharma 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.
- Jain, R. K., Yadav, S. K., Sharma, S. K. and Choudhary, R. 2017. Organic weed management: an alternate way to minimize herbicide hazards. Biennial Conference of the Indian Society of Weed Science on "Doubling Farmers' Income by 2022: The Role of Weed Science", MPUA&T, Udaipur, India during 1-3 March, 2017 pp 291.
- Jain, R. K., Yadav, S. K., Singh, M., Yadav, V. K. and Choudhary, R. 2017. Indigenous Technical Knowledge: A way to protection environment.

National Symposium on 'The Role of Vrikshayurveda and Traditional Practices in Organic Agriculture', MPUA&T, Udaipur, India during 6-8 March, 2017 pp 14.

- Kanwar, H., Trivedi, A., Sharma, S. K. and Chandrawat, B. S. 2017. Eco-friendly Approaches for Managing Major Foliar Disease of Cluster bean through Organic Inputs. National Symposium on 'The Role of Vrikshayurveda and Traditional Practices in Organic Agriculture', MPUA&T, Udaipur, India during 6-8 March, 2017 pp 46.
- K.M. Patel, B.J. Patel, J.C. Patel and A.M. Patel (2016). Response of semi Rabi castor (Ricinus communis) to irrigation and nitrogen fertigation. 4th International Agronomy Congress, organized by ISA, New Delhi, India Extended Summaries Vol. 1. pp. 790.
- Neha Chaudhary, B.B. Patel, A.M. Patel and Chatra Ram (2016). Phosphorus management in cowpea (Vigna unguiculata) on loamy sand soil. 4th International Agronomy Congress, organized by ISA, New Delhi, India Extended Summaries Vol. 1. pp. 867.
- Lenora Ditzler, T.A. Brelard, C. Francis, M Chakraborty, D.K.Singh, A. Srivastava, Eyhorn Frank, J.C.J. Groot, Johan six and Charlotte Decock. 2017.
- Nutrient management recommendation for smallholder organic basmati rice production in Northern India. In: Proceedings of the Scientific Conference "Innovative research for Organic Agriculture 3.0 of 19th Organic World Congress, New Delhi, New Delhi, Nov. 9-11, organized by ISOFAR, NCOF and TIPI during 9-11 Nov., pp 436-440.
- Srinivasan V, Thankamani CK, HamzaS, Dinesh R and John T Zachariah.2016. Influence of crop management practices on quality of ginger, turmeric and black pepper, In: Ramesh Kumar KB, Prakashkumar R, Ajiykumar KG. (Eds). International Symposium on Phytochemistry & Prop. Dr. Hisham Endowment Award Ceremony- 2016 at Malabar Botanical Garden and Institute for plant Sciences, Kozhikode. p 65. (Abs.)
- Singh, A.B. (2016) Interface Meeting on Enhancing the Preparedness of Agricultural Contingencies in kharif 2016 for Madhya Pradesh, ICAR-IISS, Bhopal.
- Singh, A.B., K Ramesh, Brij Lal Lakaria, S Ramana and J K.(2016)11th Annual Group Meeting of Net Work Project on Organic Farming ICAR-IISS, Bhopal.
- Singh, A.B.(2016) Workshop on Safe Utilization of Fly Ash in Agriculture Hotel Jehan Numa Palace, Bhopal
- Singh, A.B. (2016) 81 Annual Convention of Indian Society of Soil Science, RVSKVV, Gwalior.
- Singh, A.B.(2016) National Seminar on "Soil Health Assessment with Mridaparikshak, ICAR-IISS, Bhopal
- Singh, A.B.(2016) National Science Seminar in Hindi on Prachin Evam Aadhuneek Bharat mein Vigyan Evam Urja ke Aayam Atal Bihari Vajpayee Hindi Vishwa Vidyalaya, Bhopal
- Singh, A.B.(2016) National Summit for Farmer Producer Organization & Agri-Startups State Institute of Agriculture Extension & Training, Bhopal.

- Singh, A.B.(2016) International Conference on Environment and Agriculture in the U. N Sustainable Development Goals
- Singh, A.B.(2017) Krishi Mela on Organic Farming for Sustainable Productivity and Soil health, KVK,Burhanpur, Madhya Pradesh
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- Yadav, S. K., Jain, R. K., Yadav, V. K., Verma, B., Mali, H. and Choudhary, R. 2017. Ancient Agriculture Practices for Resources Conservation. National Symposium on 'The Role of Vrikshayurveda and Traditional Practices in Organic Agriculture', MPUA&T, Udaipur, India during 6-8 March, 2017 pp 18.

Training/workshop /programme conducted:

- Organized 11th Annual Group Meeting of Network Project on Organic Farming held during August 17-19, 2016 at ICAR-IISS, Bhopal.
- Organized World Soil Day and International Year of pulses-2016 on 5th December, 2016 at ICAR-IISS, Bhopal.
- Organized National Productivity Week in the ICAR-IISS, Bhopal on "Waste to Profit through Reduce, recycle and reuse theme during February 12-18, 2017 at ICAR-IISS, Bhopal
- Organized One day farmers training under Farmer FIRST Project on 24/03/2017 at ICAR-IISS, Bhopal.
- Organized one week Skill Development Training Programme on "Vermicompost Producer" for 20 rural youths during 22/02/2017 to 02/03/2017, at ICAR-IISS, Bhopal.
- Organized five days Farmers training Programme on "Organic Farming and Soil Health" for 20 twenty farmers from Raghougarh block Distt. Guna, Madhya Pradesh, during 27/02/2017 to 03/03/2017, at ICAR-IISS, Bhopal.
- Organized one day Kisan Sangosthi on 04/03/2017 at Mugalia Hut, Bhopal under MGMG.
- Organized one day Kisan Sangosthi on

15/03/2017 at Khamkheda village Bhopal under MGMG.

- Organized one day Kisan Sangosthi on 24/03/2017 at Bhairopura village, Bhopal under MGMG.
- Organized five days farmers training on organic farming, soil health, santuleet poudh poshan evam mridhya swasthya under TSP programme during 16-20, May, 2017 at ICAR-IISS, Bhopal. Twenty five farmers from betul district were participated in the training.

8.1.5 Radio/TV talk

- गेहूँ एवं जौ की प्रमुख फसलों में खरपतवार प्रबन्धन वद 03.01.2017 – हरी खाद मिट्टी की उपजाऊ शक्ति बढ़ाने का एक सस्ता विकल्प on 08/05/2017 by Dr. Roshan Choudhary, CO-PI, at Aakashvani Kendra, Udaipur

AWARDS

- Best Paper Award (Thankamani CK, Srinivasan V, Dinesh R, Hamza S, John Zachariah T and Kandianan K. 2017). 2016-17. Yield and economics of Ginger influenced by different management systems.National seminar on Natural Resources Management for Horticultural Crops under Changing Climatic Conditions (NRMHCCC) 16-17 March, 2017, CWRDM, Kozhikode.
- Best Teacher Award to Dr. S. K. Sharma for excellent contribution in education and service area. In: Fifth State level Teachers Award Programme 2016, Kapasan, Udaipur (Rajasthan).
- Best Poster Award to Sharvan Kumar Yadav, Ravindra Kumar Jain, Shanti Kumar Sharma and Roshan Choudhary for paper "Allelopathy: an environmentally friendly method for weed control" in the Biennial conference of Indian Society of weed science "Doubling farmer's income by 2022: The Role of Weed Science" held at MPUAT, Udaipur during 1-3 March, 2017.
- Young Scientist Award to Dr. Roshan Choudhary in 1st National Conference on Advances in Global Research in Agriculture and Technology during 19-20 March, 2017 at Agra.
- Dr. S. K. Sharma was nominated as Director, Center for Advanced Faculty Training (CAFT) on organic farming sponsored by ICAR, New Delhi at MPUAT, Udaipur.

Lead paper

- Burak, S.S., Sharma, S.K. and Jajoria, D.K. 2017. Ways, Means and Issues for doubling the income of farmers in India. In: Souvernir, 16th Naitonal COnvention on Steps for increasing Farmers' Income, Feb 26, 2017, RCA Alumni Association, Rajasthan College of Agriculture Campus, Udaipur (Raj.) Pp 57-60.
- S.K. Sharma, Roshan Choudhary and R.S. Choudhary 2017."Weed management practices in organic production system- An overview" Biennial Conference of ISWS in Mar 1-3, 2017 at Udaipur
- S.K. Sharma, Amit Trivedi, S.K. yadav, R.K. Jain, N. Ravishankar and M.L. Mehriya 2017. Production and Management of Organic Seed Spices – An Overview. National Seminar on "Reserch and Developmental Advances in Spices, Medicinal & Aromatic Crops Cultivation, Processing and Trade for Prosperity of Indian Farmers" February 1-2, 2017, Agriculture University, Jodhpur (Raj.), India Pp: 56-66.

Lecturers

Sr.	Lecture delivered/ topic	Under the scheme	Name of place/village	Month/year
Dr. S. K. Sharma				
1	जैविक प्रमाणीकरण (Organic Certification)	Unnat Bharat Abhiyan	DoR, MPUAT, Udaipur	19/01/2017
2	जैविक कृषि में उद्यमिता विकास एंव रोजगार के अवसर	Unnat Bharat Abhiyan	DoR, MPUAT, Udaipur	24/01/2017
3	बदलते स्वरूप में जैविक कृषि की भूमिका एवं बाजार प्रबन्धन	Unnat Bharat Abhiyan	DoR, MPUAT, Udaipur	21/01/2017
4	जैविक प्रमाणीकरण (Organic Certification)	Unnat Bharat Abhiyan	DoR, MPUAT, Udaipur	15/02/2017
5	जैविक कृषि में उद्यमिता विकास एंव रोजगार के अवसर	Unnat Bharat Abhiyan	DoR, MPUAT, Udaipur	16/022017
6	बदलते स्वरूप में जैविक कृषि की भूमिका एवं बाजार प्रबन्धन	Unnat Bharat Abhiyan	DoR, MPUAT, Udaipur	19/02/2017
Dr. Roshan Choudhary				
7	Biodynamic and Zero budget kheti	Unnat Bharat Abhiyan	DoR, MPUAT, Udaipur	19/01/2017
8	Jaivik Kheti main kharpatwar prabhandhan	Unnat Bharat Abhiyan	DoR, MPUAT, Udaipur	20/01/2017

Sr.	Lecture delivered/ topic	Under the scheme	Name of place/village	Month/year
9	Jaivik kheti main panchgavya ka mahtav and upyog	Unnat Bharat Abhiyan	DoR, MPUAT, Udaipur	22/01/2017
10	Organic farming in polyhouses	RKVY "Protected cultivation of vegetable crops	Hi-tech, DoR, MPUAT, Udaipur	03/02/2017
11	Jaivik kheti main poshak tatav prabhandhan	ATMA, Jalore	Organic farming unit, Udaipur	07/02/2017
12	Biodynamic and Zero budget kheti	Unnat Bharat Abhiyan	DoR, MPUAT, Udaipur	15/02/2017
13	Jaivik Kheti main kharpatwar prabhandhan	Unnat Bharat Abhiyan	DoR, MPUAT, Udaipur	16/02/2017
14	Jaivik kheti main panchgavya ka mahtav and upyog	Unnat Bharat Abhiyan	DoR, MPUAT, Udaipur	18/02/2017
15	Organic cultivation techniques of tuber crops	RKVY "Production and storage technologies of tuber crops	Hi-tech, DoR, MPUAT, Udaipur	09/03/2017
16	Organic cultivation techniques of tuber crops	RKVY "Production and storage technologies of tuber crops	Hi-tech, DoR, MPUAT, Udaipur	21/03/2017
17	Use of vermiwash and vermicompost in spices crops	RKVY project "Promotion of bio-intensive pest management techanology in spice crops in Southern Rajasthan	Sare (Chirva), Udaipur	15/02/2017
Dr. Amit Trivedi				
18	विभिन्न फसलों में जैविक खेती की तकनीकें	Unnat Bharat Abhiyan	DoR, MPUAT, Udaipur	20/01/2017
19	जैविक खेती में रोग प्रबंधन के सिद्वान्त एवं विधियाँ	Unnat Bharat Abhiyan	DoR, MPUAT, Udaipur	22/01/2017
20	विभिन्न फसलों में जैविक खेती की तकनीकें	Unnat Bharat Abhiyan	DoR, MPUAT, Udaipur	16/02/2017
21	जैविक खेती में रोग प्रबंधन के सिद्वान्त एवं विधियाँ	Unnat Bharat Abhiyan	DoR, MPUAT, Udaipur	19/02/2017
Dr. Gajanand Jat				
22	जैविक खेती में पोषक तत्व प्रबन्धन	Unnat Bharat Abhiyan	DoR, MPUAT, Udaipur	20/01/2017
23	कम्पोस्ट तैयार करने की आधुनिक विधियाँ	Unnat Bharat Abhiyan	DoR, MPUAT, Udaipur	23/01/2017
24	जैविक खेती में पोषक तत्व प्रबन्धन	Unnat Bharat Abhiyan	DoR, MPUAT, Udaipur	16/02/2017
25	कम्पोस्ट तैयार करने की आधुनिक विधियाँ	Unnat Bharat Abhiyan	DoR, MPUAT, Udaipur	19/02/2017
Dr. Hemant Swami				
26	जैविक खेती में कीट प्रबंधन	Unnat Bharat Abhiyan	DoR, MPUAT, Udaipur	17/02/2017

8.2 Human Resource Development

8.2.1 Sponsored training organised for farmers

A. Visits: During 2016-17, 61 exposure visits and training of farmers, extension functionaries and other stakeholders were conducted and 2200 stakeholders participated in these programmes (Table 14.1 and Fig 14.1)

Table: 14.1: Technology dissemination (visits)

Sr.	Date	Visitors address/ Institutes / Place	Participants
1.	05th May, 2016	SDAO, Jhabua, M.P.	30 Farmers
2.	11th June, 2016	Access Development Services, Jaipur, Tonk, Dausa	
3.	13th June, 2016	ATMA project, Valsad, Gujrat	15 Farmers
4.	23th July, 2016	National Fertilizer Limited, Jaipur	50 Trainers
1.	02nd September, 2016	ATMA, project, Dev Bhumi, Dwarika, Gujrat	25 Farmers
2.	02th September, 2016	ATMA, project, Narmada, Gujrat	54 Farmers
3.	05th September, 2016	ATMA, project, Jam Nagar, Gujrat	44 Farmers
4.	16th September, 2016	ATMA, project, Dev Bhumi, Dwarika, Gujrat	45 Women Farmers
5.	20th September, 2016	ATMA, project, Surat, Gujrat	50 Farmers
6.	26th September, 2016	ATMA, project, Junagarh, Gujrat	50 Farmers
7.	27th September, 2016	Model Training Course on Agri-tourism	
8.	28th September, 2016	Samridh Kisan Project (BAIF, Ajmer and Alwar)	35 Farmers
9.	07th October, 2016	Seminar on Vegetables Production Tech. in Polyhouse, RCA, Udaipur	12 Person
10.	15th October, 2016	ATMA, project, Anand, Gujrat	50 Farmers
11.	20th October, 2016	ATMA, project, Bhav Nagar, Gujrat	40 Women Farmers
12.	24th October, 2016	Kalyani SamagraVikas Parishad, Koliyari and Falasiya, Udaipur (Raj)	49 Youth Farmers
13.	04th November, 2016	ATMA project, Gandhi Nagar, Gujrat	45 Farmers
14.	25th November, 2016	Narmada, Gujrat (A.G.R.I. NewDelhi)	42 Farmers
15.	20th December, 2016	SwaiMadhopur, Rajasthan	45 Farmers
16.	21th December, 2016	Training on Polyhouse Farming under Horticulture unit, RCA, Udaipur	20 Farmers
17.	30th December, 2016	ATMA project, Sojat, Pali, Rajasthan	30 Cultivators
18.	05th January, 2017	Farmers Training Tour, Junagarh (Guj)	35 Women farmers
19.	12th January, 2017	Participants from training at RES Department, CTAE, MPUAT, Udaipur (Rajasthan)	4 participants
20.	12th January, 2017	Training of Tuber crops at Hi Tech Unit, RCA, MPUAT, Udaipur (Raj)	20 trainees
21.	18th January, 2017	RACP farmer tour programme, Bundi, Rajasthan	50 Farmers
22.	18th January, 2017	Farmers training Tour, Godhra, (Guj)	34 Women farmers
23.	19th January, 2017	RACP farmer tour programme, Bansur, Alwar, Rajasthan	39 Farmers
24.	25th January, 2017	Farmers training Tour, Dev Bhumi Dwarika, Gujarat	40 Farmers
25.	30th January, 2017	Farners club of Rajasthan GraminVikas and ShikshanSamiti, Bagoda, Jalore, Rajasthan.	40 Farmers
26.	31th January, 2017	ChetanaAarogyaMandir, Panerwa, Udaipur, Rajasthan	30 Women Farmers
27.	01th February, 2017	Farmers training Tour, Bharuch, Gujarat	50 Farmers
28.	02nd February, 2017	Exp. Visit (IS) under ATMA, Hisar, Hariyana	10 Farmers
29.	02nd February, 2017	ATMA Project JamNagar, Gujarat	40 Farmers
30.	03rd February, 2017	Training on Protected Cultivation on Vegetable Production at Hi Tech Unit, RCA, MPUAT, Udaipur	20 trainers
31.	04th February, 2017	ATMA Project, Chhattisgarh	65 Farmers
32.	07th February, 2017	ATMA, Jalore, Rajasthan	30 Farmers

33. 09th February, 2017	Farmer Training Center, ThaoraKheda, Gujarat	70 Farmers
34. 10th February, 2017	FTC, Godhara, Gujarat	35 Farmers
35. 15th February, 2017	ATMA, Narmada, Gujarat	60 Farmers
36. 16th February, 2017	ATMA, Godhara, Gujarat	49 Farmers
37. 17th February, 2017	Farmer Training Center, Bharuch, Gujarat	47 Farmers
38. 17th February, 2017	ATMA, GirSomnath, Gujarat	40 Farmers
39. 18th February, 2017	ATMA, Jalore, Rajasthan	25 Farmers
40. 21th February, 2017	Mukhaymantri Khet Teerth Yojana, Shajapur, M.P.	10 Farmers
41. 25th February, 2017	Pt.Deen Dayal Uppadhay Unnat Krishi ShikshaYojana, Girva, Udaipur, Rajasthan	32 Farmers
42. 27th February, 2017	ATMA, Morbee, Gujarat	40 Farmers
43. 04th March, 2017	ATMA, Sikar, Rajasthan	40 Farmers
44. 04th March, 2017	Farmer Exp Visit, Hisar	35 Farmers
45. 07th March, 2017	Farmer Training Center, Dahod, Gujarat	70 Farmers
46. 08th March, 2017	Farmer Training on HiTech Unit, RCA, Udaipur, Rajasthan	10 Farmers
47. 10th March, 2017	Pt. Deen Dayal Uppadhay Unnat Krishi Shiksha Yojana, Budal, Udaipur, Rajasthan	30 Farmers
48. 15th March, 2017	RVSKVV College of Agriculture, Sehore, M.P.	20 Farmers
49. 16th March, 2017	ATMA, Mandsour, M.P.	19 Farmers
50. 17th March, 2017	Training on Biogas, RES, CTAE, Udaipur, Rajasthan	15 Trainees
51. 20th March, 2017	ATMA, Junagarh, Gujarat	40 Farmers
52. 20th March, 2017	VandhanYojana, Sumerpur, Rajasthan	65 Farmers
53. 22th March, 2017	ATMA, Neemach, Mandsour, Jaora, M.P.	39 Farmers
54. 24th March, 2017	Farmers from Chhitorgarh, Udaipur, Rajasthan	26 Farmers
55. 27th March, 2017	Training at Polyhouse, RCA, Udaipur, Rajasthan	12 Trainers
56. 30th March, 2017	GSS School, Kejad, Sarada, Udaipur	27 Students
57. 10th April, 2017	Training on Biofertilizer, Zawar (BAIF), Udaipur, Raj	20 Farmers

8.2.2 Training organized

ICAR Sponsored 06 days training programme (02) sanctioned under "Unnat Bharat Abhiyan" were organized during 19-24 January, 2017 and 15-20 February, 2017 by NPOF, Udaipur, Rajasthan. Dr. S. S. Burark, Director Research & Dr. S. K. Sharma, Zonal Director Research and PI of the programme were present during the Inaugural Session. Thirty farmers, farm women and rural youth participated in the training programme. Eminent resource persons delivered 24 lectures including exposure of farmers to field and laboratory work during the training programme.


Farmers from ATMA Dahod (Gujarat)


Progressive farmers of ATMA Jamnagar (Gujarat)


Farm womens of ATMA Narmada (Gujarat)


Farmers of Chhitorgarh (Rajasthan)


Farmers from Jaipur, Tonk, Dausa (Rajasthan)


Farmers from ATMA Dev Bhumi Dwaraka (Gujarat)

8.3 Workshop/group Meetings

XIII Annual Group Meeting and Brainstorming on "Indigenous organic practices including zero budget natural farming vs scientific organic farming"

The 13th Annual Group Meeting of All India Network Programme on Organic Farming was organized at Tamil Nadu Agricultural University, Coimbatore (Tamil Nadu) during 27-29 November 2018 as approved by ICAR (F.No. NRM/7-7/2015-AFC dated 19 September 2018). Agenda items such as Action Taken Report of the previous group meeting, review of centre wise performance based on results and publications, a brainstorming session on "Indigenous organic practices including zero budget natural farming vs scientific organic farming" and review of progress of Tribal Sub Plan activities were taken up. The recommendations of technologies and research emerged from the group meeting are given below.

I. Recommendations of technologies for up-scaling and policy input

A. Technologies for up-scaling

1. Geo-referenced characterization of organic farmers in all the states indicated existence of wider yield gap between yield obtained by organic farmers and NPOF experimental yield for many crops. The wider yield gap is mainly due to under dose application of organic manures and adopting only indigenous practices for organic farming. Therefore, popularization of scientific organic farming packages with critical and credible input support must be made.
2. Application 75 % nutrients only through combination of organics such as FYM, vermicompost, Non edible oil cakes and other locally available sources + 2 innovative inputs such as cow urine, panchagavvya, PGPR with complete organic management for following locations and cropping systems
3. Application 100 % nutrients through combination of organics such as FYM, vermin-compost, Non edible oil cakes with complete organic management for following locations and cropping systems

State	Crop/Cropping System
Chhatisgarh	Soybean-pea, soybean-chilli
Himachal Pradesh	Kharif and summer tomato
Jharkhand	Rice (Basmati type)-wheat
Karnataka	Groundnut and Safflower
Madhya Pradesh	Soybean-wheat, soybean-mustard, soybean-chickpea, soybean-linseed
Punjab	GM-basmati rice-greengram

State	Crop/Cropping System
Himachal Pradesh	Frenchbean and summer squash
Jharkhand	Rice (Basmati type)-potato, Rice (Basmati type)-linseed
Kerala	Turmeric
Maharashtra	Field bean
Meghalaya	Rice in sunken beds and French bean, carrot, potato, brocoli and tomato in raised beds
Punjab	GM-basmati rice-wheat
Uttarakhand	GM-basmati rice-chickpea / vegetable pea and Potato

State	Crop/Cropping System
Himachal Pradesh	Frenchbean, summer squash
Tamil Nadu	Maize, chilli, beetroot and sunflower

4. Towards organic approach with 75 % organic + 25 % inorganic package and 50 % organic + 50 % inorganic package for the following cropping systems and states

5. Promotion of identified varieties of crops for organic farming in different seasons and states

State	Season	Crop	Recommended varieties
Chhattisgarh	Kharif	Scented Rice C.G. Sugandhit Bhog	CR Sugandha dhan 907
Rabi	Chickpea	JG-130 Vaibhav	
Himachal Pradesh	Kharif	Okra Indranil	Chameli 015
Rabi	Cauliflower	US 178 Chandramukhi	
	Pea	Ten Plus Nirali	
Summer	Tomato	RK-123 Heem Sohna	
Jharkhand	Kharif	Rice Lalat	MTU-1010
Rabi	Wheat	K-0307 Raj-4229	
Karnataka	Rabi	Chickpea JAKI 9218	A1
	Wheat	UAS 347(BW) DWR2006(DW)	
Kerala	Kharif	Turmeric Suguna	Pragati
Madhya Pradesh	Kharif	Soybean JS-9752	RVS-2002-4
	Maize	Kanchan Proagro 4412	
Rabi	Wheat Chickpea	GW-366 HI-8498 JG-130 JG-63	
Maharashtra	Kharif	Rice Sahyadri 3 (hybrid) Karjat 5 (Straight variety)	Sahyadri 5 (hybrid)
Rabi	Groundnut	Jaya (Straight variety) JL 26 Konkan Gaurav	
Meghalaya	Kharif	Maize RCM-75	DA-61A
Kharif	French bean	Naga local, RCM-FB-18	
Summer	Tomato	MT 2 0-17	

Punjab	Kharif	Basmati Rice Pusa Basmati 1509	Pb Basmati 4
Rabi	Wheat	PBW1 Zn Unnat PBW 550	
Tamil Nadu	Rabi	Rice Kitchidi samba CO® 48 Red kavuni	Mappillai samba
Uttar Pradesh	Kharif	Maize PMH 1	Vivek QPM 9
Rabi	Mustard	RGN 48 Urvashi	
Uttarakhand	Kharif	Basmati rice Pant Basmati-1	Pant Sugandha dhan-17
Rabi	Wheat	HD-2967 UP-2565	

6. Resource conservation practices for organic farming

Cropping System	**Land configuration**
Karnataka	
Soybean-Wheat	Conventional FB with crop residues
Groundnut + Cotton (2:1)	Conventional FB with crop residues
Greengram-Sorghum	Conventional FB with crop residues
Soybean + Pigeonpea (2:1)	Conventional FB with crop residues
Uttarakhand	
Direct seeded rice + soybean –vegetable pea +mustard	
Direct seeded rice–chickpea-moong	FIRB system
Road bed and furrow system	
Meghalaya	
Carrot- Okra	Raised bed
Rice (VD-82) -Pea	Sunken bed

7. Promotion of Integrated Organic Farming System (IOFS) models to reduced the market input cost

Components
Calicut (Kerala)
Spice based system (Turmeric, ginger, fodder, vegetable cowpea, tapioca, banana, vermicompost, 4 cows)
Coimbatore (Tamil Nadu)
Field crop based system (Green manure-okra-maize; greenmanure-cotton-red gram, fodder, pest repellant cafeteria, Teak, banana, Annual moringa, desmanthus, 1 milch cow, 1 heifer & 1bull calf + vermicompost + boundary plantations (Gliricidia, coconut)
Umiam (Meghalaya)
Field & horticulture based system (Cereals + pulses + vegetables + fruits + fodder) + Dairy (1 cow + 1 calf) + fishery + vermicompost

8. Pest management package for seed spices

- Garlic extract 10 ml/lit + azadirachtin 0.03% EC @ 5ml/lit + tumba fruit extract 10ml/lit for aphids and thrips management in Coriander and Fennel

B. Policy (based on brainstorming session)

1. Integrated organic farming systems having the components of science based inputs and also components of natural farming such as Jeevamrit and Ghanjeevamrit should be promoted for better

sustainability in organic agriculture.

2. Availability of critical and credible inputs in time for practicing organic farming in cropping systems perspective should be ensured.

3. 5P (Plan, Produce, Process, Package and Promote) model of organic farming should be encouraged through government schemes.

The consolidated recommendations pertaining to research and general points emerged from the group meeting are given below

A. Research

1. Zero Budget Natural Farming (ZBNF) farmers should also be included in the geo-referenced characterization. The proforma for data collection is to be re-visited and new parameters may be added for collecting all the details related to ZBNF. The identified scientists from Bhopal, Karjat, Pantnagar, Udaipur and Umiam will meet at Modipuram and re-design the proforma.

2. Comparative analysis of quality of produces from natural farming and organic farming should be undertaken by Modipuram, Bhopal and Narendrapur centres.

3. Successful packages adopted by organic growers should be added under innovative practices (complete organic management as per NPOP standards with 75 % supply of nutrients through organic inputs + innovative practices) wherever the yield gap between on-station (AI-NPOF) and geo-referenced survey are less than 10 %.

4. Integrated Organic Farming System (IOFS) is found to make the organic farming more profitable by reducing the market inputs to greater extent. Therefore, the study should be further strengthened by adding new locations (Pantnagar, Ludhiana and Gangtok) and also by providing adequate funds under contingencies.

5. Weed flora, weed density, dry weight and indices should be worked out in the study on weed management under organic production system.

6. Trend of yield, soil quality and also other relevant parameters should be compiled and presented for the evaluation of different production systems.

7. Analysis of seasonal (kharif, rabi and summer) response of various crops under organic production system should be undertaken for identifying the influence of seasonal variation in organic management package and research gap.

B. Others

8. Results of concluded experiment on bio-intensive complimentary organic production systems should be published as research papers and technology should be communicated to development departments for implementation.

9. Project proposal on "Molecular characterization of produces from organic, integrated and inorganic production systems" should be developed and submitted for National Agricultural Science Fund (NASF). A meeting of identified centres for the purpose may be convened and project proposal be prepared.

10. A mid –term review meeting may be arranged in June 2019 to review the progress made by different centres of AI-NPOF and institutions (ICAR-ATARI-VI, ICAR-NBAIR, ICAR-NCIPM, ICAR-NOFRI) with respect to suggesting sustainable management strategies for Sikkim.

11. The testing of products and technologies of private agencies can be undertaken in the contract research mode. Suitable proposal under contract research may be developed as per ICAR guidelines and submitted to agencies which need testing of their products / technologies under the All India Network Programme on Organic Farming (AI-NPOF).

Brainstorming session on "Indigenous organic practices including zero budget natural farming Vs Scientific organic farming"

A brain storming session on Indigenous organic practices including zero budget natural farming (ZBNF) vs Scientific organic farming involving ZBNF practicing farmers and progressive organic farming farmers from Uttar Pradesh, Madhya Pradesh, Kerala and Tamil Nadu, agricultural entrepreneurs, state govt officials, researchers from ICAR and SAU's and other stake holders was organized by ICAR-Indian Institute of Farming Systems Research, Modipuram on 28 November 2018 at Tamil Nadu Agricultural University, Coimbatore on the occasion of XIII Annual Group Meeting of All India Network Programme on Organic Farming organized during 27-29th November, 2018. The meeting was chaired by Dr. S. Bhaskar, Asst. Director General (Agronomy, Agroforestry and Climate Change), Indian Council of Agricultural Research, New Delhi along with Dr. S. Mohan, Director (Publications), TNAU as Co-Chairman. Shri P. Rajkumar, Ex-Mayor, Coimbatore corporation, Tamil Nadu also graced the occasion.

At the outset Dr. N Ravisankar, National PI, AI-NPOF and Dr. E. Somasundaram, HoD, Dept. of Sustainable Agriculture and PI, NPOF centre, Coimbatore welcomed the dignitaries and participants. Dr. N. Ravisankar explained that the brain storming is organized to discuss various forms of organic agriculture including ZBNF which are being propagated in the recent times and also to find out the possibility of converging scientific organic farming and natural farming practices. Dr. S. Bhaskar, AG (AAFCC) informed that organic farming should be promoted in niche areas and crops with proper sustainable management strategies. He said ZBNF or scientific organic farming should aim for increasing productivity and sustainability together. A detailed deliberation on various principles of ZBNF, organic farming and science based organic farming were held which was attended by more than 100 delegates including Principal / Co-Investigators of All India Network Programme on Organic Farming from 16 states. An exhibition was also held in which farmers of organic farming and natural farming displayed their produces and products. Complete video profiling of the brain storming has been made.

The following recommendations were emerged from the session:

1. All the natural farming farmers have practiced organic farming followed by natural farming. Hence it is evident that organic farming is precursor before moving to natural farming as organic farming helped to build up the resources especially soil fertility. All the natural farming farmers except one and all the organic farmers who have attended the brain storming session expressed that, scientific organic farming must be promoted and practiced to realize all the benefits of organic agriculture.
2. The name of Zero Budget Natural Farming is misleading and confusing among farmers as the term is applicable only for intercropping conditions as expressed by ZBNF farmers. The term is used for main crop where in no input is applied. Therefore, farmers expressed that name should be modified as Natural Farming with minimal external resources/inputs.
3. Integrated organic farming systems having the components of science-based inputs and also components of natural farming such as beejamrit, Jeevamrit and Ghanjeevamrit should be promoted for better productivity and sustainability in agriculture.
4. Availability of critical and credible inputs in time for practicing organic farming in cropping systems perspective should be ensured.
5. Intercropping and mulching are the common practices for all types farming such as chemical, organic and natural farming. Hence, it should not

be restricted to natural farming only.

6. The knowledge available in the public domain that one cow is enough for 30 acres under Zero Budget Natural Farming is not practiced by none of the Zero Budget Natural Farmers participated. The natural farming farmers who participated in the session expressed clearly that everyone was having more than one cow, for example 2 cows for 10 acres and 6 cows for 25 acres.
7. Research on quality of products under natural farming and organic farming can be undertaken.
8. Geo-referenced characterization of Zero Budget Natural Farming and Organic farmers to be undertaken for bringing out a clear picture. A suitable proforma may be devised for collection of data by convening a special meeting of identified centres of AI-NPOF.
9. 5P (Plan, Produce, Process, Package and Promote) model of organic farming should be encouraged through government schemes.

Brain storming session on Indigenous organic practices including zero budget natural farming (ZBNF) vs Scientific organic farming chaired by Dr. S. Bhaskar, ADG (AAFCC), Co-chaired by Dr S. Mohan, Director (Publications and Public Relations), Dr (Mrs) C. Jayanthi, Director (Crop Management), TNAU and Sh. P. Rajkumar, Ex-Mayor, Coimbatore corporation, Tamil Nadu

Participants including ZBNF and Organic Farming practicing farmers, State dept officials, researchers

ZBNF practicing farmers from Tamil Nadu and Kerala

Exhibition of produces and products by organic farming and ZBNF farmers

Address by Dr. S. Bhaskar, ADG (AAFCC), ICAR, New Delhi in the inaugural session of XIII Annual Group Meeting of AI-NPOF

Release of publications by Dr. N. Kumar, Hon'ble Vice Chancellor, TNAU and Dr. S. Bhaskar, ADG (AAFCC), ICAR, New Delhi

Address by Dr. N. Kumar, Vice Chancellor in the inaugural session of XIII Annual Group Meeting of AI-NPOF

APPENDIX

09

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 Sohna
Cauliflower (Rabi)	PSBK-1
Pea(Rabi)	Ten Plus
French bean (Summer)	Vaishnavi 264
Tomato(Summer)	Heem Sohna
Summer Squash (Summer)	Hybrid Sunny House
Bhopal	
Soybean	JS-335
Durum wheat	HI-8498 (Malwa Shakti)
Mustard	Pusa Bold
Chickpea	JG-130
Linseed	JL-9
Calicut	
Ginger	Varada, Rejatha and Mahima
Turmeric	Prathibha , AlleppeySupreme,Varna, Sobha, Sona, Kanthi, Suvarna, Suguna, Sudarsana, Kedaram, Prabha
Black Pepper	Sreekara, Panniyur
Coimbatore	
G M (Sunnhemp)	Local
Cotton	TCH1819
Maize	COH(M)6
Chillies	Sierra
Sunflower	CO4
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	A 1
Karjat	
Rice	Karjat–4
Brinijal	Krishna F1
Chickpea	Vijay
Field bean	Konkan wal-1
Onion (White)	Alibag local
Jabalpur	
Basmati rice	Pusa Basmati -1
Wheat	MPO-1106
Chickpea	JG-322
Berseem	J B - 1
Vegetable pea	Arkel
Maize fodder	African tall
Sorghum fodder	MP Chari
Sunhemp	Local
Ludhiana	
Basmati rice	Panjab basmati 3
Clusterbean	HG 365
Summer Moong	SML 668
Soyabean	SL 744
Wheat	PBW725
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
Soybean	PS 1347
Maize	PSM-3
Pigeon pea	UPAS 120
Moong	PM-5
Cowpea	PL-2
Mustard	PR-15
Okra	Arka Anamika
Raipur	
Soybean	JS – 335
Maize	Sugar-75
Vegetable pea	Pant sabji matar" (PSM 3)
Chilli	Agnirekha
Onion	Nasik red
Ranchi	
Rice	Birsamati
Wheat	K- 9107
Lentil	PL 406
Potato	Kufri Ashoka
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	Kufri jyoti
French bean	Naga local
Tomato	Rocky
New Centres	
Ajmer	
Green gram	SML-668
Cluster bean	RGC-1038
Gangtok	
Maize	Vivek Sankul makka -31
Ginger	Gorubuthane
Turmeric	RCT-10
Soybean	RCS-1-10
Pigeon Pea	UPAS-120
Buckwheat	Local Teethay
Rajmash	SKR-57
French bean	-

Narendrapur	
Paddy	Satabdi/Sohini -2
Brocolli	Princess
Capsicum	California
Mustard	Jhumka
French Beans	Falguni
Green gram	Samrat
Sesame	Tilotomma
Sardar Krushinagar	
Groundnut	TG 37
K. Green gram	GM 4
Wheat	GW 451
Cumin	GC 4
Fennel	GF 12
S.Green gram	GM 4
Vegetable cowpea	Swati
Thiruvananthapuram	
Cassava	Sree Vijaya
Groundnut	Co-7
Taro	Sree Kiran
Black gram	Co-6
Green gram	Co-8
Vegetable cowpea	Arka garima
Udaipur	
Sweet corn	Sugar 75
Blackgram	PU 31
Fodder Maize	Pratap Makka 6
Cowpea	Doli
Tomato	Sarathi 044
Chilli	VNR 109
Wheat (Durum)	HI 8713
Wheat (Aestivum)	Raj 4120
Gram	GNG 1581
Fenugreek	RMT-305
Soyabean	JS 95-60

ANNEXURES

10

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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

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