भाकृअनुप
ICAR

वार्षिक प्रतिवेदन
Annual Report
2016-17

अखिल भारतीय समन्वित कृषि प्रणाली अनुसंधान परियोजना
AICRP on Integrated Farming Systems

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

ICAR- IIFSR

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

Vision

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

Mission

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

Mandate

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

All India Coordinated Research project on Integrated Farming Systems (AICRP on IFS) is an integral part of ICAR-IIFSR with 75 centres to undertake on-station main (25 no's), on-station sub (12 no's), on-station voluntary (6 no's) and on-farm research (32 no's) spread across length and breadth of the country. The institute is also leading a Network Project on Organic Farming (NPOF) with 20 centres.

ALL INDIA CO-ORDINATED RESEARCH PROJECT ON INTEGRATED FARMING SYSTEMS

Annual Report
2016–17

ICAR-Indian Institute of Farming Systems Research

(Indian Council of Agricultural Research)

Modipuram, Meerut- 250 110, India

Correct Citation: AICRP on IFS. 2017. Annual Report 2016-17. ICAR-Indian Institute of Farming Systems Research (Indian Council of Agricultural Research), Modipuram, Meerut-250 110, pp. 1-258.

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Important Notes:

- This compilation is a joint contribution of all the associated scientists and technical staff of 75 AICRP-IFS centers (data generation), ICAR-IASRI New Delhi (statistical analysis) and ICAR-IIFSR, Modipuram (report writing, compilation, editing and printing).
- The report is based on experimental data generated during kharif, rabi and summer seasons of 2015-16 (period ending June 2016), under 'on-station' and 'on-farm' research programmes of AICRP on Integrated Farming Systems. The other details are relevant to 31st March 2017.
- The report includes both processed and semi-processed data, generated in different sub-projects under AICRP on Integrated Farming Systems, 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 scientists.

Printed at: M/s Yugantar Prakashan Pvt. Ltd., WH-23 Mayapuri Industrial Area, Phase-I, New Delhi-110 064
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ACKNOWLEDGEMENTS

All India Co-ordinated Research Project on Integrated Farming Systems (AICRP-IFS) initiated in 2010- 11 is operating with 25 main, 12 sub, 6 voluntary (ICAR Institute) and 32 on-farm centres in 24 states and 1 union territory. The results of the experiments conducted during 2015-16 by all the co-operating centres are processed and compiled in the Annual Report 2016-17 of the scheme. I take this opportunity to record my sincere thanks to Dr. T. Mohapatra, Secretary, Department of Agricultural Research and Education and Director General, Indian Council of Agricultural Research, New Delhi for his critical remarks and guidance during the review. I extend my gratitude to Dr. K. Alagusundaram, Acting Deputy Director General (Natural Resource Management) for his constant support extended to the scheme. The time to time guidance received from Dr. S. Bhaskar, Assistant Director General (Agronomy, Agroforestry and Climate Change) for improving the performance and output of the scheme is also duly acknowledged. Scientific inputs received from Quinquennial Review Team (QRT), Research Advisory Committee (RAC) and Institute Management Committee (IMC) are thankfully acknowledged as those inputs provided immense help in taking new initiatives, shaping and improvement of the programme for practical utility. I am highly thankful to each and every one of the scientists and research fellows involved in the scheme at all the centres for putting the meticulous effort to conduct the field experiments, lab analysis and generating data. The sincere efforts put forth by Dr. N. Ravisankar, Principal Scientist and Programme Facilitator (Coordination Unit) deserves appreciation for compilation of the report. I also extend my appreciation to Dr. A.K. Prusty, Senior Scientist, Dr. M. Shamim, Scientist, Mr. Dhananjay Tripathi, Chief Technical Officer, Dr. Brij Mohan Garg, Assistant Chief Technical Officer and Mrs. Jailata Sharma, PA for their cooperation in compilation of the data, its statistical analysis, drafting and proof corrections. The contributions of all the other scientific, technical, administrative and skilled supporting staff either directly or indirectly at various levels during preparation of this report are also acknowledged. I am sure; the significant findings obtained from the experiments of cropping and farming systems and its validation in the farmers field will be highly useful for the planners, and other stake holders in achieving the goals of doubling of farmers income by 2022.

(A.S. Panwar)
Director

CONTENTS

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- **if'pe fgeky; {ks=** % पश्चिमी हिमालय क्षेत्र में 3 एकीकृत कृषि प्रणाली का विकास जम्मू, पालमपुर एवं पंतनगर में क्रमशः फसल चक्र, उद्यनिकी, पशु पालन, मछली पालन एवं मुर्गी पालन अपनाया गया जिसमें प्रतिवर्ष शुद्ध लाभ 1.26 लाख–2.83 लाख तक प्राप्त हुआ है।

- **iwoh fgeky;u {ks=** % इस क्षेत्र में 2 मॉडल कृषि प्रणाली की जोराहट एवं उमियम केंद्र से विकसित किया गया दोनों कृषि प्रणाली मॉडल में फसल, उद्यान, पशुपालन एवं मत्स्य पालन मधुमक्खी पालन घटक के रूप में लिया गया था। औसत शुद्ध लाभ 1.66–4.28 लाख प्रति हेक्टेयर प्रतिवर्ष प्राप्त हुआ।

- **xxk ds vklikl ds ekuuh bykds** % हिसार एवं लुधियाना ने एक–एक कृषि प्रणाली मॉडल विकसित किए हैं कृषि प्रणाली घटक के रूप में फसल, बागवानी, पशुपालन, मशरुम, वर्मी कंपोस्ट कृषिवानकी को लिया गया था। जिससे प्रतिवर्ष 2.36 से 4.01 लाख शुद्ध आय के रूप में प्राप्त हुआ।

- **xxk ds Åijh ekuuh bykds** % इस जलवायु क्षेत्र में फसल के साथ साथ बागवानी डेयरी का समायोजन करके शुद्ध लाभ 75 हजार से 2.5 लाख प्रति हेक्टेयर प्रतिवर्ष प्राप्त किया जा सकता हैं।

- **xxk dk e/; ekuu {ks=** % पूर्वी उत्तर प्रदेश एवं बिहार को मिलाकर कुल 6 मॉडल विकसित हुए हैं। फसल, बागवानी, पशुपालन, मछली पालन, मशरुम, बत्तक मुख्य घटक कृषि प्रणाली के प्रयोग किए गए एवं शुद्ध लाभ 1.72– 3.8 लाख प्रति हेक्टेयर प्राप्त हुए।

- **xxk dk fupyk ekuu {ks=** % इस जलवायु क्षेत्र में एक कृषि मॉडल कल्याणी केंद्र द्वारा विकसित किया गया है। कृषि घटक के रूप में फसल क्षेत्र और पशुधन बागवानी एवं मछली पालन जिसमें 52373 रुपए का शुद्ध लाभ एक हेक्टेयर में प्राप्त हुआ।

- **iwoh iBkj vkj igkfM;k** % पूर्वी पठार एवं पहाड़ी क्षेत्र में 2 आईएफएस मॉडल विकसित हुए हैं दोनों केंद्रों द्वारा क्रमशः फसल, उद्यान, डेयरी, मशरुम, मछली एवं वर्मी कंपोस्ट जिससे शुद्ध लाभ 1.11–2.78 लाख प्रति हेक्टेयर प्राप्त हुआ।

- **dsæh; iBkj ,oa igkfM;k** % इस जलवायु क्षेत्र में जबलपुर केंद्र से एक कृषि प्रणाली मॉडल विकसित हुआ है इसमें घटक के रूप में फसल, डेयरी, उद्यान, मुर्गी एवं मछली कृषि मॉडल में समायोजित किया गया एवं शुद्ध लाभ प्रति हेक्टेयर 96 हजार प्राप्त हुआ।

- **if'peh iBkj vkj igkfM;k** % महाराष्ट्र के 3 जिलों में परभनी राहुरी एवं आकोला केंद्र ने कमशः 1–1 कृषि मॉडल विकसित किया फार्मिंग सिस्टम घटक के रूप में क्रम से फसल, उद्यान, बकरी, मुर्गी, पशुपालन एवं वर्मी कम्पोस्ट प्रयोग में शामिल करके रुपए 79 हजार से 2.5 लाख प्रति हेक्टेयर शुभ लाभ प्राप्त हुआ।

- **nf{k.kh iBkj ,oa igkfM;k %** इस जलवायु क्षेत्र में 4 कृषि प्रणाली विकसित हुई इन कृषि प्रणालियों में घटक के रूप में फसल, उद्यान, डेयरी, बकरी, वर्मी कम्पोस्ट एवं सीमा वृक्षारोपण अजोला प्रयोग के तौर पर प्रयोग किये गए। शुद्ध लाभ प्रति हेक्टेयर 2.04 से 2.8 लाख प्रति हेक्टेयर प्राप्त हुआ।

- **ioh rVh; eaku ,oa igkfM;k %** भुवनेश्वर केंद्र में एक कृषि प्रणाली मॉडल का विकास हुआ है जिसमें फसल प्रणाली घटक के रूप में फसल, उद्यान, डेयरी, मुर्गी, मछली, रसोई उद्यान, मधुमक्खी पालन एवं सीमा वृक्षारोपण का समायोजन करके शुद्ध लाभ 1.23 लाख प्राप्त किया गया जा सकता है।

- **if'peh rVh; eaku ,oa ?kkV %** इस जलवायु क्षेत्र में 7 कृषि प्रणाली मॉडल विकसित किए गए हैं। फसल, डेयरी, रसोई उद्यान, मुर्गी पालन, प्लांटेशन क्रॉप एवं वर्मी कम्पोस्ट घटकों का समायोजन करके 99 हजार से 3 लाख प्रति हेक्टेयर प्राप्त किया जा सकता है।

- **xqtjkr dk eaku vkj igkfM;k %** फसल प्रणाली उद्यानिकी फल एवं सब्जी सीमा वृक्षारोपण पशुपालन वर्मी कंपोस्ट का समायोजन करके एस. के. नगर गुजरात के अंदर ने कृषि प्रणाली मॉडल विकसित किया है जिसका शुद्ध लाभ 2.07 प्रति हेक्टेयर है।

- **if'peh 'kq"d çn'k %** फसल एवं पशुपालन राजस्थान की कृषि प्रणाली है जिसमें उद्यान, वर्मी कम्पोस्ट, रसोई उद्यान, अजोला जैसे घटक का समायोजन करके शुद्ध लाभ 1.5 लाख प्रति हेक्टेयर प्राप्त किया जा सकता है।

- **}hi %** फसल उगाई फसल डेयरी मछली सब्जी एवं फूल, धान + मछली को समाहित करके पोर्ट ब्लेयर केंद्र ने 2 एकीकृत कृषि प्रणाली मॉडल का विकास किया जिस में प्रति हेक्टेयर 2.15 लाख शुद्ध लाभ के रूप में प्राप्त किया जा सकता है।

Qly ç.kkyh çca/k çca/ku %

- **'kq"d tyok;q {k=** के अंतर्गत हिसार एवं एस. के. नगर में कपास गेहूं एवं वी.टी. कॉटन – कपास मूंग + कैस्टर अन्य फसल प्रणाली की तुलना में कुल शुद्ध लाभ 2.18–2.40 लाख रुपए प्रति हेक्टेयर प्राप्त हुआ।

- **v/kZ 'kq"d ikfjfLFkfrd r=** जलवायु क्षेत्र के अंतर्गत दुर्गापुरा, जयपुर, राजेंद्रनगर, रूर्दरू, परभनी, कानपुर, अकोला, लुधियाना, इंदौर एवं कोटा में विभिन्न तरह की फसल चक्रों का प्रयोग किया गया एवं पाया गया कि बाजार – गेहूं दुर्गापुर जयपुर, सोयाबीन + मक्का – गेहूँ (इंदौर), मक्का – ज्वार करैला (कोटा), बी.टी. कॉटन + मूंग – मक्का (राजेंद्रनगर), बी.टी. कॉटन + सोयाबीन – मसूंर + मूंगफली (रूर्दरू), मक्का + सोयाबीन + ढ़ैचा – चना + भिंडी (परभनी), जवार + लोबिया – गेहूं + गोभी सरसों (लुधियाना) एवं मक्का – लहसुन – मूंग (कानपुर) में वैकल्पिक फसल चक्र के रूप में अपनाया जा सकता है।

- **mi vkn ikfjfLFkfrd r= %** इस जलवायु क्षेत्र में फैजाबाद, पंतनगर, साबोर, रांची, जबलपुर, पावरखेड़ा, कैथलगैरा एवं चिपलिमा केन्द्र हैं। जिसमें धान – फूलगोभी – लोहिया (फैजाबाद), मक्का + लोबिया –मटर

+ तोरिया – मूंगफली + मेंथा (पंतनगर), धान – गोभी + धनिया – मसूर (साबोर), धान – आलू + गेहूँ – मूंग (रांची), बासमती धान – गेंदा –जवार (जबलपुर), धान – लहसुन (रीवा), सोयाबीन – मटर – प्याज (पावरखेड़ा), धान – मक्का (काब) + धनिया – लोबिया + चौलाई चिपलिमा एवं धान – पालक (कैथलगैरा) में उपरोक्त फसल चक्र अपनाने से ज्यादा कैलोरी ऊर्जा एवं शुद्ध लाभ प्राप्त किया जा सकता हैं।

- **vkn kfjfLFkfrd r= %** अरहर + ढैंचा – फ्रेंचबीन + तोरिया – लोबिया (जोहरट), हल्दी – मटर – समर स्क्वास (पालनपुर) एवं धान – आलू – भिंडी (जम्मू एवं कश्मीर) उपरोक्त फसल चक्र अपना करके अधिक से अधिक शुद्ध लाभ प्राप्त किया जा सकता है।

- **rVh; kfjfLFkfrd r= %** धान – मक्का + कोसला – लोबिया + चौलाई (भुवनेश्वर), धान – लूर्शन (नवसारी), धान – धान – कुकुंबर (करमना), हरी खाद – धान – भिंडी (तंजावुर), धान – बैंगन (कर्जत) एवं मारटेरू में धान – सोयाबीन ज्यादा लाभप्रद फसल प्रणाली पाई गई।

,dh—r ik"kd rRo dk çc/ku

- धान – धान फसल चक्र में 75 प्रतिशत एन.पी.के. के साथ 25 प्रतिशत एंन गोबर कि खाद से खरीफ में एवं 50 प्रतिशत एंन.पी.के. + 50 प्रतिशत एन स्ट्रॉ (भूसा) के रूप में डालने पर धान की उपज मारटेरू केंद्र पर 4.8 टन प्रति हेक्टेयर प्राप्त हुई। जबकि जोरहाट केंद्र पर 75 प्रतिशत एन.पी.के. के साथ 25 प्रतिशत एस्ट्रो के रूप में देने पर 4.5 टन है एवं 3.6 टन खरीफ एवं रबी में प्राप्त हुआ कॉटेज में एनपीके फर्टिलाइजर में डालने पर उत्पादन प्राप्त हुआ जबकि कर्जत में 100 प्रतिशत एन.पी.के. फर्टिलाइजर में डालने पर उच्च उत्पादन प्राप्त हुआ।

- धान गेहूं फसल चक्र में वाराणसी साबौर एवं कानपुर केंद्र पर 50 प्रतिशत संस्तुत फर्टिलाइजर के साथ 50 प्रतिशत नाइट्रोजन गोबर कि खाद के रूप में डालने पर उच्च उत्पादन प्राप्त हुआ जबकि रायपुर केंद्र पर खरीफ रबी सीजन में 100 प्रतिशत संस्तुत फर्टिलाइजर डालने पर उच्च उत्पादन प्राप्त हुआ।

- मक्का गेहूं फसल चक्र में रांची केंद्र पर 75 प्रतिशत संस्तुत फर्टिलाइजर के साथ 25 प्रतिशत एंनएफवाईएम के रूप में डालने पर खरीफ एवं रबी में 50 प्रतिशत एन.पी.के. + 50 प्रतिशत एंन फार्मीआर्ड मैन्योर के रूप में डालने पर 3.3 टन प्रति हेक्टेयर एवं 4.2 प्रति हेक्टेयर खरीफ एवं रबी में उपज प्राप्त हुई।

- बाजरा – गेहूं फसल चक्र में हिसार एवं बिचपुरी केंद्र पर 50 प्रतिशत एन.पी.के. फर्टिलाइजर एवं 50 प्रतिशत एंन फार्मीआर्ड मैन्योर से देने पर उच्च उत्पादन की प्राप्ति हुई।

- ज्वार – गेहूं फसल चक्र में राहुरी एवं परभनी में 50 प्रतिशत एन.पी.के. फर्टिलाइजर के रूप में एवं 50 प्रतिशत एंन फार्मीआर्ड मैन्योर के रूप में डालने पर उच्च उत्पादन दोनों सीजन में प्राप्त हुआ।

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- धान आधारित फसल चक्र में जम्मू एवं जोरहाट केन्द्र पर 100 प्रतिशत जैविक पोषक तत्व एफवाईएम के रूप में वर्मी कम्पोस्ट एवं नीमे तेल + अंतः फसली या ट्रेप क्रोपिंग के साथ 18.6 प्रतिशत उत्पादन में वृद्धि प्राप्त की गई 100 प्रतिशत एन.पी.के. फर्टिलाइजर की तुलना में जबकि कल्याणी एवं मारटेरू धान – आलू – मूंगफली फसल चक्र में खरीफ में 50 प्रतिशत संस्तुत एन.पी.के. + जिंक + सल्फर 50 प्रतिशत एंन फार्मीआर्ड मैन्योर के साथ डालने पर 100 प्रतिशत एन.पी.के. फर्टिलाइजर में डालने की तुलना में अधिक उपज की प्राप्ति हुई।

- मक्का आधारित फसल चक्र में मक्का – गेहूँ – प्याज फैजाबाद केंद्र पर 100 प्रतिशत जैविक पोषक तत्व एफवाईएम के रूप में वर्मी कम्पोस्ट, नीम तेल + शस्य क्रियाओं के साथ खरपतवार एवं पेस्ट कंट्रोल के रूप में करने पर ज्यादा उत्पादन की प्राप्ति हुई।

- सोयाबीन गेहूं फसल चक्र में रहुरी केंद्र पर 100 प्रतिशत जैविक पोषक तत्व खरीफ में देने पर सोयाबीन का उत्पादन 3.16 टन प्रति हैक्टयर एवं रबी में 100 प्रतिशत जैविक पोषक तत्व के साथ विभिन्न शस्य क्रियाओं के करने के उपरांत 29.4 टन प्याज की उपज प्राप्त हुई।

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विभिन्न NARP क्षेत्रो में प्रचलित फसल प्रणाली के अन्तर्गत पोषक तत्वों के अनुप्रयोग से फसलों पर पतिक्रिया के परिजनो का सारांशः

- विभिन्न NARP क्षेत्रो में और फसल प्रणालियों में पाया गया कि किसानों द्वारा मौजुदा कृषि पद्धति तथा पोषक तत्वों कि उचित मांग न देने से पेदावार में कमी पायी गयी जबकि वैज्ञानिक सिफारिश के अनुसार नाइट्रोजन, फास्फोरस, पोटाश एवं सूक्ष्म तत्वों की कम मात्रा देने से अधिक उपज प्राप्त की गयी।

- विभिन्न फसल प्रणालियां जैसे धान–धान, धान–गेहूँ, मक्का–गेहूँ, सोयाबीन–प्याज और धान–मूगं फसल प्रणाली में फसलो की उपज किसानों द्वारा दी गई पोशक तत्वों की मात्रा की तुलना में सस्तूंति मांग में नाइट्रोजन, फास्फोरस, पोटाश एवं सूक्ष्म तत्वों की मात्रा देने से फसलो की उपज अधिक होती हैं।

- मिट्टी परीक्षण के आधार पर सूक्ष्म तत्वों के इस्तेमाल से परिणाम स्वरुप धान–धान, धान–गेहूँ, मक्का–गेहूँ, सोयाबीन–प्याज और धान–मूगं फसल प्रणाली में अतिरिक्त उपज प्राप्त होती हैं।

- सभी NARP क्षेत्रों और फसल प्रणालियों में, अकेले सस्तुंति नाइट्रोजन, फास्फोरस एवं पोटाश की मात्रा के इस्तेमाल से अथवा सस्तुंति नाइट्रोजन, फास्फोरस, पोटाश एवं सूक्ष्म पोशक तत्वों की उचित मात्रा के इस्तेमाल

द्वारा अधिक उपज के साथ–साथ पोशक तत्वों की ग्रहण दक्षता भी अधिक होती हैं। उचित मात्रा में विशेषतः नाइट्रोजन कम संख्या एवं मात्रा के इस्तेमाल करने के परिणाम स्वरुप उपज कम होने के साथ पोषक तत्वों की दक्षता की कम पायी गयी।

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- विभिन्न जिलों में, कृषि प्रणालियों की संख्या 1 से 9 तक पायी गई है। कैमरूप जिला (आसाम) में सबसे अधिक 9 कृषि प्रणालियां पाई गई है जबकि दक्षिण 24 पैरागन्स (पश्चिम बंगाल) जिले में 8 कृषि प्रणाली हैं। न्यूनतम एक कृषि प्रणाली 5 जिलों जैसे सांबा (जम्मू कश्मीर), अमृतसर (पंजाब), पुणे (महाराष्ट्र) और गड्ग (कर्नाटक) में हैं।

- पंचमहल (गुजरात) एवं नैनीताल (उत्तराखंड) जिलें में 6 कृषि प्रणालीयों तथा कबीरधाम (छत्तीसगढ़), डिंडोरी (मध्य प्रदेश), श्रीकाकुलम (आंध्र प्रदेश), वारंगल (तेलंगाना) एवं केंद्रपारा (उड़ीसा) जिलों में मौजूदा 5 कृषि प्रणालियों का प्रक्षेण किया गया।

- सभी केंद्रों द्वारा सीमांत कृषक द्वारा आमतौर पर, फसल + डेयरी कृषि प्रणाली अपनाई गई तथा 20 जिलों में इस प्रणाली को अपनाने वाले कृषक परिवार की संख्या के आधार पर में (68.9 प्रतिशत कृषक परिवार) यह प्रणाली प्रमुख रूप से प्रचलित है।

- फसल + डेयरी + कुक्कट कृषि प्रणाली उदयपुर (राजस्थान), वारंगल (तेलंगाना) और श्रीकाकुलम (आंध्र प्रदेश) आदि जिलों में प्रमुख रूप से प्रचलित पाई गई। इसी तरह फसल + डेयरी + बकरी कृषि प्रणाली पूर्णिया (बिहार) जिले में प्रबल रूप से पाई गई। कानपुर देहात (आंध्र प्रदेश) जिलें में दोनों कृषि प्रणाली फसल + डेयरी एवं फसल + डेयरी + बकरी प्रणालीयों को प्रमुख रूप से अपनाते पाया गया। जबकि दक्षिण 24 पैरगनस (पश्चिम बंगाल), पंचमहल (गुजरात), कैमरुप (आसाम) एवं पाथनमीटा (केरल) जिलों में अत्यधिक विविध कृषि प्रणालियों को देखा गया।

- कबीरधाम (छत्तीसगढ़) और औरंगाबाद (महाराष्ट्र) जिलों के बड़ी संख्या में कृषक परिवारों द्वारा केवल फसल कृषि प्रणाली को प्रमुख से प्रभावी अभ्यास के रूप में अपनाते पाया गया।

- सांख्यिकीय विश्लेषण के आधार पर, प्रत्येक जिले के लिए सर्वश्रेष्ठ प्रदर्शन करने वाली कृषि प्रणाली की पहचान की गई जिससे सीमांत कृषक परिवारों की आजीविका में सुधार के लिए सभी संभावित हस्तक्षेप और विविधीकरण दृष्टिकोण के साथ – साथ बढ़ाया जा सकता है।

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सभी केंद्रों पर विभिन्न मॉड्यूल द्वारा प्राप्त परिणामों का संक्षिप्त सारांश।

- विभिन्न जिलों जैसे साबां, अंबेडकर नगर, सिरसा, अमृतसर, पाकुर, औरंगाबाद, शिवगंगई और पूडुकोटाई, गड्ग एवं पैलघर में कृषि प्रणालियों की संख्या 1 तथा श्रीकाकुलम और केंद्रपारा जिलों में 7 थी। पंचमहल, अमरावती, वारंगल, कोलार और पूर्णिया जिलों में 4 कृषि प्रणालियों की व्यवस्थाएं थी।

- 19 जिलों के कृषक परिवारों की संख्या के आधार पर (अध्ययन किए जिले का 65 प्रतिशत कृषक परिवार) फसल + डेयरी, कृषि प्रणाली प्रमुख पाया गया।

- विभिन्न जिलों जैसे श्रीकाकुलम (आंध्र प्रदेश), केंद्रपारा (उड़ीसा) दक्षिण 24 पैरागनस (पश्चिम बंगाल) एवं पंचमहल (गुजरात) में कृषि प्रणालियों में अत्यधिक विविधता पाई गयीं। इनमें कृषि प्रणाली में कई घटक जैसे फसलें, डेयरी, बकरी, कुक्कट पालन एवं मछली पालन विभिन्न संयोजनों में 1 से 5 तक पाए गये। पाथिनमिट्टा (केरल) जिले में उद्यान एवं बागवानी घटक आय का बेहतर स्रोत पाया गया।

- सामान्य रूप से, सभी स्थानों पर फसल, पशुधन, प्रसंस्करण और वैकल्पिक मॉड्यूल में बाधा आधारित हस्तक्षेप के परिणामस्वरूप उत्पादन (1.8 गुना) विपणन योग्य अधिशेष (1.9 गुना) एवं लाभ (1.6 गुना) में सुधार हुआ।

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- गुजरात राज्य के जुगदान जिले में परंपरागत कृषि विधि के मुकाबले उन्नत कृषि अपनाने से कृषकों द्वारा हाइब्रिड अरंडी की पैदावार 23.54 प्रतिशत अधिक पैदावार हुई।

- सीतमपैठा (आंध्र प्रदेश) जिले में, तिल का कृषक द्वारा घरेलू बीज बोए जाने के मुकाबले उन्नतशील नई किस्म YLM-66 का बीज द्वारा 42.65 प्रतिशत उपज में वृद्धि हुई तथा इसी स्थान पर सूरजमुखी की उपज कृषक बीज के मुकाबले प्राइवेट हाइब्रिड बीज द्वारा 54.75 प्रतिशत अधिक उपज दर्ज की गई।

- राजस्थान राज्य के फतेहपुर जिले में कृषकों के स्वयं पैदा किए सरसों के बीज की बुवाई के मुकाबले हाइब्रिड बीज RNG-229 की बुवाई द्वारा सरसों की उपज में 36.86 प्रतिशत की वृद्धि हूई। वहीं मोदीपुरम, मेरठ (उत्तर प्रदेश) के किसानों द्वारा सरसों बीज की पूसा बोल्ड के स्थान पर राजस्थान की RH-749 प्रजाति की बुवाई करने पर 71.63 प्रतिशत उत्पाद में वृद्धि गई दर्ज की गई।

- हिमाचल प्रदेश के कांगड़ा जिले में गोभी – सरसों की कंचन प्रजाति के स्थान पर प्रजाति के स्थान पर HPN-3 के बीज की बुआई करने से 101.11 प्रतिशत उपज में बढ़ोतरी हुई।

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उपज में वृद्धि के कारण सभी स्थानों पर सभी फसलों के लिए सकल एवं शुद्ध आय, उन्नत पैकेज में अधिक थे।

- जुगदान केंद्र पर केवल अरंडी फसल की तुलना में हाइब्रिड अरंडी + हरी खाद के साथ में क्रमशः 23.54 और 28.24 प्रतिशत अधिक सकल एवं शुद्ध लाभ की बढ़ोत्तरी हुई।

- आंध्र प्रदेश के सीतमपट्टा जिले में तिल में क्षेत्रीय बीज के स्थान पर उन्नत बीज उपज द्वारा सकल आय एवं शुद्ध आय में क्रमशः 42.65 एवं 52.97 प्रतिशत से वृद्धि दर्ज की गई।

- फतेहपुर जिले में सरसों की उन्नत प्रजाति के बीज बोने से किसानों की शक्ल आय एवं शुद्ध आय में क्रमशः 33.79 एवं 36.92 प्रतिशत की बढ़ोतरी दर्ज की गई जबकि मोदीपुरम, मेरठ केंद्र पर सरसों का बीज प्रतिस्थापन द्वारा सकल आय एवं शुद्ध आय में 71.68 एवं 79.46 प्रतिशत की क्रमशः बढ़ोतरी हुई।

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- भारतीय कृषि अनुसंधान परिषद–भारतीय कृषि प्रणाली अनुसंधान संस्थान, मोदीपुरम, मेरठ के माध्यम से तिलहन की खेती में नई प्रौद्योगिकियों पर 5 विभिन्न जैसे कैमरूप (असम), कांगड़ा (हिमाचल प्रदेश), फतेहपुर (राजस्थान), मोदीपुरम (उत्तर प्रदेश) एवं वारंगल (तेलंगाना) नामक केंद्रों पर प्रशिक्षण आयोजित किए गए थे। जिनके द्वारा कुल 206 लाभार्थी को प्रशिक्षण दिया गया प्रशिक्षण लेने वाले राज्य सरकार के अधीनिस्थ प्रसार अधिकारी एवं आगत विक्रेता थे

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- जनजातीय समुदाय के फार्म प्रक्षेत्र पर कृषि प्रणालियों में समुदाय बनाकर अनुसंधान करने के लिए वर्ष 2015–16 में जनजातीय उपयोजना का शुभारंभ किया गया देश के 13 राज्यों के 14 केंद्रों पर यह प्रोग्राम चलाया जा रहा है जिसको 7 फार्म प्रक्षेत्र अनुसंधान केंद्र जैसे श्रीकाकुलम (आंध्र प्रदेश), कावर्धा (छत्तीसगढ़), पंचमहल (गुजरात), पाकुर (झारखंड), डिंडोरी (मध्य प्रदेश), पैलघर (महाराष्ट्र) तथा उदयपुर (राजस्थान) एवं अन्य 7 केंद्र जैसे कारनिकोबार (अंडमान निकोबार द्वीप), कैंकर (छत्तीसगढ़), चम्बा (हिमाचल प्रदेश) साम्बा (जम्मू एवं कश्मीर), बी. आर. हिल्स (कर्नाटक), कोयंबटूर (तमिलनाडु) एवं बाली द्वीप (पश्चिम बंगाल) में चलाया जा रहा है।

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- का र्वधा जिले में सीमांत एवं छोटे कृषि को द्वारा फसल + पशुधन कृषि प्रणाली अपनाई जाने वाली विधि की तुलना में फसल + डेयरी + प्रसंस्करण मॉडयूल में हस्तक्षेप द्वारा आय में 25–35 प्रतिशत तक बढ़ोतरी दर्ज की गई।

- राजस्थान प्रदेश के उदयपुर जिले में जनजातीय समुदाय के 615 कृषकों प्रताप धान नामक प्रजाति की मुर्गियां बांटी गई जिससे कृषक परिवार अंडे तथा मीट बेचकर अपने जीवन स्तर में सुधार कर रहा है तथा उनके पोषण में सुधार हेतु 33 पैकेट किचन गार्डन के बांटे गए। 25 यूनिट वर्मी कम्पोस्ट स्थापित की गयी जिसके द्वारा उनकी भूमि की उर्वरा शक्ति को बढ़ाया गया एवं वर्ष में इन यूनिट के द्वारा 37 टन वर्मी कम्पोस्ट बनाया गया। इसी के साथ उनके ज्ञान में वृद्धि हेतु 3 प्रशिक्षण कार्यक्रम भी चलाए गए जिसके द्वारा 208 जनजातीय कृषक परिवार लाभान्वित हुए।

- श्रीकाकुलम आंध्र प्रदेश जिले में जनजातीय कृषक परिवारों के मौजूदा कृषि प्रणाली में विविधीकरण कृषि प्रणाली के सलाह उपरान्त कृषकों की शुद्ध आय में रुपए 154270 दर्ज की गई।

- पंचमहल जिले में फसल तथा जाति में विविधीकरण द्वारा शुद्ध आय एवं उपज में महत्वपूर्ण बढ़ोतरी दर्ज की गई।

- वाली द्वीप (पश्चिम बंगाल) में 120 कृषक परिवारों के पास 19 कृषि प्रणालियों में, मौजूदा कृषि प्रणाली फसल + पशुधन + कुक्कट पालन + बकरी, कृषि से अधिकतम सकल आय प्राप्त हुई परंतु हस्तक्षेप के उपरांत अकेले फसल एवं पशुधन द्वारा आय में पर्याप्त वृद्धि दर्ज की गई।

- कैकंर जिले में धान की प्रचलित प्रजाति स्वर्णा की तुलना में धान की उन्नत प्रजाति द्वारा उपज में 17.7 प्रतिशत वृद्धि दर्ज की गई चना, अलसी एवं मक्का की फसल में हस्तक्षेप द्वारा क्रमशः 22–35 प्रतिशत 25 प्रतिशत 36 प्रतिशत पैदावार में बढ़ोतरी हुई इसी के साथ–साथ फसल गहनता 109 प्रतिशत से बढ़कर 146 प्रतिशत दर्ज की गई तथा कृषक परिवारो की आय में 3 से 5 गुना की वृद्धि हुई।

- जम्मू कश्मीर राज्य के सांबा जिले में जनजाति समुदाय के कृषक परिवारों का जीवन स्तर सुधार हेतु फलों जैसे आम, अमरूद, नींबू एवं किन्नु के 800 पौधे बांटे गए।

1. INTRODUCTION

The Genesis of the "All India Coordinated Research Project on Integrated Farming Systems" may be traced back to the visit of Dr A.B. Stewart of Macaulay Institute of Soil Research, Aberdeen U.K., somewhere in mid forties. He was invited by the then 'Imperial Council of Agricultural Research' to (i) review the position in respect of soil fertility investigations, in general and manuring in particular, and (ii) suggest steps which might be taken in order to obtain, in shortest possible time, adequate information under different conditions of soil and climate to enable agricultural departments to give some advice to cultivators for increasing crop yields. His review reports, published in 1947, significantly affected philosophy and practices of fertilizers experimentation in the country, He stressed upon the need of conducting simple fertilizer trials on cultivators' fields and complex experiments at selected research centres. Prompted by these suggestions, a "Simple Fertilizer Trials at cultivators' Fields" scheme was initiated in 1953 under the IndoAmerican Technology Cooperation Agreement under "Soil Fertility and Fertilizer Use Project" with the following objectives:

i. To study crop responses to nitrogen, phosphorus and potassium when applied separately and in different combinations under the cultivators' field conditions.

ii. To investigate the relative response of different fertilizers in various broad soil groups and to work out the optimum fertilizer combinations for different agro-climatic regions.

iii. To study the relative performance of different nitrogen and phosphatic fertilizers for indigenous production.

iv. To demonstrate to the farmers the value of fertilizer use for the production of crops

Subsequently in 1956, experiments on carefully selected centers called 'Model Agronomic Experiments' were added to the project and started as all India Coordinated Agronomic Experiments Scheme (AICAES). The objectives of Model Agronomic Experiments were:

i. To study the interaction of amounts of fertilizer application with intensity and frequency of irrigation, sowing date and plant density.

ii. To work out the manure requirement of important crop rotations and their effect on soil fertility.

iii. To evaluate the relative efficiency of various sources of nitrogen and phosphorus for different crops and areas, and of different methods of application of nitrogenous and phosphatic fertilizers.

As knowledge progressed, new technology developed and the rate of growth in agriculture increased, the scheme went through various stages of evolution during which its scope expanded and its focus sharpened in accordance with newly acquired scientific knowledge. The scope of experimentation was, therefore, expanded to include agronomic research, embracing cultural practices, irrigation and nutritional requirements, chemical weed control and multiple cropping. But the emphasis continued on soil fertility and fertilizer use as influenced by soil and climatic factors and management,

In 1968-69, the scheme was sanctioned as All India Coordinated Agronomic Research Project (AICARP) with two components, viz.; 'Model Agronomic Experiments' and 'Simple Fertilizer Trials'. The main objectives of the experiments conducted at the research centres under the scheme were:

i. To obtain information of the response of high yielding varieties of cereal to different agronomic factors such as fertilizer (including micronutrients), irrigation ,weed control ,liming etc.;

ii. To study the manure requirements of important crop rotations and their effect on soil fertility;

iii. To evaluate various sources of nitrogen and phosphorus for different crops and areas;

iv. To work out the production potential per unit area, per unit time for different agro-climate condition of the country; and

v. To determine the most suitable cropping patterns and fertilizer responses under rainfed condition.

Under the revised scheme, the main objectives of the simple fertilizer trial were:

i. To study the responses of introduced high yielding and locally improved varieties to nitrogen and phosphorus applied alone and in combination and to potassium in the presence of nitrogen and phosphorus under irrigated as well as dry land condition;

ii. To compare different methods of application of nitrogen on cereals under dry-farming conditions;

iii. To study the contribution of package of soil and moisture conservation practices to increase crop production in dry farming areas;

iv. To study the relationship between crop response to fertilizer and soil test values; and

v. To formulate fertilizer recommendations for different soils and agro-climatic regions of the country.

But, during 1979 aforementioned objectives were further reviewed and redefined as under:

i. To develop, continuously update and test on cultivators' fields the technology for various crop based farming systems. For this patterns best suited for different agro-climatic zones may be identified, evolved for various emerging farming situations and package of practices developed to realize their production potential.

ii. To define/delineate all aspects of the use of fertilizers (recognizing that fertilizer is an important component of modern agricultural technology), including choice of materials maximize its use through recycling of agricultural wastes or employment of microbial aids,

iii. To provide facilities for testing new varieties at their pre-release stage. In mid-eighties, the policy planners duly recognized the importance of cropping systems approach of research to enhance resource use efficiencies for improved and sustainable crop productivity. Therefore, to strengthen all aspects of cropping systems research the 'Project Directorate for Cropping Systems Research' was established at Modipuram (Meerut) with effect from March 1989, with 'AICRP on Cropping Systems' as one of the constituent schemes of the Directorate with both the components, namely; 'On–Station Research' and 'On-Farm Research' remaining intact. However, within two decades of existence of PDCSR, the mandate of the Directorate was broadened during 2009-10 to undertake research in integrated farming system mode and the Directorate was renamed as 'Project Directorate for Farming Systems Research (PDFSR)' and mandate redefined as:

i. To characterize existing farming systems to know the productivity, viability and constraints.

ii. To develop resource efficient, economically viable and sustainable integrated farming system modules and models for different farming situations.

iii. To undertake basic and strategic research on production technologies for improving agricultural resource use efficiencies in farming system mode.

iv. To develop and standardize package of production practices for emerging cropping/ farming concepts and evaluate their long-term sustainability.

v. To act as repository of information on all aspects of farming systems by creating appropriate databases.

vi. To develop on-farm agro-processing and value addition techniques to enhance farm income and quality of finished products.

vii. To undertake on-farm testing, verification and refinement of system-based farm production technologies.

viii. To develop capacity building of stakeholders in Integrated Farming Systems through training.

The name and mandate of AICRP on Cropping Systems were also changed accordingly, with major emphasis on farming systems research and objectives modified as hereunder. The Project Directorate for Farming Systems Research was renamed as ICAR-Indian Institute of Farming Systems Research (IIFSR) during November 2014 and the mandate was redefined further as given below.

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

All India Coordinated Research project on Integrated Farming Systems (AICRP on IFS) is an integral part of IIFSR with 75 centres to undertake on-station and on-farm research across length and breadth of the country. The institute is also leading a Network Project on Organic Farming (NPOF) with 20 centres.

2. OBJECTIVES

On-Station Research

— To undertake applied and adaptive research in integrated farming systems (IFS), especially on production technologies for improving system productivity and resource use efficiencies.

— To develop efficient, economically viable and environmentally sustainable IFS models for different zones.

— To undertake capacity building and human resource development in IFS.

On-Farm Research

— To undertake characterization of existing farming systems for identification of production constraints and problem prioritization.

— To undertake on-farm testing and refinement of system-based farm production technologies.

— To optimize on-farm integration of farm enterprises for enhanced farm incomes, resource/ input use efficiencies, and employment opportunities.

3. LOCATION

Under the aegis of AICRP-IFS there are 25 main canters, 12 sub centers, 32 on-farm research centres and 5 voluntary centres. All main and sub centres are engaged in basic and applied research and are necessarily located at SAUs or their Regional Research Stations or Agricultural colleges of those general universities, where strong agricultural research base is available. Whereas, on-farm research centers (earlier known as Experiments on Cultivators' Fields/ ECF Centers) are engaged in farmers' participatory research and are located in different agro-climatic zones. These OFR centers remain shifted from one zone / farming situation to another, every 4-5 years. The voluntary centres are situated in ICAR institutes and are taking up only IFS model development activity. The location of different AICRP-IFS centers during the year under report (2015-16) is depicted in Map-1& 2, and details are given in Table-3.

Map 1. Locations of on-station research centres of AICRP-IFS during 2015-16

Map 2. Locations of on-farm research centres of AICRP-IFS during 2015-16

Table-3/1: Location of Different AICRP-IFS centres during the year under report (2015-16)

S.No.	State	Centre/ District	Status	Ecosystem	Agro-Climatie Region/Sub-Region of Planning	NARP Zone
1.	A&N	CIARI, Portblair	Voluntary	Island	Island region	Northern Zone AN-1
2.	Assam	Jorhat	Main Centre	Humid	Eastern Himalayan Region/Upper Brahmaputra Valley Sub-Region	Upper Brahmaputra Valley Zone (AS-2)
3.		Kokrajhar	OFR Centre	Humid	Eastern Himalayan Region	Central Brahmaputra Valley (AS-3)
4.	Andhra Pradesh	Maruteru (Dist. W. Godavari)	Sub Centre	Coastal	East Coast Plains and Hills Region/ South Coastal Andhra Sub-Region	Krishna Godavari Delta Zone (AP-1)
5.		Srikakulam	OFR Centre	Sub-Humid	East Coast Plains and Hills Region	North Coastal zone (AP-2)
6.	Bihar	Sabour (Dist. Bhagalpur)	Main Centre	Sub-Humid	Middle Gangetic Plains Region/ South Bihar Plains Sub-Region	South Bihar Alluvial Plain Zone (B1-3)
7.		Purnea	OFR Centre	Sub-Humid	Middle Gangetic Plains Region	North-east Alluvial Plain (B1-2)
8.		Patna	Vol. Centre	Sub-Humid	Middle Gangetic Plains Region	South Bihar Alluvial Plain Zone (B1-3)
9.	Chhattisgarh	Raipur	Main Centre	Sub-Humid	Eastern Plateau & Hills Region/ Wainganga Sub-Region	Chhattisgarh Plain Zone (CG-1)
10.		Kabirdham	OFR Centre	Sub-Humid	Eastern Plateau & Hills Region	Chhattisgarh Plain Zone (CG-1)
11.	Delhi	New Delhi	Vol. Centre	Semi-Arid	Trans Gangetic Plains region	Western Semi Arid (ND1)
12.	Goa	Old Goa	Vol. Centre	Coastal	West Coast Plains &Hills Region	South Konkan Coastal
13.	Gujarat	S.K. Nagar (Dist. Banaskantha)	Main Centre	Arid	Gujarat Plains and Hills Region/ North Gujarat Sub-Region	North Gujarat Zone (GJ-4)
14.		Junagadh	Sub-Centre	Semi-Arid	Gujarat Plains and Hills Region/ South Saurashtra Sub-Region	South Saurashtra Zone (GJ-7)
15.		Navsari	Sub-Centre	Coastal	Gujarat Plains and Hills Region/ Southern Hills Sub-Region	South Gujarat Heavy Rainfall Zone (GJ-1)
16.		Deesa	OFR Centre	Semi-Arid	Gujarat Plains and Hills Region/ North Gujarat Sub-Region	North Gujarat Zone(GJ-4)
17.		Thasra	OFR Centre	Arid	Gujarat Plains and Hills Region/ North west Sub-Region	Middle Gujarat Zone (GJ-3)
18.	Haryana	Hisar	Main Centre	Arid	Trans –Gangetic Plains Region/ Arid Sub-Region	Western Zone (HR-2)
19.		Sirsa	OFR Centre	Semi-Arid	Trans –Gangetic Plains Region	Western (HR-2)

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S.No.	State	Centre/ District	Status	Ecosystem	Agro-Climatie Region/Sub-Region of Planning	NARP Zone
20.	Himachal Pradesh	Palampur (Dist. Kangra)	Main Centre	Humid	Western Himalayan Region/ High Altitude Temperature Sub-Region	Mid-Hill Sub-Humid Zone (HP-2)
21.		Kangra	OFR Centre	Humid	Western Himalayan Region	Sub-Montane and Low Hills Sub-Tropical (HP-1)
22.	J & K	Chatha (Jammu)	Main Centre	Humid	Western Himalayan Region/High Altitude Temperature Sub-Region	Mid to High Altitude Plain Zone
23.		Samba	OFR Centre	Humid	Western Himalayan Region	Low altitude Sub-Tropical Zone (JK-1)
24.	Jharkhand	Kanke (Ranchi)	Main Centre	Sub-Humid	Eastern Plateau & Hills Region/ Chhota Nagpur, South and West Bengal Hills & Plateau Sub-Region	Western Plateau Zone (B1-5)
25.		Jamtara	OFR Centre	Sub-Humid	Eastern Plateau & Hills Region	Central and North Eastern Plateau Zone (JH-1)
26.	Karnataka	Kathalgere (Dist. Davangere)	Main Centre	Semi-Arid	Southern Plateau and Hills Region	Southern Transition Zone (KA-7)
27.		Kolar	OFR Centre	Semi-Arid	Southern Plateau and Hills Region	Eastern Dry Zone (KA-5)
28.		Siruguppa (Dist. Bellary)	Main Centre	Arid	Southern Plateau and Hills Region/ Northern Dry Region of Karnataka	Northern Dry Zone (KA-3)
29.		Gadag	OFR Centre	Arid	Southern Plateau and Hills Region	Northern dry Zone (KA-3)
30.	Kerala	Karamana (Dist. Thiruvanthapuram)	Main Centre	Coastal	West Coast Plains and Ghats / Mid land Sub-Region	Coastal Southern Zone (KE-2)
31.		Pathinamthitta	OFR Centre	Coastal	West Coast Plains and Ghats	Problem Areas Zone (KE-5)
32.	Madhya Pradesh	Jabalpur	Main Centre	Sub-Humid	Central Plateau & Hills Region/ Kymore Plateau and Satpura Hills Sub-Region	Kymore Plateau and Satpura Hills Zone (MP-4)
33.		Indore	Sub-Centre	Semi-Arid	Western Plateau &Hills Region/ Central Plateau Sub-Region	Malwa Plateau Zone (MP-10)
34.		Powarkheda (Dist. Hoshangabad)	Sub-Centre	Sub-Humid	Central Plateau & Hills Region/ Central Narmada Valley Sub-Region	Central Narmada Valley Zone (MP-6)
35.		Rewa	Sub-Centre	Sub-Humid	Central Plateau & Hills Region/ Kymore Plateau and Satpura Hills Sub-Region	Kymore Plateau and Satpura Hills Zone (MP-4)
36.		Dindori	OFR Centre	Semi-Arid	Eastern Plateau and Hills	Northern hill zone of Chattisgarh (CG-3)

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S.No.	State	Centre/ District	Status	Ecosystem	Agro-Climatie Region/Sub-Region of Planning	NARP Zone
37.		Katni	OFR Centre	Semi-Arid	Central Plateau & Hills Region	Kymore Plateau and Satpura Hills (MP-1)
38.	Maharashtra	Akola	Main Centre	Semi-Arid	Western Plateau &Hills Region/ Central Plateau Sub-Region	Western Vidarbha Zone (MH-8)
39.		Amravati	OFR Centre	Semi-Arid	West Coast Plains and Ghats	Central Maharasthra Plateau (MH-7)
40.		Karjat (Dist. Raigad)	Main Centre	Coastal	Western Plains & Ghat Regions/ Coastal Hilly Sub-Region	North Konkan Coastal Zone (MH-2)
41.		Raigad	OFR Centre	Coastal	West Coast Plains and Ghats	North Konkan Coastal Zone (MH-2)
42.		Parbhani	Main Centre	Semi-Arid	Western Plateau &Hills Region/ Central Plateau Sub-Region	Central Maharashtra Plateau Zone (MH-7)
43.		Aurangabad	OFR Centre	Semi-Arid	Western Plateau &Hills Region	Central Maharashtra Plateau Zone (MH-7)
44.		Rahuri (Dist. Ahemadnagar)	Main Centre	Semi-Arid	Western Plateau & Hills Region/ Scarcity Sub-Region	Scarcity Zone (MH-6)
45.		Pune	OFR Centre	Semi-Arid	Western Plateau & Hills Region	Western Maharashtra Plain Zone Ganeshkhind (MH-5)
46.	Meghlaya	Umiam				
47.	Odisha	Bhubaneswar	Main Centre	Sub-Humid	East Coast Plains and Hills Region/ Orissa Coastal Sub-Region	East and South –Eastern Coastal Plain Zone (OR-4)
48.		Chiplima (Dist. Sambalpur)	Sub-Centre	Sub-Humid	Eastern Plateau & Hills Region/ Wainganga Sub-Region	West-Central Table Land Zone (OR-9)
49.		Angul	OFR Centre	Sub-Humid	Eastern Plateau & Hills Region	Mid-Central Table Land (OR-10)
50.		Kendrapara	OFR Centre	Coastal	East Coast Plains and Hills Region/ Orissa Coastal Sub-Region	East and South –Eastern Coastal Plain Zone (OR-4)
51.	Punjab	Ludhiana	Main Centre	Semi-Arid	Trans-Gangetic Plains Region/ Plains Sub-Region	Central Plain Zone (PB-3)
52.	Amritsar	OFR Centre	Semi-Arid	Trans-Gangetic Plains Region/ Plains Sub-Region		Central Plain Zone (PB-3)
53.	Rajasthan	Durgapura (Jaipur)	Main Centre	Semi-Arid	Central Plateau & Hills Region/ Eastern Plains of Rajasthan	Semi-Arid Eastern Plain Zone (RJ-5)
54.		Hanumangarh	OFR Centre	Semi-Arid	Central Plateau & Hills Region/ Eastern Plains of Rajasthan	Transitional Plain Zone of Inland Drainage (RJ-3)

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S.No.	State	Centre/ District	Status	Ecosystem	Agro-Climatie Region/Sub-Region of Planning	NARP Zone
55.		Kota	Sub Centre	Semi-Arid	Central Plateau & Hills Region/ Eastern Plains of Rajasthan	Humid South –Eastern Plain Zone (South-Eastern Humid Plain Zone (RJ-9)
56		Chittorgarh	OFR centre	Semi-Arid	Central Plateau & Hills Region/ Southern Plains of Rajasthan	Sub-Humid Southern Plain & Aravali Hills Zone (RJ-7)
57.	Tamil Nadu	Coimbatore	Main Centre	Semi-Arid	Southern Plateau and Hills Region/ Central Plateau of Tamil Nadu Sub-Region	Western Zone (TN-3)
58.		Thanjavur	Sub Centre	Coastal	East Coast Plains and Hills Region/ Thanjavur Sub-Region	Cauvery Delta Zone (TN-4)
59.		Paiyur	OFR Centre	Semi-Arid	Southern Plateau and Hills Region	North western Zone (TN-2)
60.		Chettinad	OFR Centre	Semi-Arid	East Coast Plains and Hills Region	Sothern Zone (TN-5)
61.	Telangana	Rajenderaanagar	Main centre	Semi-Arid	Southern Plateau and Hills Region/ South Telangana Sub-Region	Southern Telangana Zone (AP-5)
62.		Rudrur (Dist. Nizamabad)	Sub Centre	Semi-Arid	Southern Plateau and Hills Region/ North Telangana Sub-Region	Northern Telangana Zone (AP-4)
63.		Warangal	OFR Centre	Semi-Arid	Southern Plateau and Hills Region	Southern Telangana (AP-5)
64.	Uttar Pradesh	Kanpur	Main Centre	Semi-Arid	Upper Gangetic Plains Region/ South Western Plains Sub-Region	Central Plain Zone (UP-6)
65.		Kaushambi	OFR Centre	Semi-Arid	Upper Gangetic Plains Region/ South Western Plains Sub-Region	Central Plain Zone (UP-4)
66.		Faizabad	Main Centre	Sub-Humid	Middle Gangetic Plains Region/ Eastern Plains Sub-Region	Eastern Plain Zone (UP-9)
67.		Santkabirnagar	OFR Centre	Sub-Humid	Eastern Himalayas Region/ Eastern Plains Sub-Region	Eastern Plain Zone (UP-7)
68.		Bichpuri (Dist. Agra)	Sub Centre	Semi-Arid	Upper Gangetic Plains Region/ Western Plains Sub-Region	South-Western Semi-Arid Zone (UP-5)
69.		Varanasi	Sub Centre	Sub-Humid	Middle Gangetic Plains Region/ Eastern Plains	Eastern Plain Zone (UP-9)
70.		Modipuram	Vol. Centre	Sub-Humid	Upper Gangetic Plains Region	Western Plain Zoan(UP-3)
71.		Modipuram	OFR Centre	Sub-Humid	Upper Gangetic Plains Region	Western Plain Zoan(UP-3)
72.	Uttarakhand	Pantnagar (Dist. US Nagar)	Main Centre	Sub-Humid	Western Himalayan Region/ Valley Temperate Sub-Region	Bhawar and Tarai Zone (UP-2)
73.		Nainital	OFR Centre	Sub-Humid	Western Himalayan Region/High Hill Temperate Sub-Region	Hill Zone (UK-1)
74.	West Bengal	Kalyani (Dist. Nadia)	Main Centre	Humid	Lower Gangetic Plains Region/ Central Alluvial Plains Sub-Region	New Alluvial Zone (WB-3)
75.		24-Parganas South	OFR Centre	Humid	Lower Gangetic Plains Region	Coastal Sline Zone (WB-6)

4. SOIL AND CLIMATE

The major group of soils (centre-wise), on which on-station experiments of CSR were conducted during the year 2015-16 and geographical coordinates (Latitude and Longitude) of the different research locations are given in table-4/1. The general climatic conditions for the experimental locations are described below in brief.

Table-4/1: Soil type and geographical coordinates of different on-station CSR centres

S.No.	Centre	Soil Type	Latitude	Longitude
1.	Rajendranagar	Udic Ustochrepts, black soils	18^0 59' N	78^0 55' E
2.	Maruteru	Chromusterts clayey, medium black soils	16^0 38' N	81^0 44' E
3.	Rudrur	Chromusterts clayey, deep (90 cm depth), deep black soils	18^0 30' N	77^0 51' E
4.	Jorhat	Fluaquents/ Udicaquents association, very deep (90 cm depth), alluvial sandy clay loam soils	26^0 47' N	94^0 12' E
5.	Sabour	Eutrochrepts (Very deep), low and clay soils	25^0 23' N	87^0 07' E
6.	Raipur	Ochraquals association, deep black soils	21^0 16' N	81^0 36' E
7.	S.K. Nagar	Haplaquals, deep medium black soils	24^0 19' N	72^0 19' E
8.	Junagadh	Ustochrepts deep medium black soils	21^0 30' N	70^0 30' E
9.	Navsari	Vertic Ustochrepts deep black soils	20^0 57' N	72^0 54' E
10.	Hisar	Ustochrepts, very deep silty alluvial soils	29^0 08' 55"N	74^0 41'16" E
11.	Palampur	Udic Haplustalfs, red soils	32^0 06' N	76^0 03' E
12.	Chatha (Jammu)	Eutrochrepts very deep clay soils	32^0 05' N	74^0 04' E
13.	Ranchi	Ultic Palustalfs, very deep (90 cm) red soils	23^0 17' N	85^0 19' E
14.	Kathalagere	Alfisols, dark reddish brown sandy clay loam	13^0 02' N	76^0 15' E
15.	Siruguppa	Type Chromusterts, very deep (90 cm) black soils	15^0 38' N	76^0 54' E
16.	Karamana	Typic Tropofluvents, very deep (90 cm depth)	11^0 N	77^0 E
17.	Jabalpur	Chromusterts, very deep (90 cm depth), medium to deep black soils	23^0 10' N	79^0 57' E
18.	Indore	-	22^0 04' N	79^0 57' E
19.	Powarkheda	-	23^0 25' N	73^0 98' E
20.	Rewa	Ustochrepts-Vertic Ustochrepts association, fine loamy soils	24^0 41' N	81^0 15' E
21.	Akola	Medium deep black clayey soil	20^0 42' N	77^0 02' E
22.	Karjat	Haplustults Udic-Fluvents, red soils	18^0 33' N	75^0 03' E
23.	Parbhani	Chromusterts, deep (90 cm depth), deep black soils	19^0 08' N	76^0 05' E
24.	Rahuri	Chromusterts, fine clayey soils	19^0 47' N	74^0 18' E
25.	Bhubaneswar	Haplustalfs, very deep (90 cm depth), mediumtextured lateritic soils	20^0 15' N	85^0 52' E

Contd..../-

S.No.	Centre	Soil Type	Latitude	Longitude
26.	Chiplima	Haplaquents, very deep (90 cm depth) clay, ill-drained soils	20^0 21' N	80^0 55' E
27.	Ludhiana	Ustochrepts-Ustic Psamments Association, very deep (90 cm depth), alluvial sandy and sandy-loam soils	30^0 56' N	75^0 52' E
28.	Durgapura (Jaipur)	Torrid-Psamments/ Torrid-Fluvents Association, sandy loam soils	26^0 55' N	75^0 49' E
29.	Kota	Chromsterts-Paleusterts Association, very deep (90 cm depth) clay loam soils	25^0 26' N	75^0 30' E
30.	Coimbatore	Udic Rhodustalfs, fine loamy red sandy soils	11^0 59' N	78^0 55' E
31.	Thanjavur	Typic Pellusterts, clayey very deep (90 cm depth)/ deep black soils of deltaic origin	10^0 47' N	79^0 10' E
32.	Kanpur	Udic Ustochrepts, alluvial soils	26^0 28' N	80^0 21' E
33.	Faizabad	Udic Fluvents-Fluaquents Association, lowland clayey soils	26^0 47' N	82^0 12' E
34.	Bichpuri	Ustochrepts, very deep (90 cm depth) alluvial soils	27^0 02' N	77^0 09' E
35.	Varanasi	Aeric Chroquals very deep (90 cm depth) alluvial clayey soils	25^0 18' N	83^0 03' E
36.	Pantnagar	Hapludolls, very deep (90 cm depth) alluvium coarse loamy soils	29^0 08' N	79^0 05' E
37.	Kalyani	Fluventic Eutrochrepts, very deep (90 cm depth) alluvial soils	23^0 40' N	88^0 52' E
38.	PDFSR, Modipuram	Ustochrept	29.4' N	77.46' E
39.	ICAR-RC, Patna	Alluvial soil	25^0 50' N	84^0 45' E
40.	ICAR-RC, Umiam	Alfisols, Entisols, Inceptisols	25^0 59' N	85^0 08' E
41.	ICAR-RC, Goa	Lithic dystropepts karmali soil series	15^0 30' N	75^0 55' E
42.	CARI, Port Blair	Costal alluvial soil	11^0 38' N	92^0 39' E

Weather condition at different farming system research centers during 2015-16

The annual conditions of important weather parameters e.g., rainfall, monthly average maximum temperature and minimum temperature prevailed during the reporting period (July 2015-June 2016) at the various Integrated Farming Systems Research Centers of the AICRP on IFS are depicted in figures 1-3 and described below.

Akola: During the reporting period, 791.1 mm rainfall, 34.8 mm higher from the previous year was received, out of this 79.2% rainfall was contributed by the South-west monsoon. Months of *kharif* season received 72.1 mm to 320.1 mm rainfall, however terminal monsoon was stronger where September month received 320.1 mm rainfall. Opposite to the previous season, October month also received sizable amount of rain i.e. 164.3 mm. Rest other months except June was observed as dry.

Bhubaneswar: Total rainfall received during the reporting year was 1327.7 mm which was about 256.0 mm lower than the previous season (1538.5 mm). The contribution of South-west monsoon was 68.0% to the annual rainfall. Distribution of rain was

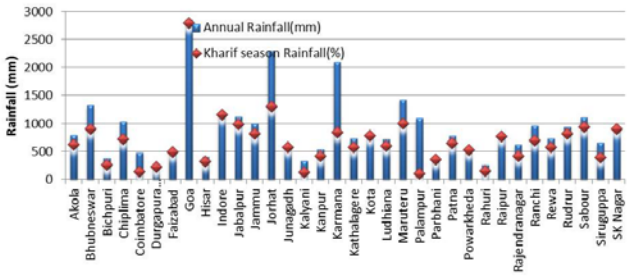


Fig. 1. Total rainfall (mm) and percentage rainfall precipitated during *kharif* season during the reporting year (2015-16) at various centers of the AICRP on IFS

fairly good during the reporting season where almost all the months received rainfall except February and April. August month received the highest rainfall (297.8 mm) in the entire season. The monthly average maximum temperature ranged between 28.8°C to 40.8 °C. The monthly average minimum temperature dropped to 15.4°C in the month of January.

Bichpuri: Comparatively half (382.3 mm) of previous season's rainfall received during the reporting period. About 66.5% of the total rainfall was precipitated during the *kharif* season. With 88.2 mm rainfall, July was found to be the wettest month however; distribution of the rain was fairly good in the season.There was no rainy day recorded during December, February and April. The highest monthly average maximum temperature (41.5°C) was recorded during the May whereas, lowest monthly average maximum temperature (22.1°C) was recorded in January. December was found to be the coldest months where mercury dropped down to 8.4°C.

Chiplima: During the reporting period, a lower rainfall of 1035.2 mm was recorded compared to the previous season. About 69.4% of total rain was received during *kharif* season. December and February were deprived of the rainfall however August was observed as the wettest month with 342.9 mm rainfall. May was observed as warmest (39.0°C) during the season whereas, December was very cool with 8.3°C monthly minimum temperature.

Coimbatore: The total rainfall (483.0 mm) received during the reporting year which was about half of rainfall occurred during previous year (888.3 mm). As usual South-west monsoon contributed only 27.7% to the total annual rainfall whereas, North-east monsoon contributed 280.6 mm rainfall to the total annual rain. Distribution of rainfall was quite good throughout the season and only January, February and March were found to be dry months.The monthly average maximum temperature was ranged between 28.6°C-37.3°C during the reporting period. The winter season was also remained moderately warm where monthly average minimum temperature remained above 19.5°C.

Durgapura: With 85.2% contribution from South-west monsoon, centre received only 253.2 mm annual rainfall. More than half of the total rain was poured in the month of July (163.8 mm). November to April except February were observed as dry where no rainy day was recorded. The monthly average maximum temperature was ranged between 24.3°C-41.3°C during the reporting period. The minimum temperature dropped down to 9.1°C during December.

Faizabad: The total rainfall of 509.6 mm was recorded during the reporting period where South-west monsoon contributed 94.5% to the total rainfall. Distribution of rain remained skewed towards initial phase of monsoon months where 373.0 mm rain was poured during July to August. There was no any rainy day was recorded during October to January. With 40.3°C monthly average maximum temperature, April was recorded as warmest month. Day temperature remained above 22.7°C even in January where mercury dropped to 6.9°C during night time.

Goa: With 2849.2 mm rainfall during the reporting period centre recorded as the wettest centre of AICRP where 98.0% of total rainfall was contributed by southwest monsoon season. November to May, no rainy day was recorded at the centre. The average monthly maximum temperature throughout the season was almost similar as it ranged 30.1°C to 35.7°C. Average monthly minimum temperature was also remained above 18.5°C.

Hisar: In comparison to last crop season, a lower rainfall (406.2 mm) was received at the centre during the reporting period. *Kharif* season received about 79.1% of total rainfall. Among all the months of reporting period, only December, January and April months were found to be dry. As usual summer was very hot and monthly maximum temperature (41.4°c) was reported highest during

the May and winter was severe during which average monthly minimum temperature dropped below 6.0°C in December.

Indore: The centre received 1187.7 mm rainfall during the reporting period where South-west monsoon contributed about 97.0% to the total rainfall. Almost half period of season i.e. November to April, no rainy day was recorded at the centre. With 557.5 mm rain July was found to be the wettest month during the period. The range of the monthly maximum temperature was 26.0°C-40.2°C. With 10.4°C minimum temperature, January was recorded as coldest month during the period.

Jabalpur: About similar amount of the rainfall (1124.5 mm) occurred as in the previous season. The contribution of the South-west monsoon was 87.4% to the total rainfall. Rainfall was fairly distributed in *kharif* season however, July with 390.8 mm rain was found to be the wettest month under the reporting period. Rainfall was also recorded during almost all months except November, December and April. Summer season was hot and the range of monthly average maximum temperature was 25.2 to 41.2°C. The mercury dropped up to 8.0°C during January.

Jammu: The center received 998.6 mm total rainfall out of which 81.3% was contributed by South-west monsoon. All the months received rainfall where July was recorded as the wettest month with 413.1 mm of rainfall and April was recorded as the driest month where only 3.2 mm rain was received. The range of monthly average maximum temperature was 17.2°C to 38.4°C. January month was fond to be coldest where night temperature was dropped to 5.4°C.

Jorhat: The reporting period received 2291.8 mm which was 364.2 mm higher over the previous season. The contribution of South-west monsoon was only 56.7%. The distribution of rainfall during the season was quite good however, July was recorded as the wettest month at the centre with 344.8 mm rainfall. February month received the least amount of rain (6.6 mm). The highest monthly mean maximum temperature (34.0°C) was observed during July, lowest monthly mean minimum temperature (9.9°C) was recorded during January.

Junagarh: The rainfall (585.5 mm) received during reporting period was about half the previous season (1043.8 mm) and this was due to 98.2% contribution from the South-west monsoon. The distribution of rainfall was fair in the season however, August month received only 16.4 mm rain. The highest monthly average maximum temperature (39.9°C) was observed during May whereas, lowest minimum temperature (12.4°C) was recorded during December.

Kalyani: Total rainfall received during the reporting period was 329.3 mm which was about 25% of the rain received during previous season however, each and every month received some rain and least rainfall was received in the month of January (18.9 mm). The range of monthly average maximum temperature was 25.8 to 39.4°C. Lowest monthly average minimum temperature (11.9°C) was recorded during January.

Kanpur: The total rainfall of 534.4mm was recorded during the reporting season out of which 77.8 was contributed by South-west monsoon. Highest rainfall (123.3 mm) was precipitated in the month of August. Distribution of rainfall was quite good throughout the season and only one month of November and April was deprived of that. With 40.0°C monthly average maximum temperature, April was recorded as the warmest month while mercury dropped down to 7.0°C during night time of December.

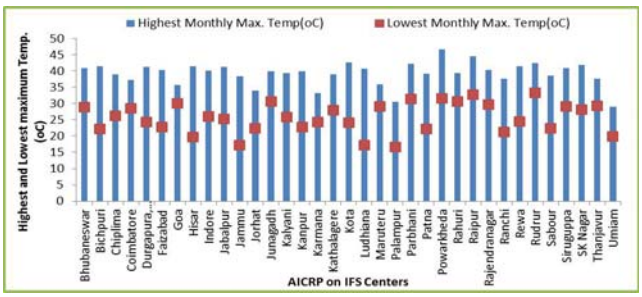


Fig. 2. Highest and lowest monthly average maximum (°C) temperature during the reporting year (2015-16) at various centers of the AICRP on IFS

Karmana: During the reporting period, the total rainfall received was 2104.4 which were lower than the rainfall received during previous season (2430.2 mm). About 40.1% of the total rainfall was contributed by the South-west monsoon. Each and every months of the reporting period received some rain except January and February. The range of monthly average maximum temperature was 24.4 to 33.2°C. Night temperature remained above 22.1°C during the reporting period.

Kathalagere: Total rainfall received during the reporting period was 728.1 where South-west monsoon contributed 78.4%. June month was recorded as the wettest month of the season where 226.2 mm rainfall was received. There was no rainfall during December to March. The range of monthly average maximum temperature was 28.0 to 39.0°C. Night temperature remained above 17.0 °C during the reporting period.

Kota: Total annual rainfall precipitated during the reporting period was 781.1 mm where 99.5% of total rain was precipitated during monsoon season. With 421.5 mm rainfall July was recorded as the wettest month of the season. The highest average monthly maximum temperature (42.6°C) was recorded during May whereas lowest minimum temperature (6.4°C) was recorded during December.

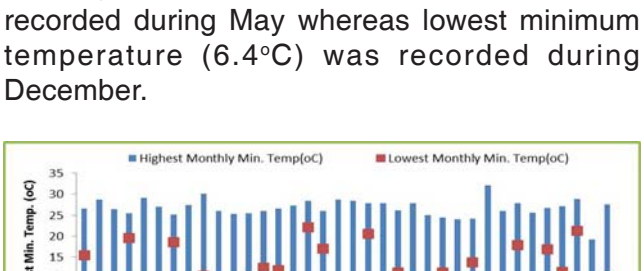


Fig. 3. Highest and lowest monthly average minimum (°C) temperature during the reporting year (2013-14) at various centers of the AICRP on IFS

Ludhiana: The total annual rainfall received during the reporting period was 716.3 which was near to double over the previous season (496.5 mm) which was about 82.9 % was contributed by the South-west monsoon season. Therewas no rainy days recorded during December and April whereas with 256.1 mm rainfall, July month was observed as the wettest month of the season. The highest monthly mean maximum temperature (40.6°C) was observed during April whereas, lowest minimum temperature (7.3°C) was recorded during December.

Maruteru: The reporting period received 1428.6 mm of rainfall where 69.5% was poured only in the *kharif* season. The highest rainfall (339.8 mm) was received in the month of August. Four consecutive months i.e. January to April were observed as dry months where no rainy day was recorded. The highest monthly mean maximum temperature (35.8°C) was observed during May whereas, lowest monthly mean minimum temperature (20.5°C) was recorded during January.

Palampur: Total rainfall received during the reporting was about 1094.5 mm out of which only 105.5 mm rain was received from the South-west monsoon season. Not a single month was recorded as dry where least rain fall was precipitated in the month of January (10.2 mm). The range of average monthly maximum temperature was 16.6 to 30.5°C. Mercury was dropped down to 3.7°C during the night of January.

Parbhani: The total annual rainfall received during the reporting period was 387.0 mm which was about 91.9% was contributed by the South-west monsoon season. There was no rainy day recorded during November to February and May month. September month was observed as the wettest month of the season with 183.9 mm rainfall. The highest monthly mean maximum temperature (42.3°C) was observed during May whereas, lowest minimum temperature (11.3°C) was recorded during January.

Patna: During the reporting year, the total rainfall received was 778.9 mm where more than 82.2% rainfall occurred during the *kharif* season. Almost all the months received rain except November, December and February whereas with 296.6 mm rainfall July was recorded as the wettest month of

the season. April was observed as warmest (39.1°C) during the season whereas, January was very cool with 8.7°C monthly minimum temperature.

Powarkheda: Total rainfall recorded during the reporting period was 523.4 which were almost half of the previous season (1158.0 mm). Cent per cent of the total rain was occurred during *kharif* season and it was July and August where rainy days were recorded. The range of monthly average maximum temperature was 31.7 to 46.6°C whereas, January was observed as coldest month and monthly mean minimum temperature was 6.1°C.

Rahuri: Total rainfall precipitated during the reporting period was 265.3 mm which was quite lower than the preceding season and it was due to less contribution of the rain by the South-west monsoon season where only 56.3% of total rainfall was received. It was fairly distributed in the *kharif* season. The highest average monthly maximum temperature (39.4°C) was recorded during May whereas lowest minimum temperature (11.3°C) was recorded during January.

Raipur: The total rainfall received during the reporting period was 817.3 mm which was quite lower than the previous season (1397.1 mm). Distribution of rainfall was good during the *kharif* season but August was observed as very wet and 224.5 mm rain was precipitated in this month. The highest monthly mean maximum temperature (44.5°C) was observed during May whereas, lowest minimum temperature (5.4°C) was recorded during January.

Rajendranagar: Total rainfall recorded during the reporting period was 628.3 mm which was lower than the previous season (765.4 mm), out of which 410.2 mm (65.3%) rain was received during *kharif* monsoon. The distribution of rain was fairly good during the *kharif* season. Only two months i.e. January and February were found to be dry where no rainy day was observed. The range of average monthly maximum temperature was 29.6 to 40.3°C whereas January was recorded as the coldest month with 13.7°C night temperature.

Ranchi: During the reporting period, the total rainfall received was 961.2 mm. with 274.3 m rainfall South-west monsoon contributed only 71.9% to the total rain however it was highly distributed in the season. Not a single month except November was found to be deprived of rainy day. May was observed as warmest (37.6°C) during the year whereas, January was very cool and dry with 6.6°C monthly minimum temperature.

Rewa: Total rainfall recorded during the reporting period was 735.8 mm which was quite lower than the previous season (909.4 mm) where 77.4% of the total rainfall was contributed by South-west monsoon. The distribution of the rain was highly skewed towards the early phase of the monsoon season where July was found to be the wettest month where 296.6 mm of rain occurred. The range of average monthly maximum temperature was 24.4 to 41.5°C whereas January was recorded as the coldest month with 6.9°C night temperature.

Rudrur: The total rainfall received during the reporting period was 943.9 mm which was almost 300 mm higher than the previous season (604.1 mm). About 86% rain occurred during the *kharif* season with 817.6 mm rain. July month was found to be the wettest month of the season during which 242.1 mm rainfall occurred. The highest monthly average maximum and minimum temperature recorded during the period was 42.5°C and 6.9°C respectively.

Sabour: The total annual rainfall received during the reporting period was 1112.7 which were about three times higher than the previous season (375.5 mm) where South-west monsoon contributed about 84.6% to the total rain occurred during the season. Only November and December months did not recorded any rainy day. The highest monthly mean maximum temperature (38.6°C) was observed during April whereas, lowest minimum temperature (7.5°C) was recorded during January.

Siruguppa: During the reporting period, the total rainfall received was 655.3 mm. with 394.4 mm rainfall South-west monsoon contributed about 60% to the total rainfall of the season. April was observed as warmest month during the period with 40.9 °C whereas, January was very cool with 16.8°C monthly minimum temperature.

SK Nagar: The total rainfall recorded during the reporting period was 905.4 mm where Southwest monsoon contributed 100% to the total of the rainfall precipitated during the reporting period. With 839.5 mm rainfall July month was found to be the wettest month of the season. The highest average monthly maximum temperature (41.9°C) was recorded during May and with 11.5°C night temperature December was found to be the coolest month of the season.

Umiam: Total rainfall recorded during the reporting period was 2739.8 mm which was about 400 mm higher than the previous season (2343.6 mm) where South-west monsoon contributed 67% to the total rainfall with very good distribution throughout the season. Only month of December was found to be dry. The range of average monthly maximum temperature was 19.8-29.0°C whereas January was recorded as the coldest month with 5.1°C night temperature.

Varanasi: During the reporting period 833.4 mm rainfall was recorded which was lower than the previous season **(**1034.7 mm) where South-west monsoon contributed about 90% to the total rainfall. Distribution of rain was highly skewed towards early phase of the monsoon where July was recorded as the wettest month with 417.6 mm rain. The highest average monthly maximum temperature (40.0°C) was observed during April whereas; lowest minimum temperature (10.1°C) was recorded during December.

5. STAFF POSITION

Out of 618 total staff sanctioned for different centers, 476 staff were actually in position as on 31st March 2017, suggesting that 22.8 per cent of total posts were vacant (Table-5.1 and Appendix-III).

Table-5.1: Staff position under AICRP-IFS (university-wise) as on 31.3.2017

S.No.	Name of the University	Scientific		Technical		Administrative		Supporting	
		Sanctioned	Filled	Sanctioned	Filled	Sanctioned	Filled	Sanctioned	Filled
1	ANGRAU, Guntur	2	2	11	7	1	1	1	1
2	PJTSAU, Hyderabad	6	6	12	3	1	0	1	1
3	HPKVV, Palampur	4	4	11	11	2	2	2	0
4	GBPUA&T, Pantnagar	5	4	11	7	2	0	2	1
5	CSAU&T, Kanpur	4	4	11	8	2	1	2	2
6	NDUA&T, Faizabad	4	3	11	9	2	2	2	1
7	BHU, Varanasi	1	1	3	0	1	1	0	0
8	BAU, Ranchi	4	4	11	11	2	2	2	2
9	BAU, Sabour	4	4	11	5	2	1	2	2
10	BCKVV, Kalyani	4	3	11	11	2	1	2	2
11	AAU, Jorhat	5	3	11	10	2	22	2	2
12	PAU, Ludhiana	4	4	11	8	2	2	2	2
13	HAU, Hisar	5	5	11	7	2	2	2	2
14	SKNAU, Jobner	4	2	11	7	2	0	2	2
15	SDAU, S.K. Nagar	5	5	11	8	2	2	2	2
16	NAU, Navsari (*)	1	1	3	2	1	0	0	0
17	JAU, Junagadh (*)	1	1	3	3	1	1	0	0
18	AAU, Anand (*)	1	1	8	6	1	0	1	0
19	JNKVV,Jabalpur	8	6	23	11	5	2	3	1
20	RVSKVV, Gwalior	1	1	3	1	1	1	0	0
21	IGKV, Raipur	5	4	11	7	2	2	2	2
22	OUAT, Bhubaneswar	7	7	22	21	4	4	3	3
23	PDKV, Akola	4	3	11	6	2	0	2	2
24	MAU, Parbhani	4	3	11	7	2	0	2	0
25	MPKV, Rahuri	5	5	11	9	2	2	2	1
26	KKV, Dapoli	4	3	11	10	2	0	2	1
27	UAS, Raichur	3	3	3	3	1	1	1	1
28	UAS, Dharwad	1	1	8	7	1	0	1	1
29	UAS, Bangalore	2	1	7	2	1	1	1	1
30	UAHS, Shimoga	3	3	4	2	1	1	1	1
31	TNAU, Coimbatore	7	7	22	16	4	4	3	3
32	SKUAST, Jammu	4	4	11	11	2	1	2	2
33	KAU, Thrissur	5	5	11	10	2	2	2	2
34	MPUAT, Udaipur	2	2	5	4	2	1	1	1
35	AU, Kota	1	1	3	2	1	1	0	0
36	RBS College, Bichpuri	1	1	3	2	1	1	0	0
37	ICAR-IIFSR, Modipuram	1	0	8	0	1	0	0	0
	Total	132	117	360	254	69	64	57	41

6. BUDGET

Table-6/1. Funds (Rs. in lakhs) released during financial years 2015-16 and 2016-17 under AICRP on Integrated Farming Systems (ICAR share only)

S. No.	Name of the University/ ICAR Institute	Pay & Allow.	T.A.	Other Contin-gencies	Contr. services	Vehicle Hiring/ POL	NRC	TSP (includ-all NRC)	Total
				Fin. Year 2015-16					
1	ANGRAU, Hyderabad	43.00	0.75	3.10	1.30	0.10	0.37	5.00	53.62
2	PJTSAU, Hyderabad	87.00	1.00	9.60	5.60	0.20	1.83	0.00	105.23
3	HPKVV, Palampur	89.00	0.75	5.60	6.00	0.20	1.46	0.00	103.01
4	GBPUA&T, Pantnagar	76.00	1.00	5.60	7.00	0.20	3.71	0.00	93.51
5	CSAU&T, Kanpur	54.00	1.00	6.50	6.00	0.20	1.46	0.00	69.16
6	NDUA&T, Faizabad	78.00	1.00	5.50	7.00	0.20	0.96	0.00	92.66
7	BHU, Varanasi	27.00	0.50	3.00	3.60	0.10	0.96	0.00	35.16
8	BAU, Ranchi	36.00	1.00	4.00	5.00	0.20	0.71	3.00	49.91
9	BAU, Sabour	55.00	1.00	5.10	7.00	0.20	3.71	0.00	72.01
10	BCKVV, Kalyani	53.00	1.00	5.00	7.00	0.20	0.71	6.00	72.91
11	AAU, Jorhat	48.00	1.50	8.53	5.50	0.00	0.37	0.00	63.90
12	PAU, Ludhiana	86.00	1.00	6.50	6.50	0.20	3.71	0.00	103.91
13	HAU, Hisar	62.00	1.00	6.00	7.00	0.20	1.46	0.00	77.66
14	SKNAU, Jobner	40.00	1.00	5.00	7.00	0.20	1.46	0.00	54.66
15	SDAU, S.K. Nagar	66.00	1.40	5.60	7.00	0.20	3.71	0.00	83.91
16	NAU, Navsari	14.00	0.50	2.00	1.35	0.10	0.37	0.00	18.32
17	JAU, Junagadh	27.00	0.50	2.00	1.35	0.10	0.71	0.00	31.66
18	AAU, Anand	15.00	0.60	0.00	1.35	0.07	0.00	2.00	19.02
19	JNKVV,Jabalpur	93.00	1.50	8.00	7.00	0.30	2.20	3.00	115.00
20	RVSKVV, Gwalior	32.50	0.50	3.00	0.85	0.10	0.71	0.00	37.66
21	IGKV, Raipur	51.00	1.00	4.00	5.00	0.10	0.71	4.00	65.81
22	OUAT, Bhubaneswar	91.00	1.50	10.50	7.50	0.30	4.08	0.00	114.88
23	PDKV, Akola	46.00	1.00	5.60	7.00	0.20	1.21	0.00	61.01
24	MAU, Parbhani	46.00	1.00	5.10	7.00	0.20	1.46	0.00	60.76
25	MPKV, Rahuri	46.00	1.00	5.10	6.50	0.20	1.46	0.00	60.26
26	KKV, Dapoli	65.00	1.00	4.60	6.50	0.13	1.46	4.00	82.69
27	UAS, Raichur	31.00	0.80	4.00	6.10	0.20	0.96	0.00	43.06
28	UAS, Dharwad	38.00	0.80	3.10	1.35	0.10	0.00	0.00	43.35
29	UAS, Bangalore	20.00	0.50	3.10	5.00	0.10	0.00	5.00	33.70
30	UAHS, Shimoga	29.00	0.60	3.50	5.60	0.20	1.46	0.00	40.36
31	TNAU, Coimbatore	130.50	2.25	13.92	3.28	0.30	4.10	2.00	156.35
32	SKUAST, Jammu	87.38	0.80	5.60	6.50	0.20	3.21	2.00	105.69
33	KAU, Thrissur	91.00	1.00	5.10	6.50	0.20	1.46	0.00	105.26
34	MPUAT, Udaipur	33.00	0.50	0.00	0.00	0.00	0.34	5.00	38.84
35	AU, Kota	12.00	0.50	2.50	0.50	0.10	0.37	0.00	15.97
36	RBS College, Bichpuri	11.00	0.50	2.50	0.00	0.10	0.37	0.00	14.47
37	ICAR-IIFSR, Modipuram	0.00	0.19	6.36	14.96	0.00	1.00	0.00	22.51
38	ICAR-IIFSR(OFR)	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
39	P.C.Unit,IIFSR, Modipuarm	0.00	0.00	2.30	0.00	0.00	1.00	0.00	3.30
40	ICAR Res. Comp., Patna	0.00	0.50	3.00	4.25	0.10	0.00	0.00	7.85
41	ICAR Res. Comp., Umiam	0.00	0.50	4.58	4.50	0.00	0.84	0.00	10.42
42	ICAR Res. Comp., Old Goa	0.00	0.50	6.00	2.00	0.20	1.34	0.00	10.04
43	CARI, Port Blair	0.00	0.50	2.00	5.00	0.20	0.00	4.48	12.18
44	IASRI, New Delhi	0.00	0.20	4.50	0.00	0.00	0.34	0.00	5.04
	Total	1909.38	35.64	206.59	205.44	6.40	57.75	45.48	2466.68

S. No.	Name of the University/ ICAR Institute	Pay & Allow.	T.A.	Other Contin-gencies	Contr. services	Vehicle Hiring/ POL	NRC	TSP (includ-all NRC)	Total
				Fin. Year 2016-17					
1.	ANGRAU, Guntur	45.00	0.76	2.00	0.00	0.30	0.00	0.00	48.06
2.	PJTSAU, Hyderabad	70.00	1.25	7.00	5.40	0.30	2.25	0.00	86.20
3.	HPKVV, Palampur	78.00	0.76	6.00	5.40	0.30	2.25	0.00	92.71
4.	GBPUA&T, Pantnagar	53.00	1.00	4.53	6.84	0.30	0.00	0.00	65.67
5.	CSAU&T, Kanpur	39.00	1.00	4.90	6.03	0.30	0.00	0.00	51.23
6.	NDUA&T, Faizabad	69.00	1.00	5.75	5.40	0.30	0.00	0.00	81.45
7.	BHU, Varanasi	20.00	0.50	2.75	7.74	0.00	0.00	0.00	30.99
8.	BAU, Ranchi	47.76	1.00	2.00	5.40	0.20	0.00	0.00	56.36
9.	BAU, Sabour	38.00	1.00	3.60	4.62	0.30	0.00	0.00	47.52
10.	BCKVV, Kalyani	49.00	1.00	4.65	5.76	0.20	2.25	0.00	62.86
11.	AAU, Jorhat	60.00	1.50	8.35	6.00	0.15	0.00	0.00	76.00
12.	PAU, Ludhiana	75.00	1.00	5.25	5.40	0.30	0.00	0.00	86.95
13.	HAU, Hisar	48.50	1.00	5.25	5.40	0.30	2.25	0.00	62.70
14.	SKNAU, Jobner	42.00	1.00	4.87	5.40	0.30	0.00	0.00	53.57
15.	SDAU, S.K. Nagar	62.00	2.00	4.88	5.40	0.20	0.00	0.00	74.48
16.	NAU, Navsari	8.00	0.50	2.00	0.00	0.00	0.00	0.00	10.50
17.	JAU, Junagadh	12.50	0.50	2.00	0.00	0.00	0.00	0.00	15.00
18.	AAU, Anand	19.50	0.60	0.00	0.00	0.00	0.00	0.00	20.10
19.	JNKVV,Jabalpur	75.00	1.50	7.28	6.32	0.30	0.00	0.00	90.40
20.	RVSKVV, Gwalior	27.00	0.50	2.00	0.00	0.00	0.00	0.00	29.50
21.	IGKV, Raipur	49.00	1.00	2.18	6.32	0.20	3.00	0.00	61.70
22.	OUAT, Bhubaneswar	80.00	1.50	10.00	5.40	0.30	3.00	0.00	100.20
23.	PDKV, Akola	49.00	0.68	9.25	2.35	0.30	0.00	0.00	61.58
24.	MAU, Parbhani	45.00	1.00	4.39	6.12	0.30	3.00	0.00	59.81
25.	MPKV, Rahuri	46.00	1.00	4.39	6.12	0.30	0.00	0.00	57.81
26.	KKV, Dapoli	57.00	1.00	2.25	5.40	0.00	2.25	0.00	67.90
27.	UAS, Raichur	32.00	0.80	2.56	5.40	0.00	0.00	0.00	40.76
28.	UAS, Dharwad	32.00	0.80	2.00	0.00	0.20	0.00	0.00	35.00
29.	UAS, Bangalore	22.00	0.50	1.25	0.00	0.10	0.00	0.00	23.85
30.	UAHS, Shimoga	19.00	0.60	2.57	5.40	0.00	0.00	0.00	27.57
31.	TNAU, Coimbatore	112.00	2.25	11.60	4.79	0.50	2.25	0.00	133.39
32.	SKUAST, Jammu	86.00	0.80	5.60	7.15	0.30	2.25	0.00	102.10
33.	KAU, Thrissur	90.24	1.50	5.75	5.40	0.30	2.25	0.00	105.44
34.	MPUAT, Udaipur	22.00	0.50	0.00	0.00	0.00	0.00	0.00	22.50
35.	AU, Kota	10.00	0.50	2.00	0.00	0.00	0.00	0.00	12.50
36.	RBS College, Bichpuri	10.50	0.50	2.00	0.00	0.00	0.00	0.00	13.00
37.	PDFSR, Modipuram	0.00	0.34	6.09	6.31	0.25	6.00	0.00	18.99
38.	PDFSR (Coord.Unit)	0.00	1.00	6.25	2.50	0.00	3.14	0.00	12.89
39.	ICAR Res. Comp., Patna	0.00	0.50	3.00	4.00	0.00	0.00	0.00	7.50
40.	ICAR Res. Comp., Umiam	0.00	0.38	3.75	9.00	0.08	0.00	0.00	13.21
41.	ICAR Res. Comp.,Old Goa	0.00	0.25	2.00	3.75	0.00	0.00	0.00	6.00
42.	CARI, Port Blair	0.00	0.25	2.00	3.75	0.00	0.00	0.00	6.00
43.	IASRI, New Delhi	0.00	0.19	0.25	3.75	0.00	0.05	0.00	4.24
		1700.00	37.21	176.19	179.42	7.18	36.19	0.00	2136.19

7. RESEARCH RESULTS

7.1 INTEGRATED FARMING SYSTEMS

7.1.1 DEVELOPMENT OF REGION-SPECIFIC ON-STATION IFS MODELS

Title of the experiment: Development of region specific on-station IFS models

Objectives

- To characterize existing farming systems to know the productivity, viability and constraints
- To develop and validate region specific Integrated Farming System models for enhanced system productivity, profitability and sustainability
- To assess the relative efficiencies of the IFS model in terms of economics, resource use and energy
- To optimize individual components of IFS in regional perspective
- Capacity building of stake holders in IFS through appropriate trainings

Year of start: 2011-12

Modules: A Location specific component of IFS has been integrated and details are given along with results.

Locations

Agro-climatic region	Locations (State)	Number of IFS models
Western Himalaya	Chatha (J&K), Palampur (HP), Pantnagar (UK)	3
Eastern Himalaya	Umiam (Meghalaya), Jorhat (Assam)	2
Trans Gangetic Plains	Hisar (Haryana), Ludhiana (Punjab)	2
Upper Gangetic Plains	Modipuram (UP), Kanpur (UP)	2
Middle Gangetic Plains	Varanasi (UP), Faizabad (UP), Patna (Bihar), Sabour (Bihar)	5
Lower Gangetic Plains	Kalyani (WB)	1
Eastern Plateau and Hills	Raipur (Chhatisgarh), Ranchi (Jharkhand)	2
Central Plateau and Hills	Jabalpur (MP)	1
Western Plateau and Hills	Akola (MS), Parbhani (MS), Rahuri (MS)	3
Southern Plateau and Hills	Rajenderanagar (Telangana), Coimbatore (TN), Kathalgere (Karnataka), Sriguppa (Karnataka)	4
East Coast Plains and Hills	Bhubaneswar (Odissa)	1
West Coast Plains and Hills	Goa, Karjat (MS), Karamana (Kerala)	7
Western dry	Kota (Rajasthan)	1
Gujarat Plains and Hills	S K Nagar (Gujrat)	1
Islands	Portblair (A&N)	2
Total		**37**

1. WESTERN HIMALAYAN REGION

Chhatta

Integrated farming system model of one hectare cultivated land designed for small and marginal farmers of six farmer's family members under irrigated condition of Jammu region comprises different enterprises viz. Crop+ horticulture (intercropped with high value vegetable crop)+ animal including vermin-compost and biogas, Fish cum Poultry, Mushroom, Apiary and boundary plantation with Albizia, Grewia, Lucenia, Rajhard, Anola, Bael, popular and Karonda as bio fencing and the second row has been planted with mango trees (Amarpalli) has been established in the year 2011-12 at research farm of SKUAST-J Main Campus, Chatha under subtropical irrigated condition of Jammu region of J&K. This IFS model of one hectare provides round the year average production of 22.25t REY/Year during 2016-17, net profit of 2.84 lakh/year/ha (Table-7.1.1/1) was comparably higher than existing farming system. Total employment of 502 man days/year was generated with main salient achievement to generate income on monthly basis. Engagement of on-farm labour could save 34.1% of the production cost. Recycling of farm wastes, crop residues etc. contributed 11.12 % saving in input cost in form of recycling/vermi-composting. Moreover this IFS model under sub-tropical condition of Jammu is having the potential to improve the farm income to three fold besides will address the sustainability issues in the long run.

Table 7.1.1/1: Area allocation and component wise economics (2016-17) in IFS Model

Component	Net Area (ha)	Total cost (Rs/ha)	Gross Return (Rs)	Net return (Rs)
Crop unit				
Cropping system	0.3802	37290	65905	28616
Horticulture unit				
Fruit crops	0.3	6548	19280	12732
Vegetables (intercrop)	-	16995	41454	24459
Floriculture	0.07	377	1377	1000
Agro-forestry	0.1	300	2000	1700
Livestock unit				
Dairy animals (including vermicompost)	0.08	149204	274586	125382
biogas unit	-	7380	15870	8490
Fish cum poultry unit				
Poultry/Ducks		35800	65736	29936
Fisheries	0.1	3118	20713	17569
Apiary unit (03 boxes)	-	1500	3000	1500
Green fodder (Fodder-fodder cropping system and on bunds planted perennial fodder crops (Hybrid Napier)	0.07	3800	17000	13200
Mushroom unit (6 qts wheat straw)	0.02	10718	29580	18863
Grand total	**1.02**	**273029**	**556501**	**283474**

Among all the enterprises, the highest average net profit of Rs. 125382 was realized from animal unit having two cow and one buffalo including Vermi-compost/farm waste recycling component contributing to 44.25 % of net profit followed by horticulture (13.48 %), crops (10.56 %), poultry (10.5 %), mushroom (6.66 %) etc. The overall average net profit (Rs. 2.84 lakh/year) was significantly higher to existing farming system which works out to be 0.80 to 0.90 lakh/ha.

Month wise farm income and employment generation round the year presented in table 7.1.1/2. The system could provide round the year production of 22.25 t/ha (REY) and net profit of Rs. 2.84 lakh/year besides generating employment of 502 man days/year. The maximum average production and profit was realized in June.

Table 7.1.1/2: Month wise cost of production, gross return, net return and employment generation (2016-17)

Month	Total cost involved (Rs)	Gross return (Rs)	Net return (Rs)	Employment generated (Man days)	Production (REY kg/ha)
July	25166	38329	13163	40	1.533
August	20201	50599	30398	30	2.024
September	14231	34864	20633	48	1.395
October	28045	26935	-1110	48	1.077
November	30095	37075	6980	46	1.483
December	28152	60900	32748	39	2.436
January	22860	98903	76043	47	3.956
February	26422	43223	16801	53	1.729
March	19939	47898	27959	36	1.916
April	17951	29632	11681	46	1.185
May	18566	38768	20202	32	1.551
June	21402	49376	27974	38	1.975
Total	**273029**	**556501**	**283474**	**502**	**22.25**

Production of Basmati rice under IFS

Mushroom production

General view of diary unit and biogas unit

Palampur

One hectare integrated farming system (IFS) model started in 2010 at CSK HPKV, Palampur developed for mid hills zone in western Himalayas comprise of cropping systems viz. Rice-Wheat, Soybean-Pea, Maize + Soybean - Potato in 0.65 ha + horticulture cum vegetable unit viz .Peach, Pecanut, Pomegranate and Litchi as main fruit crops and Frenchbean, Okra, Maize Fodder-Gobhisarson as intercrops (0.175) + Fodder unit viz. Sorghum + Bajra –Oats in Forage block (0.10 ha), Dairy crop unit (3 cows+ 4 female calves) +Mushroom cultivation and Vermicompost Unit (0.075). The farming system model developed at Bhadhiarkhar farm in 2016-17 revealed that a gross revenue of Rs. 3,06,270/- and net returns of Rs. 1, 28,698/- were obtained from one hectare farming system model. The contribution of different components viz. Cropping system resulted in net returns of Rs. 45,385/- , horticulture cum vegetable system gave net returns Rs. 9,681/-, Dairy farming with net returns of Rs. 49,684/-, fodder block with net returns of Rs. 17,031/-, mushroom component with net returns of Rs. 5,070/-, and poultry component with net returns of Rs. 1,847/-. Thus a net return of Rs. 1, 28,698/- could be realized from one hectare farming system model with annual

Table 7.1.1/3: Area allocation and component wise economics (2016-17) in IFS Model at Palampur

Component	Net Area	Total Cost (Rs./ha)	Gross Revenue (Rs./ha)	Net returns (Rs./ha)
1) Cropping systems	0.65	33363	78748	45385
2) Horticulture				
i) Vegetables	0.175	7713	17340	9627
ii) Fruit crops (Peach, Pecnut, Pomegranate, Litchi		514	568	54
3) Agro-forestry				
i) Leucenia Plants	Border plantation			
ii) Setaria grass (5000 seedlings)	Bunds plantation			
4) Livestock				
i) Dairy animals		121259	170943	49684
5) Others (Fodder Block)	0.1	2247	19278	17031
6) Mushroom		5265	10335	5070
7) Poultry		7211	9058	1847
Total		**177572**	**306270**	**128698**

Poultry unit

Director Dr. A.S. Panwar visiting IFS Model

Livestock unit

Vermicomposting unit

Table 7.1.1/4: Month wise cost of production, gross return, net return and employment generation (2016-17) of IFS model at Palampur

Month	Total Cost Involved (Rs.)	Gross Returns (Rs.)	Net Returns (Rs.)	Employment Generated (Man Days)
June	10950	36553	25602	33
July	13358	19765	6407	45
August	11137	14245	3108	34
September	10805	25355	14550	34
October	22052	27755	5703	51
November	26770	27755	985	45
December	17499	23135	5636	35
January	11383	25109	13726	37
February	10133	24541	14408	30
March	10405	21096	10691	31
April	15186	25008	9822	41
May	18464	36253	17789	46

system production of REY 26.03 t/ha with employment generation of 462 mandays/year. Area allocation and component wise economics of IFS model is given in table 7.1.1/3.

Among the different components of farming system, the maximum percent profit share was realized from animal unit including vermicompost and biogas which contributes 47% share of total profit. The model could also meet around 75% of inputs required for different enterprises within the farm besides providing all the commodities (cereals, pulses, oilseeds, vegetables, fruits, mushroom, milk, egg, and fish) required for the farm family. The maximum production and profit was realized in June while employment was in October month signifying the work even during lean period (Table 7.1.1./4) .

Pantnagar

The integrated farming systems (IFS) Model at GBPUAT, Pantnagar for *Tarai* region of Uttrakhand was started during April, 2011-12 at Norman E. Borlaugh Crop Research Centre, Pantnagar on one hectare land comprises of crops, dairy, biogas, vermicomposting, fishery, horticulture, agroforestry and boundary plantation. Details of the components and area allocated under each enterprise are given in Table 7.1.1/5.

There were five diverse cropping systems under the crop unit of the IFS model. Amongst different cropping systems, rice- veg. pea- maize system was most remunerative concerning gross

Table 7.1.1/5: Integrated farming system model (1.0 hectare model)

Particulars	Area (m^2)
Field crops	4700
Agroforestry/horticultural crops	4200
Dairy (3 cows) +vermicompost + kitchen garden	500
Fishries	600
Grand total	10000

as well as net returns and this system was closely followed by rice- potato- okra and rice-barseem(F)+oat(F)+mustard(F)- maize(F)+ cowpea(F) systems. Gross return of the rice-potato- okra system was good enough but this system involved high input value too which was the probable cause behind the low net profit with the system. Low input intensive system such as fodder dominated system and fodder-oilseed and pulse system showed promising net profit. Relative efficacy of different farm enterprises in the Integrated Farming System model at Pantnagar is given in table 7.1.1/6.

Overall production and net profit of the model in the year 2016-17 was 38.61 t REY/ ha and Rs. 242504.4/ ha respectively. Comparing the production of varied units tested, it is traceable that the livestock unit was the best and this component was followed by crop component. The production and net profit of livestock unit alone cuddled almost 56 and 58% of total production and net profit of the system correspondingly. Under crop unit, the maximum production was observed with the cereal

Table 7.1.1/6: Economics of different modules of IFS model developed at Pantnagar

IFS component	Gross returns (Rs./year)	Cost of Production (Rs./year)	Net returns (Rs./year)	B:C Ratio	Monetary efficiency (Rs/ha/day)
A. Field Crops	139374.6	77142.2	62232.4	0.81	170.5
B. Horticulture/Agroforestry	58825.0	33950.0	24875.0	0.73	68.2
C. Dairy (Milk production)	278725.0	161625.0	117100.0	0.72	320.8
D. Fisheries+Duckery	21998.0	9845.0	12153.0	1.23	33.3
E. Vermicompost+Compost+Biogas	23744.0	-	23744.0	-	65.1
F. Kitchen garden	2400.0	-	2400.0	-	6.58
Total	525066.6	282562.2	242504.4	0.86	664.4

Animal unit

Fish pond

crops followed by green fodder, veg. pea and pulses. Milk production in the livestock unit comprised of the lion share of the production of that unit. Likewise, fruit and fish production shared the most under horticulture and fishery units respectively.

Considering percentage contribution of varied farm enterprises with gross and net returns of the model, it was estimated that the crop, dairy, horticulture, fishery, duckery and kitchen garden unit contributed almost 27, 58, 11, 4, 0.3, 0.5% of the gross return and 26, 58, 10, 5, 0.2, 1% of the net returns of the IFS model. The total value of employment generation under the model was 458 days in a year. Dairy unit generated the maximum number of 210 mandays.

The quantity of farm by-products recycled in the varied units under the IFS-model in terms of N, P2O5 and K2O is given in table 7.1.1/7. Recycling could generate about 112.16 kg of N, 53.5 kg of P2O5 and 114.7 kg of K2O through on-farm recycling of by-products.

2. EASTERN HIMALAYAN REGION

In this Agro Climatic Region two AICRP-IFS centers Umaim (Meghalaya) and Jorhat (Assam) are located and have initiated IFS studies during 2011-12.

Umaim

The integrated farming systems (IFS) unit at ICAR Research Complex for NEH Region started

Table 7.1.1/7: Nutrient saving through recycling of on- farm by products, Wastes and residues in IFS Model

Source of nutrients and nutrient content (%) (N: P: K) On dry wt. basis	Available quantity at farm (kg)	Released amount (Approx.) of nutrients (kg)			Total (Approx.) released amountof nutrient NPK (kg)
		N	P_2O_5	K_2O	
Crop residues (dry wt.) i) Mung/Urd/Veg Pea/Okra (1.29:0.36:1.64)	2257	29.1	8.1	37.0	74.2
ii) Poplar leaves (2.00:0.15:0.90)	500	10.00	0.75	4.50	15.25
iii) Eucalyptus leaves (1.02:0.21:1.06)	300	3.06	0.63	3.18	6.87
vi) Cowdung (dry wt.) as vermicompost (1.5:1.2:1.5) & compost (0.5:0.25:0.5)	2000+8000	70.0	44	70.0	184
Total	-	112.16	53.5	114.7	280.32

during 9th March, 2009. All the components of IFS *viz*. crops, livestock, fruit trees, fishery were developed and incorporated during 2010-11 in one hectare area. Composition of IFS model is given in Fig 7.1.1./1.

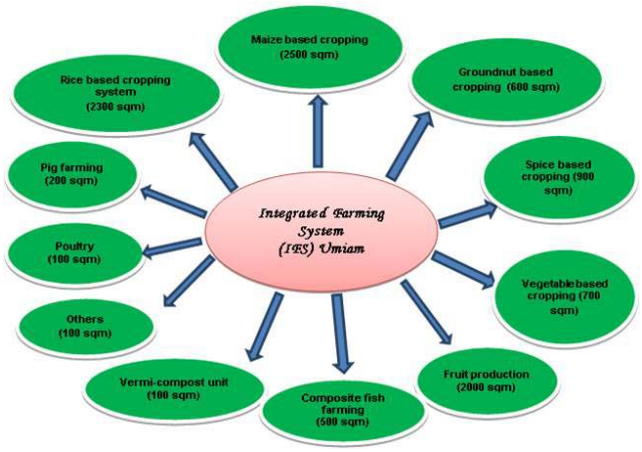


Fig. 7.1.1/1. Composition of IFS model at Umiam

The IFS model developed at Umiam have different modules viz., crop production, horticulture, fishery, poultry piggery and vermicompost/recycling of farm waste. The system generates year round income and employment to the farm family. The IFS model generated a net income of Rs. 1, 66,121/- with monthly saving of Rs.13843/- as well as 627 man days of annual employment during 2016-17. Module wise economic performance of the IFS model is depicted in table 7.1.1/8. Highest net return was obtained from cropping systems followed by livestock component. In north eastern region of India about 30-40% pond area is wasted in pond dyke, hence an innovative idea of pond dyke intensification (823 m2) provided net income of Rs 7237/- by growing of year round vegetables, besides the income from fisheries components. Similarly, by selling of green toria as a leafy vegetable provided an amount of Rs 3405/- from

Table 7.1.1/8: Economics of IFS model developed at Umiam

Component	Total cost (Rs./unit)	Gross return (Rs/unit)	Net return (Rs./unit)	B:C ratio
Crops/ cropping system	83,862	2,04,139	1,20,276	2.43
Horticulture	6,061	16,950	10,888	2.80
Livestock	1,69,848	2,00,945	31,096	1.18
Fisheries	9640	13500	3860	1.40
Total	2,69,412	4,35,534	1,66,121	1.62

Table 7.1.1/9: Month wise economics and employment generated in IFS model at Umaim

Month	Recurring cost of cultivation (Rs)	GrossReturns (Rs)	Net Returns (Rs)	Employment generated (Man days)
April	11617	21324	9707	32
May	17731	23092	5361	31
June	15393	31940	16547	40
July	25927	44208	18281	51
August	24972	31167	6195	58
September	22152	44290	22138	52
October	30091	55026	24935	72
November	32458	40274	7816	75
December	25051	39862	14811	47
January	17510	32625	15115	50
February	23326	30701	7375	53
March	23184	41024	17840	66
Total	2,69,412	4,35,533	1,66,121	627

Efficient utilization of pond dyke through vegetable production

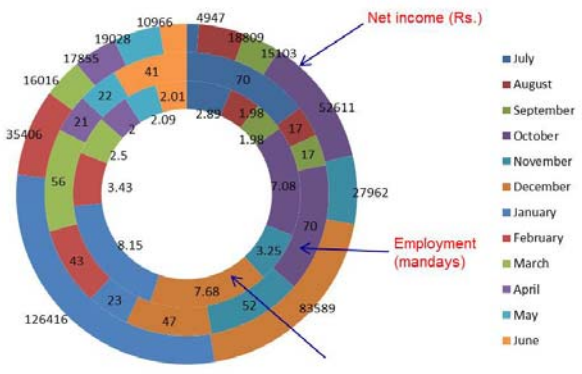
2300 m2 area without affecting the normal yield of toria in IFS.

Month wise farm income and employment generation round the year presented in table 7.1.1/ 9. The system could provide maximum gross and net return during the month of October. However, maximum employment generation was recorded to be during the month of November. Residue recycling from crop residues and straw from cropping systems to the tune of 6.4 tonnes, litter fall and residues from horticulture block to the tune of 0.2 tonnes and litter and manure from livestock unit to the tune of 1.9 tonne thus recycling about total of 8.5 tonnes residue and by products in the system. Improved IFS model was tested and validated for 1 ha area to support a farm family of 5 members.

Jorhat

Integrated Farming System model was established at Instructional and Research Farm of Assam Agricultural University, Jorhat during the year 2010-11 with a land area of 1.0 ha. The land was allocated under different components of Integrated farming system *viz.* Field crops, Horticultural crops, Cattle, Fishery, Poultry and Apiary with the objective to meet up different family requirement (of five members family. IFS model comprising of cropping systems - Rice (w) -Toria-Cowpea(F), Rice (w) – Toria - Green gram, Rice (W) - Oat(F) - Blackgram, Rice (W) – Potato - Lady's finger, Rice (W) – Cabbage - Cowpea(V); some other fodder crops *viz*. Setaria and Hybrid Napier were grown on bunds in 0.65 ha, horticulture [guava, lemon, pine apple, banana, arecanut and vegetables such as cabbage, potato, tomato, french bean, cow pea(V), okra & pea in 0.30 ha + dairy including animal shed with store house and threshing floor including biogas plant, vermin-compost & liquid manure unit in 0.11 ha and fishery 0.092 ha developed for the Marginal and Small farmers of Assam of North-east India. The Raised and Sunken bed module was also developed within the model to utilize the marshy land for production of rice and as well as vegetables. During the year 2015-16, the poultry unit is also incorporated to the IFS model for which a poultry house of 12.5 m^2 is constructed over the pond water.

The results of 2016-17 revealed that the system yield from the IFS model was 45.05 t/ha (REY) with a gross return of Rs. 759911, net return of 428708 and B:C ratio of 2.29. Recycling of farm products could save 26.10% of the total input cost while use of on-farm labour could save 36.39 % of the input cost. The system could generate 482 days of employment generation during year 2016-17. On an average the model generated nutrients of 359.4 kg N, 140 kg P2O5 and 398.6 kg K2O per year through nutrient recycling by the process of



vermicomposting, liquid manure and biogas production. From the designed IFS model, approximately 511 m3 bio-gas is produced per annum, which is equivalent to 219.73 kg of Liquid Petroleum Gas (Approx. 15 LPG cylinder). Monthly net income, employment generation and production from IFS model is presented in figure 7.1.1/2 which depicts highest net return in the month of January.

IFS approach adopted at the center suggested that Integrated Farming system plays a vital role in securing sustainable production of high quality food and other production fulfilling the basic needs of household like food (cereal, pulse, oilseed, milk, honey, fish, meat etc), fodder, fuel etc. This system helps in sustaining farm income by reducing the cost of production; as agricultural waste (bio-waste) are efficiently recycled in the system so it helps in reducing environmental pollution by low release of Green House Gases, maintain soil fertility and agricultural sustainability.

3. TRANS GANGETIC PLAINS REGION

Trans Gangetic Plains Region is represented by the states of Punjab and Haryana. Under AICRP-IFS, two independent centers one at PAU, Ludhiana (Punjab) and another one in CCHAU, Hisar are given the responsibility of development of "Region specific IFS models" at respective centers. Composition of IFS models developed and performance of the IFS approach in during its sixth year of its establishment is given here under;

Hisar

The IFS Model developed at Hisar was started in the year 2011-12 in one hectare area comprises of field crops (Cereals, pulses, oilseeds, fodder, and fibre), horticultural crops (fruits, vegetables and flower), animal unit (2 buffalos), mushroom unit, vermicompost unit/ recycling of farm waste and boundary plantation. The model has been designed for 7 member family. In order to enhance, the income and resource recycling, complementary enterprises such as vermicompost (75 m^2) and quality FYM production (75 m^2) and karonda and bael as boundary plantation were incorporated. Under horticultural crops, lemon + guava + marigold/vegetable (0.06 ha) and mushroom (75 m^2) was added as income supplementing activities in the model. The composition of different modules in the IFS model along with its economic

Table 7.1.1/10: Integrated Farming system Model of one ha with gross returns, cost of cultivation, net returns and per cent contribution during the year 2016-17

Cropping system	Gross return (Rs.)	Cost of cultivation (Rs.)	Return over variable cost/ Net returns (Rs.)	Per cent contribution of different enterprises
Cotton –wheat	43308	18725	24583	10.41
Moongbean - Wheat (Tall)	6305	4140	2165	0.92
Pearl-milet - Mustrad	28266	7782	20484	8.68
Sorghum(F) - Wheat	37155	11092	26063	11.04
Sorghum(F) - Berseem (F)	20400	3557	16843	7.14
Sorghum(F) - Oat (F)	17745	3601	14144	5.99
Veg-Veg-Veg	12925	9352	3573	1.51
Veg-Veg-Veg	17915	7956	9959	4.22
Total (Crops+Vegetables)	184019	66205	117814	49.91
Dairy component + FYM	152018	76485	75533	32.00
Mushroom Cultivation	5460	1402	4058	1.72
Hortculture	1000	700	300	0.13
Recycling of Agil.waste/ vermicompost/FYM	38346	-	38346	16.24
Total	380843	144792	236051	100

View of horticulture and vegetable block junder IFS model at Hisar

performance is depicted in Table 7.1.1/10. The allocation of area was 4500 m2 to field crops and 2000 m2 was allotted to fodder-wheat (a combination of fodder and field crop). An area of 1500 m2, 1000 m2 and 600 m2 was allotted to fodder crops, vegetables and horticultural crops, respectively.

The net return from different cropping systems during 2016-17 was recorded Rs. 117814 from an area of 9600 m2. Contribution of this component in the model was 49.91 per cent. (Fig. IFS1). The net income from dairy component was Rs.75533 (31.99 per cent) in the model. The mushroom income from a small area of 75 m2 was recorded Rs. 4058/-. Rupees 38346 was obtained from recycling of crop residue/vermicompost/FYM (16.24 %). The total net returns from this model were Rs. 236051 during 2016-17.

Percent contribution of different IFS components during 2016-17 is predicted in Fig. 7.1.1/3. Highest contribution was from crops (49.91%) followed by dairy (31.99%) and recycling of farm wastes/by - products (16.24 %) within the model to the net income during 2016-17.

One of the important objectives of the Integrated Farming system is to provide employment to the farming family round the year. 391 mandays of employment was generated durin the year 2016-17 Further it has been seen that dairy component generate maximum employment round the year amounting to 220 mandays.

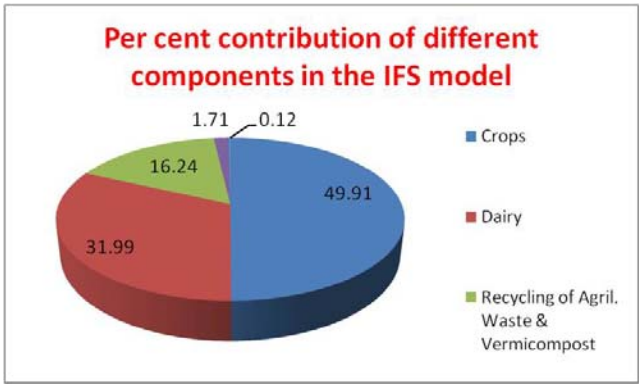


Fig. 7.1.1/3. Per cent contribution of different components in the IFS model at Hisar

Ludhiana

IFS study at PAU, Ludhiana was initiated during kharif 2010 on 1.0 ha farm area and comprise of 6400: sq.m for field crops i.e. Cereals/pulses/ oilseeds/ green fodders etc., 1900 sq.m for horticultural crops and vegetable intercropping, 300 sq.m for agro-forestry, 200 sq. m for dairy enterprise, 1000 sq.m for aquaculture (Fresh water fish production), 200 sq.m for kitchen gardening. In addition to this boundary plantations are also done in which cranberry (Karonda) and galgal are grown. In kharif crops grown in the 6400 sq m area were paddy, maize and turmeric) and in the

An Overview of IFS Model at PAU, Ludhiana

following rabi and summer season potato, berseem, wheat, gobhi sarson, onion, pearlmillet and spring maize were grown. The vegetable crops were raised as intercrops between horticultural plants. The peas-chilli cropping system gave the highest net returns of Rs 9698. The net returns obtained from all vegetables were Rs 30760. The vegetable crops being labour intensive requires 220 man hours. Two dairy cows (One HF and One Sahiwal) were integrated in the livestock component of IFS. The washings from dairy shed are managed to put into fish pond which serve as a source of nutrients for fish. Economic performance of different components of IFS model at PAU, Ludhiana is presented in Table 7.1.1/11.

The Gross returns of the IFS model was Rs 702342/ ha with input cost of Rs. 300727/ ha and net returns of Rs. 40161g/ ha with net benefit per rupee invested as 1.34. The maximum contribution of Rs 186110 was from dairy sector and has contributed about 46.34 % of total IFS farm net returns to the system. The IFS model not only fulfill the farmer family demands but is also helpful in

Table 7.1.1/11: Economic performance of IFS Model at Ludhiana during the year 2016-17

Farm Enterprises	Size of the unit (area/number)	Gross returns (Rs/year)	Cost of production (Rs/year)	Net returns (Rs/year)	BC Ratio
Field Crops (Cereals/pulses/oilseeds/ green fodders etc.)	6400 m^2	198743	66395	132348	1.99
Horticulture (Guava, Lemon, vegetable intercrops)	1900 m^2	62820	17960	44860	2.50
Agro-forestry (Poplar with Turmeric-Wheat)	300 m^2	5248	2686	2562	0.95
Dairy	200 m^2	393246	207136	186110	0.90
Aquaculture (Fresh water fish production)	1000 m^2	28189	3000	25189	8.40
Boundary plantation	-	Galgal-Karonda	0	4945	-
Kitchen gardening	200 m^2	9150	3550	5600	1.58
IFS model –total allocated land (m^2)	10000 sq m	702341	300727	401614	1.34

Dairy Unit

Overview of crops & hort. fields

Fish production

Poplar on boundary with turmeric as intercrop

generating output which can be used as an input for other components of the IFS model and make farming more economic.

For residue recycling, the straw was used to feed to the cows, heifer and two young calves. The residue of other crops viz., rice were utilized for bedding in the cattle shed during winter months and then these rice residues were decomposed in the pit along with cowdung. The remaining residues of various crops (3913 kg) were utilized for mulching. On an average these residues contained 0.6, 0.4 and 1.2 per cent N, P and K, respectively which amounts to 23.5, 15.6 and 47 kg N, P and K, respectively. These residues contained N, P and K amounting Rs 295, 697 and 862. In nut shell these residues contained fertilizer amounting to Rs 1854 which upon recycling improved soil health.

4. UPPER GANGETIC PLAINS REGION

In this Agro Climatic Region two AICRP-IFS centers namely PDFSR, Modipuram, Meerut (U.P.) a voluntary ICAR institute and ii) CSAUA&T, Kanpur (U.P.) both in Uttar Pradesh are working on the aspect of "Development of Region Specific IFS Models". The findings of IFS models at individual centers are described below;

Modipuram

To demonstrate the diversified system of farming under irrigated conditions of western U.P., a cultivated area of 0.70 hectare was undertaken for diversifying prevailing farming system *crop + dairy* (opted by more than 84% of the total farm families). Seven modules viz., Cropping systems, horti-pasture, agri-horti, dairy, vermicompost, boundary plantation and secondary agriculture (value addition) modules were integrated in order to develop sustainable resource management packages for climate smart integrated farming systems for marginal farm households. The details of the area and composition of each module as per approved new technical programme is given in Table 7.1.1/12.

Cropping systems: Three cropping systems namely basmati rice-wheat + mustard/gram-green manure, *Sesbania* (seed)-chickpea-greengram and okra-cauliflower-babycorn + cowpea was planned under the module to meet the household demand of food, feed and generate income for the family under changing climate. The *kharif 2017* results indicates that basmati rice (variety PB 1) resulted in 313 kg of grain (2499 kg/ha) and 500 kg straw from 1250 m^2. The straw of rice was recycled in as mulch in cauliflower under okra-cauliflower-baby corn + cowpea system. Seed production of green manure could not be taken up and *Sesbania* was incorporated in the soil at 50 DAS for green manuring for timely sowing of next crop. Okra recorded 1135 kg of green pod yield (9080 kg/ha) from 1250 m^2 area. Stalks of okra was incorporated *insitu* to increase soil fertility. *Rabi* experiments are in progress.

Table 7.1.1/12: Composition of climate smart IFS modules evaluation for marginal households at Modipuram

Modules	Net area (m^2)	Composition
Cropping systems	3800	**CS 1(1250 m^2)** : Basmati rice *(Kharif)*-wheat+ mustard (0.065 ha)/Wheat+ gram (0.065 ha) *(Rabi)*-Green Manure *(Summer)* **CS 2(1250 m^2)** : Sesbania (seed production) *(Kharif)*-chickpea *(Rabi)*-Green gram *(Summer)* **CS 3(1250 m^2)** : Okra *(Kharif)*-cauliflower *(Rabi)*- Baby corn + cowpea *(Summer)*
Horti-pasture	1800	Kinnow + Sorghum-Berseem(300 m^2) Kinnow + pearlmillet-lucerne (300 m^2) Kinnow + cowpea-oat (300 m^2) Kinnow + maize-mustard (300 m^2) Kinnow + maize + cowpea- Makhhan grass (300 m^2)
Agri-Horti	1200	Crop (soybean-vegetable pea-green manure) + papaya (600 m^2) Crop (soybean-vegetable pea-green manure) + banana (600 m^2)
Dairy	50	1 Desi cow + 1 Buffalo
Vermicompost	50	
Boundary plantation	—	Karonda, guava
Secondary agriculture (value addition)	-	Marketable surplus will be converted in value added products
Area under supporting activities	100	Manure pit and Fodder chopping unit
Total	7200	

Horti-pasture: Five fodder crops *viz.* sorghum, pearlmillet, maize, cowpea and maize+cowpea were evaluated during *kharif* 2017 in 5 strips (300 m^2 each) of kinnow plantation. Kinnow recorded 849 kg of fruits from 0.18 ha (27416 kg/ha). Among fodder crops, maize + cowpea recorded higher fodder production (1170 kg from 300 m^2) followed by maize (1080 kg from 300 m^2), sorghum (810 kg from 300 m^2), pearlmillet (720 kg from 300 m^2) and cowpea (450 kg from 300 m^2). It can be inferred that with the cultivation of maize + cowpea for fodder during *kharif* in 0.18 ha of horti-pasture can supply green fodder to 1 cow and 1 buffalo for 195 days. Intercropping of fodder maize, sorghum, pearlmillet and cowpea in horti-pasture can supply fodder to two animals for 180 days, 135 days, 120 days and 75 days only, respectively.

During the *rabi* season fodder crops *viz.* mustard, berseem, lucerne, oat and rye (makkhan) grass were grown under inter-row space of kinnow. Proximate analysis of these crops was done in collaboration with ICAR-Central Institute for Research on Cattle, Meerut. Highest ash content was found in berseem (14.03%) followed by lucerne (13 %) and lowest in mustard (7.24%) (Table 7.1.1/13). Acid insoluble ash content was found highest (3.90%) and lowest (0.48%) in oat

Table 7.1.1/13: Proximate analysis of fodder crops during *rabi* 2017 under horti-pasture system

Fodder crop	Ash (%)	AIA* (%)	Fiber content (%)	Fat content (%)	Protein content (%)
Mustard	7.24	0.48	48.03	1.30	11.64
Barseem	14.03	1.17	34.44	0.71	25.11
Lucerne	13.00	1.92	29.01	0.20	32.73
Oat	11.28	3.90	34.89	0.24	10.06
Rye (makkhan) grass	12.23	3.03	30.79	3.18	11.38

* AIA: Acid Insoluble Ash

and mustard respectively. Mustard recorded highest fibre content (48.03%) and least under lucerne (29.01%). Higher fat content was found under rye (makkhan) grass (3.18%) followed by mustard (1.30%) and lowest was with lucerne (0.20%). Berseem (25.11%) and lucerne (32.73%) were found superior in terms of protein over mustard, oat and rye (makkhan).

Dairy: The dairy unit is having one buffalo (murrah) and one desi cow. A total of 2533 litre of milk were produced out of which buffalo produced 1899.5 litres while and cow produced 633.5 litres (Table 8). Total cost works out to Rs. 79,205 with share of 64.5, 20.3 and 15.2% respectively on concentrates, green fodder and straw, respectively. Total gross return and net returns from dairy unit was found to be Rs. 1,13,985 and Rs. 34,780, respectively. Average daily dung production from dairy unit was found to be 54 kg which works out to 19.7 t/year.

Boundary plantation: On the boundaries of farming system model, guava and karonda plants were planted. A total 60 kg of guava fruits were harvested from boundaries.

Secondary agriculture (value addition): Protocol for production of kinnow mandarin squash (squash) was evaluated during October, 2017. Fully matured kinnow fruits were harvested, washed with clean water and sorted by removing the damaged fruits. After sorting, fruits were made into halves with the help of knife and juices were extracted with hand juice extractor. Extracted juices were further filtered with muslin cloth. Economic analysis of value addition to kinnow indicates that additional income of Rs 0.28 lakhs can be obtained from 0.18 ha by making kinnow mandarin squash. The increase in net income due to value addition was found to be 2.17 times when 50 % of produces are made as kinnow mandarin squash and 50 % sold as fresh fruits. If 100 % of produces are

Table 7.1.1/14: Economics of kinnow from 0.18 ha influenced by secondary agriculture (value addition through kinnow mandarin squash)

Sl. No.	Inputs	Quantity for 10 litres of kinnow mandarin squash	Cost (Rs/unit)	Amount (Rs) for 10 litres of kinnow mandarin squash	Amount (Rs) for 50 % mandarin production as kinnow mandarin squash	Amount (Rs) for 100% mandarin production as kinnow mandarin squash
			Cost			
1	Kinnow mandarin	9	20 /kg	180	8490*	16980*
2	Sugar	5.5	40/kg	220	10376	20753
3	Additives (colour, essence, KMS)	-	1/litres	10	472	943
4	Cost of fuel and labour	-	10/litres	100	4720	9430
5	Packaging and labelling	-	10/litres	100	4720	9430
Total cost		**-**	**-**	**610**	**28778**	**57536**
			Income			
7	Final product	-	litres	10	472	943
8	Gross income by sale raw kinnow mandarin	-	20/kg	180	16980	16980
9	Gross income by sale of kinnow mandarin squash	-	100/litres	1000	47200 + 8480=55680	94300
10	Cost of cultivation	-	10/kg	90	8490	8490
11	Cost of value addition	-	-	610	28792	57584
12	Net income by sale of raw kinnow mandarin	-	-	90	8490	
13	Net income by sale of kinnow mandarin squash	-	-	500	18398	28226
14	No. of times of improvement in net income due to value addition	-	-	-	2.17	3.32

*Yield of kinnow is 849 kg from 0.18 ha of horti-pasture system

Wheat + gram in cropping systems

Kinnow + fodder in IFS model

Value addition of kinnow fruit for juice

subjected to value addition in the form of kinnow mandarin squash, the net income increases by 3.32 times over net income obtained by selling fresh kinnow (Table 7.1.1/14).

Kanpur

Crop + Dairy is the most dominate farming system with area coverage of 89% followed by Crop + Dairy + Horticultural crops (9%). On Station IFS Model on One hectare area for small and marginal farmers of Central Plain Zone of U.P. was started at C.S.A. University of Agriculture & Technology, Kanpur during Kharif 2011 to achieve profitability, sustainability and livelihood security. This model consist three farming component i.e. (i) Crop (ii) Dairy and (iii)Horticulture. In crop component, Six cropping systems were adopted viz; (i) Rice-wheat–GG(G+R) (ii) Maize-Mustard–Sourghum (iii) Maize-Chickpea (iv)Maize-Potato-GG(G+R) (v)Maize-Garlic-GG(G+R)(vi) Sourghum (GF)-Barseem (GF) on an area of 7200 m^2. Dairy unit consisting of 4 animals i.e. One Buffalo, One Cow and two Calves along with Nadep and vermicomposting was also established on an area of 210 m^2(60+150sqm). Horticulture unit is maintained on an area of 1920 m^2 which includes plantation of Guawa (24),Aonla (09),Lemon (08), Mango(03), Jaick fruit(01) and Banana plantation. Vegetable and flower are also being grown as intercrop in horticulture unit besides five boxes apiary. Component wise economic performance

Table 7.1.1/15: Income of crop production unit during 2016-17 from IFS model at Kanpur

Cropping System	Area sq.m	Production (quintal)/ha							Market value (GMR) (Rs.)	Cost of cultivation (Rs.)	Net Income (Rs.)
		Kharif		Rabi		Summer		Total			
		Grain/ Maize	Straw / GF (kg) Cobs	Grain (Kg)/ GF	Straw (kg) / GF	Grain (kg)	Straw / GM/GF	(RYE)$^{-1}$ Q/ha			
Rice-Wheat – green gram (GM)	4000	520	800	1531	2000	GM	GM	32.54	48837	17000	31837
Maize-Mustard-Sorghum (GF)	500	600	675	65	-		1750	10.67	16010	4800	11210
Maize-Chickpea	500	700	710	40	-	-	-	3.87	5814	3000	2814
Maize-Veg. pea	500	700	725	47	-	-	-	3.17	4754	3200	1554
Maize-Potato-Green gram (G+R)	500	600	700	100	-	24	-	4.56	6844	5000	1844
Maize-Garlic-Green gram (G+R)	500	600	690	60	-	20	-	23.78	35700	12000	23700
Sorghum (GF)-Berseem (GF)	700	2450(GF)	3500 (GF)			2.81	4211	1800	2411		
Total								81.39	122170	46800	75370

Table 7.1.1/16: Income of dairy unit during 2016-17 from IFS model at Kanpur

Dairy products	Qty. Produced (Kg/liter)	Rate/Unit (Rs.)	Total Amount (Rs.)	Total Expenditure (Rs.)	Net Income (Rs.)
Cow Milk	1606	25/30.00	44781.00		
Buffalo Milk	365.5	30/35.00	11425.00		
FYM	10800	5.00	54000.00		
Total			1,10,206.00	43,950	66,256.00

Table 7.1.1/17: Income of horticulture unit during 2016-17 from IFS model at Kanpur

Fruit / Vegetable Spp.	Qty. Kg/No./Nug	Rate/Kg/No./Nug	Total Income	Total Expenditure (Rs.)	Net Income (Rs.)
Guava	20	15	300		
Karaunda	100 kg	10	1000		
Banana	-	-	-		
Aonla	28	20	560		
Palak	341 bunch	10	3410		
Lauki	20 piece	10	200		
Brinjal	53 kg	20	1060		
Cauliflower	98 piece	5	490		
Cabbage	130 piece	5	650		
Tomato	83 kg	10	830		
Brouckly	135 piece	20	2700		
Bakla(fababean)	10 kg	20	200		
Onion (saga)	26 bunch	10	260		
Methi	07 bunch	10	70		
Coriander(leaves)	40 bunch	5	200		
Total			**11930**	**8957**	**2,973.00**

Crop block in IFS model at Kanpur

Horticulture block in IFS model at Kanpur

of IFS model is presented in table 7.1.1/15, 16 and 17 for crops, dairy and horticulture modules respectively.

During 2016-17, a total net income of Rs. 1,44,599.00 was recorded from on station model. Out of total net income, crop production unit, dairy unit and horticulture unit shared Rs. 75,370.00, Rs. 66,256.00 and Rs. 2973.00 respectively. The model could also generate employment for 270 mandays highest being from crop module for 155 days followed by 90 days from dairy component. Soil fertility status after seven years was improved slightly in crop production and horticulture units in comparison to its initial value. Maximum improvements in soil fertility status was noted in green manuring followed by inclusion of legumes in cropping sequence

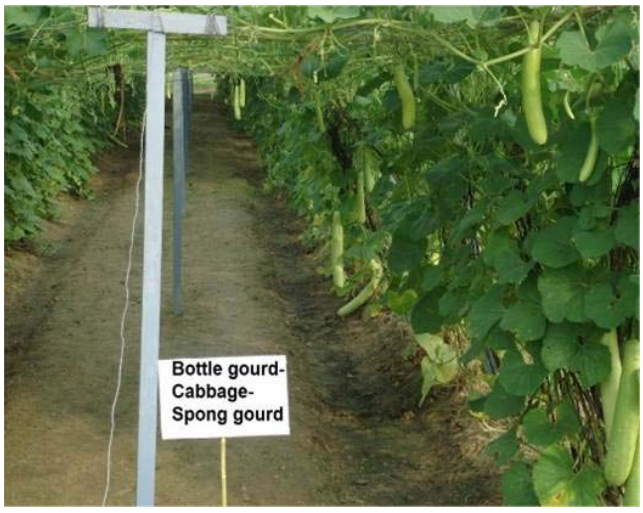
5. MIDDLE GANGETIC PLAINS REGION

Four AICRP –IFS Centers, two in eastern part of Uttar Pradesh namely i) IAS,BHU, Varanasi and NDUA&T, Kumarganj –Faizabad and two in Bihar i) ICAR Research Complex for eastern region, Patna., and BAU, Sabour-Bhagalpur (Bihar) are given responsibilities of developing Region Specific IFS Models for respective states since 2010-11. Significance of IFS approach towards production, profitability and livelihood of small land holders in the regions as reflected form the results of study during 2016-17 of the programme is summarized hereunder;

Varanasi

Varanasi lies at 25°18' north latitude and 83°03' east longitude and at an altitude of 128.93 m above mean sea level. It falls under sub-humid climate with average rainfall of 1100 mm and belongs to Eastern Plain and *Vindhyan* region and NARP zone of Eastern Plain Zone: U.P.-4 , Major farming system of the region is Crop +Dairy with area coverage of more than 70% followed by Crop + vegetables (20%).

Area and composition of 1.0 ha IFS model being developed for Varanasi region comprised of, 0.81 ha assigned to crop component with six cropping sequences , dairy component included 4 cross bred cows, the area assigned to fish pond and horticulture was 0.1 ha and 0.06 ha, respectively. Regulated drain of the cattle shed goes to the fish pond and the urine was collected in separate tank for various uses. The harvested water of the farm building entered directly to the fish pond where high density poly culture consisting of grass carp, rohu, catla and mrigal is practiced. Horticulture included 14 permanent trees viz. guava, mango, citrus, *aonla*, jack fruit along with intercrops of banana and vegetables. Cucurbits are taken on the fence of orchard during *kharif*. Boundary plantation



Cropping systems in IFS model at Varanasi

includes *karonda*, banana and papaya. Supplementary enterprises include poultry and mushroom cultivation. In poultry 200 chicks of Kroiler are reared and six cycles are completed in one year. White button mushroom is cultivated on compost prepared using 5.0 q wheat straw during winter. Value additions include processing of rice, pulses, and oilseeds as well as NADEP and Vermicompost. Boundary plantation of *karonda*, banana and papaya is being practiced in about 200 m periphery. Component wise net return and its percentage contribution to net income from IFS model during 2016-17 at Varanasi is presented in table 7.1.1/18.

Table 7.1.1/18: Component wise net return and its percentage contribution to net income from IFS model during 2016-17 at Varanasi

Component	Net return (Rs ha^{-1})	% Contribution to NR
Cropping systems	87092	22.7
Fruit crops +Vegetable	5416	1.4
Dairy animals	192200	50.0
Poultry	69531	18.1
Fisheries*	27506	7.2
Others: Mushroom	2655	0.7
Total	384400	

The contribution of dairy to the net return was maximum followed by crop, poultry, fishery and horticulture units, respectively. A net return of Rs. 384400 was realized from the IFS model of 1.0 ha area during reporting period of 2016-17.

Vegetables production in IFS model at Faizabad

Kumarganj

A model on integrated farming system (IFS) was initiated in July 2011 at the Agronomy Research Farm, N.D. University of Agriculture and Technology, Kumarganj, Faizabad, Uttar Pradesh. The On-station integrated farming system model consisted of various components on 1.01 ha area, viz. crop(0.70 ha), horticulture (0.20 ha aonla and guava orchard), dairy (two milking cows), fishery (in 0.10 ha farm pond area fingerlings of composite culture of catla, rohu common carp, silver carp and grass carp), cowshed on an area of 0.01 ha. The area wise crops grown as cereal crops (8000 sq m) , pulses (4800sq m), oilseeds (1200 sq m) vegetables(1200 sq m) and fodders (5800sq m).

The yield data showed that 4.062 t cereals, 2.880 t potato, 0.258 t oilseed, 0.677 t pulses 5.355 t dry fodder and 26.45 t green fodders were obtained from 0.7 ha area in whole year. Economics of crop production enterprise showed that net return of Rs. 105798 was obtained against incurred cash of Rs. 66674 in 0.7 ha area/annum.

The average milk production of both the cows was 9.6 lit/day. The inputs cost occurred Rs. 99800 including labour cost of Rs. 29110 during 2016-17. The income from milk production (3525 lit) was Rs. 141000 while the compost prepared from the dung and animal shed wastes were recycled in the crops. Rs. 42120 was obtained as net return from livestock enterprises against the expenditure of Rs99800 on two cows. Similarly the Rs. 24566 and Rs. 36349 was obtained as net return from

Dairy unit at IFS model at Faizabad

horticulture and fisheries against expenditure of Rs. 4904 and Rs. 18251, respectively. Results revealed that system productivity of 29.28t (REY) was realized from the IFS model providing net return of Rs 213804 against incurred expenditure of Rs.196093. Cropping modules contributed Rs. 105798 while dairy unit contributed Rs.42120 followed by Fishery unit (Rs. 36349), horticulture unit (Rs. 24566) other enterprises (Rs. 4971).

Patna

Two IFS models were developed at ICAR Research Complex for Eastern Region, Patna Research Farm comprising of Crop + Goat + poultry (one acre model: 4000m^2) and Crop + Livestock (2 Cows) + Fishery cum duckery (two acre model: 8000m^2)for upland and lowland situation which represents more than 75 percent of eastern region. Total establishment cost of one acre IFS model was Rs. 1.2 lakhs and for two acre IFS model was Rs. 2.05 lakhs which includes construction of sheds for animals and birds, mushroom, pond, vermi-pits, biogas, boundary plantation and fruit crop unit.

IFS model generates a total yearly employment by 327 and 425 man-days respectively for one acre and two acre model. Under one acre IFS model, Cowpea-cauliflower-onion cropping system along with poultry + mushroom + goatry fetched the highest NI of Rs. 87,358/- to other cropping system in a farming system mode which was about 4.5 times higher than rice-wheat cropping system. 1.58 t of vermicompost, 0.62 t of GM and 2.08 t of PM were produced and was equivalent to 77.7 kg of Urea, 145.0 kg of SSP and 46.2 kg of MOP . Additional employment of 83 man-days was also generated in one acre model. In two acre IFS model, livestock (2 cows + 2 calves), fisheries, duckery, and vegetables and fruits were integrated rice-wheat, rice-maize, rice-lentil and rice-mustard

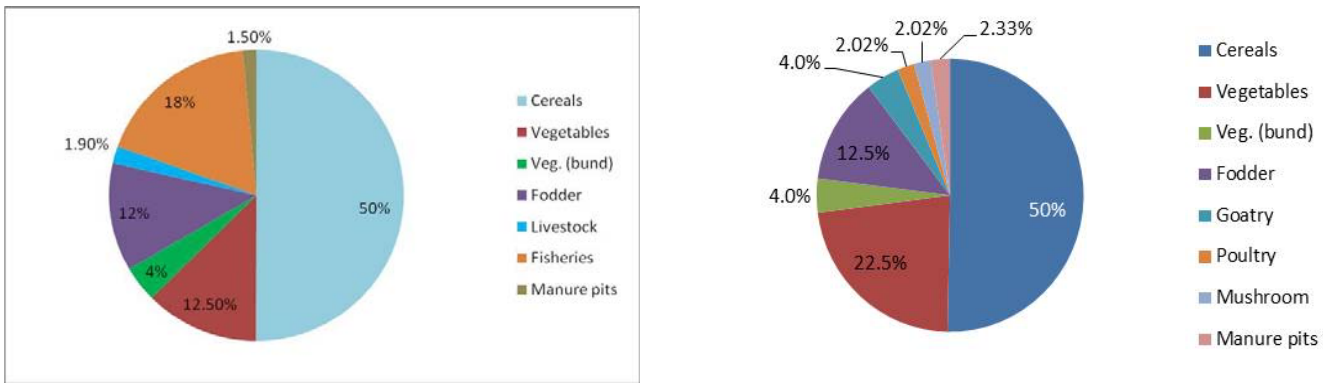


Fig. 7.1.1/4. Area allocation for one acre model (4000m^2) (L) and area allocation two acre model (8000m^2) (R)

View of one acre model at Patna

View of two acre model at Patna

cropping system. Rice-wheat + vegetables + livestock + fisheries + duckery IFS model gave the maximum NR by Rs. 1,41, 209/- with additional employment opportunity of 188 man-days. In two acre model 7.0 t of VC , 3.0 t of FYM and 1.3 t of DRD were recycled within the system and added 38.4 kg of N, 33.1 kg of P and 43.0 kg of K in the soil and were equivalent to 159 kg of urea, 419 kg of SSP and 139 kg of MOP. Crops + fish + Poultry + goat +mushroom resulted in higher income sustainability index (0.79) and was followed by Vegetable + Goat (76.8).

Sabour

The IFS model was developed at Sabour centre of Bihar Agricultural University during *kharif*, 2010. The Integrated Farming System model was synthesized using the scientific inputs from the on-station research experiments conducted at Bihar Agricultural University, Sabour for improving the productivity, profitability and sustainability of the whole farm as well as livelihood security of farmer's family. The cropping systems were modified by including cereals, pulses, oilseeds, vegetables, fruits, milk, eggs etc. to meet the family needs. The area allocated under different components of one hectare integrated farming system (IFS) model were 5916 m^2 under three cropping systems viz., rice - wheat- green gram (grain + residue incorporation), rice - winter maize + potato - cowpea (F), rice - mustard - maize (G) + cowpea (F); 1098 m^2 under fodder system, i.e. sorghum + rice bean - berseem - maize + cowpea (F), 792 m^2 under seasonal vegetables; Area under Fish production (800 m^2) and fruits (Guava and Papaya) on embankment of fish pond (620 m^2) totaling it to 1420 m^2 . Besides, 125 numbers of subabool (*Leucaenaleucocephala*) plants and 50 numbers of Moringa plants were also planted along the boundary of field in 200 m^2 areas. Vermicompost pits (3 nos.) were constructed near dairy shed for recycling of farm and animal wastes in 100 m^2area+dairy (2 cross breed milch cows) in 70 m^2 area, Goatry (10 + 1 Black Bengal breed) for meat purpose in 80 m^2 area, ducks for eggs and meat have been included in the system. All the farm and animal wastes were properly recycled into system so that nothing goes waste and output of one enterprise worked as input for other enterprises.

The system could produce REY of 42.71t with gross return of Rs. 640728 besides employment generation of 715.5 mandays. The net income of Rs. 2,84,108/- was realized from Cropping+ dairy+ goatry + fishery including fruits + duckery + boundary plantation+ vermicompost, in which cropping systems, dairy unit, goat unit, fishery, boundary plantation and recycling of farm waste contributed Rs.80,831/-, Rs.1,00,638/-, Rs.31,753/-, Rs.24,697/-, Rs.-6,475/-, Rs. 18,680/- and Rs.33,988/- respectively. Income obtained from different components, cropping, dairy unit, goat unit, fishery boundary plantation and recycling of farm waste contributed, 28.45%, 35.42 %, 11.18%, 8.69%, -2.28%, 6.57% and 11.96%, respectively to the total income of the system. Economics of different cropping systems in the IFS model is given in table 7.1.1/19.

Table 7.1.1/19: Economic performance of different cropping systems in IFS model at Sabour (2016-17)

Season			Area (m^2)	Gross income (Rs.)	Net Income (Rs.)
Kharif	Rabi	Summer			
Rice	Wheat	Mungbean	2907	47,855 (27.7)	19,737 (24.4)
Rice	Maize + Potato	Cowpea (F)	2006	65,285 (37.8)	30,193(37.4)
Rice	Mustard	Maize(G) + Cowpea (F)	1003	19,162(11.1)	7,769(9.6)
Sorghum + cowpea (F)	Berseem + oat (F)	Maize + cowpea (F)	1098	20,655 (12.0)	12,034 (14.9)
Seasonal vegetables			792	19,603 (11.4)	11,098 (13.7)
Total			7806	1,72,560	80,831

View of cropping system in IFS model at Sabour

View of fish pond in IFS model at Sabour

6. LOWER GANGETIC PLAINS REGION

AICRP-IFS Center at Kalyani (WB)

To demonstrate the benefits of diversified farming an IFS Model was established in 2012 in order cater to the needs of six-member farm family so as to sustain their livelihood under irrigated ecosystem of New Alluvial zone of West Bengal. In order to meet the requirements of the farm families and livestock, the IFS Model has been synthesized for 0.66 ha land holding to support a family of small and marginal farmer having six family members. The model encompasses components like crop (0.42 ha), horticulture (0.11 ha), dairy, vermicomposting and biogas unit (0.03 ha) and fishery (0.09 ha). Low lying area measuring 0.2 ha of the total crop area of 0.42 ha has been converted into five pairs of raised and sunken beds alternately, each bed measuring 200 m^2 for paddy cum fish cultivation in the sunken beds and for cultivation of vegetables and arable field crops in the raised beds. Slope in the junction of raised and sunken beds has been utilized for fodder cultivation (hybrid napier). Some vegetable creepers (dolichos bean, bottle gourd etc.) are also grown above the sunken beds on netted scaffolds.

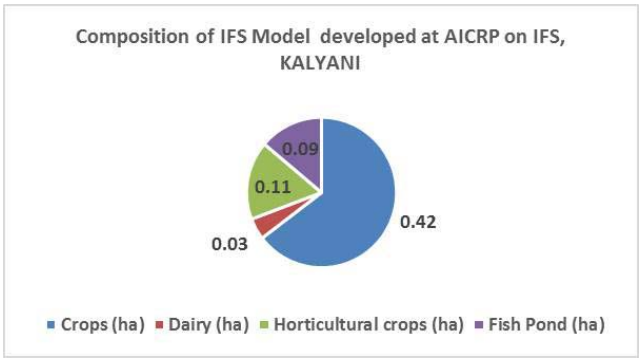


Fig. 7.1.1/5. Area allocation under different components of IFS model at Kalyani

Table 7.1.1/20: Economic performance of different components in IFS model at Kalyani (2016-17)

Components	Gross income (Rs/0.66ha)	Expenditure (Rs/0.66ha)	Net income (Rs/0.66 ha)	B:CRatio	Employment Generation (man days/yr)
Field Crops	63702	57309	6393	0.11	144
Livestock	70102	54387	15715	0.29	151
Horticulture crops	26154	8501	17653	2.08	22
Fishery	19824	7212	12612	1.75	15
Total (Rs.)	179782	127409	52373	-	332

View of raised and sunken bed system in IFS model at Kalyani

During 2016-17 system production in terms of REY was recorded to the tune of 8.01 t from the model area. Economic performance and employment generation of different modules is presented in table 7.1.1/20.

About 30.63% of the input cost of the model was realized through recycling of farm residues from different farm enterprises besides saving 45.60% of input cost through employment of family labour. The system could provided net return of Rs 52373 from the model besides meeting household food and fodder demands. The IFS model generated employment of 332 man days and 64 kg N, 36 kg P2O5 and 41 kg K2O/year through recycling and vermicomposting. The biogas unit of 2 cubic meter capacity generates biogas equivalent to 172 kg LPG (12.5 domestic gas cylinders)

7. EASTERN PLATEAU AND HILLS

IGKV, Raipur (Chhatisgarh) and BAU, Kanke Ranchi (Jharkhand), the two AICRP-IFS centers representing Eastern Plateau and Hills Region are given responsibilities to develop IFS models for livelihood improvement of small and marginal farmers of the region.

Raipur

Integrated farming system research model of 1.0 hectare has been started from the year 2010-11 with cropping system, horticultural system, fishery and poultry enterprises. From the year 2012-13, dairy component, vermicompost, biogas units have also been taken under operation in addition to the aforesaid components goatry unit was also included. Under region specific integrated farming systems model of 1.0 ha cropping system, horticulture system, fishery, poultry, dairy, goatry, vermicompost and mushroom components were under operation during 2016-17 at IGKV, Raipur. A gross income of Rs. 536647/-, was generated from IFS research model with income of Rs. 247803/- through cropping system, Rs 18366/- by horticultural cropping system, Rs. 240800/- by dairy unit, Rs. 14080/- from fishery and rest of Rs 15600/- from the other enterprises and total net return of Rs. 278689/- was achieved from the 1.0 ha model with employment generation of 467 man days.

Production under different modules along with its cost of cultivation and gross return is presented in table 7.1.1/21 which suggested that maximum return was obtained from crop module followed by dairy enterprises. The system could produce 36.51 t (REY) from different enterprises with net return per rupee invested as 1.08.

The IFS model could also 12.93 % and 41.65 % of input cost through on farm recycling of farm residues and on-farm labour respectively.

Table 7.1.1/21: Production and economic performance of different components in IFS model at Raipur (2016-17)

Component	Production (Kg)	Input cost (Rs)	Gross Return (Rs)
Crop component	Cereal – 17669, Pulses – 634, Green fodder –24173, Dry fodder – 14070, Sweetcorn– 2014, Vegetable – 13879	77010.00	247803.00
Horticulture	Papaya–264, Ber (22), Ridge guard (57), Bottle guard (128) Biter guard (36.5), Okra (87), Napier (915), Yam (8), Spinach(88), Amranthus (106), Guava (58)	8072.00	18366.00
Dairy	Milk- 2342 Lit. @ 42/- and others	85507.00	113512.00
Poultry	517 kg and Duckery – 20 kg	41200.00	84230.00
Fishery-	112 kg fish and others	4762.00	14080.00
Mushroom-	70 kg	1500.00	5600.00
Vermicompost	21 tonnes	12548.00	42000.00
Goatry	-	27360.00	1058.00
Biogas	250 kg	-	10000.00
Total		257959.00	536647.00

View of crop and fishery component in IFS model at Raipur

Ranchi

Based on the base line data of the region, an integrated farming system model of 1 ha comprising of components like cropping, milch cows, fishery, apiary, mushroom production, nutritional garden and vermicompost was undertaken at Agronomy Research Farm of Birsa Agricultural University during 2011-12 to 2015-16, to study the productivity, profitability, employment generation and resource recycling of integrated farming system.

Integrated farming system provided an opportunity to increase the economic yield per unit time by intensification of cropping and integration of allied enterprises. Among the components, the highest net return was obtained from crop (Rs. 57155) followed by livestock (Rs. 22745), vermicompost (Rs. 11972), fishery (Rs. 10660) mushroom (Rs. 8927) and apiary (Rs. 483). During 2016-17, system production of 23.61 t (REY), gross returns and net returns were reported as Rs.2,53,845 and Rs. 1,11,942/ha/year, respectively (Table 7.1.1/22). Monthwise net return from the IFS model is presented in fig 7.1.1/6.

Table 7.1.1/22: Production and economic performance of different components in IFS model at Ranchi (2016-17)

Component	Area allocated (m^2)	Yield in REY (kg) 2016-17	Cost of cultivation (Rs.)	Gross return (Rs.)	Net return (Rs.)	B:C ratio
Crops (REY)	8000	6938	55205	112359	57155	1.04
Dairy	590	6471 (2164 lit.)	71230	93975	22745	0.32
Vermi - compost	265	1042 (1837 kg)	2721	14693	11972	4.40
Mushroom	145	1348 (158 kg)	10131	19058	8927	0.88
Fishery	1000	915 (86 kg)	2300	12960	10660	4.64
Apiary	—	57 (4 kg)	317	800	483	1.52
Total	10000		1,41,904	2,53,845	1,11,942	0.79

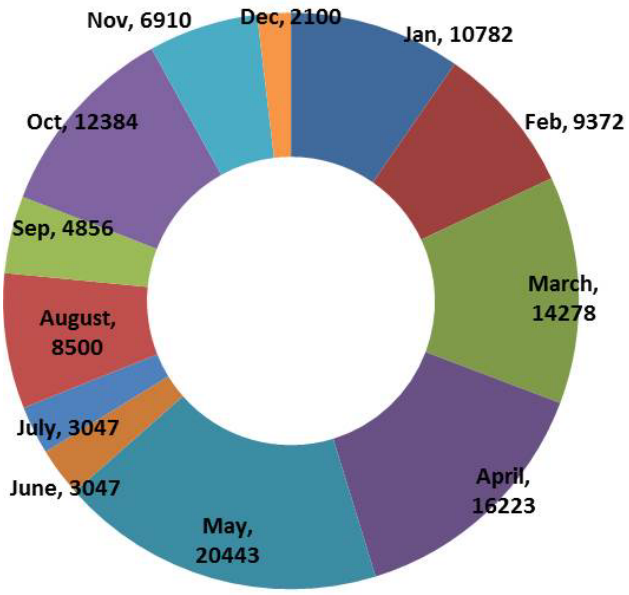


Fig. 7.1.1/6. Month wise net return from IFS model at Ranchi

8. CENTRAL PLATEAU AND HILLS

AICRP-IFS Centre Jabalpur (MP), represents ACR Central Plateau and hills region of the country. The predominant farming system of the Jabalpur is crop + dairy which rank 1st with the contribution of 80% area coverage. The 2nd ranking crop + dairy + horticulture (vegetables) contributes about 15% coverage area and other farming system is crop + dairy + fishery contributes 5% coverage area. The average family size of the region is 5 members (3 male + 2 female) with the holding size of 0.70 ha for marginal and 1.20 ha for the small farmers. IFS model of 1.0 ha was initiated at Jabalpur during kharif season of 2012. In the IFS model cropping component covers 0.64 ha, dairy component covers 0.007 ha with 3 cow + 1 calf, fisheries component 0.06 ha (1800 m^3), poultry component 300 birds, vermicompost 0.0039 ha and mandatory other enterprises like kitchen garden, boundary plantation etc. The total system productivity in terms of Rice Equivalent Yield (REY) was 15.02 t/ha during 2016-17, out of which the livestock unit (dairy) contributed 5.5 tonne followed by cropping component (5.2 tonne), fishery and poultry (2.88 tonne) and horticultural crops (1.38 tonne). The total gross and net monitory returns of the IFS model fetched was Rs 22970 and Rs. 96441 per

Table 7.1.1/23: Production and economic performance of different components in IFS model at Jabalpur (2016-17)

Enterprises	REY (t)	Cost of Cultivation (Rs/ha/yr)	Gross Return (Rs/ha/yr)	Net Return (Rs/ha/yr)	B:C Ratio	Employment (man days)
Crop Component	5.201	43458	79315	35857	1.83	94
Dairy	5.548	61449	84607	23158	1.38	120
Horticulture	1.389	9900	21182	11282	2.14	138
Fishery + Poultry	2.883	17822	43966	26144	2.47	34
Total	15.02	132629	229070	96441	1.73	386

View of crop and poultry component in IFS model at Jabalpur

ha respectively besides employment generation of 386 mandays (Table 7.1.1/23).

Maximum gross and net return (Rs 38369 and Rs 28819, respectively) was recorded in rice-wheat cropping system closely followed by okra-tomato cropping system (Rs 18834 and Rs 12944), soybean-oats (Rs 8479 & Rs 3836 respectively) and sorghum-berseem + gobhisarson (Rs 7015 & Rs 2594) among different cropping systems while maize-chickpea cropping system registered the minimum gross and net return (Rs 6619 & Rs 1577).

9. WESTERN PLATEAU AND HILLS

AICRP-IFS programme running in three representative districts of Western Plateau and Hill Region include i) AICRP-IFS Centre- Parbhani, ii) AICRP-IFS Centre – Akola and iii) AICRP-IFS center at Rahuri. Region specific on station IFS models are being developed at all the three respective centers. Composition of IFS models and production & economic trends under scientific management and prevailing farming practices are summarized below;

Akola

To increase the productivity, profitability and bring sustainability under small and marginal farmers of Vidarbha Region of Maharashtra state, an IFS model was established at main center of Dr. PDKV, Akola during 2012-13 on an one hectare irrigated land to meet out the needs of an average family of 5-6 members. This model includes crops and cropping systems (0.70 ha), horticulture (0.25 ha), goatary, poultry, kitchen gardening, boundary plantation and composting (0.05 ha) etc. One hectare Integrated farming system model

Table 7.1.1/24: Production and economic performance of different components in IFS model at Akola (2016-17)

Sr. No.	Components	Soybean Eqv. Yield (q)	Gross Return (Rs.)	Cost of cultivation (Rs)	Net Return (Rs)
1	Cropping system	23.2	71250	35952	35298
2	Horticulture	16.2	43110	20271	22839
3	Goatary	14.9	42275	35800	6475
4	Poultry	8.2	24750	18720	6010
5	Others(KG/BP)	0.4	1960	720	1240
6	Value addition	—	6250	500	5750
7	Compost recycling	—	28218	—	1489
	Total	62.9	217793	111463	79101

View of Soybean + Pigeonpea (5:1) system in IFS model at Akola

View of horticulture module in IFS model at Akola

comprising of cropping systems (Cotton + Pigeonpea (6:2) - Sesame, Soybean + Pigeonpea (5:1), Sorghum – Wheat, Soybean – Chickpea, Cowpea – Fenugreek) on 0.70 ha + Horticulture (Custard apple + Black gram/Pigeon pea – Safflower + Agasto + Drumstick) on 0.25 ha + Goatary (10+2) + Poultry (Chicken & Eggs) + Organic Kitchen garden (Leafy vegetables, root crops, vines and flowers) + Compost + Boundary plantation (Karonda and Glyricidia) on 0.05 ha area developed for small and marginal farmers of Vidarbha region in Maharashtra state provided round the year production of 62.9 q SEY besides net return of Rs.79,101/year (Table 7.1.1/24) and employment generation (379 Mandays /year). The model could provide all the commodities like food grains, vegetables, eggs, chicken (food, fruits, fodder, feed, fuel, fiber) etc. for the farm family.

Parbhani

An Integrated Farming System model was established at VNMKV, Parbhani during the year 2010-11 with a land area of 1.0 ha. The land was allocated under different components of Integrated farming system *viz.* Field crops, Horticultural crops, Livestock, Poultry and Apiary with the objective to meet up different family requirement (of five members family. IFS model comprising of cropping systems - Soybean-Wheat (0.1 ha),

View of horticulture module in IFS model at Parbhani

Vermicomposting unit in IFS model at Parbhani

Table 7.1.1/25: Yield and Monetary returns obtained from different components in IFS model at Parbhani (2016-17)

Sr. No.	Cropping System	Variety	Crops		Area (m^2)	Yield (Kg)	Rate (Rs/Kg)	Price (Rs.)
1.	Soybean- Rabi Sorghum	MAUS-71	Soybean		1000	234	33.00	7722
		SPV-1411	Rabi		Grain	212	18.45	3911
			Sorghum		Fodder	328	3.50	1148
2.	Cotton-Wheat	Dr. Brent	Cotton		1000	210	42.70	8967
		NIAW-301	Wheat			355	17.50	6213
3.	Maize-Gram	Maharaja	Maize		1000	510	13.56	6916
		BDNG-797	Gram			162	56.35	9129
4.	Green gram –Brinjal	BPMR-145	Green gram		1600	140	52.00	7280
		Hy. Gaurav	Brinjal			1382	8.00	11056
5.	Green gram – Lucerne	BPMR-145	Green gram		750	64	52.00	3328
		Amaldar-51	Lucerne	I cutting		960	3.00	2880
				II cutting		1086	3.00	3258
				III cutting		1168	3.00	3504
6.	Hybrid napier	DHN-6	Hybrid Napier	I cutting	750	1045	3.00	3135
				II cutting		1220	3.00	3660
				III Cutting		1278	3.00	3834
7.	Kagzi lime with Soybean & cabbage as inter-crop	Sai Sarbati	Kagzi Lime		2000	258	20.00	5160
		MAUS-71	(Kharif- intercrop- Soybean)			458	33.00	15114
		Hy. Ojas	(Rabi – intercrop – Cabbage)			1832	6.00	10992
8.	Turmeric	Selam	Turmeric rhizomes		1000	242	39.00	9680
9.	Boundary crop	PKM-1	Drumstick (*Moringa oleifera*)		500	242	30.00	7260
		Local	Anjan			346	2.50	865
10.	Animal Enterprises	Murrha Buffalo-one	Milk yield		-	Buffalo expired during parturation		
			Dung					
			Calves					
		Cow Holdev-one	Milk yield		155 days	612 lit	Rs. 34 /lit	20808
			Dung			2.13 tonne	2600/- tonne	5538
			Calves			Female calf	5200	5200
11.	Vermicompost Unit	Earthworm- *Eisenia foeteda*	Vermicompost			4860	4.00	19440
12.	Poultry- 1 batch	Vencomb	Meat Yield		42 days	Poultry is in progress		
13.	Apiculture Unit (6 Hives)	Apies meliferra	Honey yield		-	Apiculture unit not rared during this year.		
							Total Rs.	**185998/-**

Table 7.1.1/26: Economics and employment generation from different components in IFS model at Parbhani (2016-17)

Sl. No.	Components	Gross Return (Rs)	COC (Rs)	Net Return (Rs)	Employment generation (mandays)
A					
1.	Soybean- Rabi Sorghum	12781	6928	5853	128
2.	Soybean-Wheat/Cotton-Wheat	15180	7270	7910	
3.	Soybean-Onion/Maize-Gram	16045	9612	6433	
4.	Green gram –Cowpea/Brinjal	18336	10820	7516	
5.	Green gram – Lucerne	12970	7895	5075	65
6.	Hybrid napier	10629	5382	5247	
7.	Kagzi lime with Soybean in kharif & Cabbage / Cauliflower, Bottle gourd in rabias inter-crop	31266	16750	14516	89

Sl. No.	Components	Gross Return (Rs)	COC (Rs)	Net Return (Rs)	Employment generation (mandays)
8.	Ginger/Turmeric	9680	5100	4580	38
	Total A	**126887**	**69757**	**57130**	
B	**Boundary plantation**				
1.	Drumstick	7260	3468	3792	20
2.	Anjan	865	387	478	
	Total B	**8125**	**3855**	**4270**	
C	**Dairy component**				
1.	Murrha Buffalo	-	-		130
2.	Cow Holdev	31546	17150	14396	
	Total C	**31546**	**17150**	**14396**	
D	**Vermicompost Unit**				
1.	Vermicompost **Total D**	**19440**	**8680**	**10760**	**15**
E	**Poultry unit**				
1.	Poultry bird (broiler)- 1 batch	-	-	-	40
F	**Apiculture unit**				
1.	Honey **Total F**	**-**	**-**	**-**	
	Grand total (A+B+C+D+E+F)	**185998**	**99442**	**86556**	**525**

Soybean-Rabi Sorghum (0.1 ha), Soybean-Onion (0.1 ha), Green gram-Brinjal (0.16 ha); Fodder crops *viz*. Hybrid Napier (0.075 ha) and Lucerne (0.075 ha) were grown, horticulture [*Kagzi lime* (0.20 ha) intercrop –*Kharif* Soybean and *Rabi* Cabbage, spices- Turmeric (0.1 ha), Boundary plantation such as Anjan and Drumstick on 0.04 ha + dairy including animal shed (1 Cow-Holdev and 1 Buffallo- Murrah), vermicompost (0.05 ha) developed for the Marginal and Small farmers of Central Maharashtra Plateau Zone (MH-7) .

Detailed economics and employment generation for the year 2016-17 from different modules of IFS model developed at Parbhani is presented in table 7.1.1/25 and 7.1.1/26. Results revealed that gross return of Rs.185998 and net return of Rs. 86556 was realized from the IFS model besides employment generation of 525 mandays.

Rahuri

The integrated farming systems (IFS) unit at MPKV, Rahuri was started during 2010-11. The model is developed for small farming household with 1.00 ha area under irrigated ecosystem. The IFS model on 1.00 ha. area comprises of crops (0.72 ha) viz., Soybean –Wheat (0.30 ha), Maize – Onion (0.20 ha), Perarlmillet – Chickpea (0.10 ha), Lucerne and Napier (0.12 ha) area, Mango (0.20 ha) and cross breed cow (2), poultry four lots of 500 birds total, Vermi-compost unit (0.08 ha).

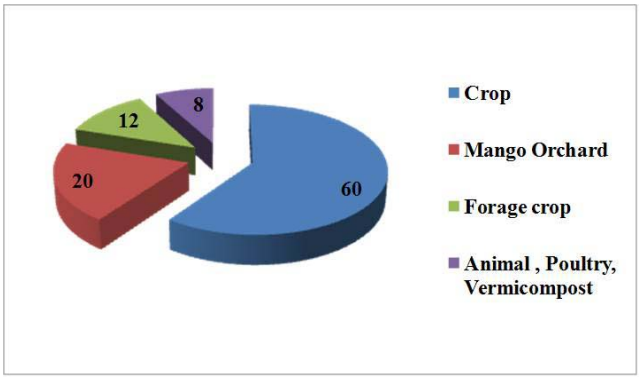


Fig. 7.1.11/7. Percentage area allocation of 1.0 ha IFS model at Rahuri

The gross monetary returns (Rs. 5,04,007 ha^{-1}) and net monetary returns (Rs. 2,95,060 ha^{-1}) were obtained from IFS Model during the year 2016-

Table 7.1.1/27: Economic performance and employment generation of from different components in IFS model at Rahuri (2016-17)

Component	Gross return (Rs.)	Cost of cultivation (Rs.)	Net Return (Rs.)	Percentage share in net return	Net return per rupee invested	Employment Generation (Man days)
Crop	177524	49390	128134	43.43	3.59	167
Animal	174233	84553	89680	30.39	2.06	215
Poultry	74875	52550	22325	7.57	1.42	28
Mango Orchard	30000	8501	21499	7.29	3.53	21
Vermi-compost/ vermi-culture	20000	5650	14350	4.86	3.54	10
Forage crop	27375	8300	19072	6.46	3.30	40
Total	504007	208944	295060	100	2.41	481

17. The overall net return per rupee invested obtained for the IFS model was 2.41. The model generated 481 man days of employment over the year under report. As regard to livelihood security, the IFS approach adopted in the model met almost all the domestic family needs of food and saved a sizeable amount of returns to meet the other family liabilities of the small farmer including education, health, etc.

Recycling of farm products and by-products and creation of labour days are the two major objectives of the IFS. Recycling of by-products and residues within the system and cost on labour contributed 26 and 35% respectively to the total cost of production of the system during the year 2016-17.

10. SOUTHERN PLATEAU AND HILLS

Four AICRP-IFS centers namely, ANGRAU, Rajendra Nagar, Hyderabad (A.P.), TNAU, Coimbatore (Tamilnadu), ARS, Kathalgarh (Karnataka) and ARS, Sirriguppa (Karnataka) are located in different NARP zones of Southern Plateau and Hill Agro Climatic Zone of the country. All the centers have developed region specific IFS models at their respective centers since 2010-11. The composition and significant achievements of last 4-5 years of respective centers are given below

Coimbatore

IFS study on development of integrated farming system model for small farmers of irrigated dryland in western zone of Tamil Nadu was initiated in research farm of TNAU, Coimbatore during June 2010, with an objective to develop and validate Integrated Farming System model for enhanced system productivity, profitability and sustainability in irrigated dryland, to assess relative efficiencies of the IFS model in terms of economics, resource use and energy and to optimize individual components of IFS in regional perspective. The predominant farming systems followed is crop + dairy in 70 % area and crop + dairy + goat in 30 % area. The average size of a farm family is five members (3 male and 2 females).

The model was designed for 1.2 ha land holding, to support a family of five to six members. The IFS model comprised of crop unit, horticulture (aonla, sapota, guava and pomegranate), dairy unit (2+1), goat unit (10+1), biogas unit (2 m^3), vermicompost unit, border plants (annual moringa, curry leaf and agathi) and area under supporting activities.

The total farm production during 2016-17 in terms of Maize equivalent yield from main product was recorded as 38.46 t/ha. Crop component recorded net return of Rs.65,420/- (32.0%) where

Table 7.1.1/28: Economic performance of different components in IFS model at Coimbatore (2016-17)

No.	Component	Size	Gross return (Rs.)	Total cost (Rs.)	Net return (Rs.)	% contribution
1.	Crop	1.02 ha	1,91,649	1,26,228	65,420	32.0
2.	Horticulture	0.16 ha	13,590	4,403	9,187	4.5
3.	Dairy	2 cow + 2 calves	2,23,140	2,04,507	18,633	9.1
4.	Goat	10 + 1	92,827	83,862	8,965	4.4
6.	Vermicompost	50 m^2	62,650	—	62,650	30.7
7.	Compost yard	–	24,338	—	24,338	11.9
8.	Boundary planting	—	20,950	5,550	15,400	7.5
		Total	6,29,144	4,24,551	2,04,593	

Horticulture module in IFS model at Coimabtore

Livestock module in IFS model at Coimabtore

as horticulture contributed 4.5 % (Rs.9187) of the net income. Dairy and goat unit registered net return of Rs.18,683 (9.1% of net income) and Rs. 8965 (4.4% of net income) respectively. By adopting the IFS approach developed at the center, a net return of Rs. 2,04,593 / year could be realized from 1.20 ha farm unit (Table 7.1.1/28).

Saving of production cost, with recycled farm products was 32.3 % (Rs. 1,37,419) and farm labour engaged was 51.1 % (Rs. 2,17,200). The IFS approach generated an employment of 725 man days round the year.

Kathalgere

The IFS study has been conducted on irrigated based integrated farming system for marginal and small farm holders with an area of 1.0 ha at Agricultural and Horticultural Research Station, Kathalagere, Davangere district of Karnataka state under Bhadra command area. The allocation of land resource for accommodating different enterprises was done as per the family needs (calculated for a family of 5 members) and size/ numbers of individual components of the system. Out of one hectare area, 0.50 hectare was allotted for crop component (Cereals, pulses and millets), 0.35 hectare was taken up with Horticulture crops (Arecanut, Coconut, Banana, Drumstick and Vegetables). Diary and Sheep components were also introduced as additional components with buffalo (one) + HF cow (two) and sheep (10+1). Green fodder block was fixed in an area of 0.03 hectare. Additional components like compost (2 units), vermicompost (3 units) and Azolla (2 units) were included subsequently in the system. Cow dung, urine, sheep excreta, farm wastes and crop residues were properly recycled by composting (FYM and vermicompost) and incorporated in to

the soil. Similarly, Azolla was released in to paddy field as source of nitrogen fixer and also used as animal feed in limited quantity (1:10 ratio of azolla and feed). Area allocation for different enterprises is presented in table 7.1.1/29

Table 7.1.1/29: Area allocation of different components in IFS model at Kathalgere (2016-17)

Components of IFS model	Area (m^2)	%
Crop Components:		
Paddy-paddy /Finger millet /Pulses	5000	50
Horticulture Components:		
Vegetable Unit (Cluster Bean, Carrot, Bhendi and Ridge Guard)	1000	10
Arecanut garden (Channagiri Local)	500	05
Coconut + Arecanut + banana inter cropping	1000	10
Drum stick (PKM-1/ Bhagya)	500	05
Banana (Elakki- Sole Crop)	500	05
Banana (Elakki) + Drum Stick inter cropping (PKM-1)	400	04
Fodder Block (CO-3)	300	03
Azolla Unit (2-Nos.)	800	08
Total	10000	100

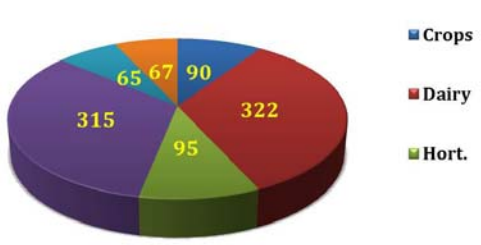


Fig. 7.1.11/8. Entreprise wise employment generation of 1.0 ha IFS model at Kathalgere

The system had net income of Rs. 1.85 Lakh, with cost of production Rs. 72,010 with a benefit: cost ratio of 2.57. Crop component has contributed > 50 per cent of total income when compared to other enterprises. Integrated farming system model has generated total 954 mandays throughout the year from various enterprises. The dairy unit was generated highest employment (322 mandays) followed by sheep unit (315 mandays). Fertilizer cost of Rs.11,052 can be saved by Incorporation of farm waste in terms of FYM /Vermicompost in the system.

View of cropping systems module in IFS model at Kathalgere

Rajendernagar

Integrated Farming Systems research was initiated at Rajendranagar, PJTSAU in 1.0 ha land under irrigated dry situation during 2010-11. The land was earmarked for developing 1 hectare Model for marginal / small farmers by integrating crops with horticulture and animal components. The crop component includes arable cropping systems viz., rice-maize, rice-sunflower, maize-castor, maize + pigeonpea-cowpea and pigeonpea + greengram-groundnut. The horticulture component includes a fruit crop guava and seasonal vegetable intercrops like tomato, green chillies, bhendi during rainy

season and carrot, beetroot, cluster bean in rabi season. Horticulture, fodder block and boundary plantation was established and initiated during 2010. The Livestock component with 2 dairy buffaloes (Murrah Breed), 6 goats (Osmanabadi) and a unit of 20 backyard poultry birds (Vanaraja) was started during kharif season 2011 and the full pledged Integrated Farming Systems research is being conducted since then. Complementary units like Vermicomposting and composting were included for residue recycling in the system. During 2015-16, new cropping systems were included in the unit viz., Bt cotton+Greengram –Fodder Sorghum, Pigeonpea + Sweet corn – Bajra, Maize-Groundnut and Sunhemp in the Maize+Pigeonpea – Cowpea system.

During the year 2016-17, holistic integration of animals with crops in 1 ha area resulted in a total productivity of 41.44 t REY ha^{-1} with the benefit cost ratio of 0.56 and net income of Rs.2,17, 493/- with the total operational expenditure of Rs.3,91,732/- compared to that of an average farmers' net income of Rs. 52,000 in Southern Telangana Zone of Telangana state in addition to generation of 830 man days of employment in the system (Table 7.1.1/30). Out of this total net income, 27.85% returns came from crop component including fodder, 4.40% returns came from horticulture component and 67.75% from livestock unit along with production of diverse needs of farm family viz., cereals, pulses, oil seeds, fruits, vegetable, milk, meat and fodder for cattle.

Table 7.1.1/30: Production and economics of different components in IFS model at Rajendra Nagar (2016-17)

Item	Cropping Unit	Livestock Unit		Horti-culture unit	Recycling unit	Total IFS
		Dairy	Goatery & Poultry			
Productivity (t REY ha^{-1} yr^{-1})	11.54	9.22	17.2	1.82	1.66	41.44
COC (Rs ha^{-1} yr^{-1})	52587	245020	65994	15427	12704	391732
Gross Returns (Rs ha^{-1} yr^{-1})	169663	135529	252867	26819	24346	609224
Net returns(Rs ha^{-1} yr^{-1})	117076	(-) 109491	186874	11392	11643	217493
B: C ratio	2.23	(-) 0.45	2.83	0.73	0.91	0.56
Employment (mandays)	116	509.5	153	27	24	829.5

View of vermicomposting unit in IFS model at Rajendra Nagar

Through residue recycling and manure production 16.50 t of FYM and 2.24 t of vermicompost was generated which is equal to 149-70-102 kg of N, P and K and saved fertilizer worth of Rs 8500/-. Continuous use of crop residues and manures through residue recycling over these years helped improving the soil fertility of the unit with perceptible improvement in organic carbon from an initial status of 0.36% in ID block to 0.49%. Improvement in status of available phosphorus and potassium was also evident in IFS unit, with increased available phosphorus from an initial status of 14.8 to 39.8 in fodder block and 30.0 kg under other cropping systems and potassium from an initial of 170 kg ha-1 to 224 kg ha^{-1} (178- 250 kg ha^{-1}).

Siruguppa

An Integrated Farming System model of 1 ha was established at Agricultural Research Station, Siruguppa, Karnataka, under AICRP on Integrated Farming System for livelihood security of small farmers in Tungabhadra Project area during the year 2010-11. The land was allocated under different components mainly on agriculture components including crop (Cereals and pulses components in 0.74 ha), horticultural in 0.18 ha (Sapota, curryleaf, papaya, vegetables and floriculture) and fodder component in area of 0.02 ha. The remaining land of 0.06 ha was allotted for agriculture allied activities such as live stock unit including 2 cows, one buffalo and goatary (14 nos.), Fish pond, Vermicomposting unit (4), compost unit (1) and Azolla unit (1). The boundary plantation with teak and glyricidia was established to protect the unit and to generate the biomass for further utilization. The internal bunds were also planted with pigeon pea, fig and banana to meet out nutritional security of a small family (of six member's family).

Results revealed that during 2016-17, among the different cropping system the horticulture crop has recorded higher B:C ratio of 4.57 followed by maize chickpea cropping system (3.33) and lowest being of 1.47 was noticed in rice followed by maize

Table 7.1.1/31: Area allocation, yield and economics of different components in IFS model at Sirruguppa (2016-17)

Components	Area (sq m)	% area	Yield kg/plot		COC (Rs)	Gross returns (Rs)	Net Return (Rs)	B:C
Crop components			Kharif	Rabi				
Paddy-paddy	1650	16.5	645	515	13560	23891	10331	1.76
Paddy-maize	1150	11.5	440	400	10250	15166	4916	1.48
Paddy-sorghum	1150	11.5	431	350	9125	14522	5397	1.59
Bt cotton-GM	1600	16	386	0	9545	19954	10409	2.09
Maize-bengalgram	1850	18.5	2002	275	12980	43189	30209	3.33
	7400	74			55460	116722	61262	2.1
Horticulture(Sapota+curry leaf + drumstick+ vegetables) +kitchen gardan	1443 256	16.99	1167		3970	24646	20676	6.2
Animal component (Cow+Buffalo)	81	0.81	36777	-	45010	135475	90465	3.01
Goatary(Goat+manure)	13	0.13	2250		29704	104151	74447	3.51
			310					
Azolla/Vermicompost	51	0.51	5728		7726	25260	17534	3.27
Crop residues +fodder + Boundary plantation +fish	527.31	5.27	3500	10002	6132	30153	24021	4.92
Total	1.0 ha	100			148002	436407	288405	2.95

Livestock and composting unit in IFS model at Siruguppa

cropping system. The 1 ha IFS model realized the Rs. 436407 and Rs. 288405 gross return and net return, respectively with a B:C ratio of 2.95 (Table 7.1.1/31). Among the different components of IFS, higher gross returns (Rs. 135475) and net returns (NR) (Rs. 90465) were recorded in animal component including buffalo and cow followed by Goatary with NR of Rs. 90465 and crop component excluding horticulture (Rs. 61262) and lowest being was observed vermicomposting and azolla unit. However, the higher B:C ratio of 6.20 was observed in horticulture system and it was followed by in Crop residues + fodder + Boundary plantation + fish system (4.92) and lowest of 2.10 was recorded in crop components. The higher contribution to the tune of 31.04 and 31.37 per cent for gross and net returns respectively was observed in animal component and least was recorded in horticulture component. The model generated 627 man days/ha/year from all the components put together however, the animal components generated higher man days of 196 when compared to other components followed by goats (182) and animal components (166 man days/ha/year) and lowest being was generated in horticulture system (15 man days/ha/year).

11. EAST COAST PLAIN & HILLS

AICRP-IFS Center at Bhubaneswar (Odisha)

AICRP-IFS center at Bhubneshwar (Odisha) representing East Coast Plain & Hill region is in process of developing an IFS Model for small land holders of the region since 2010-11. However, integrated farming systems at OUAT, Bhubaneswar could start during April, 2012 with existing infrastructures like office building, coconut plantation, dairy and poultry buildings, pond and some silvicultural plants. The IFS model is developed for small farming household with 1.25 ha area under irrigated ecosystem. The present system consists of cropping system, horticultural system, dairy, poultry, fishery, boundary plantation, kitchen garden and apiary.

The gross and net returns were Rs 3,43,874 and Rs. 1,23,167 with benefit cost ratio 1.55 from the IFS model at Bhubaneswar during 2016-17 (Table 7.1.1/32). Out of several components in the IFS the most remunerative ones were horticulture, poultry, kitchen garden and boundary plantation. Poultry and kitchen garden gave quick return. Cost of production in boundary plantation and kitchen garden was very low. Though the dairy unit contributed a major share to returns, its cost of production was very high and as such it was not much remunerative as compared to other components with respect to investment made. Inputs purchased from outside, inputs recycled within the system and cost on labour contributed 44, 13 and 43% to the total cost of production of the system during the year. The IFS system generated total employment of 474 man days during the year.

Table 7.1.1/32: Yield and economic performance of the IFS model of 1.25 ha farmland at Bhubaneswar (2016-17)

Component	Net Area (ha)	REY (t)	Total Cost (Rs)	Gross return (Rs)	Net returns (Rs)	BCR	Relative contribution (%)		
							Total Cost	Gross return	Net returns
Cropping systems	0.32	2.155	18,670	29,090	10,420	1.56	7.99	8.46	9.46
Horticulture	0.195	3.104	24,825	41,905	17,080	1.69	10.62	12.19	15.5
Dairy animals (2 crossbred Jersy cows)	0.0086	12.249	1,10,862	1,65,360	54,498	1.49	53	48.09	37.67
Poultry 300 birds (100 bird/rotation)	0.0041	4.361	34,790	58,880	24,090	1.69	14.89	17.12	21.87
Fisheries	0.5839	1.979	18,940	26,710	7,770	1.41	8.1	7.77	7.04
Kitchen garden	0.03	1.21	10,140	16,339	6,199	1.61	4.34	4.75	5.63
Apiary	1 box	0.033	200	450	250	2.25	0.09	0.13	0.23
Boundary plantation	0.03	0.381	2,280	5,140	2,860	2.25	0.98	1.49	2.6
Total	1.25	25.472	2,20,707	3,43,874	1,23,167	1.55	-	-	-

Crop component in IFS model at Bhubaneswar

Fishery unit in IFS model at Bhubaneswar

12. WESTERN COAST PLAINS & HILLS

In this particular Agro Climatic Region three AICRP-IFS centers one each in the states of Goa (ICAR Research Complex, Goa), Maharashtra (Karjat) and Kerala (Karmana) are in process of developing of Region Specific IFS Models for respective states . The composition of IFS models and performances of production and productivity in respective regions are summarized below;

Goa

Goa is a small State in the West coast of India. The average holding size of farmers is below 0.5 ha. These small land holdings are further characterized by undulating terrain with diverse soil conditions. The marginal uplands with shallow soils are dominated by cashew crop. However, the local food habits of rice-fish curry, use of coconut in most of the culinary preparations and cashew for beverage and food needs to be met continuously by the agricultural sector. Further, the local milk production is only one third of the present demand to meet the daily minimum basic requirement (0.25 litres / head).

a) Integrated farming system models for typical lowland (rice based) situations: Integrated farming system models involving

rice, pulses, oilseeds etc. in different possible crop combinations integrated with livestock and fish species for a family size of 6 members in an area of 0.5 ha under lateritic soil condition was initiated in 2012-13. The components and area allocation is as follows,

Results revealed that gross and net returns were Rs. 1,89,740 and Rs. 99,590 respectively was realized from the IFS model for low land area having 0.5 ha area (Table 7.1.1/34). Higher net return was recorded in the rice-sweet corn system (Rs. 25580) followed by rice - cowpea system (Rs. 12965), rice-chilli (Rs.12146) and rice-moong (Rs. 11224) during 2016-17. The higher benefit cost ratio was recorded with the rice-sweet corn followed by rice-cowpea due to higher market demand and higher market price. The model could also generate 275 man days of annual employment from lowland IFS.

b) Plantation crop (Upland) based integrated farming system model: A upland model of area 0.79 ha comprising of enterprises such as Plantation crops: Cashew (variety Bhaskara) + Pineapple (Variety Giant Kew), Coconut (benaulim)+ Pineapple (Giant Kew) + Noni + Tapioca, Areca nut (Mangala) +

Table 7.1.1/33: Different components of lowland IFS model

Cropping System	Area (ha)	*Kharif*	*Rabi*
Cropping system 1	0.1	Rice (Jyoti)	Sweet Corn (S-75)
Cropping system 2	0.1	Rice	Chilli
Cropping system 3	0.1	Rice	Moong
Cropping system 4	0.1	Rice	Cowpea ((DU-3)
Livestock	Cow cross breed [2 cows), Poultry (14 birds- Gramapriya)		
Supplementary	Vermicompost and mushroom (0.02 ha), Kitchen garden (80m^2), fishery		

Table 7.1.1/34: Economic performance of lowland IFS model (0.5 ha) at Goa during 2016-17

Components	Gross return	Net return	B:C Ratio	Employment
Crops	98840	61915	2.68	125
Dairy	108000	59000	2.2	120
Kitchen garden	4650	3800	-	10
Poultry (14 Birds)	9000	4650	2.06	10
Fishery	4800	3200	-	10
Recycling	30928	30928	-	-
Total	189740	99590	2.1	275

Table 7.1.1/35: Economic performance of upland IFS model (0.79 ha) at Goa during 2016-17

Components	Gross return	Net return	B:C Ratio	Employment
Crops	100280	79850	4.91	120
Piggery	41600	17250	1.71	40
Poultry	22000	14000	2.75	25
Recycled products	16110	16110	-	-
Total	179990	127210	3.41	185

Banana (G-9), piggery, poultry, vermicompost unit, compost unit was evaluated for upland situations of Goa. During 2016-17 gross return of the system was Rs. 1,79,990 lakhs and the net profit was Rs. 1,27,210 (Table 7.1.1/35). The model could also generate 185 man days of annual employment from upland IFS.

Rice-fish-poultry system in IFS model at Goa

Karjat

The prevailing farming system in Konkan region consists Field crops + Horticulture + Livestock + Composting, comprising an area of 73 % whereas, second ranking farming system adopted by farmers is Field crops + Dairy/Draught animals on an area of 18 %. The land holding of small and marginal farmers is 1.44 and 0.36 ha, respectively. The Integrated Farming System Model of 1.00 ha area has been developed under AICRP on IFS at RARS, Karjat for family having 3 males and 3 females (6 persons). The IFS model comprised different enterprises *viz.,* crops and cropping systems on an area of 0.50 ha, horticulture component (fruit crops + nursery) 0.40 ha, livestock components namely, dairy, goatary and poultry on area of 35.75 m^2 each (107.25 m^2), vermicompost unit on 18.00 m^2 and rest of the land (874.75 m^2) used for operational and other purposes.This region is dominated by rice based cropping systems due to high rainfall. Therefore, the total production of the model is converted in terms of rice grain equivalent yield (REY).

Results revealed that total system production of 49.78 t REY obtained from 1.00 ha area. In terms of economic returns, the gross and net returns were Rs. 7,31,765 and Rs. 1,92,168, respectively with B: C ratio 1.36. Under crops and cropping systems, Rice–Watermelon, Rice–Cowpea, Rice-Field bean, Finger millet-Brinjal, Groundnut-Sweet corn, Cucumber-Fodder maize, Fodder crop-Napier Bajra (perennial) systems were grown on 0.50 ha area. This component produced 11.87 t REY (23.85 %) with gross and net returns for Rs. 1,74,535 (23.85 %) and 74,918/- (38.99 %), respectively. The horticulture component included fruit crops namely, mango, aonla, sapota and coconut grown on area of 0.35 ha apart from nursery (0.05 ha). In nursery, mango and sapota grafts were prepared and sold. The contribution of horticulture component in terms of REY was 11.52 tonnes (23.14 % of total production). This component contributed Rs. 1,69,330 (23.14 %) and Rs. 37,952 (19.75 %) gross and net monetary returns, respectively. Livestock component

Table 7.1.1/36: Economic performance of different components of IFS model at Karjat (2016-17)

Component	Net Area (ha)	Gross Return	Total Cost (Rs./ha)	Net returns (Rs./ha)
Cropping systems	0.50	174535.5	99617.9	74917.5
Horticulture	0.40	169330.0	131378.2	37951.8
a. Fruit crops	0.35	24060.0	23143.2	916.8
b. Nursery	0.05	145270.0	108235.0	37035.0
Livestock				
Dairy	35.75 m^2	151417.0	118548.0	32869.0
Goatary	35.75 m^2	78960.0	58800.0	20160.0
Poultry	35.75 m^2	117678.0	92439.0	25239.0
Vermicompost	18.00 m^2	39845.0	38814.8	1030.3
Total	1.00 ha	731765.5	539597.8	192167.6

comprised dairy, poultry and goatary. Initially in the year 2012-13, two cross bred jersey and 1 local cow were purchased. Dairy component contributed 10.30 tonnes. REY which was 20.69 % of the total REY. Dairy component gave average gross and net returns of Rs. 1,51,417/- and Rs. 32,869/-, respectively. The per cent share of gross and net returns to total was 20.69 and 17.10, respectively. At the initiation of model, goat unit of 6 females and 1 male was purchased. Every year the sellable male and female goats were sold. The data of 2016-17 showed that the goat unit contributed 5.37 tonnes REY and its per cent share was 10.79. This component realized Rs. 78,960/- (10.79 %) gross and Rs. 20,160/- (10.49 %) net returns, respectively.

In 2016-17 one day old 500 number of chicks (Giriraj and Kadaknath breeds) were purchased and rared. Out of which, 485 survived birds were sold as broilers. The monetary returns from poultry were converted into REY. The average production of 8.01 tonnes REY was obtained from poultry component which was 16.08 per cent in total IFS model production. This realized Rs. 1,17,678/- and Rs. 25,239/- gross and net returns, respectively. In terms of percentage it was of 16.08 % and 13.13 % of total gross and net returns, respectively. The edible by-produce of crops and cropping systems and main produce of forage crop were fed as a dry and green fodder to dairy animals. Crop residues, livestock manures/ droppings and shed wastes were used for preparation of vermicompost. The vermicompost unit produced 2.71 t REY (5.45 %) giving Rs. 39,845 (5.45 %) and Rs. 1030/- (0.54 %) average gross and net returns, respectively. The component wise production of recycled material and their intermittent use with their market values were also estimated. Total quantity of 45,126 kg/lit/No. of farm produce and by produce for worth of Rs. 1,11,162 (20.60 %) to be purchased from the market were utilized and recycled within different components of the model during 2016-17. The average employment generation through present IFS model was found to be 1131 man days and its value was Rs. 2,26,200 which contributed 41.92 % in the total cost of production. Total cost of production of the IFS model during 2016-17 was Rs. 5,39,598 ha^{-1}, which included outside purchase for Rs. 202236 ha^{-1} (37.48%), value of recycled material within the system of Rs. 1,11,162 ha^{-1} (20.60 %) and for farm labour costing Rs. 2,26,200 ha^{-1} (41.92 %). Economic indices showed the gross and net profit of Rs. 7,31,765 and Rs. 1,92,168 ha^{-1}, respectively with B: C ratio 1.36 during 2016-17. The average employment generation through present IFS model was found to be 964 man days and its value was Rs. 1,68,504 which contributed 41.64 % in the total cost of production. Farmers can increase their net returns by saving the expenditure on farm labour through employment of family labour.

Livestock and poultry component in IFS model at Karjat

Karmana

AICRP-IFS center at Karmana has developed four IFS models viz; Homestead based, Coconut based, Rice based and Banana based farming systems havning 0.20 ha area each for different situations. Composition of 4 IFS models are presented in table 7.1.1/37 to 7.1.1/40.

Table 7.1.1/37: Area allocation under Homestead based IFS model (0.20 ha)

Components	Location	Area* (m^2)
A. Tree crops		
i. Coconut (17 Nos)	Main crop	980
ii. Fruit crops viz. Mango and Jack	Boundary planting and in the interspaces between coconut and other trees	250
B. Teak (20), Neem (2), Gooseberry (1), Caesalpinia (1) , Glyricidia (2) etc.	Interspaces between coconut + additional area	160
C. Kitchen garden		
i. Medicinal plants- 15 nos , Papaya - 5 nos. Sapota - 2 nos. Guava- 2 nos. ii. West Indian Cherry - 1 Curry leaf - 10 Turmeric (grow bags) – 50 + Vegetables	Separate area	200
D. Poultry unit (30 birds)	Separate area	100
E. Vermicompost unit	Separate area	60
F. Cow unit (1+1)	Separate area	100
G. Terrace garden + water harvesting	Separate area	150
Total		**2000**

Table 7.1.1/38: Coconut based IFS at a glance (Area allocation-0.2 ha)

Components	Net Area (m^2)	Gross area (m^2)
Coconut on bunds and adjoining areas (30 nos)	1480	1480
Border trees: Teak (15 nos)	400	400
Multi-tier cropping : (In coconut interspaces + additional area): Papaya (6 nos), Jack (1 no), Mango (1 no), Bread fruit (1 no), Fodder crops Azolla - in a shallow pit of 2 x1x 0.2 m^3 size, lined with silpaulin.	20	620
Livetsock components: 1. Cow unit (1 + 1)	100	100
Fresh water fish - GIFT : (In trenches dug between coconut bunds)	0	600
Total	**2000**	**3200**

Table 7.1.1/39: Area allocation under Rice based IFS (0.2 ha)

Components	Net Area (m^2)	Gross area (m^2)
First crop rice (medium duration var.Uma)	1500	1500
Second crop rice (medium duration var.Uma)	-	1500
Third season (summer) crops Bhindi var.Varsha Upahaar Brinjal var.Haritha Green Manure crop (Daincha)	-	1500
Fish : (Inclusive of pond and dyke area planted with crops)	450	450
Duck house	Over pond	0
Cow (1+1)	50	50
Total	**2000**	**5000**

***** The duck house being erected over the pond utilizes the vertical space and hence, no additional land area

Table 7.1.1/40: Area allocation under banana based IFS for different components of (0.2ha)

Components	Net Area (m^2)	Gross area (m^2)
Crops : (Banana + intercrops) - (Banana + intercrops) - Daincha	1880	1880
Tuber crop cassava as intercrop) , Fringe crop of fodder (on the outer bunds of banana area)		
Livestock : Cow (1+1) unit	80	80
Vermicompost unit	75	75
	2035	**2035**

The progress of all the models in brief is summarized below; system productivity from 4 different IFS models in terms of different equivalent yields were recorded as 19414 (CEY in nuts per 0.20 ha), 14846 (CEY in nuts per 0.20 ha), rice based 17.18 (REY in tonnes per ha) and banana based system 3.33 (BEY in tonnes per 0.20 ha). Production of different commodities during 2016-17 in 4 IFS models are presented in Table 7.1.1/41.

Highest number of employment generation of 150 mandays was recorded in Rice based system followed by coconut based system (100 mandays) and homestead based system (80 mandays) during 2016-17. Comparative performance of 4 IFS models vis-à-vis existing rice-rice-fallow system is presented in table 7.1.1/42.

Table 7.1.1/41: Production during 2016-17 from the different IFS Models (0.20 ha each)

Model	Crop (kg)	Milk (l)	Oil (kg)	Egg (Nos)	Fish/Meat (kg)	Fodder (kg)	Others
Homestead	1288 (F+V)	1994	48	2498	86.25 (F M)	502	115 kg vermicompost, 41 kg azolla & 11 LPG cylinders equivalent biogas
Coconut based	1650	2031	170	-	225	2786	116 kg Azolla
Rice based	3050 (C+V)	2499	-	7092	266 (F+M)	2240 dry fodder	1950 kg Daincha Vermicompost 68 kg
Banana based	1052	1403	-	-	-	6387	Vermicompost 712 kg

Table 7.1.1/42: Economic performance of different IFS models (0.20 ha)

IFS models	Gross Return (Rs. Per year)	Cost of Production (Rs. Per year)	Net Return (Rs. Per year)
Homestead based	178147	176961	1186
Coconut based	232962	181367	51595
Rice based	377839	300350	77489
Banana based*	133009	158386	-25377
Existing farming system (Rice-Rice-Fallow)	40000	32243	7757

13. GUJARAT PLAINS & HILLS

AICRP-IFS Center at S. K. Nagar (Gujarat)

The economy of the region is based on animals and mainly dairy based farming system with crops as necessary components representing more than 95% farm families with an annual net returns of Rs.68758/ha/year. Average holding size of the region ranges from 0.53 ha (marginal farmers) to 1.46 ha (Small farmers) with 6 member family.The IFS study on Integrated farming Systems at SDAU, Sardarkrushinagar of Gujarat State going on since 2010-11 with different components viz., 1. Crops (0.70 ha), 2. Multistoried horticultural crops (0.25 ha), 3. Boundary plantation, 4. Dairy unit with two

Table 7.1.1/43: Economic performance of different modules under IFS model at SK Nagar (2016-17)

S. No.	Name of component	Area allotted (m^2)	Total Cost (Rs./ha)	Gross Return (Rs./ha)	Net returns (Rs./ha)
1.	Cropping systems	7000	84997	156647	71650
2.	Multistoried Horticulture Fruits and Vegetables	2500	33138	53585	20447
3.	Boundary plantation	On the bund	5300	101738	96438
4.	Livestock+ Vermicompost, compost and nursery unit	350	109180	128512	19332
5.	Water recharging	150	0	0	**0**
	Total	10,000	4,40,482	2,32,615	2,07,867

Mahesani breed buffaloes (0.025 ha), 5. Vermicompost and Nursery unit (0.01 ha) and 6. Water recharging unit (0.015 ha). The system is based on in vogue cropping system on 0.70 ha of 1.00 ha farm viz; (i) green gram –mustard-summer pearl millet (0.24 ha), (ii) groundnut-wheat- fodder pearl millet(0.08 ha), (iii) green gram-castor relay (0.32 ha) and (iv) fodder cowpea - lucerne + chicory (0.06 ha) to ensure annual calorie and nutritional requirement of the family. Out of these four cropping systems, C4: Hy.Napier + cowpea (F) – lucerne + F. chicory recorded higher net profit on hectare basis (Rs 3,69,150/ ha). The total net profit from the cropping systems component having area of 0.70 ha was Rs 71,650. Both income and health were made more sustainable by growing fruits and vegetable in two tiers on 0.25 ha. Multistoried horticultural and intercrops with seasonal vegetables recorded Rs. 53, 585 gross return from the allotted area (0.25 ha) and net return was Rs. 20, 447. Boundary grass, hybrid napier grass, ardusa twings, ardusa leaves (Ailanthus excels) and subabool lopping were collected from boundary plantation. The net return of Rs. 96, 438 was recorded from the boundary plantation including expected income due to increase in timber wood of Ardusa. Two buffaloes Mahesani breed yielded 1089 liter milk, 6,600 kg Vermicompost (after processing of dung), 6300 liter urine, 2200 kg shed waste which generate the net profit of Rs. 19,332. Total net profit from all the component of 1.0 ha IFS Model was Rs. 2,07,867 during the year 2016-17 (Table 7.1.1/ 43).

View of IFS model at SK Nagar

14. WESTERN DRY REGION

Crop+ Dairy is the pre-dominated farming system of western dry region of Rajasthan with 90% farm families adopting the system. Average land holding of the region ranges in between 0.48 ha (marginal farmer) to 1.44 ha (small farmer) with a family size of 7 members.

Durgapura

The IFS model of Durgapura (1.45 ha) consists of crops, livestock with two cross bred Holstein Frisian (HF) cows and a herd of 6 (5 Female +1Male) *sirohi* breed goats, a unit of 20 birds poultry belonging to Pratap Dhan breed, horticulture (0.25 ha) under drip irrigation system, out of which 0.13 has mixed orchard and in remaining part seasonal vegetables are raised. A unit of vermi-compost and compost are also established to utilize the available organic waste and excreta in to valuable manure. A small unit of mushroom was also established but its production could not be taken regularly. Production of different components of IFS Durgapura model were converted in to Pearl Millet Equivalent Yield (PEY) for comparing production potential of various components. A net return of Rs. 1,99,781 was realized from the IFS model (Table 7.1.1/44) during 2016-17.

Table 7.1.1/44. Economics of different modules of IFS model at Durgapura

Component	Gross income (Rs.)	Cost of production (Rs.)	Net profit (Rs.)
Crops	85520	42650	42870
Dairy	141356	60150	81206
Goatry	62200	30250	31950
Horticulture (fruit)	52615	16900	35715
Vegetable			
Poultry	10800	6960	3840
Vermicompost	7000	2800	4200

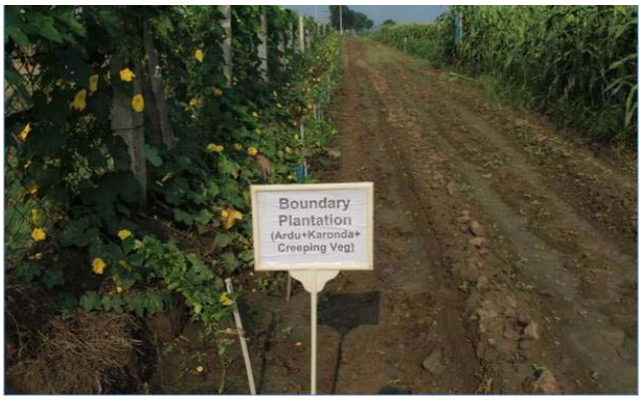
View of cropping systems under IFS model at Durgapura

Kota

Integrated Farming System Model for Small Farmers (1.0 ha) of South-Eastern Humid Plain Zone of Rajasthan developed at Kota (IFS Model) consisted of crop, dairy, vermicomposting, Kitchen gardening, mushroom unit and boundary plantation of Drumstick, Ardu, karonda and lime along with creeping vegetables. Module wise area allocation is given in Table 7.1.1/45.

Table 7.1.1/45: Area composition of IFS model at Kota

Components	Area (Sq m)	Area (%)
I. Crops/Cropping Systems	6000	60
Soybean – Wheat	1500	
Sweet Corn+Urdbean (1:1)-Coriander-Summer mungbean	1500	
Urdbean-Mustard-Cowpea (Veg+fodder)	1500	
Sorghum (f)-Makhan grass (f)	1500	
II. Two Tier Horticulture System on drip irrigation	3000	30
Guava+Veg/Flowers	2000	
Lemon+Veg/Flowers	1000	
III. Dairy*	400	4
Cow-1 (Gir)		
Buffalo-1 (Murrah)		
IV. Complementary enterprises	600	6
Vermicompost/Compost Unit	200	
Quality FYM/Biogas Unit	200	
Kitchen garden/Azolla unit/Mushroom unit	200	
V. Boundary plantation (Drumstick/Ardu/Pomegranate/Karonda/Lime/ Creeping vegetables)	On boundaries	



View of IFS model at Kota

15. ISLAND: AICRP-IFS CENTER AT PORT BLAIR (AN)

The Andaman and Nicobar group of Islands lie in the Bay of Bengal 1200 km east of main land India between 6-14^0 N latitude and 92-94^0 E longitude. Plantation crops + Pig (50 %) followed by Crop + Dairy animal cows + Fish (45 %) are two equally important and prevalent farming systems of the region. Pigs are important animal of the region and symbol of social status too. The holding size ranged in between 0.39ha (marginal farmer) to 1.38 (small farmer) with an average of 7 members in a family. An IFS model involving crops, dairy and fisheries was developed in 2011 in an area of 0.75ha for lowland or valley areas of Andamans. The area allocation for different components is given in Table 7.1.1/46.

Table 7.1.1/46: Area allocation for different components of IFS at Port Blair

Components	Area allocation (m^2)
Crop Components	6500
Rice based cropping system (Rice- Maize/pulses /oilseeds/ vegetables/fodder)	3500
Broad Bed & Furrow system (Vegetables/Flowers, Rice + Fish)	3000
Dairy, Vermicompost unit & common uses	1000
Total area	7500

The model generated system yield of 34.8 t (REY) besides gross and net income as Rs. 4,74, 565 and Rs. 2,14,402 respectively and employment generation of 365 days during 2016-17. The model is suitable for diversification of rice mono cropped areas in valley and coastal plains of Andaman Islands. Except July month, the model could it provide average income of 15,000/month and could meet 2/3rd requirement within the system. The system is sustainable and meets the nutritional requirement through crop and enterprise diversification.

IFS model for hilly land through diversification of coconut monocropped areas can be achieved by inclusion of spices, tubers, vegetables, fruits and livestock. The IFS model for hilly land generated a net income of Rs.223410 with employment generation of 198 days as against the existing 67000/ha Income is from diversified sources, except May, July, Aug it provides average income of 18,000/month; meets the 2/3rd requirement within the system.

View of IFS model at Portblair

7.2 CROPPING SYSTEMS MANAGEMENT

7.2.1 CROPPING SYSTEM DIVERSIFICATION/INTENSIFICATION

Title of the Experiment: Identification of need based cropping systems for different agro-ecosystems (**Expt**. No. 1a).

Objectives:To identify suitable cropping systems with high productivity and profitability for different agro- ecosystems.

Year of start:1990-91

Treatments: No common treatments are for all the centers; they vary from location to location. The number of cropping systems tested at each location also varies from 6 to 15. The treatments are modified after every 3-4 year. The details of treatments are given in table-7.2/1 along with experimental results.

Locations:

Ecosystem	Centre(State)
Arid	Hisar (Haryana) and S. K. Nagar (Gujarat)
Semi-arid	Durgapura (Rajasthan), Rajendranagar (A.P.), Rudrur (A.P.), Parbhani (Maharashtra), Kanpur (U.P.), Akola (Maharashtra), Ludhiana (Punjab), Indore (MP) and Kota (Rajasthan).
Sub-humid	Faizabad (U.P.), Pantnagar (Uttarakhand), Sabour (Bihar), Ranchi (Jharkhand), Jabalpur (M.P.), Powarkheda (M.P.), Kathalgere (Karnataka) and Chiplima (Orissa).
Humid	Jorhat (Assam), Palampur (HP) and R.S. Pura (J&K).
Coastal	Bhubaneshwar (Odisha), Thanjavur (T.N.), Karamana (Kerala),Navsari (Gujarat), Karjat (Maharashtra) and Maruteru (A.P.)

Results:

Data were recorded on yields, annual gross returns and annual energy output at each of the centers which have been presented in table 7.2/1. A brief description of Centre-wise results is given below.

Arid Ecosystem

Hisar: Seven cropping systems were evaluated at Hisar. Out of those, cotton-wheat-fallow system was found better than others and recorded the highest gross return of Rs. 2,18,627/ha/year followed by cluster been-broccoli-onion system with gross returns of Rs.1,66,496/ha/year. In terms of energy production, pearlmillet-wheat system was better which gave highest energy production of 28.73 K*10^6/ha/year followed by cotton-wheat-fallow cropping system (27.9 K*10^6/ha/year).

S.K. Nagar: Out of eight cropping systems evaluated, the cropping system involving bt cotton-green gram+castor-fallow–castor recorded the highest gross returns of Rs.2,40,108/ha/year followed by green gram+fannel+cauliflower-fallow (Rs 2,27,187/ha/year). Cropping system, bt cotton-green gram+castor-fallow-castor recorded the highest energy production of 23.3 K*10^6/ha/year.

Semi-Arid Ecosystem

Durgapura: Among nine cropping systems evaluated pearlmillet-wheat cropping system recorded the highest gross return of Rs. 3,56,398/ha/year followed by clusterbean-mustard cropping system (Rs. 2,01,753/ha/year). The highest energy value of 44.6 K*10^6/ha/Year was also recorded from pearlmillet-wheat system.

Table 7.2.1/1: Evaluation of alternate efficient cropping system in various ecosystems

Cropping System	Yield(kg/ha)			Total Gross Return	Total Calories
	Kharif	Rabi	Summer	(Rs/ha)	(K*10^6)
A. ARID ECO SYSTEM					
Hisar (Haryaryana)					
Pearl millet – wheat	2680	5507	—	146313	28.7
Cotton – wheat	2228	5918	—	218627	27.9
Pearl millet – barley – moonbean	2927	3210	274	92135	22.3
Clusterbean – broccoli – onion	0	2937	5422	166496	4
Mungbean – mustard + kashni	0	2387 + 121.67	—	83056	13
Pearl millet – wheat (desi) – cowpea	3060	2972	305	108055	21.5
Pearl millet + mungbean – wheat + mustard	2368 + 0.0	5150 + 157.33	—	140239	27.2
Standard Error				5081	0.6
Critical Difference(5%)				11071	1.4
S.K.Nagar (Gujarat)					
Pearlmillet-mustard -fallow	1823	1803	0	85027	16.3
GG + sunhemp (2:1) (BBF)+castor-castor continue -Green gram	405 + 6446.67 + 3913.33	0	735	201943	22.1
GG+cowpea (F) (2:1) (BBF) + castor -castor continue-sorghum (F)+ Cowpea (F) (3:1)	404 + 2876.67 + 0.0	0	0 + 2727.0	92741	3.2
GG + sunhemp (2:1) (BBF)-castor + bottlegourd -castor continue-castor + bottlegourd continue	485 + 7066.67 + 3578.67	0	2130	174818	18.8
Bt cotton + sunhemp (1:2)-castor + bittergourd-bt. Cotton + castor continue-castor + bitter gourd	1630 + 14115.0 + 2836.67	0	0	193806	20.2
Greengram-fennel + cauliflower (1:1)-fennel cont.	645	1197 + 14551.0	0	227187	12.1
Greengram-mustard + lucerne (Seed)	600	1618 + 373.0	0	150443	10.8
Bt cotton + gg+castor-castor continue-castor	2157 + 654.33 + 3180.67	0	0	240109	23.3
Standard Error				3704	0.3
Critical Difference(5%)				7946	0.5
B. SEMIARID ECOSYSTEM					
Durgapura, Jaipur (Rajasthan)					
Pearl millet-wheat	2749	5082	—	138738	27.5
Cluster bean-mustard	1114	5565	—	201753	30.5

Cropping System	Yield(kg/ha)			Total Gross Return	Total Calories
	Kharif	Rabi	Summer	(Rs/ha)	(K*10^6)
Green gram-mustard	1279	1709	—	119291	13.5
Groundnut-wheat	2945	1128	—	141244	20.6
Pearl millet-pea	1139	12869	—	356398	44.6
Pearl millet-fenugreek	1124	680	—	44418	6.3
Groundnut-chandrasur	1110	5808	—	176845	23.7
Cluster bean-pea	2939	1221	—	72768	4.9
Pearl millet-wheat	2801	1221	—	62227	14.3
Standard Error				48164	5.8
Critical Difference(5%)				99411	12
	Indore (M.P.)				
Soybean-wheat land configuration flat bed	215	3714		79857	-
Soybean-gram land configuration flat bed	276	158		19147	-
Soybean + maize (4::2)-wheat land configuration flat bed	117	3956 3904		140262	-
Soybean + maize + sesbania-gram + wheat-moong land configuration ridge & furrow	86	149 2393	130 2216	100398	-
Soybean + sorghum + sesbania-gram + mustard-cowpea + bhindi land configuration ridge & furrow	120	289 160	163 71	32798 43	-
Soybean + amaranthus-cauliflower + wheat-cowpea + maize land configuration ridge & furrow	152	3611	163 3143	110525 28	-
Soybean + maize (4:2)-pea-moong land configuration ridge & furrow	48	2708 4264	89	127495	-
Soybean + maize (4:2)-wheat + gram (1:1)-moong land configuration ridge & furrow	66	3184 3877	92 162	138064	-
Soybean + maize (1:1)-wheat + french bean (1:1)-moong land configuration ridge & furrow	23	4068 2905	80	130095	-
	Kota (Rajasthan)				
Soybean (long duration)-wheat	1149	5757	-	42921	-
Soybean (short duration)-mustard-cowpea(veg+f)	1022	2316	3044	52992	-
Soybean (s d)+red gram(2:1row)-oat(f)-Summer mungbean	349	54971 1886	855	67091	-
Rice DSR (short duration)- wheat (Desi)- summer mungbean	4018	4183	424	70646	-
Rice DSR (long duration)-berseem (f)	4107	84211	-	53323	-
Rice transplanted (l d)- wheat (ZT)	4598	5009	-	59098	-
Urdbean (BB)+DSR(F)-veg pea (BB)+coriander (F)-Spring mungbean	1009	5965 205	927 3757	59831	-
QPM Maize (Raised Bed) –fennel (Raised Bed)	3531	2140	-	57278	-

Cropping System	Yield(kg/ha)			Total Gross Return	Total Calories
	Kharif	Rabi	Summer	(Rs/ha)	(K*10^6)
Sweet corn-field pea- onion (TP)	14035	1082	4883	87872	-
Sorghum (f)-bitter gourd (Low tunnel)	55117	13406	-	127270	-
Rajendranagar (Telanangana)					
Maize – sunflower (Check)	4765	726	—	90724	20.8
Pear millet + soybean (3:2) - potato	885 + 318.0	9153	—	68264	13.4
Maize - groundnut	4920	1786	—	137179	27
Pear millet + soybean (3:2) – sunflower + groundnut (2:3)	836 + 345.0	282 + 1517.67	—	92134	14.9
Maize + soybean (2:3) – potato	3894 + 384.0	9926	—	113691	24.6
Bt cotton + soybean (1:3) – sesame + groundnut	2043 + 367.0	295 + 1430.0	—	172987	18.1
Maize (Flat) + soybean (Raised Bed) – castor (F) + green gram (RB) (2:3)	3927 + 352.0	839 + 354.33	—	61604	7
Bt cotton + greengram (1:3) - pearl millet	2085 + 285.33	1247	—	124498	12.4
Soybean - potato	1108	10341	—	83100	14.8
Bt cotton + green gram (1:2) –sesame	1905 + 212.0	403	—	114948	9.3
Pearl millet – groundnut	1135	1873	—	90804	14.7
Bt Cotton+ green gram (1:2) –maize for green cobs	1872 + 233.0	45893	—	703618	163.9
Standard Error				11875	2.6
Critical Difference(5%)				24629	5
Rudrur (Telanangana)					
Rice-rice	3875	3258	—	100575	24.7
Maize-sunflower+bengal gram	4750 + 855.0	1774	—	160275	30.3
Maize+soybean-rice	3119	3588	—	106270	25.5
Btcotton-sesamum+blackgram	4210 + 832.0	522	—	252464	19.8
Soybean-sunflower+bengal gram	1310 + 874.0	1745	—	130960	19.6
Btcotton+soybean-sesamum+groundnut	3422 + 1665.0	515	—	261207	26.3
Soybean-wheat	1375	1675	—	69250	11.7
Turmeric-sesamum	4952	632	—	165884	20.8
Maize-bengalgram	4672	1855	—	126829	22.7
Turmeric+soybean-bajra	3818	2325	—	154531	24.7

Cropping System	Yield(kg/ha)			Total Gross Return	Total Calories
	Kharif	Rabi	Summer	(Rs/ha)	(K*10^6)
Maize+soybean-tomato	3052	16520	—	220251	16.7
Turmeric+soybean-Sesamum+blackgram	3982 + 758.0	541	—	185382	22.1
Standard Error				14232	1.4
Critical Difference(5%)				29517	2.9
Parbhani (Maharastra)					
Soybean - sorghum	1832	2909	0	93310	18.1
Cotton - ground nut	2044	0	1853	166647	17.3
Soybean – wheat – cowpea(veg.)	1772	3208	6202	259095	21.7
Cotton (f) + soybean (b)- green gram (b)+ amaranthus (f) broad bed furrow at 1.5 m	1964 + 906.08	0	582 + 619.05	151321	12.7
Pigeon pea (b) + soybean (b) (in furrow sesbania) - green gram (b)+ cluster bean (f) broad bed furrow at 1.5 m	1693 + 724.87 + 4101.28	0	643 + 2154.76	168213	12.4
Maize+ soybean in furrow -sesbania (f) - chick pea (b) + wheat (f) – cowpea (residue) (b) + okra (f) broad bed furrow at 1.5 m	3750 + 740.74 + 4074.07	1351	2829 + 6824.74	283034	25.3
Pearl millet (f) + soybean (b) - chick pea (b)+ mustard (f) - cowpea(veg.) Broad bed furrow at 1.5 m	1490 + 952.38	1259	6185	237381	17
Maize (f) + soybean (b) - chick pea (b) + rabi sorghum (f)– cowpea fodder (b) + okra (f) narrow bed furrow at 90 cm	3624 + 801.59	1269	2811 + 6656.75	267260	24.1
Standard Error				5475	0.5
Critical Difference(5%)				11743	1.1
Ludhiana (Punjab)					
Rice-wheat	6285	5265	0	193924	40
Basmati rice- hayola (Transplanted) – summer moongbean (G+R)	3825	1755	1125	247494	26.5
Basmati rice- radish- spring maize	3792	26540	6275	333022	39.1
Maize- Potato- spring maize	4650	22625	6405	265261	59.8
Maize (furrow) + turmeric (Bed) - barley (Bed) + Linseed (Furrow)	3540 + 15860.0	3361 + 364.75	0	536896	80.7
Maize (furrow) + turmeric (Bed) - wheat (Bed) + linseed (Furrow)	3595 + 15985.25	3645 + 372.0	0	573055	82.7
Maize (furrow) + radish (Bed) - wheat (Bed) + linseed (Furrow) – summer moongbean	3510 + 8075.0	3560 + 348.25	1025	209399	31
Groundnut + arhar (5:1) – wheat + sarson (9:1)	1480 + 485.25	4640 + 234.75	0	167970	27.3
Maize + mash – peas (bed) + celery(furrows)	3390 + 342.0	9882 + 1028.25	0	315735	43.4

Cropping System	Yield(kg/ha)			Total Gross Return	Total Calories
	Kharif	Rabi	Summer	(Rs/ha)	(K*10^6)
Maize + arhar –gram (bed) + gobhisarson (furrows)	3285 + 870.0	1168 + 1588.0	0	138812	26.9
Maize (cobs) + vegetable cowpea + sesbania – gram+ gobhisarson	22565 + 2560.0 + 0.0	316 + 1565.0	1065	458743	91.6
Sorghum + cowpeas (fodder) - wheat + gobhi sarson	6565 5	4790 + 0.0	0 + 228.0	989049	215.2
Standard Error				10911	2
Critical Difference(5%)				22215	6.4
Kanpur (Uttarpradesh)					
Rice-wheat	4929	4237	—	154227	31.7
Hybrid rice-wheat	8072	4524	—	204283	43.6
Hybrid Rice –wheat-GG(G+R)	8244	5619	766	265752	50.5
Maize -wheat	2881	4667	—	131508	26
Maize-mustard -onion	2928	1762	12321	242592	25.7
Maize-mustard –green gram	3024	1881	860	144784	23.4
Maize+ green gram-potato+wheat	2976 + 357.25	20476 + 3190.5	—	228071	42.3
Maize+ blackgram-potato-onion	3000 + 428.5	17832	12730	302762	35.4
Maize - garlic-G.G. (G+R)	3048	6548	980	369463	23.2
Rice-wheat-okra	4762	4215	4035	203883	32.5
Standard Error				16640	2.9
Critical Difference(5%)				34145	6
Akola (Maharashtra)					
Groundnut+niger(F) - linseed + carrot - green gram+spinach (f)	1124 + 67.0	694 + 0.0	104 + 1389.0	93721	11.4
Groundnut+niger(F) - lentil + carrot - green gram +spinach (f)	1288 + 80.67	386 + 0.0	92 + 1124.0	86154	9.9
Groundnut+niger(F) - pea + carrot - green gram) +spinach (f	985 + 81.0	95 + 0.0	83 + 1010.0	61511	7.1
Groundnut+niger(F) - rajma + carrot - green gram +spinach (f)	1036 + 50.67	0 + 0.0	87 + 1578.33	66873	7.2
Groundnut+niger(F) – rajma + carrot - green gram+spinach (f)	1060 + 83.33	206 + 0.0	84 + 1136.33	69907	8
Groundnut+niger(F) - green gram+spinach (f) +	783	48	106	58128	6
carrot - green gram+spinach (f)	+ 85.67	+ 0.0	+ 1313.33		
Groundnut+niger(F) - black gram + carrot - green	846 + 69.33	22 + 0.0	94 + 1149.0	56178	6.1

Cropping System	Yield(kg/ha)			Total Gross Return	Total Calories
	Kharif	Rabi	Summer	(Rs/ha)	(K*10^6)
Groundnut+niger(F) - wheat + carrot - green gram+spinach (f)	922 + 88.0	286 + 0.0	83 + 1325.67	66252	7.6
Standard Error				8845	1.1
Critical Difference(5%)				18973	2.5
C. SUB-HUMID ECOSYSTEM					
Faizabad (Uttarpradesh)					
Rice-wheat-fallow	4620	3932	0	143782	29.6
Rice-potato-green gram	5285	21240	1262	247236	43.1
Rice-french bean-okra	4840	2434	8131	232363	20.2
Rice-mustard-black gram	5076	2251	1041	195126	33.4
Rice-berseem -berseem seed	4952	0	172	91323	17.2
Rice-gram-green fodder (maize – Jaunpuri safed+ cowpea- russian joint)	4879	2166	0	173845	24.1
Rice-lentil-sudan chari	4923	1861	0	132688	23.4
Rice-cauliflower hybrid-cowpea (Veg)	5130	13239	8480	384413	30.6
Standard Error				9528	1.2
Critical Difference(5%)				20437	2.6
Pantnagar (Uttrakhand)					
Paddy - wheat - fallow	5465	4983	0	176723	36.2
Paddy - pea veg - paddy	5313	9870	3449	361944	47.1
Paddy - pea veg - fallow	5577	10033	7067	322764	52.8
Paddy - potato - cowpea	5637	22667	15133	561682	48.8
Paddy - pea veg - maize	5523	10433	18643	249289	52.1
Paddy - mustard - cowpea	5477	1634	14956	490901	35
Paddy + sesbania - pea veg + toria - maize + mentha	3833 + 0.0	7893 + 756.67	10833 + 10633.33	575273	69.2
Soyabean + paddy - wheat + menthe - mentha	2830 + 1700.0	3800 + 0.0	11667 + 0.0	173559	31.3
Maize + cowpea - pea veg + toria - groundnut + mentha	9901 + 6304.0	7850 + 533.33	1666 + 6533.0	628985	61.1
Standard Error				5985	0.7
Critical Difference(5%)				12689	1.4
Sabour (Bihar)					
Rice-wheat	6237	4326	0	174456	36.5
Rice-maize (ZT)-mungbean-cowpea	6239	4157	760	179931	38.3
Rice-maize	6013	7118	0	179088	45.1
Rice-maize+veg. Pea (ZT)-sorghum-cowpea	6203	7415 + 4104.33	0 + 0.0	294476	59.8

Cropping System	Yield(kg/ha)			Total Gross Return	Total Calories
	Kharif	Rabi	Summer	(Rs/ha)	(K*10^6)
Rice-potato+radish-mungbean	6073	11993 + 3254.0	1332	225241	37.6
Rice-cabbage+coriander-sesamum	6233	46874 + 4522.0	1328	550036	54.7
Rice-faba bean (ZT)-okra	6112	2433	10899	286262	25.6
Rice-berseem-maize+cowpea	6095	0	0 + 415.67	95911	21.3
Ric-mustard-mungbean	6198	1866	1266	211309	35.8
Rice-chickpea+linseed-maize	6091	1209 + 666.0	6542	238023	51.3
Standard Error				13563	2.3
Critical Difference(5%)				28496	4.8
Ranchi (Jharkhand)					
Rice – wheat (F)	2252	3242	0	96595	19
Rice – mustard – green gram	2707	953	0	70078	14.5
Rice – linseed - green gram	2718	758	0	64657	13.4
Rice – potato – green gram	3068	20333	0	150014	30.3
Rice -wheat+ mustard (5:1)- green gram	2788	2505 + 201.0	0	96149	19.4
Rice – wheat + linseed (5:1)- green gram	2753	2532 + 141.33	0	94380	19
Rice- potato + wheat (1:1)- green gram	3232	21616 + 1879.0	0	196631	38.7
Standard Error				6518	1.2
Critical Difference(5%)				14202	2.7
Jabalpur (M.P.)					
Rice (Kranti)-wheat(gw-273)	5096	2744	—	126734	27.1
Rice (Kranti)chickpea (jg – 322)	5145	686	—	96555	20.3
Rice-(Danteshwari)-onion (Pusa red)-green gram (Pusa vishal)	4185	15386	706	274004	24.5
Rice-(Pusa sugandha-5)-berseem (Fodder+Seed)	3567	706	—	138482	12.5
Rice(JRH– 5)-potato (Kufri..sinduri)-sorghum fodder	4998	7517	50960	910007	202.4
Rice(JRH – 5)-gobhisarson(Teri uttam)-blackgram	5194	1733	804	149817	30.1
Rice (JRH 5)-vegetable-pea (Arkel)-sorghum fodder	5067	2621	53802	955448	207.7
Rice (JRH -5)-potato(Kufri..sinduri)-groundnut (Jyoti)	5292	6694	1960	188746	35.9
Rice (JRH -5)-gobhisarson(Teri uttam)-sorghum fodder	4949	1431	53312	939329	210.9

Cropping System	Yield(kg/ha)			Total Gross Return	Total Calories
	Kharif	Rabi	Summer	(Rs/ha)	(K*10^6)
Rice (JRH -5)-gobhisarson(Teri uttam)-okra (parbhanikranti)	5292	1547	3577	156301	27.9
Rice (JRH - 5)-frenchbean (Arkakomal)-sorghum (Mpchari) + cowpea (4:2 row)	5194	2018	39298 + 3920.0	832714	157.5
Rice (Kranti)-wheat(GW-273)	4283	5057	56350	1051275	211.7
Standard Error				18946	3.9
Critical Difference(5%)				38574	12.3
Powerkheda (M.P.)					
Soybean-wheat	461	4111	0	94202	16.2
Soybean-gram	451	1639	0	69090	7.8
Soybean-mustard-green gram	449	1722	1086	122023	14.9
Soybean-pea-onion	456	6874	18470	411040	32.9
Rice-wheat-green gram	3312	4138	1111	183355	29.5
Soybean-potato-fodder	442	26109	55967	232502	29.5
Soybean {4:2}-okra+pegionpea	476	1653	11596	33869	2.6
Rice-mustard-black gram	3271	1750	847	143913	23.7
Rice-linseed	3291	1298	0	91530	18.3
Soybean-potato-sesame	481	26178	697	182694	31.4
Standard Error				3906	0.6
Critical Difference(5%)				8014	1.2
Chiplima (Odissa)					
Rice-groundnut-fallow	3368	2262	0	138656	24.5
Rice-groundnut+sunflower-bottlegourd+ amaranthus	3202	1867 + 591.0	4511 + 1301.67	198970	26.5
Rice-groundnut+kosala-cowpea+amaranthus	3795	2278 + 1979.0	3057 + 1583.67	296683	29.1
Rice-maize+radish-lady'sfinger+amaranthus	3303	30900 + 13673.67	2781 + 1255.33	565344	120.2
Rice-knolkhol-ridgegourd	3600	41129 + 942.0	2645 + 1118.67	691825	157.6
Rice-maize+coriander-cowpea+amaranthus	3114	8054 + 1648.67	10272 + 1087.33	308488	18.6
Rice-tomato+kosala-watermelon+amaranthus	3643	9811 + 656.0	3600 + 1163.0	285028	19.3
Rice-tomato+fenugreek-cowpea+amaranthus	3105	5432 + 6581.67	5904 + 1142.33	168880	19.2
Rice-potato+radish-pumpkin+amaranthus	3714	7140 + 1435.0	1082 + 1065.67	197396	24.5
Rice-potato+kosala-greengram+amaranthus	3222	9523	3350	177331	15.8

Cropping System	Yield(kg/ha)			Total Gross Return	Total Calories
	Kharif	Rabi	Summer	(Rs/ha)	(K*10^6)
Standard Error				26052	5.5
Critical Difference(5%)				54735	11.5
Kathalagere Karnataka)					
Paddy-fallow-paddy	5458	5225	—	150626	37
Paddy-fallow-paddy	5527	5251	—	151970	37.3
Paddy-fallow-groundnut	5765	2374	—	176941	33.4
Paddy-fallow-maize	5467	5432	—	149063	37.5
Paddy-fallow-soybean	5668	2448	—	143553	30.2
Paddy-fallow-palak	5428	14205	—	246991	25.7
Paddy-fallow-finger millet	5453	3279	—	130985	29.6
Paddy-fallow-maize	5439	5451	—	148925	37.5
Standard Error				4326	0.8
Critical Difference(5%)				9279	1.8
D. HUMID ECOSYSTEM					
Jorhat (Assam)					
Winter rice – fallow – autumn rice	3417	500	2517	83660	20.5
Winter rice – toria – black gram	3100	2683	603	161506	27.3
Winter rice – potato – black gram	3033	6260	550	101073	18.5
Winter rice – oat – cowpea	3017	5933	5567	250895	35.3
Winter rice – pea (V) – cowpea	3033	7050	5067	270120	19.5
Maize+ vegetable cow pea (2:1) (BB) + dhaincha (F) - cabbage (BB)+toria F)-black gram	2850 + 7716.67	13067 + 1266.67	580	221046	23.4
Veg. Cowpea (3 rows) (BB) + rice (F)- cauliflower (BB) + toria(F)- blackgram	6467 + 3300.0	11300 + 1216.67	580	361973	30.6
Pigeon pea + black gram (2:1) (bb) + dhaincha (F) - frenchbean(BB) + toria(F) - cowpea (V)	940 + 8150.0	7090 + 1200.0	6517	430610	15.9
Green gram + sesamum (2:1) + rice (f) - chilli (BB) + toria(F) - cowpea (F)	587 + 3050.0	6267 + 1250.0	6017	408133	24
Standard Error				60928	7
Critical Difference(5%)				129168	14.9
Palampur (HP)					
Rice-wheat	3504	2642	0	102243	21.3
Rice-pea-summer squash	3551	4271	13684	268073	18.4
Okra-radish-onion	1941	11600	9849	183877	7.6
Turmeric-pea-summer squash	2462	4347	13542	335239	24.5
Rice-lettuce-potato	3409	3031	25852	286828	47.3
Rice-palak-cucumber	3173	1943	16761	285939	14.1

Cropping System	Yield(kg/ha)			Total Gross Return	Total Calories
	Kharif	Rabi	Summer	(Rs/ha)	(K*10^6)
Rice-broccoli-radish	2983	2803	11364	182211	13.5
Colocasia-pea + coriander	7292	3215 + 686.75	0	188576	11.2
Standard Error				11131	1.2
Critical Difference(5%)				23152	2.5
R.S. Pura, Chatta J&K					
Rice–wheat	2604	3542		127290	-
Rice–wheat - gm	2813	3917		140818	-
Rice–berseem–seed	3563	61667	129	158000	-
Rice–knolkhol–shimla mirch	3667	5729	3124	176083	-
Rice–pea–cowpea	3938	3979		292479	-
Rice–cauliflower–cucumber	3708	14729	4708	475415	-
Rice–barley+chickpea–green gram	3521	30417	490	243653	-
Rice–broccoli–mash	3938	7354	1021	482083	-
Rice–oat–seed	3667	37500	126	200569	-
Rice–potato- bhindi	3729	24167	4123	503854	-
Jorhat, Assam					
Winter rice – fallow – autumn rice	3417		2517	92875	-
Winter rice – toria – black gram	3100	1317	603	152253	-
Winter rice – potato – black gram	3033	4793	550	156860	-
Winter rice – oat – cowpea	3017	8833	5567	189017	-
Winter rice – pea (v) – cowpea	3033	1300	5067	237750	-
Maize+ vegetable cow pea (2:1) (BB) + dhaincha (F) - cabbage (BB)+toria (F)-black gram	2850	16250 6167 7717	580 1267	446510	-
Veg. Cowpea (3 rows) (BB) + rice (F)- cauliflower (BB) + toria(F)- blackgram	6467 3300	11300 1217	580	400533	-
Pigeon pea + black gram (2:1) (BB) + dhaincha (F) - frenchbean(BB) + toria(F) - cowpea (V)	940 600 8150	7090	6517	422290	-
Green gram + sesamum (2:1) + rice (F) - chilli (BB) + toria(F) - cowpea (V)	580 475 3050	6267 1250	6017	679067	-
E. COASTAL ECOSYSTEM					
Bhubaneswar (Odissa)					
Rice (HYV)-groundnut-fallow	3563	1665	0	117351	21.8
Rice (HYV)-groundnut+toria-bottlegourd+ amaranthus	3521	1465 + 326.0	3574 + 1152.33	166260	23.2

Cropping System	Yield(kg/ha)			Total Gross Return	Total Calories
	Kharif	Rabi	Summer	(Rs/ha)	(K*10^6)
Rice (HYB)-groundnut+kosala-cowpea+ amaranthus	3652	1931 + 1743.0	4218 + 1206.0	295849	27
Rice (HYV)-maize+radish-ladiesfinger+ amaranthus	3627	34299 + 8158.67	4729 + 969.0	614709	131.9
Rice (HYB)-maize+kosala-cowpea+amaranthus	3968	39294 + 2020.33	2919 + 721.33	710155	150.7
Rice (HYV)-tomato+radish-bittergourd+ amaranthus	3506	9435 + 7548.0	3596 + 1098.0	209463	17
Rice (HYB)-tomato+kosala-cowpea+amaranthus	4137	11033 + 1676.0	4307 + 947.67	330983	20.1
Rice (HYV)-brocolli+radish-pumpkin+amaranthus	3541	4052 + 6149.33	4418 + 883.0	269033	16.7
Rice (HYB)-brocolli+kosala-cowpea+amaranthus	3730	5772 + 1576.0	3463 + 1270.67	400012	18.5
Rice (HYV)-knolkhol+palak-cowpea+amaranthus	3352	5539 + 943.67	2742 + 979.67	190500	16.2
Standard Error				47477	8.7
Critical Difference(5%)				99748	18.3
Navsari (Gujarat)					
Rice (Jaya)-chickpea (GG-2)-fallow	4333	526	0	79501	16.9
Rice (Gurjari)-sorghum (G) (GJ-40) -sorghum ratoon (G)	3852	1669	1429	102957	24.1
Rice (Gurjari)-sweet corn (Madhuri)+ green gram under bbf planting system-green gram (Meha) (G+ R) (with zero tillage under BBFsystem)	4161	4938 + 129.0	726	171739	23.4
Rice (Gurjari)-fenugreek (Veg) -cluster bean (Veg.) (Pushanavbahar) + residue incorpo.	4241	5681	6070	387558	35.7
Rice (Gurjari)-castor (GCH-7)-castor continue (residue incorporation along with shell)	4309	1840	0	125173	23
Rice (Gurjari)-brinjal (Surtiravaiya) + radish (Japanese white) (1:1) -brinjal continue	4070	7842 + 7521.67	0	175392	17.2
Rice (Jaya)-sunnhemp(GM) (local)-groundnut (GG 2)	4424	0	1086	106126	21.5
Rice (Jaya)-cabbage (Golden acare)-green gram (G + R) (meha)	4344	10380	1040	186943	21.3
Rice (Jaya)-sweet corn(Madhuri)-groundnut (GG 2)	4401	5180	1029	178638	27.5
Rice ((Jaya)-lucerne (F)(Anandlucerne-2)-lucerne continue (seed production after third cut)	4458	29607	143	5417798	20.2
Standard Error				130052	1.2
Critical Difference(5%)				273239	2.5
Karamana (Kerala)					
Rice-rice-fallow	5259	2123	0	104084	25.5

Cropping System	Yield(kg/ha)			Total Gross Return	Total Calories
	Kharif	Rabi	Summer	(Rs/ha)	(K*10^6)
Rice + fish-rice + fish-amaranthus + fish	6222	2567	8944	284923	34.8
Rice -rice-amaranthus	4481	2253	5796	199289	26.1
Rice + fish-rice + fish-culinary melon + fish	5630	2107	19388	361132	29.3
Rice-rice-culinary melon	5593	1630	10882	243305	26.4
Rice + fish-rice + fish-fodder cowpea + fish	6593	2216	11667	141705	32.3
Rice -rice-fodder cowpea	5889	1687	23704	142371	30
Standard Error				25348	1.6
Critical Difference(5%)				55232	3.5
Thanjavour (T.N.)					
Sunnhemp-rice-blackgram (relay crop)	0	4832	875	108615	19.8
Sunnhemp-rice-sesame	0	4945	691	102202	21
Sunnhemp-rice + daincha (10:1)-maize + green gram (FIRB)	0	5293	5651 + 261.0	162165	38.5
Sunnhemp-rice + daincha (10:1) -bhendi (R&F)	0	5221	8907	189408	21.2
Sunnhemp-rice + daincha (10:1)-ragi	0	5119	2703	116773	26.6
Sunnhemp-rice + daincha (10:1)-varagu	0	5211	1781	97518	24.5
Sunnhemp-rice + daincha (10:1)-fodder cowpea	0	5354	12377	94062	20.5
Standard Error				4150	0.9
Critical Difference(5%)				9043	1.9
Karjat (Maharashtra)					
Rice-groundnut	5784	3039	—	204021	37.2
Rice- water melon	5791	20199	—	324032	29.3
Rice- sweet corn	5087	13890	—	273141	35
Rice-brinjal	5319	29295	—	411890	25.4
Rice-cabbage	5157	20566	—	221813	23.4
Rice-fodder maize	4883	57183	—	154630	26
Rice- field bean	5820	865	—	102819	20.4
Rice-dolichos bean	5892	6008	—	216447	23.3
Rice-okra	5037	12193	—	229535	21.7
Rice- bottle gourd	4981	28825	—	279221	20.7
Rice-rice	4713	5269	—	140751	34.5
Standard Error				13003	1.2
Critical Difference(5%)				27124	2.5
Maruteru (AP)					
Paddy - maize - fallow	4882	1626		79723	-
Paddy - sorghum - fallow	5120	244		67286	-

Cropping System	Yield(kg/ha)			Total Gross Return	Total Calories
	Kharif	Rabi	Summer	(Rs/ha)	(K*10^6)
Paddy - soyabean - fallow	5040	1040		96272	-
Paddy - black gram - fallow	4909	576		87307	-
Paddy - maize - fallow	4212	942		63478	-
Paddy - sorghum - fallow	4375	324		59073	-
Paddy - soyabean - fallow	4009	720		73163	-
Paddy - black gram - fallow	4722	458		79629	-
Paddy - paddy - fallow	4811	2466		90965	-

Indore: Out of nine cropping systems evaluated at Indore, soybean + maize (4::2)-wheat recorded the highest gross return of Rs. 1,40,262/ha/year closely followed by soybean + maize (4:2)-wheat + gram (1:1)-moong (rs. 1,38,064/ha/year).

Kota: Ten cropping systems were evaluated at kota out of which maize sorghum (f)-bitter gourd (low tunnel) recorded the highest gross return of Rs. 1,27,270/ha/year followed by rice DSR (short duration)- wheat (desi)- summer mungbean (rs. 70,646/ha/year).

Rajendranagar: Out of twelve cropping systems evaluated at Rajendranagar, bt cotton+green gram-maize-fallow cropping system recorded the highest gross return of Rs. 7,03,618/ha/year followed by bt cotton+soyabean-sesamum+ groundnut (Rs.1,72,986/ha/year). With regard to energy production, bt cotton+green gram-maize-fallow was found to be the best (163.9 K*10^6/ha/year).

Rudrur: Among twelve cropping systems evaluated at Rudrur, bt cotton+soyabean-sesamum+groundnut cropping system was found best in terms of gross return (Rs. 2,61,206/ha/year) followed by bt cotton-sesamum+black gram (Rs.2,52,464/ha/year). Maize-sunflower+Bengal gram attained the highest energy production (30.3 K*10^6/ha/year).

Parbhani: Among eight cropping systems evaluated maize+soybean+sesbania-chickpea-cow pea+okra found to be the best both in term of gross return (Rs. 2,83,034/ha/year) and calorific value (25.3 K*10^6/ha/year) followed by maize+soybean-chick pea-cowpea+okra (Rs. 2,67,259/ha/year).

Ludhiana: Among the twelve cropping systems evaluated at Ludhiana, sorghum+cowpea-wheat+gobhi sarson-fallow attained the highest gross returns of Rs. 9,89,048/ ha/year as well as energy value (215.2 K*10^6/ha/year) followed by maize+turmeric-wheat+linseed-fallow (5,73,055/ ha/year).

Kanpur: Out of ten cropping systems, maize-garlic-green gram system recorded highest gross returns of Rs. 3,69,462/ha/year followed by maize+black gram–potato–onion (Rs. 3,02,762/ha/year). Rice-wheat-green gram recorded the maximum clorific value of 50.5 K*10^6/ha/year.

Akola: Out of eight cropping systems evaluated at Akola, groundnut(BB)+niger(F)-linseed+carrot-green gram(BB)+spinach(F) recorded highest both gross return (Rs. 93,721/ha/year) as well as energy value (11.4 K10^6/ha/year) followed by groundnut+niger-lentil+carrot-green gram+spinach (Rs. 86,153 /ha/year).

Sub-Humid Ecosystem

Faizabad: Eight cropping systems were evaluated at Masodha; out of which rice-cauliflower-cowpea recorded highest gross return of Rs. 3,84,413/ha/year followed by rice-potato-green gram(Rs. 2,47,235/year) and the same cropping system

Rice- cabbage- green gram cropping system at Navsari

Pigeon pea (B) + Soybean (B) (in furrow Sesbania) Broad Bed Furrow at Parbhani

Cotton (F) + Soybean (B) - Broad Bed Furrow at Parbhani

recorded maximum calorific value (43.1 K*10^6/ha/year).

Pantnagar: Among nine cropping systems evaluated at pantnagar, maize+cowpea-pea+toria-groundnut+mentha recorded the highest gross return of Rs. 6,28,984/ha/year followed by rice+sesbania-pea(veg)+toria-maize+mentha (5,75,273/ha/year), which produced maximum calorific value (69.2 K*10^6/ha/year).

Sabour: Ten cropping systems were evaluated at Sabour. Out of those rice-cabbage+coriander-sesamum found the best in terms of gross return (5,50,036/ha/year) followed by rice-maize+veg pea-sorghum+cowpea (Rs.2,94,475/ha/year). Whereas with regard to energy value, rice-maize+veg pea-sorghum+cowpea proved to be the best (59.8 K*10^6/ha/year).

Ranchi: Out of seven cropping systems evaluated at Ranchi, rice-potato+wheat-green gram found the best in terms of both, gross return (Rs. 1,96,630/ha/year) and energy production (38.65 K*10^6/ha/year) followed by rice-potato-green gram both in terms of gross returns (Rs. 1,50,013/ha/year) and energy production (30.3 K*10^6/ha/year).

Jabalpur: Out of twelve cropping system evaluated, rice(basmati)-merigold-sorghum recorded the highest gross return of Rs. 10,51,275/ha/year as well as calorific value (211.7 K*10^6/ha/year) followed by rice-french bean-sorghum+cowpea (Rs. 8,32,714/ha/year).

Rewa: Out of ten cropping systems evaluated at Rewa, rice-garlic-fallow recorded the highest gross return of Rs. 3,26,756/ha/year followed by rice-berseem-berseem seed (Rs. 2,54,465/ha/year). Rice-potato-wheat followed by rice-pea (veg)-wheat recorded the highest respective calorific values (36.4 and 32.8 K*10^6/ha/year).

Powerkheda: Out of ten cropping systems evaluated at Powerkheda, soybean-pea-onion provided the highest gross return of Rs. 4,11,039/ha/year followed by soybean-potato-fodder (Rs. 2,32,501/ha/year). Whereas, energy production was maximum with soybean-pea-onion cropping system (32.85 K*10^6/ha/year) followed by soybean-potato-seamum (31.4 K*10^6/ha/year).

Chiplima: Among ten cropping system evaluated at Chiplima, rice-maize(cob)+coriander-cow pea+amaranthus recorded the maximum both gross return (Rs. 6,91,825/ha/year) as well as energy value (157.6 K*10^6/ha/year) followed by rice-maize+radish-okra+amaranthus (Rs. 5,65,343/ha/year).

Kathalgere: Out of eight cropping system evaluated at Kathalgere, Rice-spinach found the best with gross return of Rs. 2,46,990/ha/year followed by rice-groundnut (Rs. 1,76,941/ha/year). With regard to energy production rice-maize (37.5 K*10^6/ha/year) proved better than others.

Humid Ecosystem

Jorhat: Nine cropping system were evaluated at Jorhat. Out of those, pigeon pea+dhaincha-french bean+toria-cowpea recorded the highest gross return of Rs. 4,30,610/ha/year followed by green gram+ricec-hilli+toria-cowpea (Rs. 4,08,133/ha/year). Rice-oat+veg pea-cowpea recorded the highest energy value 35.3 K*10^6/ha/year.

Palampur: Among eight cropping systems evaluated at Palampur, turmeric-pea-summer squash recorded the highest gross return of Rs. 3,35,238/ha/year followed by rice-lentil-potao (Rs. 2,86,828/ha/year) with highest energy production of 47.3 K*10^6/ha/year.

R.S.Pura: Out of ten cropping systems evaluated. Rice-potato-bhindi recorded the highest gross return of Rs. 5,03,854/ha/year followed by rice-broccoli-mash (Rs. 4,82,083/ha/year).

Jorhat: Nine cropping system were evaluated at jorhat. Out of those, green gram +sesamum (2:1)+rice (F)-chilli(bb)+toria(F)-cowpea(V) recorded the highest gross return of Rs. 6,79,067/ha/year followed maize+ vegetable cow pea (2:1) (BB) + dhaincha (F) - cabbage (bb)+toria (F)-black gram (Rs. 4,46,510/ha/year).

Coastal Ecosystem

Bhubaneshwar: Ten cropping system were evaluated at Bhubaneshwar. Out of those rice-maize+kosala-cowpea+amaranthus recorded the highest gross return of Rs. 7,10,155/ha/year closely followed by rice-maize+radish-okra+amaranthus (Rs.6,14,708/ha/year). With regard to energy production, rice-maize+kosala-cowpea+amaranthus found the best with calorific value of 150.7 K*10^6/ha/year.

Navsari: Ten cropping systems were evaluated at Navsari. Rice-lucerne-lucerne provided the maximum gross returns of Rs. 5,41,780 /ha/year closely followed by rice-fenugreek-clusterbean (Rs. 3,87,558/ha/year), which also recorded the highest calorific value of 35.7 K*10^6/ha/year.

Karamana: Among seven cropping systems evaluated, rice-rice-cucumber recorded the maximum gross returns (Rs 3,61,132/ha/year) closely followed by rice-rice-amaranthus in (Rs 2,84,923/ha/year), which also recorded maximum calorific value (34.8 K*10^6/ha/year)

Thanjavur: Out of seven cropping system evaluated, green manure-rice-okra recorded the highest gross return (Rs. 1,89,407/ha/year) followed by green manure-rice-maize+green gram (Rs. 1,62,165/ha/year). Cropping system green manure-rice-finger millet recorded maximum energy production (26.6 K*10^6/ha/year).

Karjat: Among the eleven cropping systems evaluated at Karjat, rice-brinjal recorded the highest gross return of Rs. 4,11,889/ha/year followed by Rice-water melon (Rs.3,24,032/ha/year). With regard to energy production rice-groundnut (37.24 K*10^6/ha/year) followed by rice-maize (35.0 K*10^6/ha/year) proved better than other cropping systems.

Maruteru: Out of nine cropping system evaluated, rice-soybean-fallow recorded the highest gross return of rs. 96,272/ha/year followed by rice-rice-fallow (Rs 90,65/ha/year).

Maize + Soybean (2:4) at Rajenderanagar

Bt. Cotton +Soybean (BBF) at Rajenderanagar

7.3 SUSTAINABLE RESOURCE MANAGEMENT

7.3.1 INTEGRATED NUTRIENT MANAGEMENT (INM)

Title of the Experiment: Permanent plot experiment on integrated nutrient management in cereal based cropping systems (Expt. No.2a).

Objectives:

1. To develop suitable integrated nutrient supply and management system.
2. To study the long –term effect of conjunctive use of fertilizers and organic manures on the productivity of cereal based crop sequences and on soil health.

Treatments:

	Kharif	*Rabi*
T_1	No fertilizer, no organic manure(control)	No, fertilizer, no organic manure(control)
T_1	No fertilizer, no organic manure(control)	No, fertilizer, no organic manure(control)
T_2	50% rec. NPK dose through fertilizers	50% rec. NPK dose through fertilizers
T_3	50% rec. NPK dose through fertilizers	100% rec. NPK dose through fertilizers
T_4	75% rec. NPK dose through fertilizers	75% rec. NPK dose through fertilizers
T_5	100% rec. NPK dose through fertilizers	100% rec. NPK dose through fertilizers
T_6	50% rec. NPK dose through fertilizers+ 50% N through FYM	100% rec. NPK dose through fertilizers
T_7	75% rec. NPK dose through fertilizers+ 25% N through FYM	75% rec. NPK dose through fertilizers
T_8	50% rec. NPK dose through fertilizers+ 50% N through straw	100% rec. NPK dose through fertilizers
T_9	75% rec. NPK dose through fertilizers+ 25% N through straw	75% rec. NPK dose through fertilizers
T_{10}	50% rec. NPK dose through fertilizers+ 50 N through GM	100% rec. NPK dose through fertilizes
T_{11}	75% rec. NPK dose through fertilizers+ 25% N through GM	75% rec. NPK dose through fertilizers
T_{12}	Farmer's conservational practice	Farmer's conservational practice

(FYM=Farm Yard Manure and GM=Green manure)

Locations:

Cropping System	Ecosystem/ Centre (State)
Rice-Rice	**Coastal:** Maruteru (A.P.), Karjat (Maharashtra)
Rice-Wheat	**Semi-arid:** Ludhiana (Punjab), Kanpur(U.P.)
	Sub-humid: Varanasi (U.P.), Sabour (Bihar), Raipur (Chhattisgarh), Jorhat, Palampur.
Maize- wheat	**Sub-humid:** Ranchi (Jharkhand)
Pearl millet-wheat	**Arid:** Hisar (Haryana), **Semi-arid:** Bichpuri (UP)
Sorghum - wheat	**Semi-arid:** Parbhani (Maharahstra), Rahuri (Maharashtra)

Year of start, crop varieties and fertilizers doses

The centre-wise details in respect of year of start, crop varieties and fertilizer doses are given hereunder

Centre	Year of start	Crop variety		Recommended fertilizer doses ($N:P_2O_5:K_2O$ kg ha^{-1})		Farmers' practice ($N:P_2O_5:K_2$) kg ha^{-1})+ FYM, t ha^{-1}	
		Kharif	*Rabi*	*Kharif*	*Rabi*	*Kharif*	*Rabi*
Rice-rice cropping system							
Maruteru	1989	MTU-1075	MTU-1010	90:60:60	180:90:60	120:60:40	220:100:40
Karjat	2007	Palghar-1	Karjat-3	100:50:50	120:50:50	45:45:45	90:45:45
Jorhat	1987	Rajani	Disang	45:30:40	45:30:40	12.5:0:0	12.5:0:0 FYM 1 ton
Rice-wheat cropping system							
Ludhiana	1983	PR-121	HD2967	120:30:30	120:60:30	180:30:30	150:60:30
Kanpur	1983	Pant-12	DBW-17	120:60:60	120:60:60	80:30:0	80:30:0
Palampur	1985	Arize-6129	HPW-155	90:40:40	120:60:40	36:16:16	48:24:24
Varansi	1985	HUR-105	HUW-234	120:60:60	120:60:60	80:30:20	80:30:20
Sabour	1984	Sita	PBW-343	80:40:20	100:50:25	70:30:10	80:30:15
Raipur	1988	Mahamaya	GW-273	80:60:40	100:50:30	60:30:20	90:40:20
Maize-wheat cropping system							
Ranchi		Suwan	K-9107	100:50:25	100:50:25	23:0:0	23:0:0
Pearl millet-Wheat Cropping System							
Hisar	1985	HHB-197	WH-711	155:62.5:0	150:60:0	140:45:0	145:50:0
Bichpuri	1990	Bioseed-8510	UP-2338	80:40:40	120:60:40	40:0:0	40:0:0
Sorghum-wheat cropping system							
Rahuri	1984	CSH-9	DH-2189	120:60:60	120:60:60	40-20-20	60-30-30
Parbhani	1983	CHS-16	NIAW-301	80:40:40	100:50:50	60:20:20	60:30:30

Results:

Rice-rice cropping system

At Muruteru, the highest yield of rice was recorded under T_7 (4861 kg/ha) during kharif, where as maximum yield of rabi rice (6185 kg/ha) was recorded under T8. Maximum yields attained under kharif and rabi rices were 12.1 and 0.01 percent higher over T5.

At Karjat in rice-rice system application of recommended doses of fertilizers recorded the highest yields of rice in both the seasons followed

Table7.3/1(a): Grain yield(kg/ha) of rice–rice crop sequence under different integrated nutrient management treatments 2015-16

Treatments	Karjat		Maruteru		Jorhat	
	Kharif	Rabi	Kharif	Rabi	Kharif	Rabi
T - 1	3251	3648	3061	3136	2000	1725
T - 2	5101	4714	3968	5081	2800	2100
T - 3	5142	4818	3940	5579	3180	3075
T - 4	5179	5054	4195	5836	3408	3000
T - 5	5577	5877	4337	6127	4350	3675

Treatments	Karjat		Maruteru		Jorhat	
	Kharif	Rabi	Kharif	Rabi	Kharif	Rabi
T - 6	5533	5811	4167	6156	4100	3100
T - 7	5410	5602	4861	5778	3600	2625
T - 8	5205	5206	4252	6185	3950	3200
T - 9	5238	5310	4649	5981	4500	3500
T - 10	5515	5652	4365	6010	3760	2950
T - 11	5370	5501	4167	5865	3470	2200
T - 12	4161	4505	3859	5633	2670	1950
S.E.	**80**	**116**	**419**	**161**	**560**	**484**
C.D.(5%)	**163**	**237**	**869**	**333**	**1139**	**984**

by T_6 (5%recommended NPK through fertilizers and remaining 50% N through FYM in Kharif and 10% recommended doses of NP through fertilizers.

At Jorhat the highest yield of kharif (4500 kg/ha) and rabi (3675 kg/ha) rices were recorded under T9 and T5 treatments which were higher to the tune of 3..44 over T5.

Rice-wheat cropping system

At Ludhiana, the highest yield of rice was recorded under T_{11} (7225 kg/ha), and in wheat T_{12} gave the maximum yield (5525 kg/ha) which was 10.22 and 7.03 per cent higher over recommended dose of fertilizers (T_5).

At Kanpur, the highest yield of rice (4700 kg/ha) and wheat 4694 kg/ha) was recorded under T6. These yields were higher to the tune of 2.30 and 2.87 percent respectively over T5 (recommended doses of fertilizers).

At Varanasi, in rice –wheat cropping system, the treatment $T-_6$ gave maximum yield of rice (5200 kg/ha) and wheat (3185 kg/ha) which was 11.82 and 12.15 per cent higher over recommended dose of fertilizers (T_5). The yield under highest yielding

Table7.3/1(b): Grain yield (kg/ha) of rice–wheat crop sequence under different integrated nutrient management treatments 2015-16.

Treatments	Palampur		Ludhiana		Varanasi		Kanpur		Sabour		Raipur	
	Kharif	Rabi	Kharif	Rabi	Kharif	Rabi	Kharif	Rabi	Kharif	Rabi	Kharif	Rabi
T - 1	1764	1092	1475	1588	2363	960	869	563	906	751	1281	580
T - 2	2520	1052	3670	3820	3820	2135	3156	3119	2702	1952	4167	1647
T - 3	3327	2006	3812	4855	4478	2710	3538	3550	2743	3558	4500	2646
T - 4	3276	757	4585	4320	4590	2810	3569	3482	3542	2932	5115	2539
T - 5	2789	1279	6555	5162	4650	2840	4594	4563	4875	3855	6240	3348
T - 6	2915	1476	6790	5490	5200	3185	4700	4694	5615	4410	5609	3118
T - 7	3276	836	6910	5375	4950	2915	4350	4438	5210	4000	5573	2567
T - 8	2730	1318	5865	4705	4520	2995	4144	4319	5442	4096	5355	2992
T - 9	2352	1397	5980	4560	4800	2990	4175	4250	4927	3928	5677	2540
T - 10	3461	1593	7060	5280	4430	2905	4463	4500	5506	4305	6125	3146
T - 11	2940	1662	7225	5165	4663	2600	4313	4425	5185	3976	5771	2690
T - 12	2865	1288	7208	5525	4200	2355	2813	2788	3248	2522	3917	1730
S.E.	**419.3**	**322.3**	**145.2**	**334.8**	**175.5**	**145.5**	**44.4**	**49.3**	**266.7**	**207.5**	**343.6**	**129.0**
C.D.(5%)	**853.1**	**655.7**	**298.5**	**688.3**	**357.1**	**296.0**	**90.4**	**100.3**	**542.7**	**422.1**	**712.7**	**267.5**

treatment during kharif T_6 was at par with T_7 whereas during rabi T_6 treatment was at par with T_7 to T_{10}.

At Sabour, the rice and wheat yield were recorded maximum under T_6 which were to the tune of 5615 and 4410 kg/ha. These yields were 15.18 and 14.39 % higher over T_5.

At Palampur, the rice yield was maximum (3461 kg/ha) under T_{10} and the maximum yield of wheat (2006 kg/ha) was recorded under T_3. The yield of rice and wheat were higher to the tune of 19.29 and 56.84 percent respectively over T_5.

At Raipur (Chhattisgarh) in rice-wheat cropping system maximum yield of rice attained in T_5 which was to the tune of 6240 kg/ha and 3348 kg/ha, in kharif and rabi respectively.

Maize-wheat cropping system

At Ranchi, the maize yield was maximum (3320 kg/ha) under T_7 which was 0 .42 percent higher than recommended dose of fertilizer and the maximum yield of wheat (4257 kg/ha) was also under T_6 which was 14.73 percent higher than recommended dose of fertilizer.

Table7.3/1(c): Grain yield (kg ha^{-1}) of maize–wheat crop sequence under different integrated nutrient management treatments

Treatment	Ranchi	
	Kharif	*Rabi*
T - 1	1178	900
T - 2	1875	2833
T - 3	2052	3307
T - 4	2418	3208
T - 5	3306	3726
T - 6	4201	4257
T - 7	3320	3934
T - 8	2950	3508
T - 9	2732	3392
T - 10	2761	3453
T - 11	2635	3067
T - 12	1182	1567
S.E.(d)	**319**	**267**
C.D.(5%)	**661**	**553**

Pearl millet-wheat cropping system

At Bichpuri, in pearlmillet-wheat cropping system, the treatment T6 proved the maximum frain yield of pearlmitel (2910 kg/ha) where as highest wheat yield of 5211 kg/ha was recorded with T10 maximum yields attained of pearlmillet and wheat were 11.70 and 14.0 percent higher over T5 respectively.

At Hisar (Haryana) highest yields of pearlmillet (2998 kg/ha) and wheat (5736 kg/ha) were recorded under T6 which were higher to the tune of 4.24 and 2.0 percent respectively over T5.

Table7.3/1(e): Grain yield (kg/ha) of pearlmillet–wheat crop sequence under different integrated nutrient management treatments

Treatments	Bichpuri		Hisar	
	Kharif	Rabi	Kharif	Rabi
T - 1	1101	1091	931	1017
T - 2	1506	2891	1656	3714
T - 3	1690	4106	1870	4684
T - 4	2000	4012	2325	4740
T - 5	2605	4571	2876	5624
T - 6	2910	5191	2998	5736
T - 7	2610	4420	2600	5068
T - 8	2402	4701	2703	5444
T - 9	2100	4220	2343	4758
T - 10	2741	5211	2730	5560
T - 11	2471	4400	2519	4770
T - 12	1610	3111	2681	5206
S.E.	**73**	**122**	**65**	**168**
C.D.(5%)	**149**	**249**	**132**	**342**

Sorghum-wheat cropping system

At Parbhani (Maharashtra) in sorghum-wheat cropping system highest yield of sorghum (2498 kg/ha) and wheat (2460 kg/ha) were recorded under T6 followed by T5 treatment. Yields recorded under T6 treatments were 7.57 and 3.18 percent higher over T5 respectively.

At Rahuri treatment T6 recorded the highest yields of sorghum (3827 kg/ha) and wheat (4245 kg/ha). These yields were 14.30 and 10.66 percent higher respectively over T5.

Table7.3/1(f): Grain yield (kg/ha) of Sorghum–wheat crop sequence under different integrated nutrient management treatments

Treatments	Rahuri		Parbhani	
	Kharif	Rabi	Kharif	Rabi
T - 1	121	345	242	318
T - 2	2283	3049	1690	1638
T - 3	2681	3412	1700	1861
T - 4	2981	3072	1985	1937
T - 5	3348	3836	2322	2384
T - 6	3827	4245	2498	2460
T - 7	3564	3654	2170	2198
T - 8	3163	3377	2037	1975
T - 9	2860	3622	1743	1781
T - 10	3442	3843	2298	2365
T - 11	3298	3710	1633	1681
T - 12	1128	2215	1458	1586
S.E.	**261**	**337**	**84**	**95**
C.D.(5%)	**530**	**685**	**172**	**195**

INM in Maize-wheat cropping system at Ranchi

Experimental view of INM at Karjat

7.3.2 DEVELOPMENT OF ORGANIC FARMING PACKAGE

Title of the experiment: Development of organic farming packages in system based high value crops

Objectives

I. To develop organic nutrient management packages for system-based high value crops

II. To recycle farm waste to value added compost

II. To monitor soil health and crop quality and also to develop holistic approach for nutrient, pest and disease management as well as moisture conservation

Year of start: 2003-04

Treatments

T_1: 50% recommended NPK + Zn + S as per soil test + 50% N as FYM

T_2: 100% organic nutrient sources as FYM, vermicompost and neem oil cake each equivalent to 1/3 of recommended N dose of crops

T_3: T2 + intercropping/trap cropping

T_4: T2 + agronomic practices for weed and pest control

T_5: 50% N as FYM + seed treatment with Azotobacter and PSB + Rock phosphate

T_6: T2 + Azospirillum and phosphate solubilizing bacteria (PSB)

T_7: 100% NPK + Zn + S based on soil test

T_8: Dummy Plot

Results

I. Rice based cropping system

Chata

At chata centre, in rice-potato-onion/ frenchbean system, the highest yield of rice (2.70 t ha^{-1}) and potato (11.14 t ha^{-1}) was recorded under treatment T3 and T6 during kharif and rabi seasons, respectively. The yield increase in these crops over RDF was 1.5% and 18.6%, respectively. During summer season onion was replaced by frenchbean and the highest yield (3.84 t ha^{-1}) was recorded under treatment T_6 receiving 100% organic nutrient sources plus bioferilizers. However, as the yield performances of treatments over the years are concerned, the mean yield for rice, potato and frenchbean were highest under T_2, T_6 and T_2 during kharif, rabi and summer seasons, respectively.

Jorhat

At Jorhat, in rice-toria-blackgram system, highest grain yield of rice was recorded under T_3 at 3.94 t ha^{-1}. During rabi season highest yield of toria was recorded under T_4 at 1.20 t ha^{-1}. Percent increase in crop yield under these two treatments, were 83.2% and 222.6%, respectively over T_7. However, during summer season, highest grain yield of blackgram was also recorded under T_3 at 1.27 t ha^{-1} being 157.6% more as compared with RDF under T_7. The mean yield performances of treatments over the years for rice and toria were highest under T_3, while blackgram yielded highest under T_4 during kharif, rabi and summer seasons, respectively.

Kalyani

At Kalyani, in paddy-potato-groundnut system, highest grain yield of paddy (1.99 t ha^{-1}) was recorded under T_1 while highest potato yield (15.93 t ha^{-1}) was recorded under T_7 and highest groundnut yield (1.68 t ha^{-1}) was also found under T_7 with recommended dose of fertilizers on soil test basis. However, the mean yield performances of treatments over the years for paddy, potato and groundnut were highest under T_1, T_7 and T_7 during kharif, rabi and summer seasons, respectively.

Table7.3.2.a: Effect of organic nutrient management packages on crop yields (kg/ha) in rice based cropping system 2015-16

Treatment	Crop season	Chatta Rice-Potato-Onion / Frenchbean	Jorhat Rice-Toria-Blackgram	Maruteru Rice-Rice	Rewa Rice-Wheat+Mustard-Fallow	Kalyani Paddy-Potato-Groundnut
T1	Kharif	2561	2332	4681	3485	1998
	Rabi	9313	618	5292	3355	13416
	Summer	3450	478	-	-	1587
T2	Kharif	2698	2371	4170	2699	1626
	Rabi	10426	618	4027	2010	10589
	Summer	3741	495	-	-	1305
T3	Kharif	2702	3943	4090	3003	1767
	Rabi	10650	1200+650*	4050	1787+253*	7422+2333*
	Summer	3755	1275+1000**	-	-	945+1125***
T4	Kharif	1859	2373	3934	2924	1733
	Rabi	10768	544	3881	2065	10231
	Summer	3660	549	-	-	1564
T5	Kharif	2612	2076	3871	2874	1712
	Rabi	9229	429	3878	1863	9542
	Summer	3039	465	-	-	1439
T6	Kharif	2613	2042	4076	3022	1640
	Rabi	11138	466	4130	2045	10997
	Summer	3842	439	-	-	1534
T7	Kharif	2662	2152	4665	3583	1569
	Rabi	9393	372	4979	3981	15929
	Summer	3395	495	-	-	1681
T8	Kharif	2338	2332	4203	2202	1324
	Rabi	5276	618	4482	1509	8102
	Summer	1463	478	-	-	1091

Maruteru

In rice-rice system at Maruteru, highest rice yield during kharif and rabi season were recorded at 4.68 t h^{-1} and 5.29 t ha^{-1} under the treatment T_1 and this treatment was also found superior over all the rest of the treatments with the average yield of 4.03 t ha^{-1} and 5.05 t ha^{-1} obtained during both the seasons while other treatments were almost at par in respect of average yield which was around 4.0 t ha^{-1}. The mean yield performance of treatments over the years was also highest under T_7 and T_1 during kharif and rabi seasons, respectively. The yield during both the seasons was also found remarkably superior under RDF compared to rest of the treatments to the tune of 4.66 t ha^{-1} and 4.98 t ha^{-1}, respectively.

Rewa

At Rewa, in rice-wheat+mustard-fallow system the highest yield of rice (3.58 t ha^{-1}) was recorded under recommended doses of fertilizers (T_7) followed by 3.48 t ha^{-1} under integrated nutrient management (T_1). The reduction under INM compared to RDF was 2.73%. The yield of wheat under other organic nutrients management packages were almost at par. Similarly, the yield of wheat during rabi also followed the similar pattern producing 3.98 t $ha^{-1}$and 3.35 t ha^{-1} under T_7 and T_1 treatments, respectively. However, as the mean yield performances of treatments over the years are concerned, the mean rice and wheat yields were highest under T_7 (RDF) during kharif and rabi seasons, respectively.

II. Maize based cropping system

Kumarganj

In maize-wheat-onion system at Kumarganj, the highest yield of all the crops in the system viz, maize, wheat and onion was recorded highest at 3.06 t ha^{-1}, 4.61 t ha^{-1} and 2.46 t ha^{-1}, respectively under the treatment T_4 with 100% organic nutrient sources (Table…). As per mean crop yields over the years maize yield was highest under T_4 whereas wheat and onion yielded highest under T_2 and T_6, respectively.

Table7.3.2.b: Effect of organic nutrient management packages on crop yields (kg ha) in Maize based cropping system 2015-16

Treatment	Crop season	Kumarganj
		Maize-wheat-Onion
T1	Kharif	3005
	Rabi	4593
	Summer	2271
T2	Kharif	2767
	Rabi	4579
	Summer	2296
T3	Kharif	2646
	Rabi	1260+415*
	Summer	960+690**
T4	Kharif	3060
	Rabi	4606
	Summer	2459
T5	Kharif	2276
	Rabi	3824
	Summer	1944
T6	Kharif	2753
	Rabi	4177
	Summer	2327
T7	Kharif	2951
	Rabi	4373
	Summer	2357
T8	Kharif	1591
	Rabi	3566
	Summer	1836

III. Miscellaneous cropping system

Parbhani

At Parbhani, in soybean-onion-fallow system, highest yield of soybean (2.67 t ha^{-1}) and onion (19.38 t ha^{-1}) was recorded under recommended dose of fertilizer (T_7) followed by integrated nutrient management (T_1) with yield levels of 2.39 and 17.86 t ha^{-1} for soybean and onion, respectively. Among organic nutrient management packages, the treatment T_4 proved better over others producing soybean (2.32 t ha^{-1}) and onion (14.49 t ha^{-1}), respectively. As the mean performance of treatments over the years are concerned, T_7 proved superior to all with soybean and onion yields at 2.67 and 23.0 t ha^{-1}, respectively. The performance of IPNS (T_1) was superior over organic nutrient management packages. Among organic nutrient management packages T_6 proved better with kharif and rabi crop yield at 2.30 and 15.21 t ha^{-1} at yield reduction to the tune of 13.9% and 21.5% over RDF.

Rahuri

At Rahuri, in soybean-onion-fallow system highest yield of soybean (3.66 t ha^{-1}) and onion (29.4 t ha^{-1}) was recorded under 100% organic nutrient sources including bio-fertilizers (T_6) followed by highest yield of soybean (3.43 t ha^{-1}) and onion (28.01 t ha^{-1}) under T_4. The integrated nutrient management package (T_1) was inferior to organic packages including RDF (T_7) except T_5 with yield reduction of about 23% and 14% in both the crops respectively compared to T_6.

Bichpuri

At Bichpuri, in clusterbean-potato-onion system the highest yield of clusterbean (6.64 t ha^{-1}) and onion (6.84 t ha^{-1}) was recorded under integrated nutrient management T_1 and T7 (RDF), respectively. While the highest yield of potato (30.62 t ha^{-1}) was recorded under T_3 with 100% organic

Table7.3.2.c : Effect of organic nutrient management packages on crop yields (kg ha) in miscellaneous crop based cropping system 2015-16

Treatment	Crop season	Bichpuri	Prabhani	Rahuri
		Clusterbean -Potato-Onion	Soyabean-Onion-Fallow	Soyabean-Onion-Fallow
T1	Kharif	6642	2387	2816
	Rabi	23327	17860	25342
	Summer	6649	-	-
T2	Kharif	6310	1955	3169
	Rabi	20130	13333	26354
	Summer	6334	-	-
T3	Kharif	5922	2181	3318
	Rabi	30620+2040	14342	26823
	Summer	6180	-	-
T4	Kharif	6428	2325	3430
	Rabi	22563	14486	28013
	Summer	6445	-	-
T5	Kharif	6006	1790	2229
	Rabi	20242	11831	19687
	Summer	5528	-	-
T6	Kharif	6006	2304	3663
	Rabi	20769	15206	29400
	Summer	6488	-	-
T7	Kharif	6561	2675	3177
	Rabi	21796	19383	27287
	Summer	6837	-	-
T8	Kharif	5989	2084	750
	Rabi	12763	13295	7061
	Summer	5732	-	-

nutrient sources. The recommended doses of fertilizers (T_7) was found superior as compared to organic nutrient management treatment packages for all the crops in the sequence. The mean yield performance over the year for integrated nutrient management (T_1) was also found superior with yield level of 6.64 t ha^{-1}, 23.33 t ha^{-1} and 6.65 t ha^{-1} for clusterbean, potato and onion, respectively.

Onion crop in Organic Farming at Parbhani

Rice-rice cropping system at Maruteru in Organic Farming experiment

7.4 ON-FARM RESEARCH

7.4.1 ON-FARM CROP RESPONSE TO APPLICATION OF NUTRIENTS IN PRE-DOMINANT CROPPING SYSTEMS

Title of the experiment: On-farm crop response to application of major plant nutrients in predominant cropping system

Objective: To assess the response of major crops to application of N, P, K and soil test based micro nutrients at recommended rates in pre-dominant cropping systems in different agro-ecosystem under farmer's field condition.

Year of start: 1999-2000, Treatments are modified in 2010-2011.

Treatments: There are five common treatments at various locations. They are ($N_0P_0k_0$), N, N+P, N+K and N+P+K and all the nutrients are applied as per the recommended rates of crops/cropping systems evaluated at particular location. Two treatments namely, N+P+K+ application of deficient micronutrient based on soil test and farmer's practice were added during 2010-2011.

Locations:

Cropping system	OFR Centre (State)	No. of trials
Rice-rice	Thiruvalla (Kerala), Paiyur & Chettinad (T.N.), Palghar (Maharashtra), Kamrup (Assam), Seethempeta (Andhra Pradesh), Warangal (Telangana)	156
Rice-chickpea	Kawardha (C.G.)	23
Rice-green gram	Kendrapara (Orissa), Kakdwip (W.B.)	48
Rice-groundnut	Angul (Orissa), Paiyur (T.N.)	36
Rice-maize	Purnea (Bihar), Derol (Gujarat)	35
Rice-wheat	Dindori & Katni (M.P.), Ambedkarnagar, Kanpur Dehat (U.P.), Jeolikote (U.K.), Dhainsar (J.K.), Amritsar (Punjab), Pakur (Jharkhand)	152
Maize-wheat	Kangra (H.P.), Udaipur (R.J.), Dhainsar (J.K.)	60
Maize-maize	Derol (Gujarat)	12
Maize-chickpea	Gadag (Karnatka), Aurangabad (M.H.)	35
Soybean-wheat	Amravati (Maharashtra)	12
Soybean-chickpea	Amravati (Maharashtra)	12
Soybean-onion	Pune (Maharashtra)	24
Cotton-wheat	Jagudan (Gujarat), Sirsa (Haryana)	48
Groundnut-sorghum	Gadag (Karnatka)	12
Fingermillet-tomato	Kolar (Karnataka)	5
Cabbage - tomato	Kolar (Karnataka)	5
Clusterbean-wheat	Sikar (Rajasthan)	24
Total		**699**

Results: The centre-wise details of varieties, nutrients used, crop yield and crop response to NPK application in terms yield difference, are presented in Table 7.4.1. Brief descriptions of system wise result are given below.

Rice-rice: A total of 156 trials were conducted at 6 locations compromising of 7 NARP zones (North Konkan Coastal- Karjat, High altitude tribal – Seethempeta, Central Telangana -Warangal, Problem Areas-Thiruvalla, North Western- Paiyur, Southern -Chettinad and Lower Brahmaputra Valley-Kamrup). At all the locations excluding Central telangana, north western and southern zone, significantly higher yields of rice were obtained in both the seasons due to application of NPK + Zn over recommended fertilizer (NPK only). Across the locations on an average of two growing seasons the highest increase (63.7%) in the yield of rice was found in high altitude tribal area zone of Andhra Pradesh under the NPK + Zn application compared to application of NPK alone. The highest increase in the yield of rice in both the seasons (96.5 % in *kharif* and 87.8% in *rabi*) was realized in lower brahmaputra valley (Kamrup) in Assam due to combined application of NPK + Zn compared to the farmers practice. On an average, application of Zn along with recommended dose of fertilizer (NPK) recorded additional yield (421 kg/season/ha) than NPK alone. Similarly, yield gap between recommended fertilizer and control was found to be 2164 kg/ha/season while the same was found to be 116 kg /ha /season between recommended fertilizer and farmers practice.

Rice-wheat: A total 152 trials were conducted at 8 locations compromising of 8 NARP zones. Under this Jharkhand, Madhya Pradesh, Uttar Pradesh, Uttarakhand, Punjab and Jammu Kashmir states have been covered. Almost at all the NARP zones significant increase in yield of both rice and wheat crop was found due to application of Zn in addition to NPK only. Application of micro nutrient resulted in additional yield of 629 kg/ha/season in rice-wheat cropping system. Across the locations application of Zn to both crops has improved the grain yield. The yield gap between recommended fertilizer and control was found to be 2512 kg/ha/season while the same was of 975 kg/ha/season between recommended fertilizer and farmers practice.

Rice-green gram: A total 48 trials were conducted in two NARP zones. In Coastal saline Zone (West Bengal) and East& South Eastern Coastal Plain zone (Kendrapara) of Orissa, it was found that significantly higher additional yield of 277 and 138 kg ha^{-1} respectively can be obtained from rice through application of 80:40:40: Kg NPK + 25 kg zinc ha^{-1} than application of NPK alone. In green gram, the additional yield over farmer practice was found to be 239 kg ha^{-1}due to application of 20:40:20: Kg NPK ha^{-1} at Orissa. Application of zinc as micronutrient in rice and sulphur in green gram did not give significantly higher yield over NPK alone at both locations.

Rice-groundnut: A total 36 trials were conducted in two NARP zones. Significantly higher yield of rice and groundnut was observed due to addition of gypsum and boron @ 10 kg ha^{-1} to these crops respectively in North Western Zone (Paiyur) of TN resulted in higher yield. At Mid-Central Table Land Zone (Angul) Orissa in application of zinc @ 25 kg ha^{-1} in rice and Gypsum @ 250 kg ha^{-1} in groundnut along with RDF recorded 1126 kg/ha and 326 kg/ha as additional yield over the farmer practice.

Rice-chickpea: A total of 23 trials were conducted in CG Plain Zone (Kawardha) of Chhattisgarh. It was found that significantly higher additional yield of 1357 kg ha^{-1} and 3166 kg ha^{-1} can be obtained from rice through application of 100:60:40: Kg NPK + 20 kg zinc ha^{-1} as compared to farmers practice and control treatments respectively. In gram, the additional yield over farmer practice was found to be 325 kg ha^{-1} due to application of 20:50:20: Kg NPK ha^{-1} which was around 26.9% higher.

Rice-maize: In total 35 trials were conducted under rice-maize cropping system at two NARP zones *viz.,*North East Alluvial Plain Zone (Purnea) and Middle Gujarat Zone (Anand). At Purnea application of 100:40:20 Kg NPK ha^{-1} for rice gave additional yield of 2426 kg ha^{-1} and 932 kg ha^{-1} over the control and farmer practice respectively. In the similar way at the same NARP zone application of 120:75:50

Kg NPK ha^{-1} to maize gave an additional yield of 5704 kg ha^{-1} and 2270 kg ha^{-1} over the control and farmer's practice respectively which were 113 % and 25.7% higher over the control and farmer practice respectively. At Anand (Gujarat) in rice crop application of NPK along with micronutrients recorded 18 % yield increase over farmers practice and 71.4 % yield increase over control. Likewise in maize crop same treatment recorded around 105 % and 25.1 % yield increase over control and farmers practice, respectively.

Maize-wheat: A total of 60 trials were conducted at 3 NARP zones *viz.,* Kangra (H.P.), Udaipur (R.J.) and Dhainsar (J.K.). At all the 3 locations over the farmers practice application of RDF along with Zinc recorded significantly higher yield. In maize, highest increase was noticed in Kangra while for wheat the highest yield increase were noticed at Sub-Humid Southern Plain and Aravalli Hill Zone (Udaipur). Similarly at Sub-mountain and low hills sub-tropical zone (Kangra) of Himachal Pradesh due to application of Zinc, an additional yield of 165 and 192 kg ha^{-1} for maize and wheat respectively were obtained over the farmers practice. At Udaipur (Rajasthan) application of recommended dose of fertilizer in maize and wheat recorded 197% and 33% higher yield of both the crops over control. Lower increase in yield of maize and wheat (709 and 594 kg ha^{-1}, respectively) were recorded under the farmer's practices of nutrient management as compared to application of recommended quantity of NPK at Sub-Tropical Zone (Dhainser) of Jammu & Kashmir.

Maize-maize: At Derol (Gujarat) total of 12 trials was conducted involving maize-maize system. Yield difference between farmers and recommended NPK application practices were found to be 263 kg ha^{-1} in *kharif* maize and 378 kg ha^{-1} in *rabi* maize. Application of micronutrient zinc @ 25 kg ha^{-1} to maize in both the seasons resulted in additional yield of 85 and 25 kg ha^{-1} *kharif* and *rabi* respectively.

Maize-chickpea: At Gadag (Karnataka) and Aurangabad (MH), a total of 35 trials was conducted involving maize-gram cropping system. In Northern dry zone (Gadag) of Karnataka, yield difference between farmers and recommended NPK application practices were found to be 578 kg ha^{-1} in Maize and 120 kg ha^{-1} in gram. Application of micronutrient zinc @ 25 kg ha^{-1} to maize and @ 15 kg ha^{-1} in gram resulted in significantly higher yield (316 and 115 kg ha^{-1} for maize and wheat, respectively) than RDF. At Aurangabad application of 150:75:75 Kg NPK ha^{-1} in maize and 25:50:0 kg NPK in gram gave 40.9% and 43.8% higher yield over the farmer practice.

Soybean-wheat: Involving soybean-wheat cropping system a total of 12 trials were conducted in Western Vidarbha Zone (Amravati) of Maharashtra. The results of trials indicated that farmer's nutrient management practice resulted in lower yield (174 and 641 kg ha^{-1} of soybean and wheat respectively) compared to application of recommended quantity of NPK. Similarly for both of the crops the highest yield was found with treatment NPK + micronutrient application.

Soybean-chickpea: A total of 12 trials were conducted in Western Vidarbha Zone (Amravati) of Maharashtra. It was observed that there was huge yield gap between farmer's practices and recommended nutrient application which gave (additional yield of 320 and 451 kg ha^{-1}) in soybean and chickpea respectively as compared to farmer practices.

Soybean-onion: A total 24 trials were conducted in Western Maharashtra Plain Zone (Pune) of Maharashtra. It was observed that there was yield gap between farmer's practices and recommended nutrient application which gave additional yield of 459 and 4241 kg ha^{-1} in soybean and onion respectively as compared to farmer practices.

Cotton-wheat: A total 48 trials were conducted in 2 NARP zones. In Western Zone (Sirsa) of Haryana application of recommended dose of fertilizer 175:60:60 kg NPK ha^{-1}in cotton and 150:60:30 kg NPK ha^{-1} in wheat gave significantly higher yield (additional yield of 1226 and 3594 kg ha^{-1}) over the control and (96 and 349 kg ha^{-1}) over farmer

practices. Micronutrient application had only marginal effect on cotton and wheat. North Gujarat Zone (Jagudan) of Gujarat, application of RDF in cotton and wheat gave significantly higher additional yield of 238 and 353 kg ha^{-1} over the farmer practices, respectively.

Groundnut-sorghum: A total 12 trials were conducted in Northern dry zone at Gadag (Karnataka). Application of recommended dose of fertilizer gave additional yield of 202 and 161 kg ha^{-1} in groundnut and sorghum respectively. Micronutrient application improved the system yield by only marginally.

Fingermillet-tomato: Under Eastern Dry Zone - Hebbel (Bangalore) a total of 5 trials were taken in finger millet-tomato system. In finger millet 4.4% yield increase was found under NPK + micronutrient application treatment over the farmers practice.

Cabbage-tomato: Total of 5 trials was conducted at Kolar (Karnataka). Application of Zn with NPK resulted in additional yield of 2518 and 4010 kg/ha over the NPK alone in cabbage and tomato, but farmer's practices recorded higher yield than recommended dose of fertilizer alone and applied with micronutrient.

Cluster bean-wheat: At Transitional Plain Zone of Inland Drainage (Sikar) in cluster bean micronutrient use along with recommended dose of NPK gave yield increase of 63% over control which was only 6.6% higher in case of NPK application alone. Around 18.2% yield increase was noted in case of wheat crop under NPK + micronutrient application treatment over the control.

Summary of results on response of prevalent cropping system to applied nutrient in various NARP zones are:

- Across various NARP zones and cropping systems, farmer's package resulted in lower yield compared to recommended package owing to the lower application of N P_2O_5 K_2O and micronutrients.
- On-farm system yield gap between recommended dose of N P_2O_5 K_2O + micronutrient and farmer's package was found to be higher in rice-rice, rice-wheat, maize-wheat, soybean-onion and rice-green gram cropping systems.
- Application of micronutrients based on soil test resulted in additional yield of in rice-rice, rice-wheat, maize- wheat, soybean-onion and rice-green gram systems.
- In all the NARP zones and systems, application of recommended N P_2O_5 K_2O alone or N P_2O_5 K_2O + micronutrient resulted in higher yield and use efficiency of nutrients. Suboptimal application in terms of number and quantity resulted in significantly lower yield and use efficiency of nutrients especially nitrogen.

Reponse of plant nutrients in rice crop at farmers field

Table-7.4.1 : Yield potential of different cropping systems under researcher and farmer managed conditions (2015-16)

State	NARP Zone/ Centres/ No. of trials	Soil Type	Variety/ Recommened Fertilizer Dose/ Micro. Dose FP (Fert. Dose)	Initial Soil Status					Yield (kg/ha)														
				pH	OC (%)	N (kg ha^{-1})	P (kg ha^{-1})	K (kg ha^{-1})	Control	N	NP	NK	NPK	NPK+ M. Nut.	F. Pract	SE(d)	SE (M)	CD (5%)	CV	Yield gap 1 ----- RF vs Control (kg ha^{-1})	Yield gap 2 ----- RF+ vs RF (kg ha^{-1})	Yield gap 3 ----- RF vs FP (kg ha^{-1})
Rice-Rice																							
Maharashtra	North Konkan Coastal Zone - Karjat/ Palghar/24	Not Available	Sahyadri/ 120- 50-50/ ZnSO4(21%) 80- 22.5-12.5	0	0	0	0	0	2627	3698	4505	4348	5280	5940	4270	37	26	51	3	2653	660	1010
			KJT-3/ 100- 50-50/ ZnSO4(21%) 80- 22.5-12.5	-	-	-	-	-	2516	3438	4140	3961	4323	4595	3580	32	23	45	3	1807	272	743
Andhra Pradesh	High Altitude and Tribal Zone - Rastakun-tabai/ Chintapalli/ Seethampeta-AP/24	Red Soil	MTU1001/ 80- 60-50/ ZnSO4(50) 101- 46-30	6	1	157	30	222	1430	1610	1728	1499	1647	3047	4538	0	0	0	0	217	1400	-2892
			MTU-1010/ 80- 60-50/ ZnSO4(50) 101- 46-30	-	-	-	-	-	2235	2066	2200	2026	2215	3156	4759	0	0	0	0	-20	941	-2544
Tamil Nadu	Southern Zone TN - Chettinad/ 5 & 6	Clay Loam	BPT5204 (Rabi)/ 150- 50-50/ ZnSO4(25) 120-50-30	7	0	224	12.1	242	3323	3908	4091	4246	4530	4983	4375	-	-	-	-	1207	453	156
			ADT 36 (Summer)/ 150- 50-50/ ZnSO4(25)s 120-50-30	-	-	-	-	-	3323	3908	4091	4246	4530	4983	4375	0	0	0	0	1207	453	166
Tamil Nadu	North Western Zone - Paiyur/ 12	Clay Loam	White Ponni/ 150- 50-50/ ZnSO4(25) 140- 40-42	8	1	178	22	198	3165	4709	5838	5400	6630	6915	5804	0	0	0	0	3465	285	826
			ADT39/ 120- 40-40/ ZnSO4(25) 100- 40-42	-	-	-	-	-	3073	4128	5336	5252	6716	7145	5699	0	0	0	0	3643	429	1017

Contd/.....

State	NARP Zone/ Centres/ No. of trials	Soil Type	Variety/ Recommened Fertilizer Dose/ Micro. Dose FP (Fert. Dose)	Initial Soil Status					Yield (kg/ha)														
				pH	OC (%)	N (kg ha^{-1})	P (kg ha^{-1})	K (kg ha^{-1})	Control	N	NP	NK	NPK	NPK+ M. Nut.	F. Pract	SE(d)	SE (M)	CD (5%)	CV	Yield gap 1 ----- RF vs Control (kg ha^{-1})	Yield gap 2 ----- RF+ vs RF (kg ha^{-1})	Yield gap 3 ----- RF vs FP (kg ha^{-1})
Kerala	Problem Areas Zone - Kumarakom/ Thiruvalla-KER/24	Clay loam	Uma/ 90- 45 -45 / ZnSO4(25) 100- 50-50	22	2	294	12	263	1865	2582	4543	4442	5985	6168	5500	141	100	196	11	4120	183	485
			Uma/ 90- 45 -45 / ZnSO4(25) 100- 50-50	-	-	-	-	-	1842	2553	4394	4270	5944	6128	5486	138	98	192	11	4102	184	458
Telangana	CT Zone/ 3 Warangal	Red Soil	RNR 15048/ 120- 60-40/ $ZnSO_4$ 140- 58-38	8	1	185	31	214	2756	3657	3823	4138	4657	4935	4783	1385	979	2396	4	1901	278	-644
			MTU-1010/ $ZnSO_4$ 140- 58-38	-	-	-	-	-	3341	4613	4923	5234	6403	6382	5913	2592	1833	4485	6	3062	-20	-679
Assam	Lower Brahma-putra Valley Zone- Kamrup (Rural)/ Kamrup/24	Alluvial	Luit/ 40- 20 -20 / $ZnSO_4$ (25) 10-10-10	5	1	314	20	260	1992	2292	2494	2873	3412	3558	1810	68	48	94	9	1420	146	1602
			Joymati/ 60- 30 -30 / $ZnSO_4$ (25) 10-10-10	-	-	-	-	-	2833	3387	3652	3869	4351	4576	2436	83	58	114	8	1518	225	1915
Rice-Gram/Bengal Gram/Chick Pea																							
Chhattisgarh	CG Plain Zone / Kawardha-CTG/23	Black Soil (Shallo Black)	MTU-1010/ 100- 60-40/ $ZnSO_4$ (25) 60- 40-30	7	1	198	12	304	1835	2760	4244	3292	5001	5133	3644	59	42	82	5	3166	132	1357
			Vaibhav/ 20 - 50-20 / Control 15- 46-0	-	-	-	-	-	468	748	1195	979	1529	1544	1204	21	15	29	7	1061	15	325

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State	NARP Zone/ Centres/ No. of trials	Soil Type	Variety/ Recommened Fertilizer Dose/ Micro. Dose FP (Fert. Dose)	Initial Soil Status					Yield (kg/ha)													
				pH	OC (%)	N (kg ha^{-1})	P (kg ha^{-1})	K (kg ha^{-1})	Control	N	NP	NK	NPK	NPK+ M. Nut.	F. Pract	SE(d)	SE (M)	CD (5%)	CV	Yield gap 1 ----- RF vs Control (kg ha^{-1})	Yield gap 2 ----- RF+ vs RF (kg ha^{-1})	Yield gap 3 ----- RF vs FP (kg ha^{-1})
Rice-Green Gram																						
Odisha	East & South Eastern Coastal Plain / Kendrapara-OR/24	Sandy loam	Ranidhana/ 80- 40-40/ ZnSO4(21%) 25- 26.25-15	6	1	287	16	181	2751	3379	3710	4102	4423	4701	3474	12192	8621	16897	9	1673	277	950
			Local/ 20 - 40-20 / Gypsum(250) 7.5 - 20 -0	-	-	-	-	-	565	659	713	742	827	846	588	2174	1537	3013	9	262	20	239
West Bengal	Coastal Saline Zone W.B./ Kakdwip-WB/24	Coastal Saline Soil	Pratikshya/ 80- 40-40/ $ZnSO_4$ (20) 60- 40-26.25	0	0	0	0	0	3122	3680	4034	4055	4423	4561	4195	0	0	0	0	1301	138	228
			Chait Moong/ 20 - 40-40/ control 15- 40-0	-	-	-	-	-	549	636	754	747	841	869	748	0	0	0	0	292	28	93
Rice-Groundnut																						
Odisha	Mid-Central Table Land Zone - Mahispat/ Angul-OR/24	Mixed Red & Black	Naveen/ 80- 40-40/ Zinc(20) 50- 20 -30	6	1	225	11	133	1944	2540	2920	2971	3451	3611	3168	72	51	100	8	1507	160	283
			Kadiri 6/ 20 - 40-40/ Gypsum(250) 25-10-20	-	-	-	-	-	1120	1433	1779	1685	1985	2063	1777	40	28	55	8	865	78	208
Tamil Nadu	North Western Zone - Paiyur/ Paiyur-TN/12	Sandy Loam	ADT-39/ 150- 50-50/ $ZnSO_4$ (25) 110- 46-30	8	1	284	21	251	2959	3507	4439	4181	6486	6824	5360	0	0	0	0	3527	338	1126
			TMV 7/ 20 - 50-75/ Borax (10) 35 - 37.5 -60	-	-	-	-	-	1047	1238	1584	1702	2211	2372	1885	0	0	0	0	1164	161	326

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State	NARP Zone/ Centres/ No. of trials	Soil Type	Variety/ Recommened Fertilizer Dose/ Micro. Dose FP (Fert. Dose)	Initial Soil Status					Yield (kg/ha)														
				pH	OC (%)	N (kg ha^{-1})	P (kg ha^{-1})	K (kg ha^{-1})	Control	N	NP	NK	NPK	NPK+ M. Nut.	F. Pract	SE(d)	SE (M)	CD (5%)	CV	Yield gap 1 ----- RF vs Control (kg ha^{-1})	Yield gap 2 ----- RF+ vs RF (kg ha^{-1})	Yield gap 3 ----- RF vs FP (kg ha^{-1})
Rice-Maize																							
Bihar	Indo-gangetic-plain - Sabour/ Purnea, Bihar/24	Alluvial	Sabour Ardhjal/ 100-40-20/ $ZnSO_4$ (25) 80-30-20	7	1	216	22	151	2132	3069	3834	3345	4558	4695	3625	0	0	0	0	2426	137	932
			Bio-9637/ 120- 75-50/ 100-50-20	-	-	-	-	-	3843	5333	7458	6953	9547	9722	7276	0	0	0	0	5704	175	2270
Gujarat	Middle Gujarat Zone - Anand/ Derol, Gujarat/11	Alluvial	AAUDR-1/ 50- 25-25/ $ZnSO_4$ (25) 80- 15-0	7	1	228	20	224	975	1387	1551	1426	1660	1672	1413	0	0	0	0	685	12	247
			GAYMH-1/ 120- 60-60/ $ZnSO_4$ (25) 150- 45 -0	-	-	-	-	-	1275	2134	2407	2162	2583	2624	2091	0	0	0	0	1308	41	492
Rice-Wheat																							
Madhya Pradesh	Northern hill zone of chhatisgarh- Dindori/ Dindori-MP/24	Sandy Clay Loam	MTU-1010/ 120- 60-40/ $ZnSO_4$ (25) 60- 25-0	0	0	0	0	0	1853	2448	3434	3167	3915	4487	2721	47	33	65	5	2062	572	1194
			JW 3211/ 120- 60-40/ $ZnSO_4$ (25) 60- 25-0	-	-	-	-	-	1972	2545	2994	3257	3995	4347	2949	39	28	55	4	2023	352	1046
Madhya Pradesh	Keymore Platue Satpora hills /Katni-MP/12	Not Available	JRH-5/ 120- 60-40/ $ZnSO_4$ (25) 80- 30 -0	7	7	253	10	341	1680	3021	3846	3294	5968	6616	3581	87	62	124	5.34	4288	648	2387
			GW366/ 120- 60-40/ $ZnSO_4$ (25) 80- 30 -0	-	-	-	-	-	1690	2862	3479	3049	5413	6147	3759	95	67	134	6.2	3723	734	1654

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State	NARP Zone/ Centres/ No. of trials	Soil Type	Variety/ Recommened Fertilizer Dose/ Micro. Dose FP (Fert. Dose)	Initial Soil Status					Yield (kg/ha)														
				pH	OC (%)	N (kg ha^{-1})	P (kg ha^{-1})	K (kg ha^{-1})	Control	N	NP	NK	NPK	NPK+ M. Nut.	F. Pract	SE(d)	SE (M)	CD (5%)	CV	Yield gap 1 ----- RF vs Control (kg ha^{-1})	Yield gap 2 ----- RF+ vs RF (kg ha^{-1})	Yield gap 3 ----- RF vs FP (kg ha^{-1})
Punjab	Central Plain III-Ludhiana/ Amritsar/ 24	Sandy Loam	PR111/ 120-30-30 $ZnSO_4$ (25) 150-30-0	8	0	250	31.3	142	3123	5078	5614	5314	6074	6584	6194	-	-	-	-	2951	3461	-120
			HD 2967 120-30-30 $ZnSO_4$ (25) 150-60-0	-	-	-	-	-	2191	3220	3649	3455	4075	4402	4143	-	-	-	-	1884	2211	-68
Uttar Pradesh	Eastern plain zone -Faizabad/ Ambedkar Nagar/8	Sandy Loam	Sarju-52/ 150- 60-60/ $ZnSO_4$ (25) 120-30-0	8	0	183	17.3	171	1611	3112	3899	3511	4338	4915	3528	-	-	-	-	2727	577	810
			HUW-234/ 120- 60-40/ $ZnSO_4$ (25) 120-30-0	-	-	-	-	-	1020	2208	2956	2611	3275	3512	2999	-	-	-	-	2254	238	276
Uttar Pradesh	Central plain zone -Kanpur/ Daleep Nagar (Kanpur Dehat)/24	Sandy loam	Hybrid Sudha/ 150- 60-40/ $ZnSO_4$ (25) 220- 58-0	8	0	0	12	147	2130	3121	4743	3685	5240	5635	4769	38	27	53	3	3110	395	471
			PBW-343/ 120- 60-40/ control 144- 69-0	-	-	-	-	-	857	1383	2270	1728	2652	2780	2362	25	18	35	4	1795	128	290
Jharkhand	Central and North Eastern Plateau Zone- Kanke, Ranchi/ Pakur/24	Clay loam	Naveen 100-50-25 $ZnSO_4$ (5) 60-30-0	6	1	289	14.8	190	878	1928	2996	2388	3442	3532	1746	-	-	-	-	2564	90	1696
			K-9107 100-50-25 $ZnSO_4$ (5) 60-30-0	-	-	-	-	-	645	1500	2923	1812	3372	3485	1539	-	-	-	-	2728	113	1834

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State	NARP Zone/ Centres/ No. of trials	Soil Type	Variety/ Recommened Fertilizer Dose/ Micro. Dose FP (Fert. Dose)	Initial Soil Status					Yield (kg/ha)														
				pH	OC (%)	N (kg ha^{-1})	P (kg ha^{-1})	K (kg ha^{-1})	Control	N	NP	NK	NPK	NPK+ M. Nut.	F. Pract	SE(d)	SE (M)	CD (5%)	CV	Yield gap 1 ----- RF vs Control (kg ha^{-1})	Yield gap 2 ----- RF+ vs RF (kg ha^{-1})	Yield gap 3 ----- RF vs FP (kg ha^{-1})
J & K	Sub-Tropical Zone/ Dhainsar-JK/12	Submont-aneous	Basmati- 370/ 30 - 20 -10/ $ZnSO_4$ (20) 20 - 15-0	7	1	233	14	121	1241	1673	2247	1985	2635	2715	2121	32	23	46	3.74	1394	80	514
			PBW-550/ 100- 50-25/ 0 60- 30 -0	-	-	-	-	-	1268	1702	2243	2111	2691	2745	2116	74	53	106	8.59	1423	54	575
Uttarakhand	Hill Zone - Ranichauri/ Jeolikote-UK/24	Hilly	PHB-71/ 150- 60-60/ Sulphar 100- 60-0	7	1	275	18	168	2747	3546	4767	4295	5553	5723	3811	93	66	129	7.42	2806	170	1742
			UP-2565/ 150- 60-40/ Sulphar 100- 40-0	-	-	-	-	-	2454	3315	4163	3806	4912	5150	3613	84	60	118	7.47	2458	238	1299
									Maize-Wheat														
Himachal Pradesh	Sub-mountain and low hills sub-tropical zone / Kangra-HP/24	Submont-aneous	Hybrid;Kanchan/ 90- 45 -30 / $ZnSO_4$ (21%) 69- 0-0	6	1	230	19	104	1663	2096	2666	2398	3268	3433	2126	24	17	34	3.25	1605	165	1142
			HPW-236/ 80- 40-40/ $ZnSO_4$ (21%) 69- 0-0	-	-	-	-	-	1619	2076	2514	2512	3255	3447	2171	35	25	50	4.86	1636	192	1084
J & K	Sub-Tropical Zone/ Dhainsar-JK/12	Sandy loam	Kanchan/ 60- 40-20 / $ZnSO_4$ (10) 12.5- 25-0	7	1	224	14	122	1350	1908	2530	2243	2946	3079	2237	40	29	57	4.25	1596	133	709
			PBW175/ 60- 30 -20 / 0 12.5- 25-0	-	-	-	-	-	1274	1746	2305	2033	2730	2843	2136	37	26	51	4.26	1456	113	594

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State	NARP Zone/ Centres/ No. of trials	Soil Type	Variety/ Recommened Fertilizer Dose/ Micro. Dose FP (Fert. Dose)	Initial Soil Status					Yield (kg/ha)														
				pH	OC (%)	N (kg ha^{-1})	P (kg ha^{-1})	K (kg ha^{-1})	Control	N	NP	NK	NPK	NPK+ M. Nut.	F. Pract	SE(d)	SE (M)	CD (5%)	CV	Yield gap 1 ----- RF vs Control (kg ha^{-1})	Yield gap 2 ----- RF+ vs RF (kg ha^{-1})	Yield gap 3 ----- RF vs FP (kg ha^{-1})
Rajasthan	Sub-Humid Southern Plain and Aravalli Hill Zone - Udaipur/ Udaipur-RJ/24	Clay loam	Not Available/ 90- 35 -30 / ZnSO4(25) 70- 20 -0	8	0	221	16	200	690	1267	2410	2204	2744	2871	1456	54	38	74	9.56	2054	127	1288
			Not Available/ 120- 40-30 / control 20 - 20 -0	-	-	-	-	-	1485	2513	3169	2963	3471	3710	2660	67	47	92	8.09	1986	239	811
Maize-Maize																							
Gujarat	Middle Gujarat Zone - Anand/ Derol, Gujarat/ 12	Alluvial	Rasi 4794/ 100- 50-50/ $ZnSO_4$ (25) 100- 25-0	6	5	197	24	249	882	1352	1542	1428	1624	1709	1361	0	0	0	0	742	85	263
			GAYMH-1/ 120- 60-60/ $ZnSO_4$ (25) 130- 30 -0	-	-	-	-	-	1367	2211	2353	2276	2647	2669	2269	0	0	0	0	1280	22	378
Maize-Gram/Bengal gram/Chick pea																							
Karnataka	Northern dry zone/ Gadag-KAR/11	Deep Black soil	M900/ 150- 75-37.5 / $ZnSO_4$ (25) 80- 40-0	8	1	108	13	925	1860	2714	3632	3664	4646	4962	4068	148	105	210	9.52	2786	316	578
			JG 11/ 25- 50-0/ $ZnSO_4$ (15) 20 - 25-0	-	-	-	-	-	594	747	890	853	1040	1155	920	26	19	38	6.96	446	115	120
Maharashtra	Central Maharashtra Plateau Zone - Aurangabad/ Aurangabad-MH/24	Sandy Clay Loam	Sinjenta 6240/ 150- 75-75/ $ZnSO_4$ (25) 89- 52-52	0	0	0	0	0	1552	1971	2217	2098	2437	2558	2159	0	0	0	0	885	121	278
			BDNG-797/ 25- 50-0/ Sulphar 20 - 46-0	-	-	-	-	-	364	457	564	464	569	589	467	0	0	0	0	205	20	102

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State	NARP Zone/ Centres/ No. of trials	Soil Type	Variety/ Recommened Fertilizer Dose/ Micro. Dose FP (Fert. Dose)	Initial Soil Status					Yield (kg/ha)													
				pH	OC (%)	N (kg ha^{-1})	P (kg ha^{-1})	K (kg ha^{-1})	Control	N	NP	NK	NPK	NPK+ M. Nut.	F. Pract	SE(d)	SE (M)	CD (5%)	CV	Yield gap 1 ----- RF vs Control (kg ha^{-1})	Yield gap 2 ----- RF+ vs RF (kg ha^{-1})	Yield gap 3 ----- RF vs FP (kg ha^{-1})
Soyabean-Wheat																						
Maharashtra	Western Vidarbha Zone/ Amravati-MH/12	Not Available	JS-9305/ 30 - 75-30 / Sulphar 57.5- 0-0	0	0	0	0	0	414	540	651	658	843	1068	669	55	39	78	19.3	429	225	174
			AKW-3722/ 100- 50-50/ Sulphar 46- 22.5-12.5	-	-	-	-	-	1493	1711	2016	1810	2303	2524	1662	66	46	92	8.32	810	221	641
Soyabean-Gram/Bengal gram/Chick pea																						
Maharashtra	Western Vidarbha Zone/ Amravati-MH/12	Not Available	JS-9305/ 30 - 75-30 / NPK+Sulphur 0- 0-0	0	0	0	0	0	483	590	774	689	918	1076	598	44	31	62	14.8	435	158	320
			JAKI 9218/ 20 - 40-20 / NPK+Sulphur 57.5- 0-0	-	-	-	-	-	923	1102	1403	1244	1600	1855	1149	61	43	86	11.2	677	255	451
Soyabean-Onion																						
Maharashtra	Western Maharashtra Plain Zone - Pune/MH/24	Sandy Clay	JS-9305/ 50- 75-25/ Fe(20)+Zn(20) 30 - 30 -30	8	0	152	10	289	1483	1652	1761	1869	2035	2167	1576	0	0	0	0	552	132	459
			N-4-2-1/ 100- 50-50/ Fe(20)+Zn(20) 60- 30 -30	-	-	-	-	-	19049	22484	23425	24308	25637	26747	21396	0	0	0	0	6588	1110	4241
Cotton-Wheat																						
Haryana	Western Zone - Hisar/ Sirsa/24	Alluvial	Raghav/ 175-60-60/ $MgSO_4$ (5.25) 175-60-30	9	0	132	11	257	460	1177	1499	1326	1686	1897	1590	0	0	0	0	1226	211	96
			WH1105/ 150- 60-30 / $ZnSO_4$ (5.25) 150-60-0	-	-	-	-	-	1095	2928	4352	4180	4689	4963	4340	0	0	0	0	3594	274	349

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State	NARP Zone/ Centres/ No. of trials	Soil Type	Variety/ Recommened Fertilizer Dose/ Micro. Dose FP (Fert. Dose)	Initial Soil Status					Yield (kg/ha)														
				pH	OC (%)	N (kg ha^{-1})	P (kg ha^{-1})	K (kg ha^{-1})	Control	N	NP	NK	NPK	NPK+ M. Nut.	F. Pract	SE(d)	SE (M)	CD (5%)	CV	Yield gap 1 ----- RF vs Control (kg ha^{-1})	Yield gap 2 ----- RF+ vs RF (kg ha^{-1})	Yield gap 3 ----- RF vs FP (kg ha^{-1})
Gujarat	North Gujarat Agro-climatic zone/ Jagudan/ 24	Alluvial	BTII/ 180- 40-40/ $MgSO_4$ (25) 80- 40-0	8	1	198	22	252	967	1348	1591	1608	1871	1934	1633	0	0	0	0	904	63	238
			GW-496/ 120- 60-30 / $ZnSO_4$ (15) 90- 40-0	-	-	-	-	-	2190	3073	3608	3421	3914	4151	3561	0	0	0	0	1724	237	353
Groundnut-Sorghum																							
Karnataka	Northern dry zone/ Gadag- KAR/12	Medium Black Soil	GPBD-4/ 25- 50-25/ $FeSO_4$ (25) 20 - 50-0	8	1	94	17	428	1185	1360	1525	1386	1656	1734	1454	30	21	42	4.95	471	78	202
			M35-1/ 50- 25-0/ $ZnSO_4$ (15) 20-10-00	-	-	-	-	-	610	858	992	958	1074	1162	913	27	19	38	7.15	464	88	161
Fingermillet- Tomato(Summer)																							
Karnataka	Eastern dry zone- Bangalore/ Kolar- KAR/5	Alluvial	MR - 1 100- 50-50/ Mn(10) 65-50-15	7.4	0.5	168.5	18.5	51.2	1670	3025	3825	3579	4113	4317	4133	-	-	-	-	2442	204	-21
			Indus - 1030 250- 250-250/ Mn(10) 140-300-175	-	-	-	-	-	18330	28570	43930	38580	50990	55000	56445	-	-	-	-	32660	4010	-5455
Cabbage- Tomato (Summer)																							
Karnataka	Eastern Dry Zone- Bangalore/ Kolar- KAR/5	Alluvial	Unnathi 150-100-125/ Mn(10) 175-185-140	7	0	168	15.3	39	16709	19957	23473	26782	28745	31264	32582	-	-	-	-	12036	2518	-3836
			US-440 250- 250-250/ Mn(10) 230-300-288	-	-	-	-	-	10684	17781	45656	32828	39219	42893	48046	-	-	-	-	32660	4010	-5455

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State	NARP Zone/ Centres/ No. of trials	Soil Type	Variety/ Recommened Fertilizer Dose/ Micro. Dose FP (Fert. Dose)	Initial Soil Status					Yield (kg/ha)													
				pH	OC (%)	N (kg ha^{-1})	P (kg ha^{-1})	K (kg ha^{-1})	Control	N	NP	NK	NPK	NPK+ M. Nut.	F. Pract	SE(d)	SE (M)	CD (5%)	CV	Yield gap 1 ----- RF vs Control (kg ha^{-1})	Yield gap 2 ----- RF+ vs RF (kg ha^{-1})	Yield gap 3 ----- RF vs FP (kg ha^{-1})
Clusterbean-Wheat																						
Rajasthan	Transitional plain of inland drainage - Jobner / Sikar/II(a) /24	-	RGC1003 10-40-20/ Zn(20) FYM	-	-	-	-	-	871	1008	1185	1310	1420	1515	1029	-	-	-	-	549	95	391
			RAJ4120 90-35-30/ Zn(25) 100-20-0	-	-	-	-	-	3036	4045	4379	4402	4866	5053	3951	-	-	-	-	1830	187	915

7.4.2 DIVERSIFICATION OF EXISTING FARMING SYSTEMS

Title of the experiment: Diversification of existing farming systems under marginal household conditions

Objectives

- To enhance the productivity and profitability of marginal farmers households through IFS approach
- To improve the livelihood and nutritional security through diversification approach
- To estimate the impact of capacity building in diversification of crop + livestock system

Year of start: 2013-14

The experiment in farming systems perspective entitled "Diversification of existing farming systems under marginal households" was initiated with the background that 63 % households in India are in marginal category with average land holding size of 0.38 ha. Due to their size of holding, marginal farm households do not have sufficient marketable surplus for getting the decent livelihood and are most vulnerable to climate related risks. The assumptions made are marginal households are having family members of 5 with crop + livestock as the dominant farming systems and if these system is diversified, sufficient marketable surplus can be generated for sustainable livelihood.

Modules: The experiment was designed with innovative approach in which changes are made compulsorily in all components of farming systems by way of introducing new crops, livestock species and product or processing techniques in marginal households aiming to increase the marketable surplus and income of the family from a less land resource. The major strength of marginal household is having sufficient manpower (due to family size) for farm operations. After benchmarking, modules comprising of cropping system diversification (most efficient cropping systems was synthesized keeping in view of the farmers resources, perception, willingness, market and requirement other components in the system), livestock diversification [(Mineral mixture + deworming+ round the year fodder supply for existing components) + introduction of location specific low cost livestock components viz., BYP, duckery, piggery, goat etc)], product diversification (Preparation of mineral mixture/value addition of market surplus products/Kitchen /roof gardening) and capacity building (Training of farm households on farming systems including post- harvest and value addition and assessing its impact) were implemented in randomly selected 24 marginal

Farming System	Notation	Module name	Details
Existing	M0	Bench mark	Recording of bench mark data on crop, livestock, other components and household as a whole
Improved	M1	Cropping system diversification	Most efficient cropping systems wasintroduced keeping in view of the farmers resources, perception, willingness, market and requirement of other components in the system besides improving the practices of existing systems
	M2	Livestock diversification	Mineral mixture + deworming+ round the year fodder production + introduction of location specific low cost livestock components *viz.,* Backyard poultry, duckery, piggery & goat
	M3	Product diversification	Preparation of mineral mixture/value addition of market surplus products/ kitchen /roof gardens
	M4	Capacity building	Training of farm households on farming systems especially on newly added practices & components and assessing its impact

farm households in each district. The general guidelines used for designing the modules are given below

Households: Twenty four marginal households were selected for experiment in all the locations. The average holding size of in the study locations ranged from 0.20 to 1.00 ha in various farming systems. During 2015-16, study involved 678 households with mean holding size of 0.62 ha. At very few locations and farming systems, the size of holding of farming system was higher than 1 ha due to non-availability of marginal households for diversification.

Locations: During 2015-16, 29 districts in 13 agro climatic regions covering 28 NARP zones have implemented the modules in various farming systems. The details of locations, farming systems, size of holding, number of households in each farming system and module wise interventions made are given in Table 7.4.2(a). Three locations namely Fathepur (Rajasthan), Sivagangai (Tamil Nadu), Muzaffarnagar (Uttar Pradesh) have partially implemented the interventions and hence, the data is not included in this report.

Data analysis methodology: Based on the benchmark data, farming systems practiced by the households were identified and grouped in to different farming system categories such as field crops+ dairy, field crops + dairy+ goat *etc* as given in Table 7.4.2(a). Five parameters namely production (on equivalent basis of base pre-dominant crop), marketable surplus (calculated by deducting the family consumption for food, feed, seed *etc* from the total production), cost (total cost of the system including all components and diversification), returns (calculated by deducting the total cost from gross returns of the system) and profit (calculated by deducting the cost of the system from the gross income obtained from marketable surplus) were used for comparison of existing with improved (diversified) system and also different farming systems. Farming system with more than one household was subjected to ANOVA and paired t-test analysis. Paired t-test has been carried out for comparing existing and diversified systems with respect to production, marketable surplus, cost, return and profit. Similarly, one-way ANOVA has been carried out to identify the best farming system with respect to production, marketable surplus, cost, return and profit for the district. Standard error of mean values is also presented in parenthesis in Table 7.4.2(b).

Results

The components of existing and diversified farming systems in marginal farm households are given in Table 7.4.2(a), while the production, marketable surplus and economics of different farming systems are given in 7.4.2(b). Location wise and summary of results is explained briefly below.

Western Himalaya

Kangra (Himachal Pradesh): Three major farming systems *viz.*, field crops, field crops + dairy and field crops + dairy + goat were found among which field crop + dairy is being practiced by 58% households having mean area of 0.70 ha. Diversification of crops in *kharif* and *rabi* along with introduction of kitchen garden resulted in improvement in production, and increase in profit. Among the parameters, significant difference was observed between existing and diversified system for production, cost and return for field crop + dairy and field crop + dairy + goat system. Among the different farming system, field crop + dairy registered significantly higher production (3782 kg), marketable surplus (972 kg), and profit (Rs 24,562) from 0.70 ha area compared to field crop + dairy +goat and field crop alone system.

Samba (Jammu and Kashmir): Only one farming system *viz;* field crop + dairy was found in the district and practiced by 100 % households having mean area of 0.83 ha. Diversification resulted in significantly higher profit (17.8 %).

Nainital (Uttarakhand): Four farming systems *viz.*, field crops + dairy, field crops + dairy + poultry, field crops + dairy + goat, and field crops + dairy +

Table 7.4.2(a). Components of existing and diversified farming systems in marginal farm households at different locations

District (state)/ NARP zone/ soil type/ rainfall (mm)/ rainy days	Farming System (s)	Area (ha)	No. of Farm households	Existing components (As per benchmark, 2014)					Improved					
				Crop(s)/Cropping system(s)			Livestock/ houshold (including fisheries, if any)	Product diversif-ication	Crop(s)/Cropping system(s)			Livestock/ household (including fisheries, if any)	Product diversif-ication	Capacity buiding
				Kharif	*Rabi*	Summer			*Kharif*	*Rabi*	Summer			
I. Western Himalaya														
Kangra (Himachal Pradesh) / Submontanellow hills subtropical / 104 rainy days/ 2264 mm rain	Field crops	0.26	1	Maize/ rice	Wheat/ mustard	-	-	-	Maize/ rice	Wheat/ berseem/ oats	-	-	Kitchen Garden	-
	Field crops + dairy (1-2)	0.70	14	Maize/ rice/ colocassia/ sorghum	Wheat/ mustard/ potato/ berseem/ oats	-	Cow (1) + Buffalo (1-2)	-	Maize/ rice/ sorghum	Wheat/ berseem/ gobhi– sarson/ oat/ chickpea/ onion	-	Cow (1) + Buffalo (1-2)	Kitchen Garden	Training on sprouting of Pulses for dietary benefits & vermicom-posting
	Field crops + dairy (1-2) + goat (2-3)	0.67	9	Maize/ rice/ sesamum/ sorghum/ Mash	Wheat/ mustard/ berseem	-	Cow (1) + Buffalo (1-2)+ Goat (2-3)	-	Maize/ rice/ sorghum	Wheat/ berseem/ gobhi – sarson/ oat/ onion	-	Cow (1) + Buffalo (1-2) + Goat (2-3)	Kitchen Garden, Broccoli seedlings	-do-
Samba (J&K)/ sub tropical low altitude/75 rainy days/ 790 mm rain	Field crops + dairy (2-3)	0.83	24	Rice/ maize/ fodder	Wheat/ berseem	-	Cow (1-2) + Buffalo (1-2)	-	Rice/ maize/ blackgram	Wheat/ berseem	-	Cow (1) + Buffalo (1)	Kitchen Garden	Balance feeding to milch animal, Round the year mushroom cultivation
Nainital (Uttarakhand)/ Hills of Uttarakhand/ Moist Sub humid/ 90.5 rainy days/ 2597 mm rain	Field crops + dairy	0.33	15	Rice, Soybean, Berseem, urd, Jowar(F)	Wheat/ mustard/ lentil/ chick pea/ berseem	-	Bullocks (1-2) Cow (1) Calves (1) Buffalo (1)		Rice/ tomato/ blackgram/ maize cob/ french bean/ soybean/ coriander/ chilli/ ginger	Wheat/ onion/ lentil/ veg. pea/ chickpea/ berseem/ potato	Maize	Cow (1) + Buffalo (1-2) + goat(1-2)	Coriander leaves, seeds of brinjal, Cauliflower, methi & palak	Lentil, frenchbean & soyabean, Plant Protection measures for rabi crops

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District (state)/ NARP zone/ soil type/ rainfall (mm)/ rainy days	Farming System (s)	Area (ha)	No. of Farm households	Existing components (As per benchmark, 2014)					Improved					
				Crop(s)/Cropping system(s)			Livestock/ houshold (including fisheries, if any)	Product diversif-ication	Crop(s)/Cropping system(s)			Livestock/ household (including fisheries, if any)	Product diversif-ication	Capacity buiding
				Kharif	*Rabi*	Summer			*Kharif*	*Rabi*	Summer			
	Field crops + dairy + goat	0.27	3	Rice/ maize	Wheat/ pea/ gram/ lentil	-	Bullocks (1-2) Cow (1) Calves (1) Buffalo (1-2) Goat (4-5)		Rice/ french bean/ ginger	Wheat, chickpea, lentil, onion, veg. pea, potato, barseem	Maize	Cow (1) + Buffalo (1) + Goat (1), poultry (5)	Coriander leaves, Seeds of brinjal, Cauliflower, methi & palak	-Do-
	Field crops + dairy + goat + poultry	0.32	1	Rice/ maize/ black gram/ Jowar (F)	Wheat/ potato/ oats/ berseem	-	Bullocks (2) Calves (1) Buffalo (2) Goat (4) Poultry (11)		Rice/ maize/ black gram/ ginger	Wheat, chickpea, veg. pea, potato, barseem	Maize	Cow (1) + goat (1)	Coriander leaves, seeds of brinjal, cauliflower, methi & palak	-Do-
	Field crops + dairy + poultry	0.29	3	Rice/ maize/ black gram/ Jowar (F)	Wheat/ potato/ oats/ berseem	-	Bullocks (2) Cow (1) Calves (1-2) Buffalo (1)		Rice/ maize/ black gram/ soybean/ frenchbean/ tomato/ ginger coriander/ chilli	Wheat/ chickpea/ veg. pea/ potato/ onion/ berseem	Maize	Cow (1)+ Buffalo (2) + goat (3)	Coriander leaves, seeds of brinjal, cauliflower, methi & palak	-Do-
II. Eastern Himalaya														
Ambedkarnagar (Uttar Pradesh)/ Eastern Plain Zone/Sub-humid/ 54.4 rainy days/ 1426 mm rain	Field crops	0.30	1	Rice	Wheat/ mustard/ berseem	-	-	-	Rice	Wheat/ mustard/ chickpea	-	Cow (1)	-	-
	Field crops + dairy (1-2)	0.38	11	Rice/ fodder/ sorghum/ pigeonpea	Wheat/ mustard/ berseem/ potato/ chickpea/ pea/ lady's finger	-	Cow (1) + Buffalo (1-2)	-	Rice	Wheat/ chickpea/ potato/ berseem/ mustard/ pea	Green gram/ okra	Cow (1-2) + Buffalo (1-2)	-	-

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District (state)/ NARP zone/ soil type/ rainfall (mm)/ rainy days	Farming System (s)	Area (ha)	No. of Farm households	Existing components (As per benchmark, 2014)					Improved					
				Crop(s)/Cropping system(s)			Livestock/ houshold (including fisheries, if any)	Product diversif-ication	Crop(s)/Cropping system(s)			Livestock/ household (including fisheries, if any)	Product diversif-ication	Capacity buiding
				Kharif	*Rabi*	Summer			*Kharif*	*Rabi*	Summer			
	Field crops + dairy (1-2) + goat (5-6)	0.38	8	Rice/ fodder/ sorghum	Wheat/ mustard/ potato/ berseem/ sugarcane	Sugarcane/ okra/ blackgram/ mentha	Cow (1) + Buffalo (1-2)	-	Rice	Chickpea/ potato/ mustard/ pea/ berseem	Black gram/ green gram/ fodder/ sorghum/ okra	Buffalo (1-2) + Goat (5-6)		- -
Kamrup (Assam) / lowar Brahmaputra valley zone / 59 rainy days/ 1627 mm rain	Field crops + dairy (1-2) + pig	0.81	7	Rice	Rice / toria		Cow (1-2)	-	Rice/ arecanut	Toria / rice		Cow (1-2) + poultry (10-11)	Arecunut fruit	Making of supari from raw arecanut, Scientific rearing of fish, making of Vermi-compost
	Field crops + dairy(2) + poultry (9- 10)	0.65	2	Rice	Rice/ toria		Cow (2) + poultry (9- 10)		Rice/ arecanut	Toria/ rice		Cow (2) + poultry (10-11)	-do-	- do-
	Field crops + dairy (1) + poultry + goat (2) + pig	0.90	1	Rice	vegetable	-	Cow (1) + goat (2)		Rice/ arecanut	Toria		Cow (1) + goat (2)	-do-	- do-
	Field crops + dairy (1) + goat (2) + pig	0.60	1	Rice	Toria	-	Cow (1) + goat (2)		Rice/ arecanut	Toria		Cow (1) + goat (2) + poultry (7) + pig (2) + fish	-do-	- do-
	Field crops + dairy (1-2) + poultry + goat (1-2) + fish	0.67	3	Rice	Toria		Cow (1-2) + goat (1-2) + poultry (70-80)		Rice/ arecanut	Toria		Cow (1-2) + goat (1-2) + poultry (10-12) + pig (2) + fish pond (2)	-do-	- do-
	Field crops + dairy (2) + poultry (8) + fish	0.40	1	Rice	Rice	-	Cow (2) + poultry (8)		Rice/ arecanut	Rice		Cow (2) + goat (2) + poultry (8) + fish pond	-do-	- do-

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District (state)/ NARP zone/ soil type/ rainfall (mm)/ rainy days	Farming System (s)	Area (ha)	No. of Farm households	Existing components (As per benchmark, 2014)					Improved					
				Crop(s)/Cropping system(s)			Livestock/ houshold (including fisheries, if any)	Product diversif-ication	Crop(s)/Cropping system(s)			Livestock/ household (including fisheries, if any)	Product diversif-ication	Capacity buiding
				Kharif	*Rabi*	Summer			*Kharif*	*Rabi*	Summer			
	Field crops + dairy (2) + poultry (10-11) + pig	0.90	2	Rice	-		Cow (2) + poultry (10-11)		Rice/ arecanut	Toria		Cow (2) + goat (2) + poultry (10-12) + pig (2)	-do-	- do-
	Field crops + dairy (4) + fish	0.90	1	Rice	Turmeric		Cow (4)		Rice/ arecanut	Toria		Cow (4) + goat (2) + poultry (12)	-do-	- do-
	Field crops + dairy (3-4)+ poultry (25-30) + goat (2)	0.68	6	Rice	Rice / turmeric		Cow (3-4)+ goat (2) + poultry (25-30)		Rice/ arecanut	Toria / rice		Cow (3) + goat (2) + poultry (10-15)+ fish	-do-	- do-
III. Lower Gangetic Plains														
South 24 Paragnas (West Bengal)/ lower gangetic plains/100.8 rainy days/1404 mm rain	Field crops	0.56	2	Rice	Tomato	-	-	-	-	Lady's finger	-	Poultry (16)	Kitchen gardening, dal making	Improved cultivation techniques of Sunflower, Integrated pest manage-ment of lady's finger
	Field crops + dairy (1-2)	0.39	8	Rice	Green gram/ sunflower/ potato/ brinjal	Sunflower	Cow (2-3)+ goat (6-7) + poultry (30)		Rice	Lathyrus, lady's finger, onion, amaranthus		Cow (2-3) + poultry (28-29) + goat (7-8)	Kitchen gardening, dal making	-Do-
	Field crops + dairy (2) + fish	0.46	1	Rice	Tomato		Cow (3) + Pond (1)		Rice	Lathyrus	Green gram	Cow (2) + poultry (15) + goat (3)	Kitchen gardening, dal making	-Do-
	Field crops + dairy (3) + goat (5-6)	0.45	3	Rice	Sunflower/ tomato	-	Cow (3) + Goat (4-5)		Rice	Lathyrus, lady's finger	-	Cow (3) + poultry (19-20)	Kitchen gardening, dal making	-Do-
	Field crops + dairy (4) + goat (12) + poultry (30)	0.26	1	Rice	Sunflower		Cow (4) + Poultry (31)		Rice	Lathyrus, lady's finger	-	Cow (2) + Poultry (13)	Kitchen gardening, dal making	-Do-

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District (state)/ NARP zone/ soil type/ rainfall (mm)/ rainy days	Farming System (s)	Area (ha)	No. of Farm households	Existing components (As per benchmark, 2014)					Improved					
				Crop(s)/Cropping system(s)			Livestock/ houshold (including fisheries, if any)	Product diversif-ication	Crop(s)/Cropping system(s)			Livestock/ household (including fisheries, if any)	Product diversif-ication	Capacity buiding
				Kharif	*Rabi*	Summer			*Kharif*	*Rabi*	Summer			
	Field crops + dairy (3-4) + poultry (15-16)	0.52	6	Rice	Sunflower/ potato/ greengram/ lady's finger/ tomato	-	Cow (3-4)+ Poultry (5-6) + pond (1)		Rice-	Lathyrus, lady's finger	-	Cow (4-5) + Poultry (20-21) + pond (1)	Kitchen gardening, dal making	-Do-
	Field crops + goat (2)	0.67	1	Rice	Tomato	Okra	Goat (2)		Rice	Lady's finger	-	Poultry (12)	Kitchen gardening, dal making	-Do-
	Field crops + poultry (8)	0.44	2	Rice	Sunflower	-	Poultry (4)		Rice	Lady's finger	-	Poultry (12)	Kitchen gardening, dal making	-Do-
IV. Middle Gangetic Plains														
Purnea (Bihar)/ north east alluvial plain (BI-2)/ 40.5 rainy days/ 458 mm rain	Field crops	0.50	1	Rice/ vegetable	Maize/ vegetable	-	-	-	Rice	Maize	-	-	Kitchen garden, dal making	Vermi-compost
	Field crops + dairy (2-3)	0.75	4	Rice/ vegetable	Maize/ potato	Chilli/ brinjal	Cow (2)	-	Rice	Maize	-	Cow (3 -4)	Kitchen garden, ber budding	Vermi-compost
	Field crops + dairy (2-3) + goat (1-2)	0.58	19	Rice/ vegetable	Maize/ wheat/ potato/ vegetable	-	Cow (1-2) + buffalo (0-1)+ goat (2-3)	-	Rice	Maize	-	Cow (3-4)+ Goat(7-8)	Kitchen garden, dal making, ber budding	Vermi-compost, IFS
V. Upper Gangetic plains														
Kanpur Dehat (Uttar Pradesh)/ Central Plain Zone /Kanpur/	Field crops	0.80	3	Rice	Wheat	-	-	-	Rice/ green gram	Wheat/ potato/ mustard/ mentha	Green-gram	Cow (1) + goat (1)	-	Improved practices of rabi, goat rearing, poultry production, kitchen gardening

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District (state)/ NARP zone/ soil type/ rainfall (mm)/ rainy days	Farming System (s)	Area (ha)	No. of Farm households	Existing components (As per benchmark, 2014)					Improved					
				Crop(s)/Cropping system(s)			Livestock/ houshold (including fisheries, if any)	Product diversif-ication	Crop(s)/Cropping system(s)			Livestock/ household (including fisheries, if any)	Product diversif-ication	Capacity buiding
				Kharif	*Rabi*	Summer			*Kharif*	*Rabi*	Summer			
	Field crops + dairy (1-2)	0.85	8	Rice/ maize/ pigeon pea	Wheat/ chickpea/ mustard	-	Cow (0-1) + buffalo (1-2)	-	Rice/ maize/ pigeonpea/ sorghum/ sesamum	Wheat/ chickpea/ mustard/ potato	Green-gram	Cow (0-1) + buffalo (1-2) + goat (2)	-	-Do-
	Field crops + dairy (2-3) + goat (2-3)	0.76	8	Rice/ maize/ pearl millet	Wheat/ mustard/ potato	-	Cow (0-1) + buffalo (1-2) + goat (2-3)	-	Rice/ maize/ pearl millet/ sorghum	Wheat/ mustard/ potato/ chickpea	Green-gram	Cow (0-1) + buffalo (1-2) + goat (1-2) + calves (1-2)	-	-Do-
	Field crops + goat (2-3)	0.33	5	Rice/ pigeon pea	Wheat/ mustard	-	Goat (3-4)	-	Rice/ pigeon pea/ green gram/ maize/ sorghum	Wheat/ mustard/ chickpea/ potato	Green-gram	Cow (0-1) + buffalo (0-1) + goat (1-2)	-	-Do-
VI. Trans Gangetic Plains														
Sirsa (Haryana)/ Western/ 29 rainy days/272 mm rain	Field crops + dairy (1-2)	0.58	24	Cotton/ pearl millet	Wheat/ barseem	-	Cow (1) + buffalo (1)	-	Cotton	Wheat	-	Cow (1) + buffalo (1) + Goat (3-4)	Ghee making	-
Amritsar (Punjab)/ Central Plain Zone/ 47 rainy days/ 936 mm rain	Field crops + dairy (3-4)	1.08	24	Rice	Wheat	-	Cow (1-2) + Buffalo (3-4)	-	Rice	Wheat	-	Cow (1-2) + Buffalo (2-3)	Organic Kitchen garden, haldi, Preparation of Mineral Mixture	Vermi-compost Production Techniques, Poultry rearing and production technique, herbicides and Pesti-cides application Techniques

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District (state)/ NARP zone/ soil type/ rainfall (mm)/ rainy days	Farming System (s)	Area (ha)	No. of Farm households	Existing components (As per benchmark, 2014)					Improved				
				Crop(s)/Cropping system(s)			Livestock/ houshold (including fisheries, if any)	Product diversif-ication	Crop(s)/Cropping system(s)			Livestock/ household (including fisheries, if any)	Product diversif-ication	Capacity buiding
				Kharif	*Rabi*	Summer			*Kharif*	*Rabi*	Summer			
VII. Eastern Plateau and Hills														
Kabirdham (Chhattisgarh)/ Chhattisgarh Plain Zone/Sub humid Area/ 848 mm rain	Field crops	0.84	12	Rice/ soybean	Chickpea/ wheat	Vegetable		-	Rice/ soybean/ Pigeon pea/ vegetable	Chickpea/Vegetable wheat/ vegetable		Cow (1-2)+ goat (2)+ poultry (7-8)	Gram Dal & Basen, Milk Curd	Fertilizer, weed and Insect Pest manage-ment, Mushroom processing, making papad, badi, feed mana-gement for livestock
	Field crops + dairy (1-2)	0.77	9	Rice/ soybean	Wheat/ chickpea	Vegetable	Cow (1-2)	-	Rice/ soybean/ pigeon pea	Chickpea/Vegetable wheat/ vegetable		Cow (1-2) + goat (3-4) + poultry (10-11)	- do-	- do-
	Field crops + dairy (1) + goat (1)	0.60	1	Rice/ soybean	Chickpea/ wheat	Vegetable	Cow(1) + Goat (1)	-	Rice/ soybean/ pigeon pea	Chickpea/Vegetable wheat/ vegetable		Cow (2))+ goat (4) + poultry (8)	- do-	- do-
	Field crops + dairy (2) + goat (9) + poultry (3)	0.60	1	Rice/ soybean	Chickpea/ wheat	Vegetable	Cow (2)+ Goat (8)+ Poultry (10)	-	Rice/ soybean/ pigeon pea	Chickpea/Vegetable wheat/ vegetable		Cow (2) + goat (20) + poultry (10)	- do-	- do-
	Field crops + dairy (2) + poultry (6)	0.80	1	Rice/ soybean	Chickpea/ wheat	Vegetable	Cow (1)+ Poultry (8)	-	Rice/ soybean/ pigeon pea	Chickpea/Vegetable wheat/ vegetable		Cow (1)+ goat (3) + poultry (11)	- do-	- do-
Pakur (Jharkhand)/ eastern plateau and hill/86 rainy days/ 1060 mm rain	Field crops	0 .76	22	Rice	Wheat/ lentil/ chickpea/ potato/ mustard	-		-	Rice	Wheat/ lentil	W+M (8:2)	Goat (2-3) + Pig (1-2) + Poultry (8-9)	Kitchen garden, dal making, pig feed	Crop + animal + vegetable

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District (state)/ NARP zone/ soil type/ rainfall (mm)/ rainy days	Farming System (s)	Area (ha)	No. of Farm households	Existing components (As per benchmark, 2014)					Improved					
				Crop(s)/Cropping system(s)			Livestock/ houshold (including fisheries, if any)	Product diversif-ication	Crop(s)/Cropping system(s)			Livestock/ household (including fisheries, if any)	Product diversif-ication	Capacity buiding
				Kharif	*Rabi*	Summer			*Kharif*	*Rabi*	Summer			
	Field crops + dairy (3-4)	0 .72	2	Rice	Chickpea		Cow (3-4)	-	Rice	Wheat/ chickpea	W+M (8:2)	Goat (1)	Kitchen garden, dal making	Crop + animal + vegetable
Dindori (Madhya Pradesh)/Northern Hills Zone of Chhattisgarh (CG-3)/ 64 rainy days/1234 mm rain	Field crops	0.72	3	Rice/ soybean	Wheat/ chickpea/ lentil	-		-	Rice/ soybean/ kodo	Wheat/ lentil	-	Cow (1-2) + Buffalo (1) + Poultry (2-3)	-	-
	Field crops + dairy (1-2)	0.76	16	Rice/ soybean/ kodo	Wheat/ chickpea/ lentil	-	Cow (1-2)+ buffalo (1)	-	Rice/ soybean/ kodo	Wheat/ chickpea/ lentil	-	Cow (1-2) + buffalo (1)	-	-
	Field crops + dairy (1-2) + goat (8)	0.73	2	Rice/ soybean	Wheat/ chickpea	-	Cow (1-2)+ buffalo (1) + goat (8)	-	Rice/ soybean/ kodo	Wheat/ chickpea/ lentil	-	Cow (1)	-	-
	Field crops + dairy (1) + poultry (4-5)	0.69	2	Rice/ soybean	Wheat/ chickpea/ lentil	-	Cow (1)+ poultry (4-5)	-	Rice/ soybean/ kodo	Wheat/ chickpea/ lentil	-	Cow (1-2)+ poultry (5-6)	-	-
	Field crops + goat (2)	0.65	1	Rice/ soybean/ kodo	Wheat/ lentil	-	Goat (2)	-	Rice/ soybean	Wheat/ lentil	-		-	-
Angul (Odisha)/ Mid-Central Table Land, /81 rainy days/911 mm rain	Field crops	0.80	1	Rice/ brinjal/ pointed guard/ mango/ banana/ cashewnut	Pigeon pea/ maize	Sesamum	-	-	Rice/ brinjal/ cashewnut/ mango/ banana/ pointed guard	Pigeon pea/ maize/ onion/ cowpea/ cauliflower/ cabbage	Sesamum/ brinjal/ okra	Cow (2) + Poultry (30)	-	Integrated nutrient manage-ment, Back-yard poultry cultivation
	Field crops + dairy (1-2)	0.83	14	Rice/ brinjal/ cowpea/ pointed gourd/ mango/ okra/ bitter guard/ banana/ cashewnut	Groundnut/ pigeonpea/ maize/ tomato/ cowpea/ okra/ brinjal/ cucumber/ onion/ potato	Black gram/ okra/ seasamum	Cow (1-2)	-	Rice/ brinjal/ cowpea/ okra/ mango/ bitter guard/ banana/ cashewnut	Groundnut/ tomato/ cowpea/ okra/ brinjal/ cucumber/ onion/ gardenpea/ cauli-flower/ maize/ potato/ bean/ cluster bean/ sunflower	Black gram/ green gram/ okra/ bitter-guard/ sesamum/ cucumber/ brinjal/ cowpea/ pointed guard/ water melon/ ridge guard	Cow (1-2) + Poultry (25-30)	Compost Making	-do-

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District (state)/ NARP zone/ soil type/ rainfall (mm)/ rainy days	Farming System (s)	Area (ha)	No. of Farm households	Existing components (As per benchmark, 2014)					Improved					
				Crop(s)/Cropping system(s)			Livestock/ houshold (including fisheries, if any)	Product diversif-ication	Crop(s)/Cropping system(s)			Livestock/ household (including fisheries, if any)	Product diversif-ication	Capacity buiding
				Kharif	*Rabi*	Summer			*Kharif*	*Rabi*	Summer			
	Field crops + dairy (1-2) + Poultry	0.89	8	Rice/ ginger/ mango/ banana	Brinjal/ cowpea/ tomato/ cauliflower/ potato/ garden pea/ okra/ cabbage/ pointed guard/ maize	Brinjal/ cucumber, green gram, black gram	Cow (2-3) + Poultry (25-30)	-	Rice/ ginger/ mango/ banana/ bitter guard	Brinjal/ cowpea/ bitter guard/ cauliflower/ potato/ garden pea/ okra/ cabbage/ pointed guard/ maize/ onion/ sunflower	Brinjal/ cucumber/ okra/ water melon	Cow (1-2) + Poultry (25-30) + Fish	Compost Making	-do-
	Field crops + Poultry (2)	0.80	1	Rice/ cashewnut	Brinjal/ bitter guard/ cowpea/ pointed guard/ maize	Seasamum	Poultry (2)	-	Rice/ cashewnut/ bitter gourd/ cowpea/ brinjal/ pointed gourd	Maize/ onion/ cauli-flower/ cabbage/ garden pea	Sesamum/ brinjal/ okra	Goat (2)	Compost Making	-do-
VIII. Central Plateau and hills														
Katni (Madhya Pradesh)/ Kymore Pleateau and Satpura Hills/ 70 rainy days/ 677 mm rain	Field crops	0.70	3	Rice	Wheat	-	-	-	Rice/ soybean	Wheat/ chickpea	-	-	-	-
	Field crops + dairy (2)	0.71	9	Rice/ marigold	Wheat/ marigold	-	Cow (1-2)	-	Rice/ soybean	Wheat/ chickpea	-	Cow (2) + goat (1-2)	Deshi Ghee	LPM (balance diet, deworming, vaccination and dal making)

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District (state)/ NARP zone/ soil type/ rainfall (mm)/ rainy days	Farming System (s)	Area (ha)	No. of Farm households	Existing components (As per benchmark, 2014)					Improved					
				Crop(s)/Cropping system(s)			Livestock/ houshold (including fisheries, if any)	Product diversif-ication	Crop(s)/Cropping system(s)			Livestock/ household (including fisheries, if any)	Product diversif-ication	Capacity buiding
				Kharif	*Rabi*	Summer			*Kharif*	*Rabi*	Summer			
Udaipur (Rajasthan)/ Sub-humid Southern plain and aravali hills/ 22 rainy days/ 463 mm rain	Field crops	0.70	2	Maize	Wheat	-	-	-	Maize/ vegetable	Wheat/ vegetable	-	Poultry (40)	-	Crop production, vegetable production, vermi-compost, rearing of Poultry
	Field crops + dairy (1-2)	0.60	7	Maize	Wheat	-	Cow (1-2) + Buffalo (0-1)	-	Maize/ vegetable	Wheat/ vegetable		Cow (1-2) + buffalo (0-1) + poultry (20)	Vermi compost	-do-
	Field crops + dairy (1-2) + goat (3)	0.66	15	Maize/ guar	Wheat	-	Cow (1-2) + Buffalo (1-2) + Goat (3)	-	Maize/ vegetable	Wheat/ vegetable	-	Cow (2-3) + buffalo (1) + poultry (9-10)	Vermi compost	-do-
IX. Western Plateau and Hills														
Aurangabad (Maharashtra)/ CMP/57.5 rainy days/666 mm rain	Field crops	0.47	21	Maize/ cotton/ sugar cane/ pearl millet/ coriander/ pigeon pea/ fenugreek/ ginger	Wheat/ chickpea/ coriander/ fenugreek/ lucern	Fodder maize	-	-	Cotton/ sugar cane/ pearl millet/ okra/ hy.napier/ chilli/ soyabean/ coriander/ ginger/ pigeon pea	Coriendar/ wheat/ chickpea/ lucern/ fenugreek/ fodder maize	Fodder maize	Cow (1-2) + Goat (1-2)	Kitchen garden, compost	Importance of secondary and micro nutrients in cotton, clean milk prod-uction and importance of vaccination and mineral mixture
	Field crops + dairy (6)	0.75	3	Maize/ cotton/ sugarcane	Wheat/ coriander	Fodder maize	Cow (6)	-	Sugarcane/ cotton/ maize/ lucune/ hy. napier/ ginger/ okra	Coriendar/ wheat/ chickpea	Fodder maize	Cow (2-3) + Goat (2-3)	-do-	-do-

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District (state)/ NARP zone/ soil type/ rainfall (mm)/ rainy days	Farming System (s)	Area (ha)	No. of Farm households	Existing components (As per benchmark, 2014)					Improved					
				Crop(s)/Cropping system(s)			Livestock/ houshold (including fisheries, if any)	Product diversif-ication	Crop(s)/Cropping system(s)			Livestock/ household (including fisheries, if any)	Product diversif-ication	Capacity buiding
				Kharif	*Rabi*	Summer			*Kharif*	*Rabi*	Summer			
Pune (Maharashtra)/ deccan Plateau, hot semi-arid eco sub region(6.1)/ Ganeshkhind Pune-7/36 rainy days/452 mm rain	Field crops + dairy (1-2)	0.53	24	G. nut/ soyabean/ rice/ maize/ hy. napiar	Onion/ potato/ chickpea/ wheat/ maize/ garlic/ fodder/ fenugreek/ gulchadi/ brinjal/ radish	Pearl millet/ groundnut/ lady's finger/ smooth guard/ bottle guard/ Sugar cane	Cow (1-2) + Buffalo (0-1)	-	G. nut/ soyabean/ rice/ sugar cane/ radish/ Hy. nepiar	Onion/ wheat/ potato/ chickpea/ brinjal/ coriander/ lucern/ Hy. nepiar/ sugar cane	Cucurbit's crops/ fodder's crops/ Pearl millet/ sugar cane/ lady's finger	Cow (1-2) + Buffalo (0-1)+ Goat (0-1)	Onion/ wheat/ potato/ chickpea	Mango and guava grafting
Amravati (Maharahtra/) Central Maharastra Plateaue Zone (IX)/ Western Vidarbha Zone/71 rainfall days/1198 mm	Field crops + dairy (1-2)	0.87	20	Soybean/ cotton	Chickpea/ wheat	-	Cow (1-2)	-	Soybean/ cotton/ pigeon pea/ chilli	Chickpea/ wheat/ linseed	Sesamum	Cow (1-2) + Buffalo (1) + Goat (1-2)	Kitchen garden, dal making, compost, mineral mixture, bur budding, boundary plantation	Soybean based multi-tier/ inter cropping system, budding and grafting of different horticultural crops
	Field crops + goat (2-3)	0.80	3	Soybean	Chickpea/ wheat	-	Cow (1)+ Goat (2-3)	-	Soybean/ pigeonpea	Chickpea/ wheat/ linseed	Sesamum	Cow (1-2) + Buffalo (1) + Goat (1-2) + Poultry (6-7)	-do-	-do-
	Field crops + poultry (6)	0.80	1	Soyabean	Chickpea	-	Poultry (6)	-	Soybean/ pigeonpea	Chickpea/ linseed	-	Poultry (6-7) + Goat (1)	-do-	-do-
X. Southern Plateau and Hills														
Warangal (Telangana)/ C.T.Zone/ rice eco system/ 40 rainy days/ 631 mm rain	Field crops	1.00	1	Rice	Maize	-		-	Greengram/ rice	Rice		Poultry (10)		Resource conservation in rice
	Field crops + dairy (1-2)	0.90	6	Rice/ cotton	Rice/ groundnut	-	Cow (0-1) + Buffalo (1-2)	-	Rice/ cotton/ red gram	Rice/ maize/ bengal gram	-	Cow (1) + Buffalo (1-2)+ Poultry (14-15)	Vermi compost	Green gram - rice, cotton +redgram sesbania- rice, livestock mangement for higher income

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District (state)/ NARP zone/ soil type/ rainfall (mm)/ rainy days	Farming System (s)	Area (ha)	No. of Farm households	Existing components (As per benchmark, 2014)					Improved					
				Crop(s)/Cropping system(s)			Livestock/ houshold (including fisheries, if any)	Product diversif-ication	Crop(s)/Cropping system(s)			Livestock/ household (including fisheries, if any)	Product diversif-ication	Capacity buiding
				Kharif	*Rabi*	Summer			*Kharif*	*Rabi*	Summer			
	Field crops + dairy (2) + goat (41-42)	0.87	3	Rice/ cotton	Rice/ maize		Cow (2) + Buffalo (1-2) + goat (41-42)		Rice	Rice/ sun hemp/ maize		Cow (1) + buffalo (1-2) + poultry (10) + goat (10)	Kitchen gardening, dal making, vermi compost	-do-
	Field crops + dairy (3-4) + goat (25-26) + poultry (7-8)	0.92	6	Rice/ cotton	Rice/ maize	-	Cow (1-2) + buffalo (1-2) + goat (25-26) + poultry (7-8)	- cotton	Rice/ cowpea/	Rice/ redgram/ maize	- Buffalo	Cow (0-1) + (0-1) + Poultry (10-11)	-do-	-do-
	Field crops + dairy (2-3)+ poultry (6-7)	0.83	8	Rice/ cotton	Maize/ vegetable	-	Cow (0-1) + buffalo (1-2)+ poultry (6-7)		Rice/ cotton	Rice/ green gram/ cowpea/ red gram		Cow (1-2) + buffalo (1-2-) + poultry (15-16)	-do-	-do-
Kolar (Karnataka)/ AEZ 8.2/Eastern Dry Zone/40 rainy days/827 mm rain	Field crops + dairy (1-2)	0.91	12	Finger millet/ polebean/ maize/ avare/ mulberry/ cauliflower/ tomato/ ridge guard/ sweetcorn/ cabbage/ bitter gourd	Radish/ carrot/ tomato/ sweetcorn/ bitter guard/ mulberry	Tomato/ mullbery	Cow (1-2)	-	Finger millet/ polebean/ avare/ maize/ mulberry/ cauliflower/ tomato/ ridge guard/ flatbean/ carrot/ redgram/ potato/ okra	Radish/ carrot/ sweet corn/ bitter guard/ radish	Tomato/ mulberry	Cow (2) + goat (0-1) + poultry (1-2)	-	-
	Field crops + dairy (1-2) + goat (5)	1.00	5	Finger millet/ mullberry/ tomato/ sericulture	Coriander	Mango	Cow (1) + buffalo (1) + goat (5)	-	Finger millet/ mulberry/ tomato/ sericulture/ avare	Coriander/ mulberry	Mango/ mulberry	Cow (1-2) + buffalo (1) + goat (8-9)	-	-

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District (state)/ NARP zone/ soil type/ rainfall (mm)/ rainy days	Farming System (s)	Area (ha)	No. of Farm households	Existing components (As per benchmark, 2014)					Improved					
				Crop(s)/Cropping system(s)			Livestock/ houshold (including fisheries, if any)	Product diversif-ication	Crop(s)/Cropping system(s)			Livestock/ household (including fisheries, if any)	Product diversif-ication	Capacity buiding
				Kharif	*Rabi*	Summer			*Kharif*	*Rabi*	Summer			
	Field crops + dairy (3-4) + goat (4-5) + poultry (6)	1.50	6	Finger millet/ rice/ mulberry	Carrot/ coriender/ radish	Tomato/ mango/ mulberry	Cow (2-3) + buffalo (1) + goat (4-5) + poultry (5)	-	Finger millet/ rice/ tomato/ mulberry/ ridge guard/ polebean/ groundnut	Carrot/ coriender/ radish/ pumpkin/ mulberry	Tomato/ mulberry/ mango	Cow (2-3)+ buffalo (1) + goat (5-6) + poultry (7-8)	-	-
	Field crops + dairy (1-2) + poultry (20)	0.30	1	Finger millet	Fodder	Tomato	Cow (1) + Buffalo (1) + Poultry (20)	-	Finger millet	Cauliflower/ fodder	Tomato	Cow (1) + Buffalo (1) + Poultry (25)	-	-
Gadag (Karanataka)/ Northern Dry Zone / Arid/36.5 rainfall days/532 mm	Field crops + dairy (1-2)	1.14	24	Maize/ vegetable/ groundnut/ Bt.cotton	Vegetable/ chickpea/ wheat/ sunflower/ Bt.cotton/ sorghum	-	Cow (1) + Buffalo (0-1)	-	Green gram/ maize/ groundnut	Sorghum/ chickpea/ cotton/ wheat	-	Cow (1) + Buffalo (1-2) + Poultry (5-6)	Ghee preparation	Integrated Farming System a noble approach for enhancing farm income
Dharmapuri & Krishnagiri (Tamil Nadu)/NWZ/ Bimodal rainfall/ Start of deccan plateau/50 rainy days/869 mm rain	Field crops + dairy (2-3)	0.67	22	Rice/ turmeric/ groundnut/ button rose/ coconut/ fodder grass/ okra/ jesmine/ Tapioca/ cotton/ fodder maize/ redgram/ topiaca/ fodder sorghum/ horse gram/ blackgram/ lady's finger	Rice/ coconut/ tomato/ ragi/ brinjal/ cowpea/ fodder sorghum/ fodder grass / G.Nut	Coconut	Cow (2-3)	-	Rice/ turmeric/ groundnut/ button rose/ coconut/ fodder grass/ okra/ jesmine/ cotton/ fodder maize/ redgram/ topiaca/ fodder sorghum/ horse gram/ blackgram	Rice/ ragi/ cowpea/ Bitter gourd/ Ridge gourd/ brinjal/ fodder maize		Cow (2-3)+ poultry (11)	Kitchen garden	Rice, ground nut grain and dairy technology

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District (state)/ NARP zone/ soil type/ rainfall (mm)/ rainy days	Farming System (s)	Area (ha)	No. of Farm households	Existing components (As per benchmark, 2014)					Improved					
				Crop(s)/Cropping system(s)			Livestock/ houshold (including fisheries, if any)	Product diversif-ication	Crop(s)/Cropping system(s)			Livestock/ household (including fisheries, if any)	Product diversif-ication	Capacity buiding
				Kharif	*Rabi*	Summer			*Kharif*	*Rabi*	Summer			
	Field crops + dairy + poultry	0.80	2	Rice/ jasmine/ turmeric/ groundnut/ red gram/ coconut/ fodder/ bhendi	Rice/ coconut/ brinjal/ ragi	-		-	Rice/ jasmine/ turmeric/ groundnut/ red gram/ coconut/ fodder/ bhendi/ tomato	Rice/ maize/ groundnut/ ragi	-	Cow (3)+ poultry (8-9)	-do-	-do-
XI. East Coast Plains and Hills														
Srikakulam (Andhra Pradesh)/ high altitude and tribal area zone/ 58 rainy days/ 916 mm rain	Field crops	0.20	1	Rice/ Maize	Maize	-	-	-	Rice	Blackgram		Cow-2 + goat 3 + poultry-5		ZBNF for nutrtion and value addition, Neera preparation, nutritious feed to cow/ buffalo
	Field crops + dairy	0.63	6	Rice/ maize/ green gram	Groundnut/ maize		Cow (0-1) + Buffalo (1-2)		Rice	Rice- blackgram/ Pigeon pea/ green gram/ maize	Sesame	Cow-0-1 + Poultry (9-10)	-d0-	-do-
	Field crops + dairy + goat	0.73	3	Rice/ maize/ green gram	Maize		Cow (1-2)+, Buffalo (1-2) + Goat (32-33)		Rice	Rice- black gram/ pigeonpea/ Finger millet/ green gram/ maize	Sesame	Goat (2-3) + Poultry (9-10)	-do-	-do-

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District (state)/ NARP zone/ soil type/ rainfall (mm)/ rainy days	Farming System (s)	Area (ha)	No. of Farm households	Existing components (As per benchmark, 2014)					Improved					
				Crop(s)/Cropping system(s)			Livestock/ houshold (including fisheries, if any)	Product diversif-ication	Crop(s)/Cropping system(s)			Livestock/ household (including fisheries, if any)	Product diversif-ication	Capacity buiding
				Kharif	*Rabi*	Summer			*Kharif*	*Rabi*	Summer			
	Field crops + dairy + goat + poultry	0.73	6	Rice/ maize/ green gram	Chilli/ maize		Cow (1-2) + Buffalo (1-2) + Goat (37-38) + Poultry (7-8)		Rice	Rice/ black gram/ green gram/ finger millet	Sesame	Cow (1-2) + Buffalo (1-2) + Goat (37-38) + Poultry (10)	-do-	ZBNF for nutrtion and value addition, Neera preparation, nutritious feed to cow/ buffalo
	Field crops + dairy + poultry	0.62	8	Rice/ maize/ green gram	Rice/ maize/ okra		Cow (1) + Buffalo (1-2) + Poultry (7-8)		Rice	Black gram/ sugar cane/ maize/ green gram/ finger millet/ black gram		Cow (1) + Buffalo (1-2) + goat (1-2) + Poultry (10-15)	-do-	ZBNF for nutrtion and value addition, Neera preparation, nutritious feed to cow/ buffalo
Kendrapara (Odisha)/east-south eastern coastal plain zone/68 rainy days/ 1180 mm rain	Field crops + dairy (2)	0.88	8	Rice/ jute / vegetable	Green gram/ rice/ black gram/ vegetable	-	Cow (2)	-	Rice/ jute	Green gram/ rice/ black gram/ vegetable/ bitter guard/ mustard	-	Cow (3-4)+ goat (1-2) + Poultry (8-9) + pond	-	Nutrient mgt in Paddy
	Field crops + dairy (1-2)+ Fish	1.02	5	Rice/ jute/ vegetable	Green gram/ black gram/ vegetable	-	Cow (2)+ Fish	-	Rice/ jute	Green gram/ mustard/ black gram/ vegetable/ bitter guard	-	Cow (4)+ Poultry (10) + pond	Kitchen gardening, compost making, ber budding	Nutrient mgt in Paddy

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District (state)/ NARP zone/ soil type/ rainfall (mm)/ rainy days	Farming System (s)	Area (ha)	No. of Farm households	Existing components (As per benchmark, 2014)					Improved					
				Crop(s)/Cropping system(s)			Livestock/ houshold (including fisheries, if any)	Product diversif-ication	Crop(s)/Cropping system(s)			Livestock/ household (including fisheries, if any)	Product diversif-ication	Capacity buiding
				Kharif	*Rabi*	Summer			*Kharif*	*Rabi*	Summer			
	Field crops + dairy (1-2) + goat (15-16)	1.09	7	Rice/ vegetable	Green gram/ black gram/ vegetable	-	Cow (2)+ Goat (15-16)	-	Rice	Green gram/ vegetable/ black gram/ groundnut/ Bitter gourd	-	Cow (3-4)+ Poultry (8-9)+ Goat (5-6) + pond	Kitchen gardening, compost making, ber budding	-do-
	Field crops + dairy (1) + goat (3-4) + Fish	1.00	2	Rice/ vegetable	Green gram/ black gram/ vegetable		Cow (1)+ Goat (3-4) + Fish	-	Rice	Green gram/ black gram/ vegetable/ groundnut/ mustard/ bitter guard	-	Cow (3-4)+ Poultry (10)+ Goat (2-3)	Kitchen gardening, compost making, ber budding	-do-
	Field crops + dairy (3) + goat (2-3) + Poultry (409-410)	0.89	2	Rice	Rice/ green gram/ black gram/ vegetable	-	Cow (3) + Goat (2-3) + Poultry (409-410)	-	Rice/ jute	Rice/ black gram/ green gram/ bitter guard/ groundnut	Jute	Cow (3-4)+ Poultry (10) + Goat (3-4)	Kitchen gardening, mushrom production	-do-
XII. West Coast Plains and Ghats														
Palghar (Maharashtra)/ North konkan coastal Zone/ 67 rainy days/ 1882 mm rain	Field crops	0.40	11	Rice	Rice/ cowpea	-	-	-	Rice	Rice/ cowpea/ Cluster bean	-	Cow (1-2) + Buffalo (0-1) + goat (1)	Cow & buffalo Milk	Hygenic milk production
	Field crops + Dairy (2-3)	0.39	13	Rice	Rice/ cowpea		Cow (2-3) + Buffalo (2-3)	-	Rice	Rice/ cowpea/ Cluster bean		Cow (1-2) + Buffalo (2-3) + goat (1)	Cow & buffalo Milk	Hygenic milk production

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District (state)/ NARP zone/ soil type/ rainfall (mm)/ rainy days	Farming System (s)	Area (ha)	No. of Farm households	Existing components (As per benchmark, 2014)					Improved					
				Crop(s)/Cropping system(s)			Livestock/ houshold (including fisheries, if any)	Product diversif-ication	Crop(s)/Cropping system(s)			Livestock/ household (including fisheries, if any)	Product diversif-ication	Capacity buiding
				Kharif	*Rabi*	Summer			*Kharif*	*Rabi*	Summer			
Pathinamthitta (Kerala)/ Hot Humid per Humid eco region/ Southern Zone/ 95 rainy days/ 3679 mm rain	Field crops	0.43	10	Rice/ coconut	Rice/ cocoa/ nutmeg	-	-	-	Rice/ coconut	Banana/ rice/ cocoa/ nutmeg	Green manure– cow pea, dhaincha	poultry (25-30)	Kitchen gardening, Pisiculture	Crop production technology, dairy & Poultry production, INM&IPM
	Field crops + Dairy (1-2)	0.45	14	Rice/ coconut	Rice	-	Cow (1-2)	-	Rice/ coconut	Banana/ rice	Green manure– cow pea	Cow (1-2) + poultry (20-25)	-do-	-do-
XIII. Gujarat Plains and Hills														
Mehsana (Gujarat)/ north Gujarat agroclimate zone/ 21 rainy days/ 400 mm rain	Field crops	0.95	2	Cotton/ fodder sorghum	Wheat/ mustard/ lucerne	Fodder sorghum	-	-	Cotton/ black gram/ sorghum/ tomato	Wheat/ lucerne/ funnel	-	Cow (3-4) + Buffalo (3)	Kitchen Gardening, Compost making	-
	Field crops + dairy (1-2)	0.97	15	Cotton/ castor/ pearl millet/ sorghum/ rice/ cluster bean/ fodder sorghum/ lucern	Wheat/ mustard/ lucerne/ tobbaco	Sorghum/ pearl millet/ fodder sorghum	Cow (0-1)+ Buffalo (2-3)	-	Cotton/ cluster bean/ castor/ sorghum/ lucern/ pearl millet/ tomato/ fodder maize/ brinjal/ cowpea/ okra/ chikori/ greengram	Wheat/ castor/ mustard/ oat/ lucerne/ chicory/ funnel	Fodder sorghum/ pearl millet	Cow (0-1) + Buffalo (4-5)	Compost making	-
	Field crops + dairy (3-4) + goat (40-41)	1.07	7	Fodder sorghum/ cotton/ pearl millet/ castor/ cluster bean/ rice/	Wheat/ lucerne/ tobacco/ mustard	Sorghum/ lucerne/ pearl millet	Cow (1) + Buffalo (2-3) + Goat (40-41)	-	Cotton/ cluster bean/ fodder sorghum/ castor/ bottle guard/ rice	Wheat/ lucerne/ cumin/ mustard/ fennel/ okra/ chicory	Fodder sorghum/ lucerne/ pearl millet	Cow (1) + Buffalo (2-3)	Compost making	-

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District (state)/ NARP zone/ soil type/ rainfall (mm)/ rainy days	Farming System (s)	Area (ha)	No. of Farm households	Existing components (As per benchmark, 2014)					Improved					
				Crop(s)/Cropping system(s)			Livestock/ houshold (including fisheries, if any)	Product diversif-ication	Crop(s)/Cropping system(s)			Livestock/ household (including fisheries, if any)	Product diversif-ication	Capacity buiding
				Kharif	*Rabi*	Summer			*Kharif*	*Rabi*	Summer			guar
Panchmahal (Gujarat)/Middle Gujarat III/ 20 rainfall days/ 486 mm rain	Field crops + dairy (2-3)	0.90	7	Rice/ maize/ pigeon pea	Maize/ wheat	Pearl millet	Cow (0-1) + Buffalo (2-3)	-	Rice/ maize/ pigeon pea/ guar/ Bt.cotton	Maize/ wheat/ guar/ cotton	Pearl millet	Cow (0-1) + Buffalo (2-3)	-	Package of practices for Bt. cotton and guar, rearing of calves, Importance of green fodder in animal nutrition, management of goatry and backyard poultry
	Field crops + dairy (1-2) + goat (3-4)	0.69	7	Rice/ maize/ pigeon pea	Maize/ wheat	Groundnut/ pearl millet	Cow (1-2) + Buffalo (1-2) + Goat (3-4)	-	Rice/ maize/ pigeon pea/ guar/ Bt. cotton/ castor	Maize/ wheat/ guar/ cotton/ castor	Ground nut/ pearl millet	Cow (1-2) + Buffalo (1-2) + Goat (3-4)	-	-do-
	Field crops + dairy (1-2) + goat (4-5) + Poultry (5-6)	1.06	7	Rice/ pigeon pea/ maize	Maize	Pearl millet/ ground nut	Cow (0-1) + Buffalo (1-2) + Goat (4-5) + Poultry (5-6)		Rice/ maize/ pigeon pea/ guar/ Bt.cotton	Maize/ guar/ cotton	Pearl millet/ ground nut	Cow (0-1) + Buffalo (2-3) + Goat (4-5) + Poultry (5-6)		-do-
	Field crops + goat (1)+ Poultry (6)	0.84	1	Rice/ maize	Maize		Goat (1)+ Poultry (6)		Rice/ maize/ cotton	Maize/ cotton		Goat (2-3)+ Poultry (8)		-do-
	Field crops + dairy (1) + Poultry (6)	0.84	1	Rice/ maize	Maize		Buffalo (1)+ Poultry (6)		Rice/ maize/ cotton	Maize/ cotton		Buffalo (1)+ Poultry (6)		-do-
	Field crops + goat (3)	0.54	1	Rice/ maize	Maize	-	Goat (3)		Rice/ maize/ castor	Maize/ castor		Goat (3)		-do-

Table 7.4.2(b). Production (on equivalent basis of base crop), marketable surplus and economics of existing and improved farming systems in marginal households

Farming System	Area (ha)	No. of Households	Existing System					Improved (Diversified System)					P value Significance - Existing vs Improved				
			Production (kg)	Marketable Surplus (kg)	Cost (Rs)	Return (Rs)	Profit (Rs)	Production (kg)	Marketable Surplus (kg)	Cost (Rs)	Return (Rs)	Profit (Rs)	Production (kg)	Marketable Surplus (kg)	Cost (Rs)	Return (Rs)	Profit (Rs)
Kangra (Himachal Pradesh)																	
FC	0.26	1	3529	1225	25633	26847	-8483	3758	1225	26875	30062	-8483	-	-	-	-	-
FC+D	0.7	14	3643 (443)	962 (202)	38175 (2937)	14907 (5087)	24705 (3688)	3762 (448)	972 (205)	38949 (2945)	16567 (5127)	24562 (3712)	0.0005***	0.0005***	0.5	0.001***	0.5
FC+D+G	0.67	9	3388 (553)	440 (252)	28572 (3663)	20929 (6345)	22408 (4600)	3554 (558)	440 (256)	29431 (3673)	23250 (6394)	22408 (4629)	0.0156**	-	0.0313**	0.0156**	-
Overall FS						**P value Significance - Existing vs Improved**							<0.0001***	0.1617	<0.0001***	<0.0001***	0.1617
CD [P = 0.05]		FS2 vs FS3	1473	672	9765	16912	12260	1488	682	9792	17045	12340					
Samba (Jammu and Kashmir)																	
FC+D	0.83	24	3009	1597	34446	40781	5478	3085	1663	35109	42018	6457	<0.0001***	<0.0001***	<0.0001***	<0.0001***	<0.0001***
Jeolikote (Uttrakhand)																	
FC+D	0.33	24	7450	5344	41676	55178	23103	9624	7134	44362	80753	43688	<0.0001***	<0.0001***	<0.0001***	<0.0001***	<0.0001***
Ambedkarnagar (Uttar Pradesh)																	
FC	0.3	1	5492	3336	27034	41617	14669	5644	3434	27985	42560	14937	-	-	-	-	-
FC+D	0.38	11	5855 (422)	3667 (277)	31918 (2021)	41270 (5313)	13921 (3589)	5994 (394)	3748 (261)	32912 (2016)	42011 (4928)	13933 (3365)	0.016**	0.016**	0.02**	0.432	0.922
FC+D+G	0.38	8	6696 (495)	3079 (325)	36393 (2370)	47304 (6230)	2091 (4208)	7046 (462)	3317 (306)	38687 (2364)	49383 (5779)	2779 (3946)	0.0313**	0.008***	0.313	0.844	0.063*
Overall FS						**P value Significance - Existing vs Improved**							0.0018***	0.004***	<0.0001***	0.0413**	0.4338
CD [P = 0.05]		FS2 vs FS3	1374	901	6573	17276	11668	1281	848	6554	16024	10942					
South 24 Paragnas (West Bengal)																	
FC	0.56	2	1623 (1367)	685 (1200)	14464 (10468)	8261 (9540)	4879 (7985)	2733 (2832)	1830 (2671)	23688 (19071)	14576 (20974)	1937 (18877)	0.5	0.5	0.5	0.5	0.5
FC+D	0.39	8	2364 (683)	1411 (600)	19577 (5234)	13514 (4770)	173 (3992)	4191 (1416)	2991 (1335)	33247 (9535)	25429 (10487)	8632 (9438)	0.1953	0.1953	0.1953	0.25	0.25
FC+D+F	0.46	1	1717	946	17212	6828	-3968	4711	3785	31748	34199	21238	-	-	-	-	-
FC+D+G	0.45	3	1418 (1116)	833 (980)	18166 (8547)	1683 (7789)	6510 (6519)	3702 (2312)	2184 (2181)	28853 (15571)	22974 (17125)	3125 (15413)	0.25	0.25	0.25	0.25	0.25
FC+D+G+P	0.26	1	2441	1198	21229	12946	-4459	4690	1818	27112	38549	-1427	-	-	-	-	-
FC+D+P	0.52	6	3253 (789)	1447 (693)	24820 (6045)	20723 (5508)	4558 (4610)	7510 (1635)	6105 (1542)	58646 (11010)	46494 (12109)	26827 (10899)	0.3125	0.3125	0.2188	0.3125	0.1563
FC+G	0.67	1	4504	922	46181	16875	-33275	597	229	5383	2970	-2183	-	-	-	-	-

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Farming System	Area (ha)	No. of Households	Existing System					Improved (Diversified System)					P value Significance - Existing vs Improved				
			Production (kg)	Marketable Surplus (kg)	Cost (Rs)	Return (Rs)	Profit (Rs)	Production (kg)	Marketable Surplus (kg)	Cost (Rs)	Return (Rs)	Profit (Rs)	Production (kg)	Marketable Surplus (kg)	Cost (Rs)	Return (Rs)	Profit (Rs)
FC+P	0.44	2	3563 (1367)	2535 (1200)	34013 (10468)	15872 (9540)	1480 (7985)	2733 (2832)	1242 (2671)	24479 (19071)	13779 (20974)	7094 (18877)	1	0.5	0.5	1	0.5
Overall FS						**P value Significance - Existing vs Improved**							0.0304**	0.0309**	0.0582*	0.0178**	0.0233**
CD [P = 0.05]		FS1 vs FS2	3239	2844	24810	22610	18924	6712	6330	45199	49711	44741					
		FS1vs FS4	3740	3284	28648	26108	21852	7750	7310	52192	57401	51662					
		FS1 vs FS6	3345	2937	25624	23352	19545	6932	6538	46682	51341	46208					
		FS1 vs FS8	4097	3598	31382	28600	23938	8490	8007	57173	62880	56593					
		FS2 vs FS4	2774	2436	21246	19362	16206	5748	5421	38707	42570	38314					
		FS2 vs FS6	2213	1943	16948	15446	12928	4585	4325	30877	33959	30564					
		FS2 vs FS8	3239	2844	24810	22610	18924	6712	6330	45199	49711	44741					
		FS4 vs FS6	2897	2544	22191	20223	16926	6003	5662	40428	44463	40017					
		FS4 vs FS8	3740	3284	28648	26108	21852	7750	7310	52192	57401	51662					
		FS6 vs FS8	3345	2937	25624	23352	19545	6932	6538	46682	51341	46208					
Purnea (Bihar)																	
FC+D+G	0.58	19	7024 (505)	3277 (66)	34203 (2262)	204597 (15645)	77216 (1926)	7610 (533)	3660 (102)	34203 (2262)	224543 (16660)	90234 (3198)	<0.0001***	<0.0001***	-	<0.0001***	<0.0001***
FC+D	0.75	4	7184 (1100)	3072 (145)	39275 (4930)	204997 (34098)	65172 (4198)	7888 (1161)	3607 (222)	39275 (4930)	228933 (36310)	83373 (6971)	0.125	-	0.125	0.125	0.125
FC	0.5	1	14778	3593	50500	451946	71656	14778	3593	50500	451946	71656	-	-	-	-	-
Overall FS						**P value Significance - Existing vs Improved**							<0.0001***	<0.0001***	-	<0.0001***	<0.0001***
CD [P = 0.05]		FS1 vs FS2	2516	331	11280	78020	9606	2657	508	11280	83079	15949					
Kamrup (Assam)																	
FC+D+Pig	0.81	7	5293 (1288)	3866 (1012)	12971 (1762)	50541 (14042)	33425 (10778)	5667 (1290)	4174 (1016)	15371 (1775)	52631 (14048)	34715 (10795)	0.0313**	0.0313**	0.0313**	0.0313**	0.0313**
FC+D+P	0.65	2	5732 (2409)	4631 (1893)	16650 (3296)	52132 (26270)	38927 (20165)	6181 (2413)	5000 (1901)	19450 (3320)	54722 (26281)	40554 (20196)	0.500	0.500	0.500	0.500	0.500
FC+D+G + P+Pig	0.90	1	10132	8409	19400	102180	81510	10569	8788	22200	104630	83260	-	-	-	-	-
FC+D+G +Pig	0.60	1	7642	5633	20700	71000	46890	7642	5633	20700	71000	46890	-	-	-	-	-
FC+D+G+P+F	0.67	3	10257 (1967)	7803 (1546)	21800 (2691)	101284 (21449)	71835 (16464)	10555 (1970)	8058 (1552)	23667 (2711)	102999 (21458)	73025 (16490)	0.500	0.500	0.500	0.500	0.500
FC+D+P+F	0.40	1	3884	2961	12900	33712	22627	4293	3296	15700	35812	23852	-	-	-	-	-

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Farming System	Area (ha)	No. of Households	Existing System					Improved (Diversified System)					P value Significance - Existing vs Improved				
			Production (kg)	Marketable Surplus (kg)	Cost (Rs)	Return (Rs)	Profit (Rs)	Production (kg)	Marketable Surplus (kg)	Cost (Rs)	Return (Rs)	Profit (Rs)	Production (kg)	Marketable Surplus (kg)	Cost (Rs)	Return (Rs)	Profit (Rs)
FC+D+P+Pig	0.90	2	8209 (2409)	6101 (1893)	20550 (3296)	77963 (26270)	52668 (20165)	8435 (2413)	6298 (1901)	21950 (3320)	79275 (26281)	53630 (20196)	1.000	1.000	1.000	1.000	1.000
FC+D+F	0.90	1	12052	8730	25900	118724	78864	120529	8730	25900	118724	78864	-	-	-	-	-
FC+D+G+P	0.68	6	4415 (1391)	3647 (1093)	20267 (1903)	32719 (15167)	23495 (11642)	4855 (1393)	4013 (1097)	23067 (1917)	35192 (15173)	25093 (11660)	0.0313**	0.0313**	0.0313**	0.0313**	0.0313**
Overall FS								**P value Significance - Existing vs Improved**					<0.0001***	<0.0001***	<0.0001***	<0.0001***	<0.0001***
CD [P = 0.05]		FS1 vs FS2	5823	4575	7965	63490	48735	5831	4594	8024	63517	48810					
CD [P = 0.05]		FS1 vs FS5	5012	3937	6855	54644	41944	5019	3954	6906	54666	42009					
CD [P = 0.05]		FS1 vs FS7	5823	4575	7965	63490	48735	5831	4594	8024	63517	48810					
CD [P = 0.05]		FS1 vs FS9	4041	3174	5527	44055	33816	4046	3187	5567	44073	33869					
CD [P = 0.05]		FS2 vs FS5	6630	5209	9069	72287	55487	6639	5230	9135	72317	55573					
CD [P = 0.05]		FS2 vs FS7	7263	5706	9934	79186	60783	7273	5729	10007	79219	60877					
CD [P = 0.05]		FS2 vs FS9	5930	4659	8111	64655	49629	5938	4678	8171	64682	49706					
CD [P = 0.05]		FS5 vs FS7	6630	5209	9069	72287	55487	6639	5230	9135	72317	55573					
CD [P = 0.05]		FS5 vs FS9	5136	4035	7025	55993	42980	5143	4051	7076	56016	43047					
CD [P = 0.05]		FS7 vs FS9	6630	5209	9069	72287	55487	6639	5230	9135	72317	55573					
								Kanpur Dehat (Uttar Pradesh)									
FC	0.80	3	9610 (2534)	7537 (2243)	62612 (13201)	62322 (20595)	35372 (17382)	11265 (2672)	8387 (2191)	69522 (13242)	76920 (22368)	39512 (16679)	0.250	0.250	0.250	0.250	0.250
FC+D	0.85	8	12417 (1552)	9997 (1374)	68960 (8084)	92732 (12612)	60998 (10644)	14517 (1636)	10753 (1341)	77327 (8109)	111657 (13698)	62464 (10214)	0.0078***	0.0078***	0.0078***	0.0078***	0.5469
FC+D+G	0.76	8	8063 (1552)	6665 (1374)	50162 (8084)	54652 (12612)	36482 (10644)	9428 (1636)	7494 (1341)	60521 (8109)	62049 (13698)	36895 (10214)	0.0078***	0.0078***	0.0078***	0.0078***	0.4609
FC+G	0.33	5	8050 (1963)	6650 (1738)	48907 (10225)	55745 (15953)	37545 (13464)	9603 (2070)	7442 (1697)	57812 (10257)	67023 (17326)	38938 (12919)	0.0625*	0.0625*	0.0625*	0.0625*	1.000
Overall FS								**P value Significance - Existing vs Improved**					<0.0001***	<0.0001***	<0.0001***	<0.0001***	0.1084
CD [P = 0.05]		FS1 vs FS2	6199	5487	32289	50376	42516	6536	5358	32390	54713	40797					
CD [P = 0.05]		FS1 vs FS3	6199	5487	32289	50376	42516	6536	5358	32390	54713	40797					
CD [P = 0.05]		FS1 vs FS4	6687	5919	34831	54341	45863	7050	5780	34940	59020	44008					
CD [P = 0.05]		FS2 vs FS3	4578	4053	23847	37205	31400	4827	3957	23922	40408	30130					
CD [P = 0.05]		FS2 vs FS4	5220	4621	27190	42420	35802	5504	4512	27275	46073	34354					
CD [P = 0.05]		FS3 vs FS4	5220	4621	27190	42420	35802	5504	4512	27275	46073	34354					

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Farming System	Area (ha)	No. of Households	Existing System					Improved (Diversified System)					P value Significance - Existing vs Improved				
			Production (kg)	Marketable Surplus (kg)	Cost (Rs)	Return (Rs)	Profit (Rs)	Production (kg)	Marketable Surplus (kg)	Cost (Rs)	Return (Rs)	Profit (Rs)	Production (kg)	Marketable Surplus (kg)	Cost (Rs)	Return (Rs)	Profit (Rs)
Sirsa (Haryana)																	
FC+D	0.58	24	2487	814	68886	31739	3429	2487	3129	73943	36796	(37037)	-	0.0001***	<0.0001***	<0.0001***	0.0037**
Amritsar (Punjab)																	
FC+D	1.08	24	12788	10150	94124	161644	108872	14788	11158	98156	164565	117882	<0.0001***	<0.0001***	-	<0.0001***	<0.0001***
Kabirdham (Chhatisgarh)																	
FC	0.84	12	5777 (509)	4617 (466)	16862 (2083)	52463 (4594)	38545 (4270)	11115 (353)	9310 (346)	14783 (132)	55146 (4503)	46694 (4408)	0.495	0.898	0.404	0.661	0.184
FC+D	0.77	9	6913 (588)	5398 (538)	22267 (2405)	60689 (5305)	42509 (4931)	13259 (407)	11082 (399)	14922 (152)	68213 (5199)	59535 (5089)	0.392	0.684	0.003***	0.335	0.067*
FC+D+G	0.60	1	5233	3283	18500	44300	20900	5626	5031	15010	58691	50841	-	-	-	-	-
FC+D+G+P	0.60	1	4192	3346	13050	37250	27100	7312	6716	15320	80464	72664	-	-	-	-	-
FC+D+P	0.80	1	7800	6058	20390	73200	52310	5592	4970	14440	58817	50667	-	-	-	-	-
Overall FS			**P value Significance - Existing vs Improved**										0.374	0.449	0.010**	0.186	0.006***
CD [P = 0.05]		FS 1vs FS 2	1629	1488	6660	14688	13653	1128	105	20	4395	4092					
Pakur (Jharkhand)																	
FC	0.76	22	2119 (195)	1455 (189)	9014 (263)	12178 (1851)	5531 (1775)	3599 (201)	2117 (191)	24488 (264)	11506 (1910)	3319 (1793)	0.0001***	0.0001***	0.0001***	0.0392**	0.0001***
FC+D	0.72	2	890 (647)	612 (628)	7267 (874)	1634 (6139)	1147 (5887)	2399 (665)	1271 (633)	22741 (874)	1250 (6336)	10034 (5948)	0.500	0.500	0.500	0.500	0.500
Overall FS			**P value Significance - Existing vs Improved**										0.0001***	0.0001***	0.0001***	0.0349**	0.0001***
CD [P = 0.05]		FS1vs FS2	1402	1360	1892	13298	12751	1440	1371	1892	13725	12883					
Dindori (Madhya Pradesh)																	
FC	0.72	3	5384 (1389)	3764 (1076)	17498 (2205)	63261 (20435)	38960 (15814)	7095 (1949)	5158 (1492)	27898 (2926)	78522 (27473)	49472 (20725)	0.2500	0.2500	0.2500	0.2500	0.2500
FC+D	0.76	16	5028 (601)	3525 (466)	19633 (955)	55784 (8849)	33243 (6848)	7246 (844)	5329 (646)	31111 (1267)	77574 (11896)	48831 (8974)	0.0001***	0.0001***	0.0001***	0.0001***	0.0001***
FC+D+G	0.73	2	4873 (1701)	3255 (1318)	18850 (2700)	54238 (25028)	29975 (19368)	7364 (2387)	5053 (1828)	31025 (3584)	79435 (33647)	44770 (25383)	0.500	0.500	0.500	0.500	0.500
FC+D+P	0.69	2	2284 (1701)	1649 (1318)	12950 (2700)	21310 (25028)	11785 (19368)	4257 (2387)	3306 (1828)	23350 (3584)	40510 (33647)	26235 (25383)	0.500	0.500	0.500	0.500	0.500
FC+G	0.65	1	6448	4961	27750	68970	46670	7823	6020	38150	79195	52145	-	-	-	-	-
Overall FS			**P value Significance - Existing vs Improved**										0.0001***	0.0001***	0.0001***	0.0001***	0.0001***
CD [P = 0.05]		FS1 vs FS2	3168	2455	5029	46609	36069	4446	3404	6675	62661	47270					
CD [P = 0.05]		FS1 vs FS3	4597	3562	7297	67628	52335	6451	4939	9685	90918	68586					

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Farming System	Area (ha)	No. of Households	Existing System					Improved (Diversified System)					P value Significance - Existing vs Improved				
			Production (kg)	Marketable Surplus (kg)	Cost (Rs)	Return (Rs)	Profit (Rs)	Production (kg)	Marketable Surplus (kg)	Cost (Rs)	Return (Rs)	Profit (Rs)	Production (kg)	Marketable Surplus (kg)	Cost (Rs)	Return (Rs)	Profit (Rs)
CD [P = 0.05]		FS1 vs FS4	4597	3562	7297	67628	52335	6451	4939	9685	90918	68586					
CD [P = 0.05]		FS2 vs FS3	3777	2927	5995	55562	42997	5300	4058	7957	74697	56349					
CD [P = 0.05]		FS2 vs FS4	3777	2927	5995	55562	42997	5300	4058	7957	74697	56349					
CD [P = 0.05]		FS3 vs FS4	5035	3902	7993	74083	57330	7067	5411	10609	99596	75132					
Angul (Odisha)																	
FC	0.80	1	4158	2402	41570	17060	-7700	6888	4851	60701	36414	5654	-	-	-	-	-
FC+D	0.83	14	3637 (8431)	2499 (583)	35257 (3575)	16024 (117518)	-16 (5218)	8981 (8576)	5970 (711)	57037 (4085)	69600 (118503)	37837 (8910)	0.0001***	0.0001***	0.0001***	0.0001***	0.0001***
FC+D+P	0.89	8	21429 (11153)	2604 (771)	22141 (4730)	280007 (155462)	14571 (6902)	25454 (11345)	5713 (941)	40270 (5404)	318628 (156765)	42233 (11786)	0.008***	0.008***	0.008***	0.008***	0.008***
FC+P	0.80	1	4851	4117	27125	41275	30925	7082	5812	40917	58941	42790	-	-	-	-	-
Overall FS								**P value Significance - Existing vs Improved**					<0.0001***	<0.0001***	<0.0001***	<0.0001***	<0.0001***
CD [P = 0.05]		FS2 vs FS3	29164	2017	12367	406516	18049	29666	2461	14132	409924	30820					
Katni (Madhya Pradesh)																	
FC	0.70	3	6404 (329)	5736 (196)	31490 (412)	54967 (4099)	45940 (2359)	9718 (314)	8197 (195)	39417 (987)	91771 (3716)	71239 (2319)	0. 250	0. 250	0. 250	0. 250	0. 250
FC+D	0.71	9	5560 (190)	5114 (113)	30070 (238)	44989 (2367)	38964 (1362)	8797 (181)	7495 (112)	39181 (570)	79579 (2145)	62002 (1339)	0.0039***	0.0039***	0.0039***	0.0039***	0.0039***
Overall FS								**P value Significance - Existing vs Improved**					<0.0001***	<0.0001***	<0.0001***	<0.0001***	<0.0001***
CD [P = 0.05]		FS1vs FS2	846	504	1061	10546	6068	807	501	2538	9559	5968					
Udaipur (Rajasthan)																	
FC	0.70	2	3061 (955)	1089 (862)	29734 (13193)	11591 (15355)	-15034 (17540)	3720 (535)	4008 (913)	21450 (1217)	28765 (6515)	32652 (11906)	1.00	0.500	0.500	0.500	0.500
FC+D	0.60	7	2780 (510)	810 (461)	37017 (7052)	515 (8207)	-26085 (9376)	3101 (286)	4529 (488)	20407 (650)	21458 (3483)	40733 (6364)	0.6875	0.0156**	0.0781	0.0313**	0.0156**
FC+D+G	0.66	15	4014 (349)	2029 (315)	43913 (4818)	10276 (5607)	-16524 (6405)	3069 (195)	3722 (333)	21350 (444)	20079 (2379)	28902 (4347)	0.0413**	0.0054***	<0.0004***	0.0833*	<0.0001***
Overall FS								**P value Significance - Existing vs Improved**					0.1748	<0.0001***	<0.0001***	<0.0038***	<0.0001***
CD [P = 0.05]		FS1 vs FS2	2251	2034	31111	36208	41361	1263	2153	2870	15363	28075					
CD [P = 0.05]		FS1 vs FS3	2113	1909	29209	33994	38833	1185	2022	2694	14424	26359					
CD [P = 0.05]		FS2 vs FS3	1285	1161	17761	20671	23613	721	1229	1638	8771	16028					
Aurangabad (Maharashtra)																	
FC	0.47	21	2087 (214)	2127 (242)	59174 (6172)	24308 (5835)	25889 (6689)	2471 (251)	2533 (313)	70174 (7677)	28679 (6047)	31148 (7409)	<0.0001***	0.0005***	<0.0001***	0.0049***	0.4980

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Farming System	Area (ha)	No. of Households	Existing System					Improved (Diversified System)					P value Significance - Existing vs Improved				
			Production (kg)	Marketable Surplus (kg)	Cost (Rs)	Return (Rs)	Profit (Rs)	Production (kg)	Marketable Surplus (kg)	Cost (Rs)	Return (Rs)	Profit (Rs)	Production (kg)	Marketable Surplus (kg)	Cost (Rs)	Return (Rs)	Profit (Rs)
FC+D	0.75	3	1003 (567)	856 (640)	52625 (16331)	-12523 (15439)	-18399 (17697)	1038 (665)	891 (829)	53639 (20311)	-12136 (15998)	-18013 (19603)	1.000	1.000	1.000	1.000	1.000
Overall FS							**P value Significance - Existing vs Improved**						0.0006***	0.0049***	0.0004***	0.1078	0.0827*
CD [P = 0.05]		FS 1 vs FS2	1258	1418	36206	34229	39236	1475	1837	45032	35468	43461					
							Pune (Maharashtra)										
FC+D	0.53	24	6455	5720	62725	156729	131750	7310	6575	63304	185220	160241	<0.0001***	<0.0001***	<0.0001***	<0.0001***	<0.0001***
							Amravati (Maharashtra)										
FC+D	0.87	20	913 (156)	788 (133)	15469 (1967)	16484 (3964)	12115 (3202)	1624 (177)	1305 (147)	23536 (2244)	33304 (4321)	22129 (3471)	<0.0001***	<0.0001***	<0.0001***	<0.0001***	<0.0006***
FC+G	0.80	3	368 (404)	298 (343)	10753 (5078)	2127 (10235)	-313 (8269)	766 (457)	469 (380)	17554 (5795)	9247 (11156)	-1133 (8963)	0.250	0.250	0.250	0.250	1.000
FC+P	0.80	1	790	582	16713	10937	3657	1389 (792)	1023	25157	23463	10663	-	-	-	-	-
Overall FS							**P value Significance - Existing vs Improved**						<0.0001***	<0.0001***	<0.0001***	<0.0001***	<0.0004***
CD [P = 0.05]		FS1 vs FS2	903	767	11359	22895	18496	1023	851	12962	24956	20049					
							Warangal (Telangana)										
FC	1.00	1	12434	1145	32719	526790	18812	12843	1508	38239	539705	29627	-	-	-	-	-
FC+D	0.90	6	2282 (3248)	624 (1033)	25742 (10729)	2321 (36825)	2631 (3257)	865 (1042)	31142 (10805)	31142 (10805)	87271 (138091)	7786 (37169)	0.1250	0.1250	0.1250	0.1250	0.1250
FC+D+G	0.87	3	243 (3564)	230 (1133)	6559 (12363)	4396 (150774)	3796 (40223)	711 (3580)	613 (1146)	15907 (12727)	16085 (151417)	11672 (40615)	0.250	0.250	0.250	0.250	0.250
FC+D+G+P	0.92	6	2159 (2520)	833 (801)	17347 (8742)	79808 (106613)	20120 (28442)	2533 (2531)	1067 (810)	24399 (8999)	89569 (107068)	23611 (28719)	0.0313**	0.0313**	0.0313**	0.0313**	0.0313**
FC+D+P	0.83	8	4859 (2183)	1788 (694)	24944 (7571)	193719 (92330)	55513 (24631)	5120 (2192)	1982 (702)	31850 (7794)	198540 (92724)	57322 (24871)	0.0078***	0.0078***	0.0078***	0.0234**	0.1953
Overall FS							**P value Significance - Existing vs Improved**						<0.0001***	<0.0001***	<0.0001***	<0.0001***	<0.0001***
CD [P = 0.05]		FS2 vs FS3	10467	3330	34579	443522	118678	10495	3358	34824	445038	119788					
CD [P = 0.05]		FS2 vs FS4	8846	2814	29224	374845	100301	8870	2838	29432	376126	101239					
CD [P = 0.05]		FS2 vs FS5	8392	2670	27725	355609	95154	8415	2693	27921	356824	96044					
CD [P = 0.05]		FS3 vs FS4	9690	3083	32014	410622	109875	9717	3109	32241	412025	110902					
CD [P = 0.05]		FS3 vs FS5	9278	2952	30651	393140	105197	9303	2977	30868	394484	106181					
CD [P = 0.05]		FS4 vs FS5	7401	2355	24451	313618	83918	7421	2375	24624	314689	84703					
							Kolar (Karnataka)										
FC+D	0.91	12	49245 (10627)	26404 (3466)	155307 (19132)	435633 (118835)	161545 (31056)	82966 (13800)	60229 (10702)	265914 (38035)	729684 (142809)	456829 (101385)	0.0005***	0.001**	0.0005***	0.0005***	0.0034***

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Farming System	Area (ha)	No. of Households	Existing System					Improved (Diversified System)					P value Significance - Existing vs Improved				
			Production (kg)	Marketable Surplus (kg)	Cost (Rs)	Return (Rs)	Profit (Rs)	Production (kg)	Marketable Surplus (kg)	Cost (Rs)	Return (Rs)	Profit (Rs)	Production (kg)	Marketable Surplus (kg)	Cost (Rs)	Return (Rs)	Profit (Rs)
FC+D+G	1.00	5	13884 (16463)	10686 (5369)	89806 (29639)	76804 (184099)	38431 (48112)	14994 (21379)	10686 (16579)	99696 (58924)	80234 (221239)	28541 (157065)	0.0625*	-	0.0625*	0.8125	0.0625*
FC+D+G+P	1.50	6	47537 (15029)	27156 (4901)	137149 (27057)	433290 (168058)	188728 (43920)	88018 (19516)	64993 (15134)	191391 (53790)	864830 (201963)	588521 (143380)	0.0313**	0.0313**	0.0313**	0.0313**	0.0313**
FC+D+P	0.30	1	45142	13845	110760	430940	55380	149743	53498	240960	1555954	401020	-	-	-	-	-
Overall FS								**P value Significance - Existing vs Improved**					<0.0006***	0.0007***	<0.0006***	<0.0013***	0.0014**
CD [P = 0.05]		FS1 vs FS2	40874	13330	73589	457079	119452	53080	41162	146295	549291	389960					
CD [P = 0.05]		FS1 vs FS3	38395	12521	69124	429351	112206	49860	38665	137420	515969	366304					
CD [P = 0.05]		FS2 vs FS3	46498	15164	83714	519970	135888	60383	46826	166424	624869	443616					
								Gadag (Karnataka)									
FC+D	1.14	24	1396	1152	20342	34439	25746	2867	2588	44508	69119	59015	<0.0001***	<0.0001***	<0.0001***	<0.0001***	<0.0001***
								Dharmapuri & Krishnagiri / Paiyur (Tamil Nadu)									
FC+D	0.67	22	14484 (1551)	12762 (1535)	128624 (12351)	88641 (12668)	62802 (14281)	17467 (1700)	15501 (1704)	161447 (13799)	100565 (13014)	71065 (14570)	0.005***	0.005***	0.0001***	0.0338**	0.0874*
FC+D+P	0.80	2	8672 (5145)	8034 (5091)	64681 (40965)	65403 (42016)	55835 (47365)	13837 (5638)	13098 (5650)	121427 (45765)	86124 (43162)	75050 (48325)	0.500	0.500	0.500	0.500	0.500
Overall FS								**P value Significance - Existing vs Improved**					0.0009***	0.001***	0.0003***	0.0174*	0.0495**
CD [P = 0.05]		FS1 vs FS2	11145	11029	88734	91011	102597	12212	12239	99132	93492						
								Srikakulam (Andhra Pradesh)									
FC	0.20	1	1390	355	7250	10124	(2810)	2842	427	7400	28124	-2060	-	-	-	-	-
FC+D	0.63	6	11457 (9847)	11021 (5847)	14301 (4419)	128916 (122215)	123466 (71162)	14050 (12273)	11100 (6560)	14496 (4420)	161127 (152777)	124249 (80430)	0.0313**	0.0313**	0.0313**	0.0313**	0.0313**
FC+D+G	0.73	3	11101 (13926)	10592 (8269)	10633 (6250)	128129 (1728380)	121772 (100639)	13317 (17356)	10652 (9277)	10827 (6250)	155640 (216060)	122328 (113746)	0.2500	0.2500	0.2500	0.2500	0.2500
FC+D+G+P	0.73	6	10485 (9847)	10128 (5847)	6325 (4419)	124734 (122215)	120275 (71162)	12493 (12273)	10239 (6560)	6530 (4420)	149628 (152777)	121459 (80430)	0.0313**	0.0313**	0.0313**	0.0313**	0.0313**
FC+D +P	0.62	8	23425 (8528)	8778 (5064)	9297 (3827)	283521 (105841)	100432 (61628)	31341 (10628)	13087 (5681)	9495 (3828)	382265 (132309)	154090 (69655)	0.0078***	0.0078***	0.0078***	0.0078***	0.0078***
Overall FS								**P value Significance - Existing vs Improved**					0.009***	0.1363	<0.0001***	0.0093***	0.1403
CD [P = 0.05]		FS2 vs FS3	35699	21198	16021	443056	257980	44492	23781	16023	553852	291579					
CD [P = 0.05]		FS2 vs FS4	29148	17308	13081	361753	210639	36327	19417	13082	452218	238073					
CD [P = 0.05]		FS2 vs FS5	27265	16190	12236	338389	197035	33981	18163	12237	423011	222697					
CD [P = 0.05]		FS3 vs FS4	35699	21198	16021	443056	257980	44492	23781	16023	553852	291579					
CD [P = 0.05]		FS3 vs FS5	34179	20295	15339	424193	246997	42597	22768	15340	530273	279165					

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Farming System	Area (ha)	No. of Households	Existing System					Improved (Diversified System)					P value Significance - Existing vs Improved				
			Production (kg)	Marketable Surplus (kg)	Cost (Rs)	Return (Rs)	Profit (Rs)	Production (kg)	Marketable Surplus (kg)	Cost (Rs)	Return (Rs)	Profit (Rs)	Production (kg)	Marketable Surplus (kg)	Cost (Rs)	Return (Rs)	Profit (Rs)
CD [P = 0.05]		FS4 vs FS5	27265	16190	12236	338389	197035	33981	18163	12237	423011	222697					
Kendrapara (Odhisha)																	
FC+D	0.88	8	8621 (915)	5620 (769)	35148 (4271)	68302 (7417)	32289 (5824)	10775 (972)	6883 (900)	42408 (4576)	86898 (7754)	40194 (6946)	<0.0078***	<0.0078***	<0.0078***	<0.0078***	<0.0078***
FC+D+F	1.02	5	7484 (1157)	4589 (972)	33209 (5402)	56600 (9382)	21856 (7367)	10070 (1229)	6619 (1139)	44330 (5788)	76511 (9808)	35101 (8786)	0.0625*	0.0625*	0.0625*	0.0625*	0.0625*
FC+D+G	1.09	7	6619 (978)	3861 (822)	34469 (4566)	44963 (7929)	11863 (6226)	8484 (1039)	5189 (962)	39612 (4891)	62197 (8289)	22658 (7426)	0.0156**	0.0156**	0.0156**	0.0156**	0.0156**
FC+D+G+F	1.00	2	8761 (1829)	5765 (1537)	39811 (8542)	65322 (14834)	29366 (11648)	10232 (1943)	6151 (1800)	44308 (9151)	78481 (15508)	29508 (13892)	0.500	0.500	0.500	0.500	0.500
FC+D+G+P	0.89	2	8708 (1829)	5090 (1537)	47484 (8542)	57007 (14834)	13597 (11648)	10180 (1943)	6193 (1800)	52090 (9151)	70065 (15508)	22227 (13892)	0.500	0.500	0.500	0.500	0.500
Overall FS								**P value Significance - Existing vs Improved**					<0.0001***	<0.0001***	<0.0001***	<0.0001***	<0.0001***
CD [P = 0.05]		FS1 vs FS2	3087	2594	14414	25032	19656	3279	3038	15442	26168	23443					
CD [P = 0.05]		FS1 vs FS3	2802	2355	13085	22725	17845	2977	2758	14019	23757	21282					
CD [P = 0.05]		FS1 vs FS4	4281	3598	19988	34713	27258	4547	4213	21414	36289	32509					
CD [P = 0.05]		FS1 vs FS5	4584	3853	21404	37171	29188	4869	4512	22931	38859	34811					
CD [P = 0.05]		FS2 vs FS3	3171	2665	14804	25711	20189	3368	3121	15861	26878	24078					
CD [P = 0.05]		FS2 vs FS4	4530	3808	21154	36737	28847	4812	4459	22663	38405	34405					
CD [P = 0.05]		FS2 vs FS5	4530	3808	21154	36737	28847	4812	4459	22663	38405	34405					
CD [P = 0.05]		FS3 vs FS4	4341	3649	20272	35206	27645	4612	4273	21718	36804	32970					
CD [P = 0.05]		FS3 vs FS5	4341	3649	20272	35206	27645	4612	4273	21718	36804	32970					
CD [P = 0.05]		FS4 vs FS5	5415	4551	25283	43909	34479	5752	5329	27087	45902	41121					
Palghar (Maharashtra)																	
FC		11	8723 (1442)	6980 (1359)	39774 (4037)	83223 (16354)	58650 (15203)	5570 (214)	5134 (193)	37004 (1509)	41528 (1652)	35383 (1222)	0.3203	0.6377	0.6377	0.3203	0.6377
FC+D		13	8937 (1326)	7281 (1250)	38748 (3714)	87259 (15043)	63910 (13985)	5074 (197)	4541 (177)	32476 (1388)	39063 (1519)	31557 (1124)	0.0105**	0.0171**	0.1909	0.0081***	0.0215**
Overall FS								**P value Significance - Existing vs Improved**					0.0013***	0.0190**	0.1161	0.0004***	0.0113**
CD [P = 0.05]		FS1 vs FS2	4063	3830	11377	46082	42839	604	543	4252	4655	3443					
Pathinamthitta (Kerala)																	
FC		10	2862 (696)	2803 (645)	25921 (8568)	35613 (7777)	34353 (7043)	4056 (575)	2803 (645)	43266 (6866)	43940 (7056)	17009 (9149)	0.0010***	-	0.0010***	0.0010***	0.0010***
FC+D		14	5843 (589)	5601 (545)	56411 (7241)	69221 (6573)	64004 (5952)	6822 (486)	5601 (545)	70767 (5803)	75906 (5963)	49647 (7733)	0.0156**	-	0.0156**	0.0156**	0.0156**

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Farming System	Area (ha)	No. of Households	Existing System					Improved (Diversified System)					P value Significance - Existing vs Improved				
			Production (kg)	Marketable Surplus (kg)	Cost (Rs)	Return (Rs)	Profit (Rs)	Production (kg)	Marketable Surplus (kg)	Cost (Rs)	Return (Rs)	Profit (Rs)	Production (kg)	Marketable Surplus (kg)	Cost (Rs)	Return (Rs)	Profit (Rs)
Overall FS								**P value Significance - Existing vs Improved**					<0.001***	<0.001***	<0.001***	<0.001***	0.013**
CD [P = 0.05]		FS1 vs FS2	1891	1752	23264	21117	19124	1562	1752	18645	19159	24844					
								Mehsana (Gujarat)									
FC	0.95	2	19347 (12117)	17709 (11390)	115275 (64566)	78198 (75613)	61813 (73155)	23652 (11754)	21939 (11007)	141730 (67436)	94793 (72230)	73458 (71779)	0.5000	0.5000	0.5000	0.5000	0.500
FC+D	0.97	15	25578 (4424)	20554 (4159)	190212 (23576)	65565 (27610)	15332 (26713)	27599 (4292)	22176 (4019)	205521 (24624)	70466 (26375)	16590 (26210)	<0.0001***	0.0001***	<0.0001***	0.0479**	0.2769
FC+D+G	1.07	7	28507 (6477)	24758 (6088)	127347 (34512)	157722 (40417)	120229 (39103)	31455 (6283)	27515 (5884)	143572 (36046)	170975 (38609)	130570 (38367)	0.0313**	0.0313**	0.0156**	0.0313**	0.0313**
Overall FS								**P value Significance - Existing vs Improved**					0.0001***	0.0001***	0.0001***	0.0028***	0.0442**
CD [P = 0.05]		FS1 vs FS2	26826	25218	142943	167401	161960	26022	24370	149297	159913	158912					
		FS1 vs FS3	28572	26859	152250	178301	172504	27716	25956	159017	170325	169259					
		FS2 vs FS3	16312	15334	86919	101792	98483	15823	14818	90783	97238	96630					
								Panchmahal (Gujarat)									
FC+D	0.90	7	13688 (1841)	11275 (1741)	73016 (7955)	63866 (11260)	39734 (10460)	17462 (1824)	15444 (1825)	83053 (7596)	91571 (11450)	71382 (12761)	0.0156**	0.0156**	0.0156**	0.0156**	0.0156**
FC+D+G	0.69	7	17671 (1841)	13247 (1741)	78700 (7955)	98015 (11260)	53768 (10460)	21669 (1824)	18274 (1825)	91090 (7596)	125596 (11450)	91650 (12761)	0.0156**	0.0156**	0.0156**	0.0156**	0.0156**
FC+D +G +P	1.06	7	16020 (1841)	12636 (1741)	75764 (7955)	84438 (11260)	50595 (10460)	20739 (1824)	16110 (1825)	90464 (7596)	116923 (11450)	70638 (12761)	0.0156**	0.0156**	0.0156**	0.0156**	0.0156**
FC+D +P	0.84	1	14030	8796	42060	98235	45895	19979	12746	60960	138835	66495	-	-	-	-	-
FC+G	0.54	1	5051	3179	17200	33310	14585	8901	4579	34000	55010	11785	-	-	-	-	-
FC+G +P	0.84	1	8182	5994	36450	45365	23490	16082	13894	61650	99165	77290	-	-	-	-	-
Overall FS								**P value Significance - Existing vs Improved**					<0.0001***	<0.0001***	<0.0001***	<0.0001***	<0.0001***
CD [P = 0.05]		FS1 vs FS2	5469	5173	23636	33455	31077	5419	5423	22568	34019	37915					
CD [P = 0.05]		FS1 vs FS3	5469	5173	23636	33455	31077	5419	5423	22568	34019	37915					
CD [P = 0.05]		FS2 vs FS3	5469	5173	23636	33455	31077	5419	5423	22568	34019	37915					

Note: FC: Field crops, D: Dairy, P: Poultry,G:Goat, F: Fish
* indicates significance at 10% level
* indicates significance at 5% level
*** indicates significance at 1% level
- Values in ( ) indicates standard error of mean values
- The farming system with only one household were not considered for ANOVA as well as for paired t test.

goat + poultry were found among which field crop + dairy is being practiced by 62.5% households having mean area of 0.33 ha. Diversification of crops in *kharif* and *rabi* along with introduction of kitchen garden resulted in improvement in production, and increase in profit. Among the parameters, significant difference was observed between existing and diversified system for production, marketable surplus, cost, return and profit for field crop + dairy system. Diversification resulted in additional profit of Rs 20,585 from 0.33 ha.

Eastern Himalaya

Ambedkarnagar (Uttar Pradesh): Three farming systems *viz*; field, crops, field crops + dairy and field crops + dairy + goat was found among which field crops + dairy was practiced by 55 % farm households having mean area of 0.38 ha while field crops + dairy + goat system was found in 40 % households having mean area of 0.38 ha. Diversification of cropping and livestock components resulted in significantly higher production, marketable surplus and cost in field crops + dairy and field crop +dairy +goat systems. Among the systems, higher production (7046 kg on rice equivalent basis) was observed in field crops +dairy + goat system while the marketable surplus was higher in field crop + dairy system (3748 kg on rice equivalent basis).

Kamrup (Assam): Nine farming systems *viz*; field, crops + dairy + poultry + goat, field crops + dairy + poultry, field crops + dairy + goat + poultry + pig, field crops +dairy + goat + poultry + fish, field crops + dairy +poultry + fish, field crops + dairy + pig +poultry, field crops + dairy + goat + poultry and field crops + dairy + fish were found among which field, crops + dairy + poultry + goat and field crops + dairy + goat + poultry are dominant based on number of households adopting the system. Diversification of cropping and livestock components resulted in difference in production, marketable surplus, cost, return and profit in field crops + dairy + pig and field crops + dairy + goat + poultry system. Among the systems, higher production after diversification was observed in in field crops + dairy + goat + pig + poultry (10569 kg on rice equivalent basis).

Lower Gangetic Plains

South 24 Paragnas (West Bengal): Eight farming systems *viz;* , field crops, field crops + dairy, field crops + dairy + fish, field crops + dairy + goat, field crops + dairy + goat + poultry, field crops + dairy + poultry, field crops + goat and field crops + poultry were found among which field crops + dairy system is practiced by 33 % households having mean area of 0.39 ha followed by field crops + dairy +poultry by 25 % households having mean area of 0.52 ha. Diversification did not result in significant improvement in production, marketable surplus, cost, return and profit in all the farming systems during the year, however, field crops + dairy + poultry system recorded higher profit after interventions among the different farming systems.

Middle Gangetic Plains

Purnea (Bihar): Three farming systems *viz;*, field crops, field crops + dairy and field crops + dairy + goat was found among which 79% households were having the field crops + dairy + goat system. Among the farming systems, field crops + dairy + goat system resulted significant change in production, marketable surplus, return and profit (additional amount of Rs 13,018 from 0.58 ha).

Upper Gangetic Plain

Kanpur Dehat (Uttar Pradesh): Four farming systems *viz;,* field crops, field crops + dairy, field crops + dairy + goat and field crops + goat were found among which field crops + dairy and field crops + dairy + goat were practiced by 66 % households. Diversification of existing systems resulted in significantly higher production, marketable surplus, cost and returns in field crops + dairy, field crops + dairy + goat and field crops + goat systems. Among the farming systems, significantly higher production (14,517 kg on rice equivalent basis) and returns (Rs 1,11,657 from 0.85 ha) were observed in field crop + dairy system.

Trans Gangetic Plains

Amritsar (Punjab): Only one farming system *viz*;, field crops + dairy was observed in all the households having mean area of 1.08 ha. Diversification did not result in significant change in production, marketable surplus and profit.

Sirsa (Haryana): Only one farming system *viz*;, field crops + dairy was observed in all the households having mean area of 0.58 ha. Diversification resulted in significantly higher marketable surplus (3129 kg on rice equivalent basis) and profit (Rs 37,037).

Eastern plateau and hills

Kabirdham (Chhatisgarh): Five farming systems namely field crops, field crops + dairy, field crops + dairy + goat, field crops + dairy + goat + poultry and field crops + dairy + poultry were found among which field crops alone was practiced by 50% households having mean area of 0.84 ha followed by field crops + dairy by 37.5 % households having mean area 0.77 ha. Significant change in cost and profit was observed in field crops + dairy system. Diversification resulted in 32.9 % reduction in cost mainly due to recycling and 40 % increase in profit of field crops + dairy system. Among the systems, field crops + dairy + goat + poultry resulted in higher profit (Rs 72,664 from 0.60 ha) compared to field crop + dairy (Rs 59,535 from 0.77 ha).

Pakur (Jharkhand): Two farming systems namely field crops and field crops + dairy were found among which 91% households were having the field crops + dairy system with mean area of 0.76 ha. Diversification of existing system resulted in significant change in field crop alone system in terms of production, marketable surplus, cost, returns and profit. Among the farming systems higher production and marketable surplus was observed in field crops alone system while profit and returns were higher in field crops + dairy system.

Dindori (Madhya Pradesh): Five farming systems namely field crops, field crops + dairy, field crops + dairy + goat, field crops + dairy + poultry and field crops + goat were found among which 66% farm households were having field crops + dairy system with mean area 0.76 ha. Diversification resulted in significantly higher production (14 %), marketable surplus (51 %), cost, returns (39 %) and profit (additional amount of Rs 15,588 from 0.76 ha) in field crops + dairy system only. Among the systems, field crops + goat resulted in higher profit (Rs 52,145 from 0.65 ha).

Angul (Odisha): Four farming systems namely field crops, field crops + dairy, field crops + dairy + poultry and field crops + poultry were found among which 58% households were having field crops + dairy with mean area 0.83 ha followed by 33 % households having field crops + dairy + poultry system with 0.89 ha as mean area. Diversification resulted in higher production, marketable surplus, cost, return and profit in field crops + dairy, field crops + dairy + poultry and field crops + poultry systems. Among the systems, higher profit was observed in of field crops + poultry system.

Central Plateau and hills

Katni (Madhya Pradesh): Two farming systems *viz;*, field crops and field crops + dairy were found among which 75 % households were having field crops + dairy farming system. Diversification resulted in significantly higher production (58 %), marketable surplus (46 %), cost (30 %), return (76 %) and profit (59 %) in field crops + dairy system. Among the system, field crops alone system resulted in higher profit (Rs 71,239 from 0.70 ha) after diversification.

Udaipur (Rajasthan): Three farming systems *viz;* field crops, field crops + dairy and field crops + dairy + goat were found among which 62.5 % households were having the field crops + dairy + poultry system with mean area of 0.66 ha followed by 29% households having field crops + dairy with mean area of 0.60 ha. After diversification, significant improvement in marketable surplus (5.59 times) and profit (56 %) was observed in field crops + dairy system. Among the different farming

systems, crop + dairy system resulted in higher profit (Rs 40,733 from 0.60 ha) after diversification.

Western Plateau and hills

Aurangabad (Maharashtra): Two farming systems namely field crops and field crops + dairy were found among which 87.5 % households were having field crops alone with mean area of 0.47 ha. Significantly higher production (18 %), marketable surplus (19 %), cost (18 %) and return (10.7 %) were observed in field crops system due to diversification.

Pune (Maharashtra): All the households were having field crops + dairy farming system with mean area of 0.53 ha. Significantly higher production (13 %), marketable surplus (14.9 %) , cost (0.9 %), return (18 %) and profit (21.6 %) was recorded due to diversification of cropping systems and livestock component in field crops + dairy system.

Amravati (Maharashtra): Three farming systems *viz;*, field crops + dairy, field crops + goat and field crops + poultry were found among which 83% households were having field crops + dairy system with mean area of 0.87 ha followed by 12.5 % households with field crops + goat having mean area of 0.80 ha. Field crops + dairy system resulted in significant improvement in production (77 %), marketable surplus (65 %), cost (52 %), return (102 %) and profit (82 %).

Southern Plateau and hills

Warnagal (Telangana): Five farming systems *viz;,* field crops, field crops + dairy, field crops + dairy + goat, field crops + dairy + goat + poultry and field crops + dairy + poultry were found among which 33 % households were having field crops + dairy + poultry having mean area of 0.83 ha followed by 25% households each of field crops + dairy (mean area 0.90 ha) and field crops + dairy + goat + poultry (mean area 0.92 ha). Diversification in field crops + dairy + goat + poultry and field crops + dairy + poultry resulted in significantly higher production, marketable surplus, cost, returns and profit. Among the systems, field crops + dairy + poultry recorded higher profit of Rs 57,322 from 0.83 ha after interventions.

Kolar (Karnataka): Four farming systems namely field crops + dairy, field crops + dairy + goat, field crops + dairy +goat + poultry and field crops + dairy + poultry were observed among which 50% households were having field crops + dairy system with mean area of 0.91 ha. Except field crops + dairy + poultry system, all the other systems recorded significant improvement in all the parameters studied. Among the systems, higher profit of Rs 5,88,521 was recorded in field crops + dairy + goat + poultry from 1.50 ha. Significantly higher profit was due to sericulture component.

Gadag (Karnataka): Only one farming system of field crops + dairy was observed with mean area of 1.14 ha. Significantly higher production (105 %), marketable surplus (124 %), cost (118 %), return (100 %) and profit (additional amount of Rs 33,269 from 1.14 ha) was observed with diversification of field crops + dairy system compared to existing system.

Dharmapuri / Krishnagiri (Tamil Nadu): Two farming systems namely field crops + dairy and field crops + dairy + poultry were found among which 92% households were having field crops + dairy system with mean area of 0.67 ha. Significantly higher production (17467 kg), marketable surplus (15501 kg), return (Rs 1,00,565) and profit (Rs 71,065) were recorded with diversification than existing system in field crops + dairy system. Among the two farming systems, diversification approach resulted in higher production, marketable surplus and return in field crops + dairy system while profit is higher in field crops +dairy+ poultry (Rs 75,050 from 0.80 ha).

East coast plains and hills

Srikakulam (Andhra Pradesh): Five farming systems namely field crops, field crops + dairy, field crops + dairy + goat, field crops + dairy + goat + poultry and field crops + dairy + poultry were found among which 33 % households were having field crops + dairy + poultry having mean area of 0.62 ha followed by 25 % each of field crops +

dairy and field crops + dairy + goat + poultry having mean area of 0.63 and 0.73 ha respectively. Diversification resulted in significant improvement in field crops + dairy, field crops + dairy + goat + poultry and field crops + dairy + poultry system. Among the systems, field crops + dairy + poultry system recorded higher profit of Rs 1,54,090 from 0.62 ha.

Kendrapara (Odisha): Five farming systems namely field crops + dairy, field crops + dairy + fish, field crops + dairy + goat, field crops + dairy + goat + fish and field crops + dairy + goat + poultry were found among which 33 % households were having field crops + dairy (mean area 0.88 ha) followed by field crops + dairy + goat having mean area of 1.09 ha. Diversification of existing systems resulted in significantly higher production, marketable surplus, cost, returns and profit in field crops + dairy, field crops + dairy + fisheries and field crops + dairy + goat systems. Among the various faming systems, higher profit of Rs 40,194 from 0.88 ha was observed in field crops + dairy system which is 24 % higher than before intervention.

West coast plains and ghats

Palghar (Maharashtra): Two farming systems namely field crops alone and field crops + dairy was observed among which 54 % households were having field crops + dairy system with mean area of 0.39 ha. Interventions in field crops+ dairy system resulted in significant reduction in cost due to recycling of wastes.

Pathinamthitta (Kerala): Two farming systems namely crops including horticulture and field crops including horticulture + dairy was found among which 58 % households were having field crops + dairy. Diversification resulted in significant change in both the systems and field crops + dairy recorded higher profit of Rs 49,647 from 0.45 ha.

Gujarat plains and hills

Mehsana (Gujarat): Three farming systems namely field crops, field crops + dairy and field crops + dairy + goat were found among which 62.5 % households were having field crops + dairy with mean area of 0.97 ha followed by field crops + dairy + goat in 29% households having area of 1.07 ha. The interventions and diversification resulted in significant change in field crops + dairy and field crops + dairy + goat system in terms of all the parameters. Among the systems, field crops + dairy+ goat resulted in higher profit of Rs 1,30,570 from 1.07 ha.

Panchmahal: Six farming systems *viz;,* field crops + dairy, field crops + dairy + goat, field crops + dairy + goat + poultry, field crops + goat + poultry, field crops + dairy + poultry and field crops + goat were found among which the first three farming systems were found in each 29% of households having mean area of 0.90, 0.69 and 1.06 ha respectively. Significantly higher production, marketable surplus, cost, returns and profit was observed in all the 3 dominant farming systems namely field crops + dairy, field crops + dairy + goat and field crops + dairy + goat + poultry. Among the systems, field crops + dairy + goat resulted in higher profit (Rs 91,650 from 0.69 ha) which is 70% higher than before interventions.

The results across the locations are summarized below

- The number of farming systems in different districts varied from 1 to 9. Presence of maximum of 9 farming systems was observed in Kamrup district (Assam) followed by 8 systems in South 24 Paragnas (West Bengal). Minimum of one farming systems in 5 districts namely Samba (Jammu & Kashmir), Amritsar (Punjab), Pune (Maharashtra) and Gadag (Karnataka).

- Existence of six farming systems at Panchmahal (Gujarat) and Nainital (Uttarakhand) and 5 farming systems at Kabirdham (Chhatisgarh), Dindori (Madhya Pradesh), Srikakulam (Andhra Pradesh), Warangal (Telangana), Kendrapara (Odisha) districts were observed.

- Field crops + dairy was found to be the common farming system at all locations in marginal households and it is the dominant system practiced in 20 districts (68.9%) based on number of households adopting the system.
- Field crops + dairy + poultry is found to be the dominant farming system in Udaipur (Rajasthan), Warangal (Telangana) and Srikakulam (Andhra Pradesh). Similarly, field crops + dairy + goat were found to be pre-dominant system in Purnea (Bihar) district. At Kanpur Dehat (Uttar Pradesh), both field crops + dairy and field crops + dairy + goat were found as dominant systems. In case of South 24 Paragnas (West Bengal) and Panchmahal (Gujarat), Kamrup (Assam), Pathinamthitta (Kerala), highly diversified system was noticed.
- Field crops alone was found to be dominant practice adopted by large number of households in Kabirdham (Chhatisgarh) and Aurangabad (Maharashtra) districts.
- Based on the statistical analysis, best performing farming system has been identified for each district which can be up-scaled along with all possible interventions and diversification approach for improving the livelihood of marginal farm households.

Crop diversification module in farming system diversification experiment at farmers field

7.4.3 ON-FARM EVALUATION OF FARMING SYSTEM MODULES

Title of the experiment: On-Farm evaluation of farming system modules for improving profitability and livelihood of small and marginal farmers

Objectives

- To address critical constraints of small and marginal farm holders for overall improvement of productivity
- To increase the profitability of small and marginal households and ensure livelihood

Year of start: 2011-12

Modules: The experiment was designed with holistic approach where in improvement of productivity of existing components of the farming system was concentrated by appropriate interventions besides farmer opinion based introduction of new components in optional module. Benchmarking of all components was done before making interventions in different modules. Four modules comprising of crop (low cost interventions in existing cropping systems based constraint analysis), Livestock (low cost interventions in existing livestock components based on constraint analysis), On farm processing & value addition (on farm agro processing and value addition of marketable surplus produces) and optional (Introduction of additional components based on households perception) were implemented in 2 farm households in each village comprising of 1 marginal and small household. The experiment was implemented in randomly selected 12 marginal farm households in each district. The general guidelines used for designing the modules are given below

Households: Twelve households consisting of 6 each in small and marginal categories was selected for experiment in all the locations except Kangra (Himachal Pradesh) and South 24 Paragnas (West Bengal) where in all the selected 12 households belong to marginal. The average holding size of households in the study locations ranged from 0.27 to 2.00 ha for small households.

Locations: During 2015-16, a total of 29 districts in 13 agro climatic regions covering 28 NARP zones have implemented the interventions in different modules. The details of locations, number of households covered and farming systems are given in Table 7.4.3(a). Three locations namely Fathepur (Rajasthan), Nainital (Uttarakhand) and Muzaffarnagar (Uttar Pradesh) have partially implemented the interventions and hence, the data is not included in this report.

Data analysis methodology: Based on the benchmark data, farming systems practiced by the households were identified and grouped in to different farming system categories such as field crops+ dairy, field crops + dairy+ goat *etc* as given in Table 7.4.3(a). Four parameters namely production (on equivalent basis of base pre-

Farming System	Notation	Module name	Details
Existing	M0	Bench mark	Recording of bench mark data on crop, livestock, other components and household as a whole
Improved	M1	Crop	Low cost interventions in existing cropping systems based constraint analysis
	M2	Livestock	Low cost interventions in existing livestock components based on constraint analysis
	M3	On farm processing & value addition	On farm agro processing and value addition for marketable surplus
	M4	Optional	Introduction of additional components based on households perception

dominant crop), marketable surplus (calculated by deducting the family consumption for food, feed, seed *etc* from the total production), cost (total cost of the system including all components and diversification) and profit (calculated by deducting the cost of the system from the gross income obtained from marketable surplus) were used for comparison of existing with improved system and also different farming systems. Farming system with more than one household was subjected to ANOVA and paired t-test analysis. Paired t-test has been carried out for comparing existing and diversified systems with respect to production, marketable surplus, cost and profit. Similarly, one-way ANOVA has been carried out to identify the best farming system with respect to production, marketable surplus, cost and profit for the district. Standard error of mean values is also presented in parenthesis in Table 7.4.3(b).

Results

The interventions made in different modules are given in Table 7.4.3(a), while the production, marketable surplus and economics of different farming systems are given in 7.4.3(b). Location wise and summary of results is explained briefly below.

Western Himalaya

Kangra (Himachal Pradesh): Two farming systems namely field crops + dairy and field crops + dairy + goat were found among which 75% households were having field crops + dairy system with mean area of 0.78 ha. Interventions made in crop, livestock, processing and optional module resulted in significant improvement in profit (176 %) of field crops + dairy system. Other parameters were not significantly influenced by the interventions in both the farming systems. Among the two systems, field crops + dairy recorded higher production (8597 kg on rice equivalent basis) and profit (Rs 39, 084 from 0.78 ha).

Samba (Jammu and Kashmir): Only one farming system of field crops+ dairy was observed with mean area of 1.14 ha. Interventions in crop module (introduction of pea in *rabi*), livestock and optional module (nutritional kitchen garden) resulted in significant improvement in production, marketable surplus, cost and profit.

Eastern Himalaya

Ambedkarnagar (Uttar Pradesh): Field crops + dairy farming system were found in all the households with mean area of 0.73 ha. Interventions made in crop, livestock and optional (kitchen garden) modules resulted in significant improvement in production (82 %), marketable surplus (67 %) and profit (1.8 times) in the field crops + dairy system.

Kamrup (Assam): Two farming systems namely field crops + dairy + fishery and field crops + dairy was found. Interventions made in crop, livestock, processing and optional module resulted in significantly higher improvement in marketable surplus and profit in both the systems. Among the systems, field crops + dairy + fisheries recorded higher profit of Rs 1,25,846 from 1.65 ha after interventions.

Lower Gangetic plains

South 24 Paragnas (West Bengal): Three farming systems namely field crops, field crops + dairy and field crops + dairy + poultry were found among which 66% households were having field crops + dairy with mean area of 0.44 ha. Interventions made in crop, livestock, processing (sunflower oil, vermicompost) and optional (nutritional kitchen garden) resulted in significant improvement in production, marketable surplus and cost in field crops + dairy system. Among the systems, performance of field crops + dairy systems resulted in better profit of Rs 92,087 from 0.44 ha after interventions.

Middle Gangetic plains

Purnea (Bihar): Four farming systems namely field crops, field crops + dairy, field crops + dairy + goat and field crops + goat were found among which 50% households were having field crops +

Table 7.4.3(a). Details of interventions made in crop, livestock, processing and optional modules at different locations

District (state)/ NARP zone/ soil type/ rainfall (mm)/ rainy days	Farming System (s)	Area (ha)	No. of Farm households	Existing components (As per benchmark, 2013)					Improved					
				Crop module			Livestock module	Processing module	Crop module			Livestock module	Processing module	Optional module
				Kharif	*Rabi*	Summer			*Kharif*	*Rabi*	Summer			
I. Western Himalaya														
Kangra (Himachal Pradesh) /Sub montanellow hills subtropical / 104 rainy days/ 2264mm rain	Field crops + dairy (1-2)	0.78	9	Maize/ sorghum/ rice/ colocasia	Wheat/ mustard/ berseem	-	Cow (0-1) + Buffalo (1-2)	-	Maize/ sorghum/ rice	Wheat/ mustard/ berseem/ Gobhi-sarsoni/ oats	-	Cow (1) + Buffalo (1-2)	Graded seed	Nutritional kitchen garden
	Field crops + dairy (1) + goat (2)	0 .57	3	Maize/ sorghum/ rice	Wheat/ barley/ berseem/ Gobhi-sarsoni/ oats	-	Cow (0-1) + Buffalo (1) + Goat (2)	-	Maize/ sorghum/ rice	Wheat/ berseem/ Gobhi-sarsoni/ oats/ onion	-	Cow (1) + Buffalo (1-2) + Goat (2)	Graded seed	-do-
Samba (J&K)/ sub tropical low altitude /75 rainy days/ 790 mm rain	Field crops + dairy (2-3)	1.14	12	Rice/ fodder crops/ maize/ mesh	Wheat/ berseem	-	Cow (2-3) + Buffalo (1-2)		Rice/ maize	Wheat	-	Cow (1-2) + Buffalo (0-1)	-	-do-
II. Eastern Himalaya														
Ambedkarnagar (Uttar Pradesh)/ Eastern Plain Zone/ Sub-humid/ 54.4 rainy days/ 1426 mm rain	Field crops + dairy (1-2)	0.73	10	Rice/ pigeon pea/ sorghum	Wheat/ berseem/ pea/ chickpea/ mustard/ tomato/ potato/ pea	Lady's finger/ mentha/ sudanchary	Cow (0-1) + Buffalo (1-2)	-	Rice	Wheat/ pea/ mustard/ potato/ chickpea	-	Cow (0-1) + Buffalo (1-2)	-	Nutritional kitchen gardening
Kamrup (Assam)/ Central Brahmaputra Valley Zone	Field crops + Dairy (1-2)+ Fishry	1.65	6	Winter rice/ arecanut	Rabi vegetable/ toria	Summer rice/ turmeric	Cow (1-2) + Poultry (20) + Fishery		Winter rice/ arecanut	Toria	-	Cow (2) + Poultry (14-15) + Pig (5-6) + Fishery	Making of supari from raw arecanut	Nutirtional kitchen garden
	Field crops + Dairy (2-3)	1.50	6	Winter rice/ arecanut plantation in homestead garden	Rabi vegetable/ toria	Summer rice/ turmeric	Cow (2-3) + Poultry (15-16)		Winter rice/ arecanut	Toria	-	Cow (1-2) + Goat (1-2) + Poultry (16-17) + Pig (4-5) + Fishery	-do-	-do-

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District (state)/ NARP zone/ soil type/ rainfall (mm)/ rainy days	Farming System (s)	Area (ha)	No. of Farm households	Existing components (As per benchmark, 2013)					Improved					
				Crop module			Livestock module	Processing module	Crop module			Livestock module	Processing module	Optional module
				Kharif	*Rabi*	Summer			*Kharif*	*Rabi*	Summer			
III. Lower Gangetic Plains														
South 24 Paragnas (West Bengal)/ lower gangetic plains/100.8 rainy days/1439mm rain	Field crops	0.71	3	Rice	Okra/ sunflower	Green gram/ okra/ sunflower	-	-	Rice/ bittlevine	Sunflower/ khesari/ onion	Green gram/ okra/ sunflower	Cow (3) + Goat (7) + Poultry (13-14) +Fish pond	Sunflower oil/Vermi-compost	Nutritional kitchen garden
	Field crops + dairy (2-3)	0.44	8	Rice	Okra/ sunflower/ Green gram	Green gram/ okra/ rice/ Lady's finger	Cow (2-3)	-	Rice/ bittlevine	Sunflower/ tomato/ potato/ pointed guard/ khesari/ cauli flower/ onion/ snake gourd/ barboti	Green gram/ okra/ amaran-thus/ sunflower/ cucumber/ boro rice	Cow (2-3) + Goat (1-2) + Poultry (17-18) + Fish pond	-do-	-do-
	Field crops + dairy (3)+ poultry (15)	0.40	1	Rice	Okra/ cucumber/ sunflower	-	Cow (3) + Poultry (15)	-	Rice	Sunflower/ onion/ potato	Green gram/ okra	Cow (3)+ Poultry (5) + Fish pond	-do-	-do-
IV. Middle Gangetic Plains														
Purnea (Bihar)/ north east alluvial plain (Bl-2) /40.5 rainy days/459 mm rain	Field crops	0.95	1	Rice/ maize	Wheat/ brinjal	-			Rice/ maize	Wheat/ chickpea		-	-	Nutritional kitchen garden
	Field crops + dairy (1-2)	1.30	6	Rice/ brinjal/ vegetable/ maize fodder	Maize/ wheat/ vegeatble/ potato/ lentil	-	Cow (1-2)		Rice	Wheat/ maize	Chickpea	Cow (2-3) + Goat (0-1)	Grading, vermi-compost	-do-
	Field crops + dairy (1-2) + goat (4-5)	1.13	3	Rice/ brinjal	Wheat/ cucumber/ maize	-	Cow (1-2) + Goat (4-5)		Rice	Wheat/ maize	Chickpea	Cow (1-2) + Goat (3)	Grading	-do-
	Field crops + goat (2-3)	0.7	2	Rice/ maize/ vegetable	Wheat/ cucumber	-	Goat (2-3)		Rice	Wheat/ maize	Chickpea	Cow (2-3) + Goat (3-4)	Grading	-do-

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District (state)/ NARP zone/ soil type/ rainfall (mm)/ rainy days	Farming System (s)	Area (ha)	No. of Farm households	Existing components (As per benchmark, 2013)					Improved					
				Crop module			Livestock module	Processing module	Crop module			Livestock module	Processing module	Optional module
				Kharif	*Rabi*	Summer			*Kharif*	*Rabi*	Summer			
V. Upper Gangetic plains														
Kanpur Dehat (Uttar Pradesh)/ Central Plain Zone/Kanpur/	Field crops	1.00	1	Rice	Wheat	-	-	-	Rice	Wheat	Green-gram	Cow (1)	-	Nutritional kitchen garden
	Field crops + dairy (1-2)	1.10	10	Rice/ pigeon pea/ maize/ pearl millet	Wheat/ potato/ mustard	Greengram	Cow (0-1)+ Buffalo (1-2)	-	Rice/ pigeon pea/ maize/ pearl millet	Wheat/ potato/ mustard/ berseem	Green-gram	Cow (0-1) + Buffalo (1-2) + Goat (0-1)	-	-do-
	Field crops + dairy (2) + goat (2)	0.60	1	Maize/ pigeon pea/ pearl millet	Wheat/ potato	Greengram	Buffalo (2) + Goat (2)		Maize/ Til	Wheat/ chickpea	Green-gram	Buffalo (1) + Goat (1)	-	-do-
VI. Trans Gangetic Plains														
Sirsa (Haryana)/ Western/ 21 rainy days/207 mm rain	Field crops + dairy (2-3)	0.85	12	Cotton/ guar/ rice/ sorghum	Wheat/ berseem	-	Cow (0-1)+ Buffalo (2-3)	Ghee	Cotton	Wheat	-	Cow (0-1) + Buffalo (2-3)	Ghee	Nutritional kitchen garden
Amritsar (Punjab)/ Central Plain Zone/ 47 rainy days/ 936 mm rain	Field crops + dairy (3-4)	0.97	12	Rice	Wheat	-	Cow (0-1) + Buffalo (3-4)	-	Rice	Wheat	-	Cow (0-1) + Buffalo (2-3)	Preparation of mineral mixture, vermi-compost	Nutirtional kitchen garden, mushroom & haldi
VII. Eastern Plateau and Hills														
Kabirdham (Chhattisgarh)/ Chhattisgarh Plain Zone/ Sub humid area/ Rain 843mm	Field crops + dairy (2) + goat (7) + poultry (8) + fishery	1.3	1	Rice/ soybean	Chickpea/ wheat/ veg.	Vegetable	Cow (2)+ goat (7) + poultry (8) + fishery	-	Rice/ soybean/ veg.	Chickpea/ wheat/ veg.	Vege-table	Cow (2) + Goat (10) + Poultry (25) + Pig (2)	Gram dal. besan, Ghee	Nutritional kitchen garden
	Field crops + dairy (1-2) + goat (2-3) + poultry (10-11)	1.11	11	Rice/ soybean	Chickpea/ wheat/ veg.	Vegetable	Cow (1-2) + goat (2-3) + Poultry (10-11)	-	Rice/ soybean/ veg.	Chickpea/ wheat/ veg.	Vege-table	Cow (1-2) + Goat (2-3) + Poultry (25-26) + Pig (1)	-do-	-do-

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District (state)/ NARP zone/ soil type/ rainfall (mm)/ rainy days	Farming System (s)	Area (ha)	No. of Farm households	Existing components (As per benchmark, 2013)					Improved					
				Crop module			Livestock module	Processing module	Crop module			Livestock module	Processing module	Optional module
				Kharif	*Rabi*	Summer			*Kharif*	*Rabi*	Summer			
Pakur (Jharkhand)/ eastern plateau and hill-VII/ central and north eastern plateau zone/86 rainy days/1060 mm rain	Field crops	1.14	12	Rice	Wheat/ chickpea	-		-	Rice	Wheat/ chickpea	-	Goat (1-2) + Pig (1-2)	Wheat, gram processing	Nutritional kitchen garden
Dindori (Madhya Pradesh)/Northern Hills Zone of Chhattisgarh (CG-3)/72.6 rainy days/1234mm rain	Field crops + dairy (1-2)	1.25	9	Rice/ black gram	Wheat/ chickpea		Cow (1-2) + Buffalo (1-2)	-	Rice/ black-gram	Wheat/ chickpea		Cow (2-3) + Buffalo (2-3) + Poultry (70)	-	-
	Field crops + dairy (2-3) + goat (3)	0.90	2	Rice/ black-gram	Wheat/ chickpea		Cow (2-3) + Buffalo (2-3) + Goat (3)		Rice/ black-gram	Wheat/ chickpea	-	Cow (2-3) + Buffalo (2-3) + Goat (3) + Poultry (80)	-	-
	Field crops + dairy (6) + goat (4) + poultry (22)	0.75	1	Rice/ black-gram	Wheat/ chickpea		Cow (6) + Goat (4) + Poultry (22)		Rice/ black-gram	Wheat/ chickpea		Cow (5) + Goat (10) + Poultry (60)	-	-
Angul (Odisha)/ Mid-Central Table Land, /81 rainy days/911 mm rain	Field crops + dairy (1-2)	1.19	4	Rice/ ginger/ snake guard/ ridge guard	Groundnut/ brinjal	Bitter guard/ okra	Cow (0-1)+ Buffalo (0-1)	-	Rice/ maize/ cowpea/ brinjal/ bitter guard/ okra/ cucumber/ colocasia	Groundnut/ maize/ onion/ garden-pea/ okra/ tomato/ cauli-flower/ sunflower/ cluster-bean	Bitter guard/ pumpkin/ water mellon/ okra	Cow (1)+ Poultry (35-40)	Pruning of branches of trees, fingerlings	Fruits, boundary plantations, fisheries
	Field crops + dairy (3-4) + poultry (65-66)	1.23	8	Rice/ brinjal/ cowpea	Groundnut/ sunflower/ pointed guard/ onion/ cowpea/ brinjal/ garden-pea/ potato	Green gram/ cowpea/ bitter guard	Cow (3-4) + Poultry (65-66)		Bitter-guard/ cowpea/ brinjal/ okra/ colocasia	Groundnut/ maize/ onion/ garden-pea/ okra/ tomato/ cauli-flower/ cabbage/ sunflower/ cluster-bean/ radish	Bitter guard/ pumpkin/ okra/ cucumber/ green-gram/ black-gram/ cluster bean	Cow (1-2) + Poultry (30-31)	- do -	-do-

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District (state)/ NARP zone/ soil type/ rainfall (mm)/ rainy days	Farming System (s)	Area (ha)	No. of Farm households	Existing components (As per benchmark, 2013)					Improved					
				Crop module			Livestock module	Processing module	Crop module			Livestock module	Processing module	Optional module
				Kharif	*Rabi*	Summer			*Kharif*	*Rabi*	Summer			
VIII. Central Plateau and hills														
Katni (Madhya Pradesh)/ Kymore Pleateau and Satpura Hills/ 42 rainy days/ 328 mm rain	Field crops	0.80	2	Rice/ ginger	Wheat/ chickpea	-	-	-	Rice	Wheat/ chickpea	-	Cow (2)	Chana Dal	Boundary plantation i.e. papaya, guava, jack fruit
	Field crops + dairy (1-2)	0.71	4	Rice/ ginger/ marigold	Wheat/ chickpea/ chilli	-	Cow (1-2) + Buffalo (0-1)	-	Rice/ soybean	Wheat/ chickpea	-	Cow (1-2) + Buffalo (0-1)	Chana Dal & ghee making	-do-
Udaipur (Rajasthan)/ Sub-humid Southern plain and aravali hills/ 22 rainy days/ 462mm rain	Field crops + dairy (1-2)	0.75	2	Maize	Wheat	-	Cow (1-2) + Buffalo (0-1)		Maize/ vegetable	Wheat/ vegetable	-	Cow (1-2) + Buffalo (0-1) + Goat (1)	Vermicompost	Fruits, boundary plantations
	Field crops + dairy (2) + goat (4-5)	0.75	10	Maize	Wheat	-	Cow (2) + Goat (4-5)		Maize/ vegetable	Wheat/ vegetable	-	Cow (2) + Goat (1)	-do-	-do-
IX. Western Plateau and Hills														
Aurangabad (Maharashtra)/ CMP/55 rainy days/648 mm rain	Field crops + Dairy (0-1)	0.74	12	Cotton/ sugar-cane/ maize/ pearl millet/ maize fodder/ Hy.napair/ coriander/ okra	Chickpea/ wheat/ okra/ maize fodder		-	-	Sugarcane/ cotton/ maize/ pearl millet/ maize fodder/ coriander/ napier/ feenugreek/ ginger	Wheat/ chickpea/ maize/ onion/ garden-pea/ okra/ fenugreek/ coriander	Fodder maize	Cow (1-2) + Buffalo (0-1) + Goat (1)	Sugarcane juice, ghee & ghee making	-
Pune (Maharashtra)/ Deccan Plateau, hot semi-arid eco sub region (6.1)/ Ganeshkhind Pune-7/48 rainy days/606 mm rain	Field crops + dairy (1-2)	0.76	5				Cow (1-2) + Buffalo (0-1)		Soybean/ rice/ maize/ Hy.nepiar/ maize fodder	Onion/ wheat/ brinjal/ Hy.nepier/ marigold/ garlic/ lucern grass	Pearl millet/ Hy.nepiar/ smooth-gaurd/ lucern grass/ bitter-gaurd/ bottle-gaurd	Cow (1-2) + Poultry (2)	Soybean flour	Nutritional kitchen garden

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District (state)/ NARP zone/ soil type/ rainfall (mm)/ rainy days	Farming System (s)	Area (ha)	No. of Farm households	Existing components (As per benchmark, 2013)					Improved					
				Crop module			Livestock module	Processing module	Crop module			Livestock module	Processing module	Optional module
				Kharif	*Rabi*	Summer			*Kharif*	*Rabi*	Summer			
	Field crops + dairy + poultry (1-2)	0.72	7	Groundnut/ soybean/ rice	-	-	Cow (1-2) + Buffalo (0-1)		Soybean/ groundnut/ rice/ maize fodder/ maize/ lucern grass/ Hy.napier	Onion/ wheat/ chickpea/ lucern grass/ Hy.napier/ sorghum/ garlic	Pearl millet/ Hy.nepiar/ lucern grass/ ground nut	Cow (1-2) + Poultry (7-8)	Soybean flour	-do-
Amravati (Maharahtra/) Central Maharastra Plateaue Zone (IX)/ Western Vidarbha Zone/30 rainfall days/727 mm	Field crops + dairy (1-2)	1.08	8	Soybean/ cotton/ pigeon pea/ orange	Wheat/ chickpea		Cow (1-2)	-	Soybean/ pigeon pea/ sorghum/ cotton	Wheat/ chickpea/ linseed		Cow (1-2)	Horticultural fruit plants saplings, Improvement in local ber by budding of improved variety	Nutritional kitchen garden, fruit / boundary plantations, compost
	Field crops + dairy (1) + goat (3)	1.30	2	Soybean/ orange/ pigeon pea	Wheat		Cow(1) + Goat (3)		Pigeon pea/ soybean	Wheat/ chickpea	Sesamum	Cow (1) + Goat (3) + Poultry (2)	-do-	-do-
	Field crops + dairy (1) + poultry (4)	1.40	1	Soybean/ pigeon pea	Cotton		Cow (1) + Poultry (4)		Soyabean	chickpea	-	Cow (1) + poultry (5)	-do-	-do-
	Field crops + goat (5)	1.20	1	Soybean/ sorghum	-	-	Goat (5)		Soybean/ pigeon pea	Sorghum	Chickpea/ linseed	Goat (2)	-do-	-do-
X. Southern Plateau and Hills														
Warangal (Telangana)/ C.T. Zone/ Rice eco system/ 40 rainy days/ 631 mm rain	Field crops + dairy (1-2)	1.32	5	Rice/ cotton/ maize	Rice/ groundnut/ maize/ veg.	-	Cow (0-1)+ Buffalo (1-2)		Rice/ green gram	Rice/ maize/ bengal-gram	-	Cow (0-1)+ Buffalo (1-2) + Poultry (13-14)	Ghee	Nutritional kitchen garden, Azolla
	Field crops + dairy (4)+ goat (10)	1.00	1	Rice/ cotton	Rice/ maize	-	Cow (1) + Buffalo (3) + Goat (10)		Greengram	Rice	-	Cow (1) + Buffalo (2) + Poultry (10)	-do-	-do-
	Field crops + dairy (2-3) + goat (24-25) + poultry (5-6)	1.44	3	Rice/ cotton/ maize/ chilli/ groundnut	Rice/ maize/ groundnut/ vegetables	-	Cow (1) + Buffalo (1-2) + Goat (24-25) + Poultry (5-6)		Rice	Rice/ maize	-	Cow (1-2) + Buffalo (2) + Goat (27-28) + Poultry (7-8)	-do-	-do-

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District (state)/ NARP zone/ soil type/ rainfall (mm)/ rainy days	Farming System (s)	Area (ha)	No. of Farm households	Existing components (As per benchmark, 2013)					Improved					
				Crop module			Livestock module	Processing module	Crop module			Livestock module	Processing module	Optional module
				Kharif	*Rabi*	Summer			*Kharif*	*Rabi*	Summer			
	Field crops + dairy (1-2) + poultry (7-8)	1.13	3	Rice/ cotton/ maize/ groundnut	Rice/ maize	-	Buffalo (1-2) + Poultry (7-8)		Cotton/ dhaincha	Rice/ maize	-	Buffalo (2-3) + Poultry (8-9)		-do- -do-
Kolar (Karnataka)/ AEZ 8.2/Eastern Dry Zone/ 40 rainy days/ 826 mm rain	Field crops + dairy (2-3)	0.88	7	Finger millet/ sericulture/ rice/ cabbage/ groundnut/ tomato	Potato/ radish/ ridge guard/ beetroot	Fodder maize/ tomato	Cow (2-3)	-	Finger millet+ field bean+ red-gram/ sericulture/ tomato/ rice/ cabbage/ fodder maize/ pole beans/ chilli/ mulberry	Radish/ coriander/ finger millet/ fodder maize/ carrot	Fodder maize/ okra	Cow (2-3) + Goat (1-2) + poultry (0-1)		Nutirtional kitchen garden
	Field crops + dairy (3) + goat (1)	0.50	1	Finger millet/ tomato/ grass	Grass	Cabbage/ maize/ grass	Cow (2) + Buffalo (1) + Goat (1)	-	Finger millet/ avare/ redgram/ fodder maize	Pumpkin	Tomato	Cow (2)		-do-
	Field crops + dairy (3-4) + goat (5-6) + poultry (6-7)	0.84	3	Finger millet+ redgram/ brinjal/ grass/ sericulture	Rabi grass	Knol-khol/ fodder maize/ grass	Cow (2-3) + Buffalo (1) + Goat (5-6) + Poultry (6-7)	-	Tomato/ mulbery/ aware/ polebeans/ finger millet + avare	Tomato/ mulbery	-	Cow (1-2) + Buffalo (1-2) + Goat (4-5) + Poultry (14-15)		-do-
	Field crops + dairy (2) + poultry (2)	0.27	1	Finger millet/ fodder maize	-	-	Cow (2) + Buffalo (2) + Poultry (2)		Finger millet/ avare/ red gram/ fodder maize	-	-	Cow (1) + Buffalo (1) + Goat (1)		-do-

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District (state)/ NARP zone/ soil type/ rainfall (mm)/ rainy days	Farming System (s)	Area (ha)	No. of Farm households	Existing components (As per benchmark, 2013)					Improved					
				Crop module			Livestock module	Processing module	Crop module			Livestock module	Processing module	Optional module
				Kharif	*Rabi*	Summer			*Kharif*	*Rabi*	Summer			
Gadag (Karanataka)/ Northern Dry Zone/ Arid/36 rainfall days/531 mm	Field crops + dairy (1-2)	1.30	12	Groundnut/ Bt. cotton/ Hy. maize/ onion/ chilli/ vegetable	Sorghum/ chickpea/ wheat	-	Cow (1-2) + Buffalo (0-1)	-	Bt.cotton/ ground nut/ Hy. maize/ green gram/ sunflower/ lady's finger/ crysan-thmum/ marigold/ bitter-gourd/ napier grass/ onion	Fodder mazie + menthe (veg.)/ sorghum/ chickpea/ onion (seed)/ wheat/ crysan-thmum/ brinjal/ cucumber/ napier grass/ ground-nut	-	Cow (1-2) + Buffalo (0-1)	Butter, vermi-compost	Nutritional kitchen garden
Dharmapuri & Krishnagiri (Tamil Nadu)/NWZ/ Bimodal rainfall/ Start of deccan plateau/50 rainy days/869mm rain	Field crops + dairy (2-3)	1.02	10	Rice/ coconut/ fodder grass/ sugar-cane/ green-gram/ groundnut/ turmeric/ redgram/ fodder sorghum/ chick pea/ crossandra	Rice/ coconut/ okra/ fodder sorghum/ ground-nut/ mango	Lemon	Cow (2-3)	-	Rice/ tuberose/ cotton/ turmeric/ sugar-cane/ coconut/ fodder grass/ fodder sorghum/ chilli/ sorghum/ black gram/ ridge gourd	Rice/ coconut/ fodder grass/ ragi/ ground-nut/ crysan-thimum	Fodder sorghum	Cow (2-3) + Poultry (14-15)	Cleaning & grading of rice	Nutirtional kitchen garden
	Field crops + dairy (2-3) + goat (3-4)	1.36	2	Rice/ coconut/ jasmine/ fodder grass	Rice	-	Cow (2-3) + Goat (3-4)	-	Rice/ fodder grass/ jasmine/ groundnut/ coconut	Rice/ ragi	-	Cow (2-3) + Poultry (9-10)	-do-	-do-

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District (state)/ NARP zone/ soil type/ rainfall (mm)/ rainy days	Farming System (s)	Area (ha)	No. of Farm households	Existing components (As per benchmark, 2013)					Improved					
				Crop module			Livestock module	Processing module	Crop module			Livestock module	Processing module	Optional module
				Kharif	*Rabi*	Summer			*Kharif*	*Rabi*	Summer			
XI. East Coast Plains and Hills														
Srikakulam (Andhra Pradesh)/ high altitude and tribal area zone/ 58.5 rainy days/ 916mm rain	Field crops	0.90	2	Rice	Black gram/ ragi	-			Rice	Ragi	-	Buffalo (1) + Poultry (9)	Red sandal wood, cattle feed	Nutirtional kitchen garden, mango and cashew grafts
	Field crops + dairy (1-2)	0.30	2	Rice	Sesamum/ blackgram	-	Cow (1-2) + Buffalo (0-1)		Rice	-	-	Cow (1) + Buffalo (2) + Goat (4) + Poultry (4-5)	-do-	-do-
	Field crops + dairy (4) + goat (10)	1.00	1	Rice	Rice	-	Cow (1) + Buffalo (3) + Goat (10)		Rice	Rice/ maize	-	Cow (2) + Goat (15) + Poultry (9)	-do-	-do-
	Field crops + dairy (1) + goat (35) + poultry (5)	0.52	1	Rice	Rice	-	Cow (1) + Goat (35) + Poultry (5)		Rice	Green-gram	-	Buffalo (4) + Poultry (12)	-do-	-do-
	Field crops + dairy (1) + poultry (10)	0.70	2	Rice	Rice/ ragi	-	Cow (0-1) + Buffalo (1) + Poultry (10)		Rice	Ragi/ finger-millet	-	Buffalo (1-2) + Poultry (9-10)	-do-	-do-
	Field crops + goat (4)	0.20	1	Rice	Sesamum	-	Goat (4)		Rice	-	-	Buffalo (3) + Poultry (8)	-do-	-do-
	Field crops + goat (1) + poultry (1)	1.00	1	Rice	Blackgram	-	Goat (1) + Poultry (1)		Rice	-	-	Buffalo (1) + Poultry (8)	-do-	-do-
	Field crops + poultry (6)	0.70	2	Rice	Rice	-	Poultry (6)		-	Mesta	-	Poultry (8)	-do-	-do-
Kendrapara (Odisha)/ East-south eastern coastal plain zone/ 68 rainy days/ 1180 mm rain	Field crops + dairy (2-3)	0.66	2	Rice	Rice/ green-gram/ black-gram/ veg.	-	Cow (2-3)	-	Rice	Rice/ green-gram/ black-gram/ veg.	Jute	Cow (4-5) + Poultry (9) + fish pond	Cleaning of rice, ghee and cheese making	Nutritional kitchen garden, mushroom, fish
	Field crops + dairy (3) + fish	0.64	2	Rice	Rice/ green-gram/ black-gram/ veg.	-	Cow (3) + Fish pond	-	Rice	Rice/ green-gram/ black-gram/ veg.	-	Cow (5-6) + Poultry (12-13) + fish pond	-do-	-do-

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District (state)/ NARP zone/ soil type/ rainfall (mm)/ rainy days	Farming System (s)	Area (ha)	No. of Farm households	Existing components (As per benchmark, 2013)					Improved					
				Crop module			Livestock module	Processing module	Crop module			Livestock module	Processing module	Optional module
				Kharif	*Rabi*	Summer			*Kharif*	*Rabi*	Summer			
	Field crops + dairy (3) + goat (4)	1.10	1	Rice/ jute	Rice/ green-gram/ black-gram/ veg.	-	Cow (3) + Goat (4)	-	Rice	Rice/ green-gram/ black-gram/ veg.	Jute	Cow (5) + Goat (3) + Poultry (12) + fish pond	-do-	-do-
	Field crops + dairy (1) + goat (2-3) + poultry (14-15)	1.00	3	Rice/ jute	Rice/ green-gram/ black-gram/ veg.	-	Cow (1) + goat (2-3) + poultry (14-15)		Rice	Rice/ green-gram/ black-gram/ veg.	Jute	Cow (3-4) + Goat (3-4) + Poultry (16-17) + fish pond	-do-	-do-
	Field crops + dairy (4) + goat (1) + poultry (10) + fish	1.06	1	Rice	Green-gram	-	Cow (4) + Goat (1) + Poultry (10) +Fish pond		Rice	Green-gram	-	Cow (5)+ Goat (2) + Poultry (11) + fish pond	-do-	-do-
	Field crops + dairy (2) + poultry (10)	0.89	2	Rice/ jute	Green-gram/ black-gram/ veg.	-	Cow (2) + Poultry (10)		Rice	Green-gram/ Black-gram/ veg.	Jute	Cow (2-3) + Goat (2-3) + Poultry (15-16)	-do-	-do-
	Field crops + dairy (2) + poultry (10) + fish	1.2	1	Rice	Black-gram/ veg.	-	Cow (2) + Poultry (10) + Fish pond		Rice	Black-gram/ rice	-	Cow (4) + Poultry (11)	-do-	-do-
Sivagangai (Tamil Nadu)/ Southern/ Semi Arid Eco-Sub Region 8.1/ Southern Zone TN 5 & 6/ 64 rainy days/ 1035 mm rain	Field crops + dairy (3-4)	1.05	12	Rice/ sugar-cane/ black-gram/ pumpkin	Rice/ ground nut/ gingelly/ pumpkin/ maize/ black-gram	Black gram	Cow (3-4) + Poultry (15-16)	-	Rice/ sugar-cane	Gingelly/ black-gram/ ground nut/ rice	Black-gram/ sugar-cane/ pumpkin/ ground nut	Cow (3-4) + Poultry (10-11)	Grains with out chaffy, plump pods, vermicompost	Nutritional kitchen gardening, poultry
XII. West Coast Plains and Ghats														
Palghar (Maharashtra)/ North konkan coastal Zone/ 67 rainy days/ 1881 mm rain	Field crops + dairy (2-3)	0.55	12	Rice	Rice/ cowpea/ cucumber	-	Cow (1) + Buffalo (1-2)		Rice	Rice/ cowpea/ cucumber	-	Cow (1) + Buffalo (1-2) + Poultry (3-4)	Cleaned rice seed & preparation of curd	Nutritional kitchen garden

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District (state)/ NARP zone/ soil type/ rainfall (mm)/ rainy days	Farming System (s)	Area (ha)	No. of Farm households	Existing components (As per benchmark, 2013)					Improved					
				Crop module			Livestock module	Processing module	Crop module			Livestock module	Processing module	Optional module
				Kharif	*Rabi*	Summer			*Kharif*	*Rabi*	Summer			
Pathinamthitta (Kerala)/Hot humid per humid eco region/ Southern Zone/ 101 rainy days/ 1963 mm rain	Field crops + horticulture + dairy (2-3)	1.30	11	Rubber/ coconut/ pepper/ nutmeg/ rice	Banana/ rice	Vegetable/ tapioca	Cow (3) + Buffalo (0-1)		Coconut/ nutmeg/ pepper	Rice/ banana	Vegetable	Cow (3-4)+ Buffalo (0-1) + Duck (9-10)	Cured garcinia, coconut oil, graded coconut, garbled pepper, dry mace, packed milk after filtration	Fisheries, terrace gardening, apiary, Vermi-compost
	Field crops + horticulture + dairy (2) + Poultry (8)	0.96	1	Coconut	Rice	-	Cow (2) + Poultry (8)	-	Coconut/ banana	Rice	-	Cow (2)	Packed milk after filtration	Terrace gardening
XIII. Gujarat Plains and Hills														
Mehsana (Gujraat)/ north Gujrat agro climate zone / 20.5 rainy days/ 400 mm rain	Field crops	1.10	2	Pearl millet/ cotton/ sorghum	Wheat/ mustard/ lucerne	Fodder sorghum		-	Cotton/ castor/ green-gram/ sorghum/ guargum	Lucerne/ wheat/ mustard/ fenugreek	Fodder sorghum	Cow-4	Ghee making	Vermi-compost
	Field crops + dairy (1-2)	1.16	10	Sorghum/ rice/ cotton/ pearl millet/ castor/ cluster-bean/ rajka bajri	Cumin/ lucerne/ tobbaco/ mustard/ wheat	Sorghum/ pearl millet/ cluster-bean/ fodder sorghum	Cow (0-1) + Buffalo (1-2)	-	Cotton/ sorghum/ cluster-bean/ fodder sorghum/ green-gram/ pearl millet/ rice/ castor/ cotton+ fennel/ cotton+ castor/ sweet potato/ guargum/ Black-gram	Wheat/ lucerne/ chikory/ castor/ fodder maize/ mustard/ lucerne+ maize/ fennel	Fodder sorghum/ pearl-millet/ cluster-bean	Cow (0-1) + Buffalo (1-2)	Ghee making	Vermi-compost

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District (state)/ NARP zone/ soil type/ rainfall (mm)/ rainy days	Farming System (s)	Area (ha)	No. of Farm households	Existing components (As per benchmark, 2013)					Improved					
				Crop module			Livestock module	Processing module	Crop module			Livestock module	Processing module	Optional module
				Kharif	*Rabi*	Summer			*Kharif*	*Rabi*	Summer			
Panchmahal (Gujarat)/middle gujarat III/ 20 rainfall days/ 486mm rain	Field crops + dairy (2)	0.40	1	Rice	Maize	-	Buffalo (2)	Maize, chaff cutting	Rice/ maize	Maize	-	Buffalo (2)	Grading	Nutritional kitchen garden, fruits, boundary plantations, stubbles of fodder crop
	Field crops + dairy (3) + goat (4-5)	0.72	3	Rice/ maize	Maize	Groundnut	Buffalo (3)+ Goat (4-5)	Maize, chaff cutting & Storage of fodder	Rice/ maize	Maize	Groundnut	Buffalo (3) + Goat (4-5)	-do-	-do-
	Field crops + dairy (2-3) + goat (5-6) + poultry (6-7)	1.04	6	Rice/ maize	Maize/ maize (fodder)	-	Buffalo (2-3) + Goat (5-6) + Poultry (6-7)	Maize, chaff cutting	Rice/ maize/ pigeon pea	Maize	Pearl millet	Buffalo (2-3) + Goat (5-6) + Poultry (6-7)	-do-	-do-
	Field crops + dairy (1) + poultry (5)	0.90	2	Rice	Maize	Groundnut	Buffalo (1) + Poultry (5)	Maize, chaff cutting	Rice/ maize	Maize	Groundnut	Buffalo (1) + Poultry (5)	-do-	-do-

Table 7.4.3(b). Improvement of production (on equivalent basis of base crop), marketable surplus and economics in different farming systems in various locations

Farming system	Area (ha)	No. of households	Existing System				Improved System				P value Significance - Existing vs Improved			
			Production (kg)	Marketable Surplus (kg)	Cost (Rs)	Profit (Rs)	Production (kg)	Marketable Surplus (kg)	Cost (Rs)	Profit (Rs)	Production (kg)	Marketable Surplus (kg)	Cost (Rs)	Profit (Rs)
Kangra (Himachal Pradesh)														
FC+D	0.78	9	10139 (2963)	3353 (2331)	19383 (7731)	14150 (18424)	12597 (1439)	5064 (1363)	11558 (878)	39084 (13294)	0.500	0.203	0.359	0.039**
FC+D+G	0.57	3	7862 (1711)	2013 (1346)	18550 (4463)	12810 (10637)	8666 (831)	2598 (787)	12387 (507)	13594 (7675)	0.750	0.750	0.250	0.750
Overall FS			**P value Significance - Existing vs Improved**								0.0548***	0.4057	0.1072	0.1047
CD [P = 0.05]	FS1 Vs FS2	7623	5998	19890	47402	3702	3507	2259	34204					
Samba (Jammu and Kashmir)														
FC+D	1.14	12	1962	888	34723	79170	5843	4036	68189	93271	0.0028**	0.0071**	0.0097**	0.0108*
Ambedkarnagar (Uttar Pradesh)														
FC+D	0.73	10	10763	6171	58395	3319	19595	10347	94020	9450	0.0001***	0.0001***	0.0124**	0.0026***
Kamrup (Assam)														
FC+D+F	1.65	6	11190 (3844)	2695 (1193)	36875 (6316)	-12624 (5505)	18162 (2968)	17970 (3459)	35883 (4220)	125846 (27687)	0.63	0.031**	1.000	0.031**
FC+D	1.50	6	13268 (3844)	2106 (1193)	35183 (6316)	-16234 (5505)	14143 (2968)	14452 (3459)	26950 (4220)	103120 (27687)	0.438	0.031**	0.063***	0.031**
Overall FS			**P value Significance - Existing vs Improved**								0.0998*	<0.0001***	0.3281	<0.0001***
CD [P = 0.05]	FS1 Vs FS2	12113	3760	19903	17346	9353	10901	13298	87245					
South 24 Paragnas (West Bengal)														
FC	0.71	3	6190 (8784)	4115 (8405)	56880 (13777)	-19844 (69502)	11284 (16984)	5286 (13592)	71492 (67403)	-23917 (63747)	0.250	0.250	0.250	0.500
FC+D	0.44	8	7699 (5072)	5253 (4853)	41159 (7954)	6118 (40127)	44157 (9806)	22440 (7848)	109872 (38915)	92087 (36804)	0.008***	0.008***	0.008***	0.313
FC+D+P	0.40	1	9933	6613	42835	16684	27104	16608	109382	40089	-	-	-	-
Overall FS			**P value Significance - Existing vs Improved**								0.0008***	0.0100***	0.0050***	0.1675
CD [P = 0.05]	FS1 Vs FS2	13453	12873	21099	106442	26010	20816	103227	97628					
Purnea (Bihar)														
FC+D	1.30	6	11212 (1753)	8078 (1773)	40431 (7293)	32269 (9766)	13110 (996)	11501 (870)	31025 (2220)	72488 (6131)	0.4217	0.1270	0.2635	0.0095**
FC+D+G	1.13	3	9942 (2479)	6927 (2507)	48039 (10314)	14301 (13811)	15184 (1409)	13084 (1230)	33010 (3140)	84743 (8671)	0.0317*	0.0176*	0.1011	0.0131*

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Farming system	Area (ha)	No. of households	Existing System				Improved System				P value Significance - Existing vs Improved			
			Production (kg)	Marketable Surplus (kg)	Cost (Rs)	Profit (Rs)	Production (kg)	Marketable Surplus (kg)	Cost (Rs)	Profit (Rs)	Production (kg)	Marketable Surplus (kg)	Cost (Rs)	Profit (Rs)
FC+G	0.70	2	7063 (3036)	5836 (3070)	24565 (12632)	27961 (16915)	11716 (1726)	10155 (1506)	22395 (3845)	68999 (10620)	0.1682	0.1681	0.9181	0.0844
FC	0.95	1	7609	5198	34171	12609	7510	6539	18650	40197	-	-	-	-
Overall FS			P value Significance - Existing vs Improved								0.0274*	0. 0020**	0.0428*	<0.0001**
CD [P = 0.05]	FS1 Vs FS2	4293	4342	17864	23921	2441	2130	5438	15019					
CD [P = 0.05]	FS1 Vs FS3	4957	5014	20628	27622	2818	2459	6279	17342					
CD [P = 0.05]	FS2 Vs FS3	5542	5605	23063	30882	3151	2750	7020	19389					
Kanpur Dehat (Uttar Pradesh)														
FC+D	1.10	10	13633 (1122)	11023 (1182)	56952 (3035)	53273 (10081)	24555 (3821)	16026 (1469)	92556 (7783)	67705 (8845)	0.020**	0.004***	0.004***	0.065*
FC+D+G	0.60	1	12955	8565	62500	23150	12203	6454	52855	11680	-	-	-	-
FC	1.00	1	9800	8655	47000	39550	13007	11252	69023	43498	-	-	-	-
Overall FS			P value Significance - Existing vs Improved								0.0204**	0.0034***	0.0009***	0.0856*
Sirsa (Haryana)														
FC+D	0.85	12	2493	1054	53428	10198	8021	7821	63482	31070	0.1770	0.1762	0.0168*	0.0199*
Amritsar (Punjab)														
FC+D	0.97	12	5776	4905	58663	39441	10454	7781	76247	79377	<0.0001***	<0.0001***	<0.0001***	<0.0001***
Overall FS			P value Significance - Existing vs Improved								-	<0.0001***	-	-
Kabirdham / Kawardha (Chhatisgarh)														
FC+D+ G+ P+ Fishery	1.3	1	25727	8216	50900	60020	34383	21902	64400	231275	-	-	-	-
FC+D + Goat + Poultry	1.11	11	13669 (1794)	6062 (524)	36132 (1654)	45705 (6251)	18251 (1133)	11413 (764)	42949 (2528)	111130 (7931)	0.067*	0.001***	0.002***	0.001***
Overall FS			P value Significance - Existing vs Improved								0.0228**	<0.0001***	0.0011***	<0.0001***
Pakur (Jharkhand)														
FC	1.14	12	9597	3354	29261	14341	7767	5326	24181	45054	0.3280	0.1984	<0.0001**	<0.1191
Dindori (Madhya Pradesh)														
FC+D	1.25	9	3770 (2825)	2020 (1871)	20600 (11785)	9700 (19385)	10315 (4135)	6778 (2937)	19287 (14900)	82388 (31577)	0.004***	0.020**	0.250	0.008***
FC+D+G	0.90	2	11633 (1997)	6515 (1323)	31650 (8333)	66075 (13707)	14237 (2924)	10307 (2076)	33187 (10536)	121413 (22328)	1.000	0.500	1.000	0.500
FC+D+P	0.75	1	7426	5108	34839	41783	11889	7822	27326	90007	-	-	-	-

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Farming system	Area (ha)	No. of households	Existing System				Improved System				P value Significance - Existing vs Improved			
			Production (kg)	Marketable Surplus (kg)	Cost (Rs)	Profit (Rs)	Production (kg)	Marketable Surplus (kg)	Cost (Rs)	Profit (Rs)	Production (kg)	Marketable Surplus (kg)	Cost (Rs)	Profit (Rs)
Overall FS					P value Significance - Existing vs Improved						0.0002***	0.0016***	0.2542	<0.0001***
CD [P = 0.05]	FS1 Vs FS2	4995	3309	20840	34280	7312	5193	26349	55841					
						Angul (Odhisha)								
FC+D+P	1.23	8	6997 (1265)	2114 (564)	45088 (8317)	23950 (10864)	7924 (1837)	6925 (1803)	46757 (16165)	22493 (16516)	0.250	0.008***	0.742	0.008***
FC+D	1.19	4	10654 (895)	3674 (399)	64841 (5881)	28105 (7682)	12731 (1299)	11884 (1275)	66856 (11430)	51988 (11679)	0. 875	0.125	1.000	0.125
Overall FS					P value Significance - Existing vs Improved						0.1425	<0.0001***	0.7717	<0.0001***
CD [P = 0.05]	FS1 Vs FS2	3453	1540	22695	29647	5013	4920	44112	45071					
						Katni (Madhya Pradesh)								
FC+D	0.71	4	9468 (5910)	7463 (7721)	27150 (4412)	47475 (79401)	8782 (1790)	6327 (1649)	10651 (724)	52622 (15769)	0.875	0.875	0.125	0.875
FC	0.80	2	8488 (4179)	9477 (5459)	16763 (3120)	30034 (5614)	6179 (1266)	3972 (1166)	9690 (512)	78006 (11150)	1.000	1.000	0.500	1.000
Overall FS					P value Significance - Existing vs Improved						0.5879	0.3575	0.0216**	0.4988
CD [P = 0.05]	FS1 Vs FS2	20097	26254	15002	269998	6087	5606	2460	53620					
						Udaipur (Rajasthan)								
FC+D+G	0.75	10	5276 (1427)	3209 (1039)	6000 (2152)	32513 (13088)	5269 (1559)	3231 (1390)	25219 (2392)	13552 (15316)	0.0175*	0.0415*	<.0001**	0.5981
FC+D	0.75	2	4785 (638)	2367 (464)	7640 (962)	20761 (5853)	6439 (697)	3781 (622)	28440 (1070)	16934 (6849)	0.9970	0.9892	0.0716	0.4714
Overall FS					P value Significance - Existing vs Improved						0.0260*	0.0505	<0.0001**	0.3422
CD [P = 0.05]	FS1 Vs FS2	2211	1609	3334	20276	2415	2154	3705	23727					
						Aurangabad (Maharashtra)								
FC + D	0.74	12	2100	1864	42259	32286	3238	3538	97832	43700	0.0167**	0.0015***	0.0002***	0.2864
						Pune (Maharashtra)								
FC+D+P	0.72	7	2227 (413)	1668 (389)	53442 (7093)	NA	7950 (1613)	6952 (1827)	93367 (13094)	NA	0.0019***	0.0027***	0.0435**	-
FC+D	0.76	5	795 (488)	610 (460)	37747 (8392)	NA	9085 (1909)	8456 (2162)	63449 (15493)	NA	0.0538*	0.0957*	0.0675*	-
Overall FS					P value Significance - Existing vs Improved						0.0002***	0.0010***	0.0058***	-
CD [P = 0.05]	FS1 Vs FS2	640	603	10989	-	2500	2831	20285	-					

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Farming system	Area (ha)	No. of households	Existing System				Improved System				P value Significance - Existing vs Improved			
			Production (kg)	Marketable Surplus (kg)	Cost (Rs)	Profit (Rs)	Production (kg)	Marketable Surplus (kg)	Cost (Rs)	Profit (Rs)	Production (kg)	Marketable Surplus (kg)	Cost (Rs)	Profit (Rs)
Amravati (Maharashtra)														
FC+D	1.08	8	2339 (352)	2148 (326)	37900 (5760)	41575 (8156)	3793 (621)	3097 (479)	60756 (5975)	53819 (13703)	0.008***	0.008***	0.008***	0.547
FC+D+G	1.30	2	2497 (996)	2246 (923)	11000 (16292)	72100 (23069)	3209 (1756)	2759 (1356)	16000 (16901)	86075 (38757)	0.500	0.500	0.500	1.000
FC+D+P	1.40	1	3011	2864	42200	63750	4016	3468	58486	69814	-	-	-	-
FC+G	1.20	1	2878	2676	49000	50000	3598	3503	63117	66481	-	-	-	-
Overall FS			**P value Significance - Existing vs Improved**								0.0018***	<0.0001***	0. 1478	0.0018***
CD [P = 0.05]	FS1 Vs FS2	1815	1683	29700	42055	3202	2472	30811	70656					
Warangal (Telangana)														
FC+D	1.32	5	10030 (4297)	4019 (2542)	5500 (1590)	23072 (22805)	18081 (3352)	16660 (3361)	25150 (8679)	194425 (40817)	0.0780	0.0001**	0.0244*	0.0002**
FC+D+P	1.13	3	14369 (4297)	8260 (2542)	43870 (86790)	55255 (22805)	35233 (3352)	33375 (3361)	75000 (1590)	393000 (40817)	0.3220	0.0203*	0.4669	0.0270*
FC+D+G	1.00	1	9781 (3509)	2268 (2076)	23330 (1299)	19867 (18620)	21472 (2737)	19414 (2745)	73530 (7086)	230633 (33327)	0.2137	0.1769	0.2204	0.1325
FC+D+G+P	1.44	3	10466 (2718)	5122 (1608)	32000 (1006)	39891 (14423)	18101 (2120)	16750 (2126)	21577 (5489)	197804 (25815)	0.0200*	0. 6098	0.2298	0.0366*
Overall FS			**P value Significance - Existing vs Improved**								.0020**	<.0001**	.0013**	<0.0001**
CD [P = 0.05]	FS1 Vs FS2	4896	4910	2323	59618	6276	3713	12676	33309					
CD [P = 0.05]	FS1 Vs FS3	5609	5625	2661	68301	7190	4254	14522	38161					
CD [P = 0.05]	FS1 Vs FS4	5609	5625	2661	68301	7190	4254	14522	38161					
CD [P = 0.05]	FS2 Vs FS3	6120	6137	2904	74522	7845	4642	15845	41637					
CD [P = 0.05]	FS2 Vs FS4	6120	6137	2904	74522	7845	4642	15845	41637					
CD [P = 0.05]	FS3 Vs FS4	6704	6723	3181	81635	8594	5085	17357	45611					
Kolar (Karnataka)														
FC+D	0.88	7	11587 (5263)	10200 (5303)	67342 (23645)	55061 (66857)	317712 (9781)	32077 (9995)	65200 (13822)	319724 (117706)	0.938	0.938	0.016**	0.938
FC+D+G+P	0.84	3	20280 (3446)	19091 (3471)	96329 (15480)	132765 (43768)	18289 (6403)	17558 (6543)	33616 (9049)	177086 (77057)	0.250	0.250	1.000	0.250
FC+D+G	0.50	1	19700	13597	99227	63933	15680	13403	43900	116940	-	-	-	-
FC+D+P	0.27	1	8100	6900	62100	20700	4517	4133	17150	32450	-	-	-	-

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Farming system	Area (ha)	No. of households	Existing System				Improved System				P value Significance - Existing vs Improved			
			Production (kg)	Marketable Surplus (kg)	Cost (Rs)	Profit (Rs)	Production (kg)	Marketable Surplus (kg)	Cost (Rs)	Profit (Rs)	Production (kg)	Marketable Surplus (kg)	Cost (Rs)	Profit (Rs)
Overall FS					P value Significance - Existing vs Improved						0.5731	0.4683	0.0089***	0.1682
CD [P = 0.05]	FS1 Vs FS2	14507	14615	65172	184272	26957	27549	38097	324422					
					Gadag (Karnataka)									
FC+D	1.30	12	4163	3758	16700	39673	9616	8801	57450	74568	<0.0001***	0.0002***	<0.0001***	0.0055***
					Dharmapuri & Krishnagiri /Paiyur (Tamil Nadu)									
FC+D	1.02	10	12125 (1842)	10136 (1884)	158427 (47571)	6389 (46091)	18843 (3560)	19130 (3892)	149021 (22357)	137935 (45755)	0.1107	0.0726	0.8346	0.0745
FC+D+G	1.36	2	17105 (4118)	13915 (4214)	158562 (106371)	50166 (103062)	28587 (7960)	26039 (8703)	275829 (49991)	114755 (102312)	0.1936	0.2208	0.3877	0.1551
Overall FS					P value Significance - Existing vs Improved						0.0393*	0.0263*	0.7759	0.0509
CD [P = 0.05]	FS1 Vs FS2	6380	6528	164789	159664	12332	13483	77445	158501					
					Srikakulam /Seetampetta (Andhra Pradesh)									
FC	0.90	2	1667 (1215)	300 (900)	10000 (6665)	-5800 (11017)	4221 (1375)	2544 (1262)	17795 (8773)	17821 (14727)	0.1291	0.1763	0.3388	0.3309
FC + D+ G	1	1	4525	2674	26500	10936	4576	2659	23725	5997		-	-	-
FC + D+ G + P	0.52	1	6007	3740	26833	25533	5867	3600	14813	35582		-	-	-
FC + G	0.2	1	6254	5336	38000	36700	1243	73	4553	-3536		-	-	-
FC +D	0.30	2	14000 (1718)	9107 (1273)	90310 (9425)	37190 (15580)	3899 (1944)	2123 (1784)	15585 (12407)	14140 (20827)	0.9878	0.9963	0.9055	0.8802
FC + G+ P	0.80	3	18229 (1718)	5129 (1273)	49300 (9425)	22500 (15580)	7665 (1944)	3322 (1784)	6860 (12407)	22751 (20827)	0.9579	0.9546	0.3832	0.6702
FC + P	0.70	2	2864 (1718)	125 (1273)	11000 (9425)	-9250 (15580)	5245 (1944)	3871 (1784)	46600 (12407)	7590 (20827)	0.0844	0.0171*	0.0010**	0.0306*
Overall FS					P value Significance - Existing vs Improved						0.2092	0.4070	0.1290	0.8573
CD [P = 0.05]	FS1 Vs FS5	2429	1800	13329	22033	2749	2523	17547	29454					
CD [P = 0.05]	FS1 Vs FS6	2218	1644	12168	20113	2510	2303	16018	26888					
CD [P = 0.05]	FS1 Vs FS7	2429	1800	13329	22033	2749	2523	17547	29454					
CD [P = 0.05]	FS5 Vs FS6	2218	1644	12168	20113	2510	2303	16018	26888					
CD [P = 0.05]	FS5 Vs FS7	2429	1800	13329	22033	2749	2523	17547	29454					
CD [P = 0.05]	FS6 Vs FS7	2218	1644	12168	20113	2510	2303	16018	26888					
					Kendrapara (Odisha)									
FC+D	0.66	2	5326 (1028)	2440 (793)	47452 (11316)	-26714 (10660)	27465 (5405)	15215 (2733)	35162 (6786)	94163 (17891)	0. 500	0. 500	0. 500	0. 500

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Farming system	Area (ha)	No. of households	Existing System				Improved System				P value Significance - Existing vs Improved			
			Production (kg)	Marketable Surplus (kg)	Cost (Rs)	Profit (Rs)	Production (kg)	Marketable Surplus (kg)	Cost (Rs)	Profit (Rs)	Production (kg)	Marketable Surplus (kg)	Cost (Rs)	Profit (Rs)
FC+D+P	0.89	2	8466 (1028)	5814 (793)	55457 (11316)	-6038 (10660)	22350 (5405)	12616 (2733)	42014 (6786)	65221 (17891)	0.500	0.500	0.500	0.500
FC+D+G+P	1.00	3	5345 (839)	1553 (647)	48778 (9240)	-35578 (8704)	31421 (4413)	16949 (2232)	45145 (5541)	98923 (14608)	0.250	0.250	0.750	0.250
FC+D+F	0.64	2	5832 (1028)	3151 (793)	30269 (11316)	-3486 (1060)	17561 (5405)	8627 (2733)	27822 (6786)	45505 (17891)	0.500	0.500	0.500	0.500
FC+D+G	1.1	1	8648	4132	71395	-36272	33192	19985	50649	119226	-	-	-	-
FC+D+G+P+F	1.06	1	5056	2697	24083	-1155	20752	9969	22532	62208	-	-	-	-
FC+D+P+F	1.2	1	7958	4220	44578	-8708	44697	14752	47212	78184	-	-	-	-
Overall FS			P value Significance - Existing vs Improved								<.0001***	<0.0001***	0.0191**	<0.0001***
CD [P = 0.05]	FS1 Vs FS2	3736	2882	41139	38751	19650	9936	24669	65039					
CD [P = 0.05]	FS1 Vs FS3	3410	2631	37555	35375	17938	9070	22519	59372					
CD [P = 0.05]	FS1 Vs FS4	3736	2882	41139	38751	19650	9936	24669	65039					
CD [P = 0.05]	FS2 Vs FS3	3410	2631	37555	35375	17938	9070	22519	59372					
CD [P = 0.05]	FS2 Vs FS4	3736	2882	41139	38751	19650	9936	24669	65039					
CD [P = 0.05]	FS3 Vs FS4	3410	2631	37555	35375	17938	9070	22519	59372					
Sivagangai & Pudukotai / Chittned (Tamil Nadu)														
FC+D	1.05	12	14696	12618	102719	48697	22971	19310	148784	82936	<0.0001***	<0.0001***	<0.0001***	<0.0002***
Palghar (Maharashtra)														
FC+D	0.55	12	13437	6123	64165	9305	11628	9607	49579	65708	0.1152	0.0038**	<.0001**	0.0010**
Pathinamthitta (Kerala)														
FC+horticulture+D	1.30	11	11493 (4489)	10510 (4465)	86060 (59141)	344842 (141581)	20524 (14522)	19949 (14303)	152000 (61267)	665924 (556764)	0.0016**	0.0013**	0.0057**	0.0016**
FC+horticulture+D+P	0.96	1	14745	13659	136123	423887	34616	33845	227560	1160068	-	-	-	-
Overall FS			P value Significance - Existing vs Improved								0.0011**	0.0009**	0.0033**	0.0011**
Mehsana (Gujarat)														
FC	1.10	2	11312 (3743)	6512 (3310)	57200 (43458)	40475 (26766)	35801 (5491)	20410 (4578)	368549 (38448)	62399 (52559)	0.0087**	0.0505	0.0249*	0.1736
FC+D	1.16	10	14054 (1674)	9630 (1480)	87744 (19435)	56702 (11970)	24194 (2456)	10456 (2047)	88744 (17195)	99082 (23505)	0.0144*	0.7320	0.0003**	<0.0001**
Overall FS			P value Significance - Existing vs Improved								0.0024**	0.2420	<0.0001**	<0.0001**
CD [P = 0.05]	FS1 Vs FS2	5799	5127	67325	41466	8507	7093	59564	81424					

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Farming system	Area (ha)	No. of households	Existing System				Improved System				P value Significance - Existing vs Improved			
			Production (kg)	Marketable Surplus (kg)	Cost (Rs)	Profit (Rs)	Production (kg)	Marketable Surplus (kg)	Cost (Rs)	Profit (Rs)	Production (kg)	Marketable Surplus (kg)	Cost (Rs)	Profit (Rs)
Panchmahal (Gujarat)														
FC+D+P+G	1.04	6	10561 (432)	5947 (449)	56553 (3851)	26699 (7858)	15234 (507)	11702 (430)	86853 (5555)	76980 (4156)	0.031**	0.031**	0.031**	0.031**
FC+D+P	0.90	2	4961 (749)	3598 (778)	33080 (6670)	17285 (13611)	8221 (878)	5938 (746)	35710 (9621)	47425 (7199)	0.510	0.500	0.500	0.500
FC+D+G	0.72	3	9487 (611)	5072 (635)	48620 (5446)	22388 (11113)	13851 (717)	10677 (609)	84200 (7856)	65279 (5878)	0.250	0.250	0.250	0.250
FC+D	0.40	1	5775	4500	41600	21400	9378	7147	58100	41960	-	-	-	-
Overall FS			**P value Significance - Existing vs Improved**								<0.0001***	<0.0001***	0.0006***	<0.0001***
CD [P = 0.05]	FS1 Vs FS2	1223	1994	2072	17760	36243	2339	1985	25619					
CD [P = 0.05]	FS1 Vs FS3	1059	1727	1794	15381	31387	2026	1719	22187					
CD [P = 0.05]	FS2 Vs FS3	1367	2229	2317	19856	40521	2615	2219	28643					

Note: FC: Field crops, D: Dairy, P: Poultry,G:Goat, F: Fish; * indicates significance at 10% level; ** indicates significance at 5% level; *** indicates significance at 1% level; - Values in ( ) indicates standard error of mean values; - The farming system with only one household was not considered for ANOVA as well as for paired t test.

dairy with mean area of 1.30 ha followed by field crops + dairy + goat with 25 % households practicing with area of 1.13 ha. Interventions made in crop, livestock, processing and optional (nutritional kitchen garden) modules resulted in significant improvement in marketable surplus and profit of all the systems. Among the systems, field crops + goat recorded the higher profit while field crops + dairy system recorded higher production.

Upper Gangetic plains

Kanpur Dehat (Uttar Pradesh): Two farming systems namely field crops and field crops + dairy were found among which 66 % households were having field crops alone with mean area of 1.18 ha. Interventions made in crops, livestock, processing and optional (nutritional kitchen garden) resulted in significant improvement in profit of field crops + dairy system while production, marketable surplus and profit in field crops + dairy + goat system. Among the systems, higher profit of Rs 84,743 from 1.13 ha was observed in field crops + dairy + goat system after interventions.

Trans Gangetic plains

Sirsa (Haryana): All the households were having only one farming system of field crops + dairy (2-3 animals) with mean area of 0.85 ha. Interventions in crop, livestock, processing (ghee) and optional (kitchen garden) modules resulted in significant change in cost and profit only.

Amritsar (Punjab): All the households were having only one farming system of field crops + dairy with mean area of 0.97 ha. Interventions in existing systems in different modules such as crop, livestock, processing and optional modules resulted in significant change in production (80.9 %), marketable surplus (58 %), cost (increase by 29 %) and profit (additional amount of Rs 39,936 from 0.97 ha).

Eastern plateau and hills

Kabirdham (Chhatisgarh): Two farming systems namely field crops + dairy + goat + poultry + fishery and field crops + dairy + poultry + goat was found among which 91% households were having field crops + dairy + poultry + goat with mean area of 1.11 ha area. Interventions in crop, livestock, processing (pulse dal, besan and ghee) and optional (nutritional kitchen garden) resulted in significantly higher production (33 %), marketable surplus (88 %) and profit (143 %) in field crops + dairy + poultry + goat. Among the farming systems, field crops + dairy + goat + poultry + fishery recorded higher profit of Rs 2, 31,275 from 1.35 ha.

Pakur (Jharkhand): All the households were having the field crops alone system with mean area of 1.14 ha. Interventions made in crop and livestock module resulted in significant increase in profit by Rs 30,713 from 1.14 ha.

Dindori (Madhya Pradesh): Three farming systems namely field crops + dairy, field crops + dairy + goat and field crops + dairy + poultry were found among which 75 % households were having field crops + dairy system with mean area of 1.25 ha. Interventions made in crop and livestock module resulted in significant increase in production, marketable surplus and profit of crop + dairy system. Among the farming systems, field crops + dairy + goat system recorded higher profit (Rs 1,21,413 from 0.90 ha) after interventions.

Angul (Odisha): Two farming systems namely field crops + dairy and field crops + dairy + poultry were found among which one third households were having field crops + dairy + poultry and remaining with field crops + dairy with mean area of 1.23 and 1.19 ha respectively. Interventions made in crop, livestock, processing (ghee) and optional (fruits plantation, boundary plantation and fisheries) modules resulted in significantly higher marketable surplus (2.7 times) and profit in field crops + dairy + poultry system. Among the two farming systems, after interventions, field crops + dairy system resulted in higher profit of Rs 51,988 from 1.19 ha.

Central Plateau and hills

Katni (Madhya Pradesh): Two farming systems namely field crops and field crops + dairy were found among which 83% households were having field crops + dairy system with mean area of 0.71 ha. Interventions made in crop and livestock module did not result in significant changes in any of the parameters. Among the two systems, field crops + dairy gave higher profit (Rs 52,622/- in 0.71 ha).

Udaipur (Rajasthan): Two farming systems namely field crops + dairy + goat and field crops + dairy were found among which 83% households were having field crops + dairy + goat system. Interventions made in crop, livestock, processing (vermicompost) and optional (fruits and boundary plantations) resulted in significant improvement in marketable surplus (3231 kg on rice equivalent basis) in field crops + dairy + goat. Among the systems, field crops + dairy was found to be more profitable (Rs 16,934 from 0.75 ha).

Western Plateau and hills

Aurangabad (Maharashtra): All the households were having field crops + dairy system with mean area of 0.74 ha. Interventions made in crop, livestock and processing (sugarcane juice and ghee) resulted in significant improvement in production (54 %), marketable surplus (89 %) and cost (11 %).

Pune (Maharashtra): Two farming systems namely field crops + dairy + poultry, field crops + dairy were found among which 58 % households were having field crops + dairy + poultry systems with mean area of 0.72 ha. The interventions made in crop, livestock, processing and optional module (nutritional kitchen garden) resulted in significantly higher production, marketable surplus and cost in both the systems.

Amravati (Maharashtra): Four farming systems namely field crops + dairy, field crops + dairy + goat, field crops + dairy + poultry and field crops + goat were found among which 66 % households were practicing field crops + dairy system with mean area of 1.08 ha. Interventions made in crop, livestock, processing (fortified wheat atta and mineral mixture) and optional (nutritional plantation) resulted in significant improvement in production, marketable surplus and cost in field crops + dairy system only. Among the systems, higher profit was observed in field crops + dairy + goat system (Rs 86,075 from 1.30 ha) after interventions.

Southern Plateau and hills

Warangal (Telangana): Four farming systems namely field crops + dairy, field crops + dairy + goat, field crops + dairy + goat + poultry and field crops + dairy + poultry were found among which 41 % households were having field crops + dairy with mean area of 1.32 ha. Interventions made in crop, livestock, processing (ghee) and optional (nutritional kitchen garden and azolla) resulted in significant improvement in marketable surplus, cost and profit of field crops + dairy system. Among the systems, field crops + dairy + poultry recorded higher profit compared to other systems after interventions.

Kolar (Karnataka): Four farming systems namely field crops + dairy, field crops + dairy + goat, field crops + dairy + goat + poultry and field crops + dairy + poultry were found among which 58 % households were having field crops + dairy system with mean area of 0.88 ha. Interventions made in crop and livestock module resulted in improvement of only cost in field crops + dairy system. Among the farming systems, field crops + dairy was found to be more profitable.

Gadag (Karnataka): All the households were having field crops + dairy system with mean area of 1.30 ha. Interventions made in crop, livestock, processing (butter, vermicompost) and optional (nutritional kitchen garden) resulted in significantly higher production (130 %), marketable surplus (134 %) and profit (87 %) in the system.

Dharmapuri and Krishnagiri (Tamil Nadu): Two farming systems namely field crops + dairy and field crops + dairy + goat was found among which 83 % households were practicing field crops + dairy system with mean area of 1.02 ha.

Interventions made in crop and livestock module did not result in significant improvement in any of the parameters.

East coast plains and hills

Srikakulam (Andhra Pradesh): Seven farming systems namely field crops, field crops + dairy + goat, field crops + dairy + goat + poultry, field crops + goat, field crops + dairy, field crops + dairy + poultry and field crops + poultry were found among which field crops, field crops + dairy, field crops + poultry and field crops + dairy were found predominant. Interventions made in crop, livestock and optional (azolla) modules in field crops + poultry system resulted in significant improvement in marketable surplus, cost and profit from the system. Among the various farming systems, after interventions, the production (5867 kg), marketable surplus (3600 kg) and profit (Rs 35,582) was higher in field crops + dairy + goat + poultry system with the total cost of Rs 14,813/- in 0.52 ha.

Kendrapara (Odisha): Seven farming systems namely field crops + dairy, field crops + dairy + poultry, field crops + dairy + goat + poultry, field crops + dairy + fishery, field crops + dairy + goat, field crops + dairy + goat + poultry + fish and field crops + dairy + goat + poultry + fish were found. Interventions made in crop, livestock, processing and optional (nutritional kitchen garden mushroom and fishery) modules did not result in significant improvement. Among the different farming systems, field crops + dairy + goat gave higher profit of Rs 1,19,226 from 1.10 ha.

Sivagangai and Pudukottai (Tamil Nadu): All the households were having the field crops + dairy system with mean area of 1.05 ha. Interventions in crop, livestock, processing and optional modules resulted in significant improvement in production (56 %), marketable surplus (53 %), cost (44.8 %) and profit (70 %).

West Coast Plains and ghats

Palghar (Maharashtra): All the households were having field crops + dairy system with mean area of 0.55 ha. Interventions in crop, livestock and optional (nutritional kitchen garden) modules resulted in significant improvement in marketable surplus (56 %), cost (23 % reduction) and profit (7 times).

Pathinamthitta (Kerala): Two farming systems namely field crops + horticulture + dairy and field crops + horticulture + dairy + poultry were found among which 92 % households were having field crops + horticulture + dairy system with mean area of 1.30 ha. The interventions made in crop, livestock, processing (curing of garcinia, coconut oil, dry mace, graded pepper and packed milk after filtration) and optional (fisheries, terrace gardening, apiary and vermicompost) in field crops + horticulture + dairy system resulted in higher production (78.5 %), marketable surplus (89 %) and profit (93 %). Among the two farming systems, higher production, marketable surplus and profit were observed in field crops + horticulture + dairy system after interventions.

Gujarat plains and hills

Mehsana (Gujarat): Two farming systems namely field crops and field crops + dairy was found among which 83 % households were having the field crops + dairy system with mean area of 1.16 ha. Interventions made in crop and livestock modules resulted in significant improvement in production, cost and profit of both the systems. Among the two systems, higher profit was observed in field crops + dairy system.

Panchmahal (Gujarat): Four farming systems namely field crops + dairy + poultry + goat, field crops + dairy + poultry, field crops + dairy + goat and field crops + dairy were found among which field crops + dairy + poultry + goat were present in 50 % of households having mean area of 1.04 ha. Interventions made in crop, livestock, processing and optional (nutritional kitchen garden, fruit, boundary plantations and utilization of stubbles of fodder crop) resulted in significantly higher production (44 %), marketable surplus (96 %), cost (reduction by 15.3 %) and profit (1.8 times) of field crops + dairy + poultry + goat system. Among the

different farming systems, field crops + dairy + poultry + goat registered higher profit of Rs 76,980 from 1.04 ha.

The results across the locations are summarized as below:

- The number of farming systems in different districts ranged between 1 (Samba, Ambedkarnagar, Sirsa, Amritsar, Pakur, Aurangabad, Sivagangai & Pudukottai, Gadag and Palghar) to 7 (Srikakulam and Kendrapara). Purnea, Amravati, Warangal, Kolar and Panchmahal districts were having 4 farming systems.
- Field crops + dairy was found to be the dominant farming system based on number of households in 19 districts (65 % of total districts studied).
- Highly diversified system was observed in Srikakulam district of Andhra Prades, Kendrapara district of Odisha, South 24 Paragnas in West Bengal, Panchmahal district of Gujarat having many components of farming system namely field crop, dairy, goat, poultry, fish in different combinations ranging from 1 to 5. Horticulture component was found to be contributing for better income in Pathinamthitta district.
- In general, at all the locations, constraint based interventions in crop, livestock, processing and optional modules resulted in improvement in production (1.8 times), marketable surplus (1.9 times) and profit (1.6 times).




Integrated farming system approach at farmers field

7.4.4 FRONTLINE DEMONSTRATION ON FARMING SYSTEMS INVOLVING OILSEEDS

During 2016-17, FLD's were conducted at 11 OFR centres of All India Coordinated Research Project on Integrated Farming Systems (AICRP on IFS) in four agro ecosystems *viz.,* Arid, Semi-Arid, Sub Humid, and Humid; covering 10 states. Crops/cropping systems in which FLDs were conducted are given in Table 7.4.4 (a). In Arid ecosystem, at Jagudan (Gujarat), a total of 15 demonstrations were conducted. Likewise, in the semi-arid region (Amritsar, Seethampeta, Warangal and Chettinad) a total of 54 demonstrations were conducted.

Under Sub humid agro-ecosystem, 10, 8, 27 and 5 demonstrations were conducted by Fathepur (Rajasthan), Kanpur Dehat (UP), Modipuram (Uttar Pradesh) and Jeolikote (Uttrakhand) centres, respectively. In humid agro-ecosystem which included Kangra (Himachel Pradesh) and Kamrup (Assam); 7 and 10 demonstrations were conducted, respectively. In total, 136 demonstrations were conducted during 2016-17.

Major cropping systems in which oilseed crops were tested are hybrid castor without sunhump in farmers practice and with sunhump in improved practice and rice-mustard in arid ecosystem, Gobhisarson, sunflower (Rabi), soybean + red gram, soybean – maize, ground nut (Co-7), ground nut (VRI -7) in semi arid, cluster bean –mustard, mustard and soybean in sub –humid and toria in Humid ecosystems. Total of 50 demonstrations were on systems involving mustard crops across the different agro-ecosystems. The systems involving soybean was undertaken in 25 demonstrations while gobhi-sarson and ground nut were taken in 12 demonstrations each.

There were only two treatments taken for comparison, i.e. farmers practice (FP) and improved practice (IP). These treatments were applied on a time tested; well recognized oilseed based cropping systems of the location.

Crop varieties along with other management practices adopted in farmers and improved

Table 7.4.4(a). List of Front Line Demonstrations (FLD) on frming systems involving oilseeds (2016-17)

Agro Ecosystem	Name of Centre (State)	Crop/cropping system (s)	Number of demonstrations conducted
1. Arid	Jagudan (Gujarat)	Hy. castor without sunhump in Farmers practice & with sunhump in improved practice	10
		Rice - Mustard	5
2. Semi-Arid	Amritsar (Punjab)	Gobhisarson	12
	Seethampeta (Andhra Pradesh)	Sunflower (Rabi)	10
		Sesame (Summer)	
	Warangal (Telangana)	Soybean + Red gram	10
		Soybean - Maize	10
	Chettined (Tamil Nadu)	Ground nut (Co-7)	6
		Ground nut (VRI -7)	6
3. Sub humid	Fathepur (Rajasthan)	Cluster bean-Mustard	10
	Kanpur Dehat (Uttar Pradesh)	Mustard	8
	Modipuram (Uttar Pradesh)	Mustard	27
	Jeolikote (Uttrakhand)	Soybean	5
4. Humid	Kamrup (Assam)	Toria	10
	Kangra (Himachal Pradesh)	Maize-Gobhi-sarson	7
Total			136

practice under various cropping systems are presented in Table 7.4.4 (b).

A total of 10 demonstrations were conducted to improve farmer's income with inclusion of castor as well as 5 were conducted with mustard in rice-wheat cropping system. As per the new intervention, green manuring of the sunhemp was done in kharif season an improved practice over the farmers practice along with the introduction of

Table 7.4.4(b). Details of interventions in FLD (2016-17)

Agro Ecosystem (Centre)	Cropping system		Particulars of package	Farmer Practice		Improved Practice	
	Kharif	*Rabi*		*Kharif*	*Rabi*	*Kharif*	*Rabi*
1.Arid							
Jagudan (Gujarat)	Hy. castor		Green manuring (GM)	Sole castor	-	GMby sunhemp	-
	Hy.castor		variety	-	-	GCH-7	-
	Rice	Mustard	-	Rice	-	-	Mustard
2. Semi Arid							
Amritsar (Punjab)	-	Gobhi sarson	Spacing	-	Broad-casting no thinning	-	45 X 10 maintain by thinning
			variety		GSL 1		GSL 1
Seethampeta (Andhra Pradesh)	-	Sunflower	Variety	-	Local	-	Private hybrid
	-	Sesame	Variety	-	Local	YLM-66	YLM-66
Warangal (Telangana)	Soybean + Red gram		Variety	-	-	Soybean JS 335 Redgram LRG 41	
			Spacing	-	-	30 cm x 5 cm 180 cm x 15 cm	
			Ratio	-	-	5:1	
	Soybean	Maize	Variety	-	-	JS 335	Private hybrid
			Spacing	-	-	45X5 cm	60X 20 cm
Chettinad (Tamil Nadu)		Groundnut	Variety	TMV-7			Co-7 VRI-7
			Spacing	20-30x10			30x10
3. Sub Humid							
Fathepur (Rajasthan)	Cluster bean	Mustard	Variety	Local	Local	RGC-1003	RNG-229
			Spacing	20x10	30x15	30x15	30x15
Kanpur Dehat (Uttar Pradesh)	-	Mustard	Variety	-	Varuna	-	Varuna
Modipuram (Uttar Pradesh)	Rice	Mustard	Variety	-	Pusa Bold	-	RH-749
Jeolikote (Uttrakhand)	Soyabean		Varity	Local		PS 1347	
4. Humid							
Kamrup (Assam)	Rice	Toria	Variety	Local	TS-67	-	TS-67
Kangra (Himachal Pradesh)	Maize	Gobhi-sarson	Variety	-	Kanchan	-	HPN-3

new variety GCH-7. Mustard was grown in rabi season. Similarly, in Amritsar a planting geometry of 45 X 10 was used in gobhisarson as an improved practice as against the broadcasting. The improved private hybrid of sunflower and an improved variety of sesame (YLM-66) was introduced in place of the local variety under FLD's conducted at Seethampeta (Andhra Pradesh). For soybean + red gram intercropping system at Warangal (Telangana) improved varieties (Soybean; JS 335 and Redgram; LRG 41) were introduced as a part of improved practice. In Chettinad (Tamil Nadu), two new varieties of ground nut *viz.,* Co-7 and VRI-7 were introduced as new intervention. At Fathepur (Rajasthan) improved variety of clusterbean (RGC-1003) and mustard (RNG- 229) was introduced. Similarly at Modipuram an improved mustard variety RH 749 was introduced in place of Pusa bold. For rice-toria cropping system in Kamrup (Assam) improved toria variety TS-67 was taken as an improved practice. Likewise at Kangra (HP) in maize-gobhi sarson system old variety (kanchan) was replaced with HPN-3.

At Jagudan (Gujarat) in Hybrid castor without sunhump in Farmers practice & with sunhump in improved practice, all NPK fertilizers were applied in farmer's as well as in improved practice. In Chettinad (Tamil Nadu) improved nutrient management schedule was adopted for groundnut crop with NPK application @ 25:50:75 kg/ha along with foliar nutrition with groundnut rich @ 5 kg/ha at flowering and pegging stage. At Fathepur (Rajasthan) in clusterbean-mustard cropping system, NPK application was made @ 30:40:0 kg/ha for clusterbean and 60:40:0 kg/ha for mustard, respectively under improved practice as against farmer's practice. At Kanpur Dehat (Uttar Pradesh) in mustard crop NPK application @ 120:60:60 kg/ha was suggested as per improved practice as against farmer's practice (NPK application @ 75:55:0). Similarly at Jeolikote (UK) farmers were advised to provide a balance fertilization (N:P:K @ 20:60:40 kg/ha) in soybean crop.

Results

Yield: The influence of different improved production practices on the yield of different crops is presented in Table 7.4.4 (c). At Jagudan (Gujarat), 23.54% increase in hybrid castor yield was observed due to improved practice over farmer's practice. At Amritsar in Punjab due to maintaining of 45 X 10 spacing by thinning 19.76% increase in gobhi sarson yield was noted. Likewise in Seethampeta (Andhra Pradesh), 42.65 % improvement in sesame yield was seen due to introduction of the new variety YLM-66 over the farmer's variety. At the same location with the introduction of the private hybrid 54.76% yield enhancement was noted over Local cultivar in the sunflower crop. At Chettinad in Tamil Nadu introduction of new varieties Co-7 and VRI-7 has enhanced the yield by 26.6 and 25.05% over the farmers cultivar TMV-7. At Fathepur (Rajasthan), 33.76% and 36.86% increase in the yields of clusterbean and mustard were seen owing to the adoption of new cluster bean (RGC-1003) and mustard varieties (RNG- 229) over the farmer's variety. Replacement of mustard variety Pusa bold with RH 749 has increased the grain yield of mustard by 71.63% at Modipuram, Meerut. Similarly at Jeolikote (Uttarakhand), improvement in soybean yield was seen due to adoption of new soybean variety PS 1347 over the farmer's local variety. Enhancement in yields of gobhi-sarson (101.11%) at Kangra (Himachal Pradesh) was found due to replacement of Kanchan with the new improved variety HPN-3.

Cost of cultivation: At Jagudan centre in Gujarat, green manuring with sunhemp in Hybrid castor as an improved practice has increased cost of cultivation by (48754 Rs/ha) as compared to farmers practice involving no green manuring with sunhemp (40331 Rs/ha) (Table 7.4.4c). At the same location with 5 demonstrations, it was revealed that an additional cost of 28490 Rs/ha is required for inclusion of mustard after rice in rice-mustard system. In a similar fashion, in semi-arid

Table 7.4.4(c). Influence of farmers and improved practices on cost of cultivation (Rs/ha) of various crops under FLD (2016-17)

Agro Eco system / Centre	Cropping system		No. of demonstrations	Farmers Practice (FP)		Improved Practice (IP)		% increase over FP	
	Kharif	*Rabi*		*Kharif*	*Rabi*	*Kharif*	*Rabi*	*Kharif*	*Rabi*
1. Arid									
Jagudan (Gujarat)	Hy. Castor without sunhump in Fm & with sunhump in IP		10	40331		48754		20.93	
	Rice	Mustard	5	37420			28490		
2. Semi Arid									
Amritsar		Gobhi sarson	12		32735		31735		-3.05
Seethampeta (Andhra Pradesh)		Sunflower	10		2860		4520		58.04
		Sesame (S)	10		8600		9304		8.19
Warangal (Telangana)	Soybean + Redgram	-	10	50255		36517		-27.34	
	Soybean	Maize	10		37658	35765	36765		-2.37
Chettinad (Tamil Nadu)		Groundnut (R/S)	6		54687		60168		10.03
		Groundnut (R/S)	6		53254		59390		11.53
3. Sub Humid									
Fathepur (Rajasthan)	Cluster bean	Mustard	10	20100	20800	21400	22800	6.47	9.62
Kanpur Dehat (Uttar Pradesh)		Mustard	8		19570		20798		6.28
Modipuram (Uttar Pradesh)	Rice	Mustard	27	-	10703	-	13923	-	30.09
Jeolikote (Uttrakhand)	Soybean	-	5	-	-	20785	-	-	-
4. Humid									
Kamrup (Assam)	Rice	Toria	10	-	-	-	-	-	-
Kangra (Himachal Pradesh)	Maize	Gobhi sarson	7	-	-	-	-	-	-

agro-ecosystem of Amritsar (Punjab), maintenance of 45 x 10 cm spacing by thinning in gobhisarson has reduced the cost of cultivation. Likewise in Chettinad (Tamil Nadu), replacement of the existing ground nut variety (TMV-7) with the new one has increased the cost of cultivation. The magnitude of increase was 10.03 and 11.53% respectively, with Co-7 and VRI-7 varieties. Under the sub-humid agro-ecosystem at Fathepur (Rajasthan) replacement of local cluster bean and mustard varieties with improved one (RGC-1003 for cluster bean and RNG- 229 for mustard) has

increased the cost of cultivation by 6.47 and 9.62 % respectively, over the old varieties. Similarly in mustard at Modipuram variety replacement of Pusa bold with RH 749 has resulted in higher cost of cultivation.

Gross and Net returns: Gross and net returns were higher in improved package for all the crops at all locations due to increase in yield (Table 7.4.4 (d & e) and 7.4.4 (f). A total 10 demonstrations involving Hybrid castor were conducted at Jagudan

Table 7.4.4(d). Influence of farmers and improved practices on gross returns (Rs/ha) of various crops under FLD (2016-17)

Agro Eco system / Centre	Cropping system		No. of demonstrations	Farmers Practice (FP)		Improved Practice (IP)		% increase over FP	
	Kharif	*Rabi*		*Kharif*	*Rabi*	*Kharif*	*Rabi*	*Kharif*	*Rabi*
1. Arid									
Jagudan (Gujarat)	Hy.Castor without sunhump in Fm & with sunhump in IP		10	1721		2127		23.54	
	Rice	Mustard	5	4981	-		2088	-	-
2. Semi Arid									
Amritsar (Punjab)		Gobhi sarson	12		1248		1495		19.76
Seethampeta (Andhra Pradesh)		Sunflower	10		210		325		54.76
		Sesame (S)	10		340	-	485	-	42.65
Warangal (Telangana)	Soybean + Redgram	-	10	-	-	2104+ 1874	-	-	-
	Soybean	Maize	10		5740	2244	6474	12.79	
Chettinad (Tamil Nadu)		Groundnut (R/S)	6		1838		2328		26.6
		Groundnut (R/S)	6		1772		2217		25.05
3. Sub Humid									
Fathepur (Rajasthan)	Cluster bean	Mustard	10	873	864	1168	1183	33.76	36.86
Kanpur Dehat (Uttar Pradesh)		Mustard	8	-	1661	-	1865	-	12.27
Modipuram (Uttar Pradesh)	Rice	Mustard	27	-	1699	-	2916	-	71.63
Jeolikote (Uttrakhand)	Soybean	-	5	1492	-	1972	-	32.17	-
4. Humid									
Kamrup (Assam)	Rice	Toria	10	-	-	-	869	-	-
Kangra (Himachal Pradesh)	Maize	Gobhi sarson	7	1718	597	2893	1195	68.78	101.11

Table 7.4.4(e). Influence of farmers and improved practices on gross returns (Rs/ha) of various crops under FLD (2016-17)

Agro Eco system / Centre	Cropping system		No. of demonstrations	Farmers Practice (FP)		Improved Practice (IP)		% increase over FP	
	Kharif	*Rabi*		*Kharif*	*Rabi*	*Kharif*	*Rabi*	*Kharif*	*Rabi*
1. Arid									
Jagudan (Gujarat)	Hy. Castor without sunhump in Fm & with sunhump in IP		10	64764		80012		23.54	
	Rice	Mustard	5	82399			67288		
2. Semi Arid									
Amritsar (Punjab)		Gobhi sarson	12		42443		50830		19.76
Seethampeta (Andhra Pradesh)		Sunflower	10		6100		16500		170.49
		Sesame (S)	10		37400		53350		42.65
Warangal (Telangana)	Soybean + Redgram	-	10	119784		155658		29.95	
	Soybean	Maize	10			67320	74451		
Chettinad (Tamil Nadu)		Groundnut (R/S)	6		91917		116417		26.56
		Groundnut (R/S)	6		79725		99750		25.05
3. Sub Humid									
Fathepur (Rajasthan)	Cluster bean	Mustard	10	30555	32832	40880	44954	33.79	36.92
Kanpur Dehat (Uttar Pradesh)		Mustard	8		84581		95208		12.55
Modipuram (Uttar Pradesh)	Rice	Mustard	27	-	67945	-	116648	-	71.68
Jeolikote (Uttrakhand)	Soybean	-	5			58945			
4. Humid									
Kamrup (Assam)	Rice	Toria	10	-	-	-	-	-	-
Kangra (Himachal Pradesh)	Maize	Gobhi sarson	7	-	-	-	-	-	-

centre in the Arid agro-ecosystem. On an average of the 10 demonstrations it was seen that green manuring with sunhemp in hybrid castor gave 23.54 and 28.24% higher gross and net returns than only sole castor crop. At same centre inclusion of mustard in rice fallows has provided additional gross and net returns (Rs 67288/ha and Rs 38798/ha) over the fallow land. At Amritsar (Punjab), higher gross and net returns of 19.76 and 118.76% respectively, were found in gobhisarson with

Table 7.4.4(f). Influence of farmers and improved practices on net returns (Rs/ha) of various crops under FLD (2016-17)

Agro Eco system / Centre	Cropping system		No. of demonstrations	Farmers Practice (FP)		Improved Practice (IP)		% increase over FP	
	Kharif	*Rabi*		*Kharif*	*Rabi*	*Kharif*	*Rabi*	*Kharif*	*Rabi*
1. Arid									
Jagudan (Gujarat)	Hy. Castor without sunhump in Fm & with sunhump in IP		10	24433		31258		28.24	
	Rice	Mustard	5	44979			38798		
2. Semi Arid									
Amritsar (Punjab)		Gobhi sarson	12		9708		19095		118.76
Seethampeta (Andhra Pradesh)		Sunflower	10		3240		11980		269.75
		Sesame (S)	10		28800		44046		52.94
Warangal (Telangana)	Soybean + Redgram	-	10	69529		119141		71.35	
	Soybean	Maize	10		37686	31555			
Chettinad (Tamil Nadu)		Groundnut (R/S)	6		37230		56249		50.88
		Groundnut (R/S)	6		26471		40360		52.46
3. Sub Humid									
Fathepur (Rajasthan)	Cluster bean	Mustard	10	10455	12032	19480	22154	86.32	84.13
Kanpur Dehat (Uttar Pradesh)		Mustard	8		65012		74395		14.40
Modipuram (Uttar Pradesh)	Rice	Mustard	27	-	57242	-	102725	-	79.46
Jeolikote (Uttrakhand)	Soybean	-	5			38160			
4. Humid									
Kamrup (Assam)	Rice	Toria	10	-	-	-	-	-	-
Kangra (Himachal Pradesh)	Maize	Gobhi sarson	7				**38118**		

maintaining 45 x 10 spacing by thinning. At Seethampeta (Andhra Pradesh) in sunflower and sesame crops replacement of local cultivars of both crops has resulted in 170.49 and 42.65% increase in gross returns and 269.75 and 52.94% increase in net returns over farmers practice. Under the sub-humid agro-ecosystem at Fathepur (Rajasthan) replacement of local cluster bean and mustard varieties with improved one (RGC-1003 for cluster bean and RNG- 229 for mustard) has

increased the gross returns by 33.79 and 36.92 % respectively in both the crops. For this particular FLD increase in net returns was 86.32 and 84.13%, respectively. Similarly in mustard at Modipuram variety replacement of Pusa bold with RH 749 has resulted in improvement of gross and net returns by 71.68 and 79.46%, respectively.

Results for large scale application

The cropping systems involving oilseeds promise to increase the production of oilseeds on the one hand and improve the profitability for farmers on the other hand. In all the FLDs, it was proved that yield and net returns can be increased by adopting improved package in place of farmers practice. The gist of the practices for various crops is given below for large scale adoption.

Sl. No.	Crop	Location (ecosystem)	Improved Package	Increase in yield (%)	Increase in net returns (%)
1.	Mustard	Fathepur (Sub humid)	Variety RNG 229 + 60:40:0 kg NPK/ha Spacing 30 X 15 cm	39	84
		Kanpur Dehat (Sub humid)	Variety : Varuna120:60:60 kg NPK/ha	12	14
		Modipuram (Uttar Pradesh)	Farmer Variety : Pusa Bold	72	79
			Improved variety- RH-749		
2.	Cluster bean	Fathepur (Sub humid)	Variety RGC-1003 30:40:0 kg NPK/ha Spacing 30 X 15 cm	34	86
3.	Hybrid Castor	Jagudan (Arid)	Improved variety- GCH-7	24	28
4.	Sesame	Seethempeta (Semi Arid)	YLM-66 variety	43	53
5	Sunflower	Seethempeta (Semi Arid)	Private hybrid	55	270
6	Soybean + Red gram (5:1)	Warangal (Semi Arid)	Variety- JS 335 Spacing 30 X 5 cm Variety- LRG 41Spacing 180 X 15 cm	-	71
7.	Soybean	Warangal (Semi Arid)	Variety- JS 335Spacing 45 X 5 cm	13	-
		Jeolikote (Sub humid)	New variety-PS 1347 Line sowing 60 cm 20:60:40 kg NPK/ha	32	-
8.	Gobhi sarson	Amritsar (Semi Arid)	Variety : GSL-1 100: 30 : 0 kg NPK/ha Spacing: 45 X 10 cm through thinning	20	119
		Kangra (Sub humid)	Improved variety HPN-3	101	-
9.	Groundnut	Chettinad (Semi Arid)	Variety CO – 7 Spacing: 30 X 10 cm	27	51
			Variety VRI – 7 Spacing: 30 X 10 cm	25	52

Training on New technologies and development in oilseeds cultivation

As per new guidelines of NMOOP, 5 trainings on “New technologies in oilseeds cultivation” through four OFR centres and ICAR-IIFSR were organized for the benefit of farmers, extension officers, input dealers and development officials. The details of the training conducted are given below.

Sl. No.	Location (State)	Title of training	Date (s)	Number of participants		
				Extension officials	Input dealers	Total
1.	Kamrup (Assam)	Importance of introducing an oil seed crop to the existing mono- cropping system	28 February 2017	-	35	35

Sl. No.	Location (State)	Title of training	Date (s)	Number of participants		
				Extension officials	Input dealers	Total
2.	Kangra (Himachal Pradesh)	New technologies & developments in oilseed cultivation	23-24 March 2017	20	-	20
3	Fathepur (Rajasthan)	Field day	13 February 2017	-	56	56
4.	Modipuram (Uttar Pradesh)	A field day on Mustard	15 February 2017	-	65	65
5.	Warangal (Telangana)	Oil seed crops and crop sequences	10-11, January, 2017	30	-	30
	Total			**50**	**156**	**206**

Glimpses of FLDs and trainings

Sunflower Front Line Demonstrations (Seethampeta OFR centre, Andhra Pradesh)

Mustard Front Line Demonstrations (Samba OFR centre, Jammu)

Sesamum Front Line Demonstrations (Seethampeta OFR center, AP)

Training on nutrient management in oilseed crops

Red gram + Soybean Front Line Demonstrations (Warangal OFR centre, Telangana)

Soybean – Maize Front Line Demonstrations (Warangal OFR centre, Telangana)

Training organised at Warangal OFR centre, Telangana

Jeolikote (Uttarakhand)

Soybean demonstration

Fatehpur (Rajasthan)

Mustard demonstration

Training organised at Fathepur OFR centre, Rajasthan

7.4.5 TRIBAL SUB PLAN

Title of the study: On-Farm participatory research in tribal farming systems through Cluster approach

Objectives

- To identify the farming systems practiced by tribal households in different regions
- To improve the profitability of the tribal farming systems by addressing technological constraints

Year of start: 2015-16

Households: As per the tribal sub plan guidelines, tribal households have been selected for characterization, identification of constraints and technological interventions. A criteria of 100 households or 40 ha was used for the identifying the tribal cluster for interventions.

Locations: During 2015-16, the programme was implemented in 14 locations in 13 states. It includes 7 OFR centres namely Srikakulam (Andhra Pradesh), Kawardha (Chhatisgarh), Panchmahal (Gujarat), Pakur (Jharkhand), Dindori (Madhya Pradesh), Palghar (Maharashtra) and Udaipur (Rajasthan) and 7 cluster programmes at Carnicobar (Andaman and Nicobar Islands), Kanker (Chhatishgarh), Chamba (Himachal Pradesh), Samba (Jammu and Kashmir), BR hills (Karnataka), Coimbatore (Tamil Nadu) and Bali Island (West Bengal).

Results

The salient findings from tribal farming systems study are given below.

Kawardha (Chhatisgarh): In marginal households, crop, livestock module and processing module gave additional return (25-35%) over farmer practices. The highest mean net income was obtained from crop + dairy + goat+ pig + poultry (Rs. 130,850 over benchmark Rs 65200 in 1.13 ha), followed by crop + dairy + fish + goat + poultry (Rs. 118,050 over benchmark Rs 55750 in 1.10 ha) system. In the small households, crop, livestock and processing module gave additional return (25-35%) over before intervention or farmer practices. The highest mean net income was obtained from crop + horticulture + dairy + goat + pig + poultry + fishery (Rs. 1,90,300 over benchmark Rs 1, 11, 900 in 1.30 ha).

Pakur (Jharkhand): Crop + pig farming system gave higher income (Rs.29018 in 0.83 ha) followed by crop + goat farming system (Rs.15745 in 0.64 ha) under marginal household conditions. In small household conditions, crop + pig farming system recorded higher income (Rs.135627 in 1.42 ha) followed by crop + goat (Rs.86352).

Dindori (Madhya Pradesh): Application of 120:60:40 NPK kg/ha + Zn to both rice and wheat crop, resulted in higher yield.

Udaipur (Rajasthan): Five farming systems were found in marginal farmers' fields. Third year data indicated that crop + dairy + goat farming system was the best having highest net income of Rs.1, 08,879 from 0.66 ha. It was also observed that during all the three years the farming system having crop + dairy + goat earned more net average income of Rs. 98,126 over other two farming systems which shows that the households having this farming system can earn about 188 % more income in comparison to benchmark income. The results of three years experimentation on small holders indicated that the farmers having crop + dairy + goat farming system recorded the highest net income of Rs. 80,245/- in 0.66 ha on average basis of three years and increased the profitability of households and livelihood security. Findings from the tribal clusters are as follows.

- Hybrid maize (Pratap Maize - 5), about 69.3 % of yield increase was noticed and in wheat about 28.3 % increase was recorded due to distribution of improved seed (variety Raj 4079) along with recommended doses of nutrients to tribal households.

- Since inception of this Participatory Research Programme at OFR Udaipur till date a total of about 74 goat kids and 3 bucks of Sirohi breed were distributed to improve the breed status in tribal villages. Now at present, there are about more than 289 new kids during these three and half years of this breed and they are earning money by selling new kids in the market by selling at fair prices.

- In the same cluster of villages, distributed about 615 no. of "Pratap Dhan" poultry from which households are improving their livelihood by selling eggs as well as poultry for chickens. From these poultry 1600 eggs and five cocks have been sold.

- In horticulture, distributed 33 packets of kitchen garden to TSP households enable them to improve their nutritional status and at the same time the average income of each household was approx. Rs. 3400/- per season.

- Developed 25 units of vermicompost for having their own source of organic manure and during the year produced 37 tons of vermicompost and the same are being utilized for vegetable and fruit cultivation.

- Conducted three training programmes to enable them to update their knowledge about present technologies. About 208 households were benefitted. In addition to this, have conducted three animal treatment camps for cure of the animals. About 1096 animals were treated in these camps.

Srikakulam (Andhra Pradesh): In the Diversification of existing farming systems the diversification of cropping system module recorded additional benefit of Rs. 101030. In livestock diversification module, the net income increased from Rs. 12538 to Rs. 42138 with an additional net income 12538. Similarly, poultry and product diversification modules recorded an additional net income of Rs. 23640, respectively over their respective bench mark net income. On the whole, through diversification the total net income increased from Rs. 55506 to Rs. 209776 giving an additional net income of Rs. 154270/. In the On Farm Evaluation of Farming System Modules for improving profitability and livelihood of small & marginal farmers crop diversification module has recorded an additional net return of Rs. 29,159 over bench mark net income (Rs.32800). Similarly, livestock, processing (value addition), vermi-composting & nutritional kitchen garden modules recorded an additional net income of Rs. 6209, Rs. 6999, Rs. 9609 & Rs. 4741, respectively over their respective bench mark net income. The overall improvement in total net income increased from Rs. 53570 to Rs. 191116/- with net gain of 137596. In the tribal clusters, Vanaraja birds were supplied@ 15 (4 weeks old) to each tribal household family and provided poultry feed @ 100 g to each bird daily which increased the weight to 5.4 kg in 150 days compared to 2.1 kg in local poultry birds. Other findings are

- Conservation of energy and low cost technology: Demonstrations were conducted on zero tillage maize in rice fallows at 6 locations. Farmers realized saving in land preparation cost Rs. 3250- per ha in Zero tillage maize compared to normal sown maize. Higher net returns (Rs.42340/-) and seed yield (4421kg/ha) were recorded in zero tillage maize compared to conventional maize (Rs.32370/- and 3943 kg/ha, respectively) in rice fallows.

- Self-sustenance achieved the new high yielding varieties(Seed banks) in field crop & planting Material of orchard crops

- Componential (field crops – fallow) systems change (field crop – millet/Pulse/Oilseeds cropping systems) is achieved in the clusters.

- Exposure & capacity Building leads to improvement of knowledge to a tune of 25-35 % skill to tune of 25-50 %and income enhancement of 15-40 %.

Palghar (Maharashtra): There are two dominant farming systems viz. crop + dairy (0.40 ha) and crop + dairy + poultry (0.38 ha) adopted by 13 and 11 households respectively. In benchmark status, the mean total net income from crop + dairy and

crop + dairy + poultry farming systems was Rs. 64368/- and 53020/- respectively. In case of crop + dairy farming system, the net income generated due to interventions in cropping system, livestock diversification and product diversification were Rs. 30201/-, 88205/- and 4836/- respectively. The similar values for Crop + Dairy + Poultry farming were Rs.32894/, 85478/- and 4550/- respectively. The net income received due to diversification were 91.4 and 131.8% more as compared to benchmark status of crop + dairy and crop + dairy + poultry farming systems respectively. Three types of dominant farming systems viz. crop + dairy (0.76 ha), crop + dairy + poultry (0.52 ha) and crop + goat + poultry (0.40 ha) adopted by 7, 4 and 1 household respectively under small holder system. In benchmark status, the mean total net income from crop + dairy, crop + dairy + poultry and crop + goat + poultry farming systems was Rs. 71345/-, 62022/- and 39210/- respectively. In case of crop + dairy farming system, the net income generated due to interventions in cropping system, livestock, processing and kitchen garden were Rs. 137065/-. Similarly net income generated in Crop + Dairy + Poultry system and crop + goat + poultry farming systems were Rs.87082/- and 62735/- respectively. The net income generated due to interventions were 92.1, 40.4 and 60.0 % more as compared to benchmark status of Crop + Dairy , Crop + Dairy + Poultry and Crop + Goat + Poultry farming systems respectively.

Panchmahal (Gujarat): There was significant increase in net income due to diversification of crops/varieties. There was significant increase in net income due to diversification in poultry. Maize – maize cropping system can be replaced by Bt cotton / castor / cluster bean. The profitability of households was increased by 10 % over previous year and 102 % over benchmark year.

Bali Island (West Bengal): Nineteen types of farming systems existed in 120 number of farm households and crop + dairy + poultry + goat system recorded the maximum gross return (21816/ household) in bench mark. After the interventions, sufficient enhancement of return in individual crop and livestock components were noticed. Among the crops rice, summer rice, potato, sunflower, khesari and vegetable recorded enhancement of 936/-, 461/-, 3057/-, 1725/-, 1908/- and 1225/ household respectively over the benchmark. In dairy, poultry, duck, goat, sheep and fishery, the income enhancement was to the tune of 2551/-, 215/-, 657/-, 3881/-, 2350/- and 6650/ household respectively.

Kanker (Chhatisgarh): Improved of rice variety recorded 17.7% higher yield (5650 kg/ha) as compared to existing variety Swarna (4840 kg/ha). Improved of finger millet variety GPU-28 recorded with higher yield (1800 kg/ha) over farmers practice (800 kg/ha) with additional income of Rs.8000/ ha. Chickpea yield increased by 36 % due to interventions. Adoption of zero till seed cum fertilizer drill for chickpea resulted in 1000-1200 kg/ha of yield compared to farmers practice (815 kg/ha). Similarly linseed (22-35 % increase), hybrid maize (25% increase) yield increase was noticed due to intervention. Cropping intensity was increased from 109 to 146% due to double cropping. Farmers also adopted vegetable cultivation in cluster basis. Employment generated 145 man days per year per badi. Average income increased, 3-5 times folds. Sharing of irrigation resources on community basis was ensured. Kitchen gardening (Rs.20,000/ year/family), use of bamboo floor for goat (39% increase) in body weight 55 % reduction in mortality), bread improvement of goat (employment 242 man days/year), kadaknath bread backyard poultry (Rs.1200/ household as net income), azolla as feed supplementation in poultry (27 % increase in body weight), fishery and vermicompost interventions resulted in better output for the clusters as a whole. In general, farmers income increased by 2-2.5 times.

Coimbatore (Tamil Nadu): Conducted three days exposure visit for 25 nos.of tribal farmers to Gengu chettipatti village (Farmers' Meet) to RRS Paiyur, Dharmapuri district.

BR hills (Karnataka): Intervention such as introduction of kitchen garden kit for maintaining backyard Nutritional garden near households and Introduction and demonstration of vermi

TSP intervention of vegetables in Bali Island

TSP intervention of azolla as poultry feed in Bali Island

Poultry rearing in B.R hills (Karnataka)

Sirohi goat at Cluster based TSP household

Vermicompost unit at Cluster based TSP HH

Training organised at Devgarhbaria, Gujarat

composting through recycling forest and farm waste through supply of plastic (HDPE) vermibags were carried out. Distributed (10+2) swarnadhara 5weeks old chicks for backyard/scavenging type rearing, gender equity, additional income. Bee Boxes distributed on group basis with training and demonstrations through AICRP on Apiculture, UAS (B). Improved farm tools, implements and materials Crow bar, Multipurpose: Plastic drums, Trays, Basins and HDPE Tarpaulins for threshing and storage. Training on Jack and its multiple uses - Chips Making, Juice Making, Raw Jack fruit Palao were conducted. Nippatu making from amaranth seed was done. Additional inputs like Plastic crates, Drums, Bandli have improved agricultural operations and activities. Subsidiary occupation has been developed through scavenging poultry and kitchen garden establishing. Improved skill development in Bee keeping through training and demonstration and Bee boxes have helped soliga livelihood. Recycling farm and forest waste has been introduced and practiced through vermicomposting. Overall impact indicated confidence in soliga tribals social though and IFS intervention through enhance income and improved life style.

Carnicobar (A&N Islands): Homestead based farming system components were demonstrated for Nicobarese tribals in Nicobar district. Improvement in diet diversity was observed from tubers to vegetables. Income of the farm households were also increased significantly due to interventions. Benchmark survey has been completed in the Hutbay, Little Andaman Islands. The activities will be undertaken in new cluster.

Samba (J&K): Tribal sub plan is operating in the village Meencarka and Badikhad of Samba district of Jammu region. About 100 farmers are selected. The average holding is 0.6ha and area under rainfed. Major cropping system is maize-wheat and predominant farming system is field crop+ dairy. The work started in Kharif 2016.High yielding maize (Kanchan) and wheat (PBW 644 & PBW 175) and more than 800 plants of mango, guava, lemon and kinnow have been distributed among the farmers.

Chamba (Himachal Pradesh): Three training camps were organized in the tribal areas of Chamba District of Himachal Pradesh.

8. GENERAL/MISCELLANEOUS

8. GENERAL/MISCELLANEOUS

8.1 LIST OF PUBLICATIONS

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Agricultural University, Kota

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TNAU, Coimbatore

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8.1.3 Popular Articles

Agricultural University, Kota

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UAHS,Shimoga

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HAU, Hisar

Mehta A. K.2015. 'Success of Marginal Farmer with IFS approach.' in Farming Systems Research Success stories (series 1) ICAR-IIFSR pp 54-55.

JNKVV, Jabalpur

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CSAUA&T, Kanpur

Y.K. Singh, P.K. Rathi and S.B. Pal 2016. *Paudhon ke liye awashyak poshak tatva. Krishak bharti, Kharif Visheshank-2016.* pp: 42-47.

Videsh Kumar Verma, Karam Husain, Ram Pyare and Vishram Singh 2016. Sugandhit Dhan Bharat ki sanskritiik dharohar. Krishak bharti, Kharif Visheshank-2016. pp: 1-2 & 8.

GBPUA&T, Pantnagar

दिनेश कुमार, वीरेन्द्र सिहं, गौरवदीप सिहं, रोहिताव सिहं. 2015. उत्तराखण्ड के पर्वतीय क्षेत्रों के (1200 मीटरऊँचाई तक) के सीमान्त एवं छोटे किसानों के लिए एकिकृत कृषि प्रणाली। *रिसर्च बुलेटिन* नं0 206.

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Rohitashav Singh, Indu Bala Sethi, and V.K. Singh. 2016. Integrated Farming System for Small Farmers, IFD

8.14 Book and Book chapter

AAU, Jorhat

Baishya, A. 2015. Integrated Farming System for Organic Food Production. ICAR Sponsored Winter School on Advances in Organic Production System and Conservation agriculture. 24th September-14th October, 2015. Department of Agronomy, Assam Agricultural University, Jorhat. pp: 312-324.

Baishya, A., Borah, M., Gogoi, Bhabesh, Hazarika, J., Bora, A., Rajbongshi, A. and Deori, P. 2015. Waste Recycling through Integrated farming System-An Assam Agriculture Experience.Extended Abstract of paper In: Proceedings of RAMIRAN 2015-16th International Conference on *Rural-Urban Symbiosis* (Ed. Ina Korner) (ISBN: 978-3-941492-95-0), 8th -10th September 2015, Hamburg, Germany. pp: 170.

KAU, Karamana

Sukumari, P., Rani, B., Jacob, J., Babu, P.M., Varughese, K. 2015. Rice based cropping systems: Karamana (Kerala). In: *Long term Integrated Nutrient Management in Coconut based Cropping Systems* [Gangwar, B., Prasad, K., Ravishankar, N. and Singh, J.P (eds)], All India Co-ordinated Research Project on Integrated Farming Systems, Indian Institute of Farming Systems Research, Modipuram, Meerut, India, pp: 219-231.

JAU, Junagadh

Dabhi, B.M., Sagarka,B.K, Dabhi, Anupand Patel B.S. 2015. A chapter on “ÖrganicNutrient Management in Groundnut-onion Cropping System” published in a book “System Based Organic Nutrient Management” by ICAR-IIFSR, Modipuram. pp: 184-194.

Dabhi, B.M., Sagarka,B.K, Dabhi, Anup and Mathukia, R.K. 2015. A chapter on “Long Term Integrated Nutrient Management in pearl millet-wheat cropping System of Saurashtra Region. ” published in a

book " Long Term Integrated Nutrient Management in Cereal Based Cropping Systems" by ICAR-IIFSR, Modipuram. pp: 342-353.

HAU, Hisar

Kumar, Pawan; Sharma, Manoj Kumar; Nanwal, R.K and Yadav, S.K. 2015. Long term integrated nutrient management in pearl millet – wheat cropping system. Chapter in book entitled, "Long term integrated nutrient management in cereal based cropping systems" Published by ICAR-Indian Institute of Farming System Research, Modipuram. pp: 301-317.

R.K.Nanwal and Pawan Kumar Text book on farming systems 2016 by Published by Agri-Biovet Press, N.Delhi-11002.

JNKVV, Jabalpur

Shukla V.K., Vishwakarma S.K. and Lokesh Dubey 2015 A chapter on Long-Term Integrated Nutrient Management in Cereal Based Cropping Systems. Edited by B. Gangwar, Kamta Prasad, N Ravisankar and J.P. Singh, published by AICRP on Integrated Farming Systems ICAR- Indian Institute of Farming Systems Research, Modipuram, Meerut-250110, India.

Shukla V.K., Vishwakarma S.K. and Lokesh Dubey 2015 Enhancing Pulses Production: Technologies and Strategies. Edited by B.Gangwar and A.K.Singh, published by New India Publishing Agency, 2014.

UAS, Raichur

Krishnamurthy, D. ,Chittapur B.M., Desai, B.K. and Basavanneppa M.A. 2015. Sanna Raitara Susthirategagi Raichuru Krishi Vishvavidyalaydadiyalli Alavadisiruva vividha samgra Krishi Padadhati Yojanegalu. In: Samgra Krishi-Sampanna Krishi tatvagalu mattau vidhanagalu. Edited by Chittapur B.M. and Krishnamurthy, D. published by Director of Research, UAS, Raichur. pp: 22-31.

PJTSAU, Rajendranagar

Venkata Ramana. M., Sridevi. S., Suresh. K., Bhavya Sree. K. and Madhavi. M. 2015 Longterm Integrated Nutrient Management in rice-rice cropping system in Rajendranagar (Telangana) In Longterm Integrated Nutrient Management in Cereal based Cropping Systems. Edited by Gangwar. B., Prasad, Kamta, Ravisankar, N and Singh, JP .2015. All India Coordinated Research Project on Integrated Farming Systems, ICAR - Indian Institute of Farming Systems Research, Modipuram, Meerut – 250 110, India pp: 416.

UAS, Raichur

Basavanneppa M.A., Ashok Kumar Gaddi. and Tevari, P. 2015, Development of organic nutrient management practices to paddy-sesamum cropping system In: System based organic nutrient management. Edited by, Pal, S.S. and Gangawar,B. pp: 151-162.

Basavanneppa M.A., Ashok Kumar Gaddi, Biradar, D.P., Chittapur B.M., Basavarajappa, R., Shetty, R.A., Nagalikar, V.P and Veeranna V.S. 2015, Long term integrated nutrient management in rice-rice based cropping system. In: Long-Tem Integrated Nutrient Management in cereal based cropping system. Edited by Gangwar, B., Kampta Prasad, Ravishankar, N. and Singh, J.P. pp: 278-288.

UAHS, Shimoga

Kumara, O., Sannathimmappa, H.G., Vijay S. Danaraddi, Basavarajappa, D. N., Akmal Pasha and Mallesh, K. V., 2016. Integrated farming system model for marginal and small farmers towards profitability sustainability and livelihood security. Published by *AICRP- IFS, Kathalagere centre.* pp: 1-6.

Kumara, O., Sannathimmappa, H.G., Vijay S. Danaraddi., Ramappa Patil and Manjunath, B., 2015, Integrated farming system (Kannada language) Published by *AICRP-IFS Kathalagere centre*. pp: 1-19 (under RKVY Project).

TNAU, Coimabatore

Latha. K.R. and L. Vimalendran, 2016. Recent technologies to enhance productivity of pulse based cropping system. In: Farming systems for the future-approaches and applications. CAF training held during 20.1.2016 to 09.02.2016. Edited by M. Mohamed Amanullah, K. R. Latha, K. Srinivasan, T. Selvakumar, R. Venkitaswamy and C. Jayanthi. Jointly Published by The Director, Centre for Soil and Crop Management Studies, TNAU, Coimbatore-3 and A.E Publications, Coimbatore. pp: 159-166.

Udhaya Nandhini, K.R. Latha and M. Prem Sekhar. 2015. Optimization of spacing for long duration pigeonpea (*Cajanus cajan* L.), Spacing optimization of pigeonpea under intercropped and irrigated situation. Lambert Academic Publishing, ISBN: 978-3-659-80495-3. pp: 1-167.

CSAUA&T, Kanpur

Yadav M. P., Tiwari U.S., Naushad Khan and Rai J. 2015 " Effect of Organic Nutrient Management Package on Yield and Soil fertility in Maize- Potato –Onion Cropping System on an Ustochrept of Indo Genetic Plain". Published by Director ICAR- Indian Institute of Farming System Research, Modipuram, Meerut-250110 (U.P.) India. pp: 96-106.

Yadav M. P., Tiwari U.S., Naushad Khan and Rai J. 2015 "Long term Integrated Nutrient Management in Cereal Based Cropping System" . Published by Director ICAR- Indian Institute of Farming System Research, Modipuram, Merrut-250110 (U.P.) India. pp: 68-101.

8.2 PARTICIPATION OF SCIENTIST IN SYMPOSIA/SEMINARS CONFERENCES/WORKSHOP/TRAINING

AAU, Jorhat

Dr. A. Baishya, Chief Agronomist, AICRP-IFS, AAU, Jorhat, attended the International Conference on *Rural-Urban Symbiosis* (RAMIRAN 2015-16) and made an Oral presentation of the paper on "Waste Recycling through Integrated farming system-An Assam Agriculture Experience" during 8th -10th September 2015, at Hamburg, Germany.

TNAU, Coimbatore

Dr. K. Sathyamoorthi, Chief Agronomist attended Technical Program Review workshop at IIFSR, Modipuram, Meerut, U.P during17.05.2015 – 21.05.2015.

Dr. S. Porpavai Agronomist, Thanjavour, attended Technical Program Review workshop at IIFSR, Modipuram, Meerut, U.P during17.05.2015 – 21.05.2015.

Dr. K. Sathyamoorthi Chief Agronomist, Dr.S. Porpavai Agronomist, Dr. N. TamilSelvan OFR Agronomist Dr.N. Satheesh Kumar OFR Agronomist attended Annual Group meeting of AICRP on Integrated Farming Systems at AAU, Jorhat, Assam, during 16-18, December, 2015.

Dr. N. TamilSelvan OFR Agronomist Dr.N. Satheesh Kumar OFR Agronomist Dr.S.Padama Rani Agrl. Economist attended Group Meeting of OFR Agronomists /Economists, AICRP on Integrated Farming System at IIFSR, Modipuram, Meerut, U.P.during 28-30, May, 2015.

JNKVV, Jabalpur

Dr. R.P. Sahu participated and presented Research paper (Oral) on Effect of Different Nutrient Management Practices on Productivity of Various Rice Based Cropping Systems. In *National Conference on Organic Farming and National Food Security (NCOF-2016)*" held on 19-20 February, 2016 at *School of Agriculture, ITM University Gwalior* (M.P.)

Dr. V.K. Shukla, S. K. Vishwakarma, R.P. Sahu participated as member of committee in a two day State level workshop on "Identification on Researchable Issues and Development of strategies for promotion of organic farming in M.P." at JNKVV, Jabalpur (M.P.) on 25-26 February 2016.

Dr. R.P. Sahu attended the Group Meeting of OFR Agronomists & Agricultural economists of AICRP-IFS at Modipuram during 28-30 May 2015.

S. K. Vishwakarma attended National Seminar on "Weather and Climate risks in Agriculture under Changing Climate: Management and Mitigation" and participated in the poster session on "Productivity and economics of scented rice (*Oryza sativa*)- potato (*Solanum tuberosum*) high value cropping system as affected by different nutrient management practices, "held at College of Agriculture, Tikamgarh during 12-13 March, 2015

S. K. Vishwakarma attended National symposium on "Organic Agriculture" and participated in the poster session on."Studies on Comparitive efficiency of organic chemical and Integrated nutrient management

practices on crop productivity and Soil health under various cropping system ". to be held on 26-27 Feb 2015 at Agriculture Collage and Research Institute, Madurai.

S. K. Vishwakarma attended the National Symposium on organic Agriculture for Sustainable Food Security Challenges and opportunities Organized at Agricultural College and Research Institute, Tamil Nadu Agricultural University, Madurai from February 26-27, 2015.Paper Present entitled" Studies on Comparative efficiency of organic , chemical and INM on Crop Productivity and soil health under various cropping system.

SKUAST, Jammu

Dr. A. K. Gupta, Sr. Scientist (Agronomy) attended group meeting of OFR Agronomist and Economist of AICRP–IFS form 28–30th, May 2015 at IIFSR, Modipuram.

Dr. Vijay Khajuria, Jr. Scientist (Agronomy), attended international training cum workshop on farming system conducted by ICAR and CIMMYT during 18–23rd May, 2015, at CSSRI, Karnal (Haryana).

Dr. A. K. Gupta, Sr. Scientist (Agronomy) attended 7th RAC meeting of ICAR–IIFSR 28th Oct, 2015.

Dr. Vijay Khajuria, Jr. Scientist (Agronomy), attended training programme on "Tillage and nutrient dynamies for better crop production" from 10th to 30th Oct, 2015 at CAFT– Agronomy, Deptt. Of Agronomy, collage of Agriculture, G. B. Pant University of Agriculture and Technology, Pant Nagar, Uttarakhand.

Dr. Dileep Kachroo, Chief scientist (Agronomy) delivered lead lecture on IFS in international conference from 18th to 20th Feb at SKUAST–J, Main Campus, Chatha.

UAS, Raichur

Dr. Basavanneppa M.A attended 18th National Conference on Impact of Aerosols on Health, Heritage and Enviroment (NCIAHHE-2015) a Tumkur University Tumakuru during 28-30 Sept 2015.

Dr. Basavanneppa M.A attended Technical Programme Review Workshop at ICAR-IIFSR Modipuram during 18-19 May 2015.

Dr. Basavanneppa M.A attended IPNI Review Meet 2015 at IPNI, Asia and OAUT, Bhubaneswar during 18-20th August 2015

CSAUA&T, Kanpur

Dr. Karam Husain, attended of 4th National Symposium on Transforming Indian Agricultural towards Food and Nutritional Security held at Jhansi during (20-21 February, 2016)

Dr. Karam Husain, attended of 4th U.P. Agricultural Science congress on statistic governance and Technological Advancement for sustainable Agriculture held at C.S. Azad Univ. of Agriculture and Technology, Kanpur during (2-4 March, 2016)

Agricultural University, Kota

Dr.J.P.Tetarwal,attended International Training Workshop on "Approaches for integrated analysis of agricultural systems in South-Asia: field, to farm, to landscape scale" CIMMYT, CCAFS, CSISA, ICAR, ICAR-CSSRI, Karnal (Haryana) during 18-23rd May, 2015.

J.P.Tetarwal attended 21 days winter school on "Advance soil biological approaches for enhancing carbon sequiestration and mitigate climate change" at ICAR-IISS, Bhopal during 2-22nd September, 2015

J.P.Tetarwal attended National Dialogue on "Efficient Nutrient Management for Improving Soil Health" TAAS, ICAR, CIMMYT, APAARI, IPNI, FAI, at IARI, New Delhi during28-29th September, 2015.

PJTSAU, Rajenderanagar

Dr. M.Venkata Ramana and Dr. S.Sridevi Attended 25th Asia-Pacific Weed Science Conference and presented a paper on "Influence of weed management practices on weed dynamics, yield and economics of pigeonpea."during 13-15 Oct 2015 at University Auditorium PJTSAU, Rajendra-nagar.

Dr. S.Sridevi Attended 80th Annual Convention of Indian Society of Soil Science and presented a paper "Soil physical, chemical and biological properties under longterm INM in rice-rice cropping system." At Bangalore during 5-8 Dec 2015.

Dr. M.Venkata Ramana Dr. K.Suresh Dr. S.Sridevi Attended National Seminar on "Integrated Farming systems for Sustainable Agriculture and Enhancement of Rural Livelihoods".at NAARM, Rajendra-nagar during 13-14 Dec 2015.

ANGRAU, Guntur

Dr. M. Srinivas attended Review meeting with Japan Team regarding Sumitomo Project implementation at Vijayawada on 22-6-2015.

Dr. M. Srinivas attended International Rice Symposium at Hyderabad during 18- 20 Nov 2015.

Dr. M. Srinivas attended 51st Annual Rice Group Meeting of AICRIP on Rice at IGKV, Raipur during 2-5 April 2016.

PAU, Ludhiana

Dr. S S Walia attended International Conference on Natural Resource Management: Ecological Perspective. conducted by Indian Ecological Society at Sher-e-Kashmir University of Agricultural Sciences and Technology of Jammu (SKUAST), India from 18-20 February, 2016.

Dr. S S Walia attended 3rd National Seminar on Market Imperfections, Farmers Distress and Agrarian Crisis in India organized by the Society of Economics and Development at Punjab Agricultural University, Ludhiana on April 17, 2016.

KAU, Karamana

Dr. Jacob John attended 4th International study congress on Integrated Farning Systems at Palakkad on 28 April 2015.

Dr. Jacob John attended Eighth Biennial Conference on Urbanization and the Environment at Indian Institute of Science, Bengaluru during 46 Jan 2016.

Dr. Jacob John attended ICAR-CAFTA training programme Farming System for the Future: Approaches and Applications at TNAU Coimbatore during 20Jan to 09 Feb 2016.

Dr. Jacob John attended Consultation meeting of Nutrient Experts at ICARIIFSR Modipuram Meerut on 01/05/2015.

8.3 TRAININGS, GROUP MEETINGS, WORKSHOPS ORGANIZED

Training on Carbon sequestration and GHG measurement in IFS models of AICRP on Integrated Farming Systems

A three days training on "Carbon sequestration and greenhouse gas (GHG) emission measurement in IFS models of AICRP on Integrated Farming Systems" was organized by ICAR-Indian Institute of Farming Systems Research (IIFSR), Modipuram in collaboration with ICAR-Indian Agricultural Research Institute, New Delhi during 2-4th August, 2016. Dr. Brahma Prakash, Director ICAR- CIRC, Meerut iaugrated the training on 02 August 2016 with a specific remarks that, organizing such a training is essential for developing human resource to address the various issues emerging in agriculture. Dr. Devendra Kumar, Joint Director ICAR- CPRS, Modipuram pointed that this type of training is important at national level to apply uniform methodology across the locations. Dr AS Panwar, Director, ICAR-IIFSR made it clear that specific programme will be developed for measurement of carbon sequestration and GHG in all the on-station IFS models for which this training is a first step. Resource persons and experts in the field of Carbon Sequestration and GHG from ICAR-NDRI (Karnal), ICAR-CAFRI (Jhansi), ICAR-CIFA (Bhubaneswar) ICAR-IISWC (Dehradun) trained participants on various methodologies of measurement of carbon sequestration and GHG in various components of farming system. First day training was held at ICAR-IIFSR, Modipuram while second and third day training was organized at ICAR-IARI, New Delhi. Practical hands on training were imparted at Centre of Environmental Science and Climate Resilient Agriculture (CESCRA), ICAR-IARI, New Delhi.

Dr S.K. Choudhuri, ADG (SWM) addressing the trainees on importance of GHG and Carbon sequestration measurement in IFS models

Chief Guest of Valedictory function Dr. S.K. Choudhari, ADG (SWM), NRM division distributed the certificates to participants and highlighted that focused short term trainings to AICRP scientists are essential to upgrade the skills. He also said, IFS plays a critical role in addressing several issues of climate change and the outcome of the training will lead to measurement of carbon sequestration rate and GHG emission in various IFS models. Dr. S. Bhaskar, ADG (AAFCC), NRM division, Dr. K.K. Singh ADG (FE), Agricultural Engineering division, Dr. M.B. Chetti, ADG (HRD) Education division, Dr SD Singh, Head (CESCRA) and Dr V.K. Singh, Head (Agronomy) of ICAR-IARI, New Delhi also graced the occasion. A total of 46 participants from 23 states representing 25 main, 6 sub and 5 voluntary centres of AICRP on IFS participated in the training. As an outcome of the training, measurement of carbon sequestration and GHG in on-station IFS models of AICRP on IFS will be taken up using empirical (IPCC) and closed chamber methods.

The training was organized by Dr N. Ravisankar as Course Director and Dr Debashis Dutta as Course Coordinator.

On-Farm Farming Systems Research: Impact and Farmers perception

In order to assess the impact made by on-farm research centres in the adopted villages, a farmers meet ***"On-Farm Farming Systems Research: Impact and Farmers Perception"*** was organized on **18 November 2016** in Dr K. Alagusundaram, DDG (NRM), Dr A.S. Panwar, Director, ICAR-IIFSR, Dr Maheswaran, Director of Research and Dr (Mrs) C. Jayanthi, Director participated and

interacted with the farmers. An exhibition was also arranged on the occasion.

Dr K. Alagusundaram, DDG (NRM) addressing the farmers meet at Paiyur on 18 November 2016

IV (XXXII of project) Biennial workshop of ICAR-AICRP on Integrated Farming Systems

The IV (XXXII of project) Biennial workshop of ICAR-AICRP on Integrated Farming Systems was organized during 20-23 December, 2016 at Sher-E-Kashmir University of Agricultural Sciences & Technology (SKUAST-J), Chatha, Jammu (Jammu and Kashmir) in which review of on-going research programmes of on-station and on-farm centres including Tribal Sub Plan, discussion and finalization of new experiments, administrative, financial issues and special lectures on identified topics were undertaken.

The inaugural programme of the workshop started with ICAR song and lighting of lamp. Dr.J.P. Sharma, Director of Research, SKUAST-Jammu welcomed the guests and delegates. He briefly informed about research activities being carried out by the university and the importance of systems research for enhancing the sustainability and income of the farmers. Prof. PK Sharma, Vice Chancellor, SKUAST-Jammu inaugurated the programme as chief guest. Dr. AS Panwar, Director, ICAR-IIFSR also welcomed the delegates and gave brief scheme report. He appraised the participants that although 84 % of farm households in India have crop and dairy together, their recycling is very low (< 25 %) and depend for markets for their farm inputs including meeting the family food and nutritional requirement. Generating sustainable and regular income (round the year) from farm is a major challenge for farmers in the present day context. Union government has declared to double the farm income by 2022 which is possible by adopting scientifically designed diversified Integrated Farming Systems. Dr S. Bhaskar, ADG (AAFCC) in his address, informed that farming Systems are not new especially for Indian farmers as our forefathers have been practicing farming systems as crop and dairy (cattle & buffalo) were integral part of rural life. These systems were low productive but it was sustainable. He also said that in the present day context, agriculture is becoming un-sustainable, less remunerative and attractive to youth due to many factors such as low returns on investment, involvement of drudgery, higher input cost, risks associated with market glut, weather and climate related risks etc. Due to the above facts, the present government is concentrating on schemes such as doubling of farmers income through soil health, more from less resources (input use efficiency), har khetko pani (water management), har med me pad (Agroforestry), national gokul mission etc. Dr Bhaskar also pointed out that truly speaking; AICRP on Integrated Farming Systems is the only scheme in entire ICAR system which addresses the Integrated Agriculture mostly being practiced by small holders who constitute 86 %. In the inaugural session, the annual report and also state wise publications brought out by the ICAR-IIFSR and AICRP on IFS centres were released by the chief guest and other dignitaries.

Release of publications during the workshop

Chief guest Prof. PK Sharma, Vice Chancellor, SKUAST-Jammu congratulated all the delegates for involving in farming systems research and bringing out useful publications for the researchers, policy makers, farmers and other stakeholders. He suggested that the size of publications for each category like books, bulletins, folders, phamplets etc and also design may be kept uniform within the project to have identity. He confirmed that IFS models developed by AICRP on IFS are good income earners for farmers as he himself witnessed from his university IFS model depositing around Rs 3 lakhs/ha in to university account. Elaborating on the importance of farming systems research, he stressed that methodology for replication of on-station models in to on-farm needs to worked out. Furthering of research on farming systems by setting up of long term ecological sites probably in a larger area is also essential. Dr Dileep Kachroo, Chief Agronomist, AICRP-IFS & Registrarof SKUAST-Jammu proposed the vote of thanks.

The following recommendations for research and general were finalized in the workshop after discussions.

Recommendations

On-station Research

- Uniform methodology for calculation of economics of on-station and on-farm farming systems should be developed and adopted. Complete economic analysis including B:C ratio, NRPRI, NPW, IRR etc is required to be made for on-station IFS models.
- Identified cropping systems from need based alternative cropping systems should be included in the farming systems being developed /refined at on-station and on-farm.
- Successful practices and modules of one location (*Sesbania* and organic practices for weed and pest control by Maruteru centre & terrace gardening/vertical integration by Karamana centre) needs to be replicated at other locations also.
- Modified experiments such as ***Sustainable resource management for climate smart IFS*** *and* ***Identification of cropping systems module for different farming systems*** should be initiated from *Kharif 2017* as per the guidelines.
- New experiment of ***Evaluation of weed management practices under organic production system (only at 8 identified locations)*** should be initiated from *Kharif* 2017 as per the guidelines.
- New studies on **Carbon crediting and GHG emission in IFS models** and **Preparation of Bankable IFS project using available data bank** are to be initiated immediately as per the guidelines.
- Experiment on "Permanent plot experiment on integrated nutrient management in cereal-based cropping systems" to be continued at 14 locations (Ludhiana, Rahuri, Kalyani, Hisar, Pantnagar, Agra, Jorhat, Sabour, Faizabad, Varanasi, Ranchi, Jammu, Raipur and Karjat). University support for the experiment may also be explored for additional studies.
- Development of region specific integrated farming system models study to be started/ continued at the sub centres (except Varanasi and Thanjavur), as these centres started establishing the model from 2016-17 onwards only.

On-Farm Research

- Module wise contribution towards the farmer's income should be worked out using the characterization survey data and should be reported in standard format across different farming systems.
- Analysis of performance of farming system modules under different climate change related stresses like drought and heat needs to be made in order to find out the climate resilient modules of farming systems across the locations. A pilot study using the available on-

farm data may be initiated by taking any one agro-climatic zone.

- Modelling approach should be explored/ employed for comparing different farming systems and converting to same unit.
- Impact of module wise interventions made in on-farm farming systems needs to be documented.
- Technical programme for new mandated district should be developed farming system wise and interventions in all the modules should be uniform for all the farmers with in the farming system. In each farming system,minimum of 4 households for OFR 2 and minimum of 3 households for OFR 3 should be selected. Interventions should be common to all the households with in the particular farming systems and farmer to farmer variation should be avoided.
- Benchmark data along with the technical programme as per the guidelines for the new mandated district should be submitted to ICAR-IIFSR for approval by April 2017.

General

- A manual having methodology, guidelines and observation sheet is to be prepared for the modified experiments and new studies by ICAR-IIFSR with the help of subject matter specialists and circulated to all centers. Individual centres should get their technical programme approved from ICAR-IIFSR by May 2017.
- Custom-hiring centres for farm machineries in each cluster may be established by linking with available government schemes.
- Soil health cards can be issued by the centres to adopted families either by linking with government scheme or at university/institute level.
- Stakeholder's workshop involving progressive farmers, bankers, officials of NABARD should be organized to discuss and further improve the bankable projects on IFS being prepared.
- Regular capacity building and updating of knowledge of all the staff of the scheme are to be undertaken by ICAR-IIFSR through regional level capacity building programmes.

Recommendations finalized for up-scaling through developmental schemes are given below.

I. Profitable and sustainable Integrated farming System models

District (State)	District	Prevailing Farming System (PFS)	Suggested IFS Model	Increase over PFS (%)
Andhra Pradesh	Medak	Crop + Dairy	Crop + Dairy + Horticulture +Goat/poultry	135
Assam	Jorhat	Crop+ Dairy	Crop + Dairy + Horticulture +Fishery+Apiary	669
Bihar	Sabour	Crop + Dairy	Crop + Dairy + Horticulture +Fishery+Goat+Duck	296
	Patna	Crop + Dairy	Crop + Dairy + Horticulture +Fishery+Goat/poultry/ duckery+ Mushroom	184
Chhatisgarh	Raipur	Crop + dairy	Crop + Dairy + Horticulture +Fishery+Poultry+Mushroom	134
Goa	Goa	Crops + dairy	Crop + Dairy + Horticulture +Fishery+Mushroom	643
Gujarat	S.K.Nagar	Crop + Dairy	Crop + Dairy + Horticulture	354
Haryana	Hisar	Crop + Dairy	Crop + Dairy + Horticulture	257

District (State)	District	Prevailing Farming System (PFS)	Suggested IFS Model	Increase over PFS (%)
Himachal Pradesh	Palampur	Livestock + cereals based	Crop + Dairy + Horticulture +	306
Jammu and Kashmir	Chhata	Crop+Dairy	Crop + Dairy + Horticulture +Fishery+ Poultry+ Agroforestry +Apiary	254
Jharkhand	Ranchi	Crop + dairy/Goat + Pig	Crop + Dairy + Horticulture +Fishery+Mushroom	298
Karnataka	Siruguppa	Crop + Dairy	Crop + Dairy + Horticulture +Fishery+Goat	118
Maharashtra	Akola	Crop + Goat + Horti. + Poultry	Crop + Dairy + Horticulture +Goat/poultry	216
	Rahuri	Crop + Dairy	Crop + Dairy + Horticulture +Poultry	226
	Karjat	Crop + Livestock	Crop + Dairy + Horticulture +Goat/poultry	26
Orissa	Bhubneswar	Crop + Dairy +Hort. (vegetables)	Crop + Dairy + Horticulture + Apiary + Fishery + Poultry/ duckery/ + Agroforestry + Mushrrom	265
Punjab	Ludhiana	Crop + Dairy	Crop + Dairy + Horticulture + Fishery + Agroforestry + Apiary	144
Rajasthan	Durgapura	Crop + Dairy	Crop + Dairy + Horticulture + Goat/poultry	78
Tamil Nadu	Coimbatore	Crop + Dairy	Crop + Dairy + Horticulture + Goatery	88
	Thanjavur	Crop + Dairy + Horticulture	Crop + Dairy + Horticulture +Fishery+Poultry	222
Uttar Pradesh	Meerut	Crop + Dairy	Crop + Dairy + Horticulture +Mushroom+Biogas	373
	Varanasi	Crop + Dairy	Crop + Dairy + Horticulture +Fishery+Poultry+Mushroom	431
Uttarakhand	US Nagar	Crop + Dairy + Tree plantations	Crop + Dairy + Horticulture +Agroforestry	92
West Bengal	Nadia	Crop + Dairy + Vegt./ Goat /Poult.	Crop + Dairy + Horticulture +Fishery	109

II. On-farm nutrient application to pre-dominant cropping systems

State	District	Pre dominant cropping systems	Recommendation	% increase in yield over FP
Andhra Pradesh	Srikakulam	Rice-Rice	80-60-50-50 kg NPK & ZnSo4	38
Assam	Kamrup	Post flood Rice-Pre flood Ricex	40:20:20:25 kg N:P:K:ZnSo4/ha (Kharif)-60:30:30:25 kg N:P:K:ZnSo4(Rabi)	70
Bihar	Purnea	Rice-Maize	100:40:20 kg NPK+25 kg Zn/ha	37
Chhattisgarh	Kawardha	Rice-Chickpea	100-60-40-20 & 20-50-20 kg of NPK & $ZnSo_4$ for Rice and chickpea respectively	40
Gujarat	Mehsana	Hy. Cotton- wheat	180 N:40P: 40K:25 MgSo4 for BT Cotton & 120 N:60P: 30K:25 ZnSo4 for wheat respectively	17
	Panchmahal	Maize- Maize	100 N:50P: 50K:25 ZnSo4 for maize & 120 N:60P: 60K:25 ZnSo4 for maize respectively	80
		Paddy (UL)- Maize	50 N:25P: 25K:25 ZnSo4 for paddy & 120 N:60 P: 60K:25 ZnSo4 for maize respectively	17
J&K	Samba	Rice-Wheat	30:20:10 &20kg ZnSo4 and 100:50:25	27

State	District	Pre dominant cropping systems	Recommendation	% increase in yield over FP
		Maize-wheat	60:40;20%10kg Znso4 and 60:30:20	34
Jharkhand	Pakur	Rice-wheat	100:50:25:25 ::N:P:K:ZnSO4	40
Karnataka	Gadag	Groundnut-*rabi* sorghum	25-50-25 & 25 -50-25-0 & 15 kg NPK $FeSo_4$ & /$ZnSo_4$ for groundnut/sorghum, respectively	23
		Hybrid maize-chickpea	150-75-37.5 & 25 -25-50-0 & 15 kg NPK & $ZnSo_4$ for maize/chickpea, respectively	44
Kerala	Pathanamthitta	Rice-Rice-Water Fallow	90-45-45-25 kg of NPK+$ZnSO_4$ for rice	11
Madhya Pradesh	Dindori	Rice-Wheat	120-60-40-25 &120-60-40-25 kg of NPK & $ZnSo_4$ for Rice and wheat respectively	38
Madhya Pradesh	Katni	Rice-Wheat	120-60-40-25 &120-60-40-25 kg of NPK & $ZnSo_4$ for Rice and wheat respectively	38
Maharashtra	Amravati	Soybean- wheat	30-75-30-25 &100-50-50-25 kg of NPK & S for soybean and wheat respectively	43
		Soybean-Chickpea	30-75-30-25 &20:40:20 :25 kg of NPK & S for soybean and chickpea respectively	19
Maharashtra	Pune	Soybean- Onion	50-75-25-20- & 20 of N-P-K-ZnSo4 and FeSo4 for soybean and 100-50-50-20 & 20 N-P-K-ZnSo4 and FeSo4 for Onion	32
Maharashtra	Palghar	Rice - rice	NPK + Zn 120:50:50:6 and 100:50:50:0 kg NPK & Zn for *kharif* and *rabi* rice respectively	35
Odisha	Angul	Rice-groundnut	80-40-40-25 and 20-40-40-250 kg of N-P-K-Zn and N-P-K-Gypsum for rice-groundnut, respectively	22
Rajasthan	Sikar	Clusterbean- Wheat	$N_{10}P_{40}K_{20}Zn_{20}N_{90}P_{35}K_{30}Zn_{25}$	28
Rajasthan	Udaipur	Maize-Wheat	90 : 35 : 30: 25 kg and 120: 40:30 kg of NPK & $ZnSO_4$ for maize and wheat, respectively	76
Tamil Nadu	Krishnagiri	Rice-rice	150-50-50-25 &120-40-40-25 kg/ha of NPK & Zn for Kharif Rice & Rabi rice respectively	29
	Dharmapuri	Rice-groundnut	150-50-50-25 kg/ha of NPK & Zn for Kharif Rice & 20-50-75-10 kg/ha of NPK & Bo respectively	27
	Sivagangai and Pudukkottai	Rice-Rice	150-50-50-25 kg/ha of NPK & Zn	9
Telangana	Warangal	Rice-Rice	120-60-40-50 NPK & Zn	12
Uttar Pradesh	Muzaffarnagar	Rice- Wheat	120:60:60:25:25(NPK+MN) and 120:60:60:25 (NPK+MN)	58
		Sugarcane-ratoon-wheat	180:60:120:25:25(NPK+MN) and120:60:60:25 (NPK+MN)	59
Uttarakhand	Nainital	Rice-wheat	150-60-60-20 &150-60-40-20 kg of NPK & S for hybrid rice and wheat respectively	47
West Bengal	South 24 Parganas	Rice -Greengram	80-40-40-5 & 20-40-40-0 kg/ha of NPK & Zn for rice and green gram respectively	12

III. Recommended farming Systems and interventions based on farmer participatory research

State	District	Recommended farming systems	Area (ha)	Suggested interventions	% Improvement in production on equivalent basis over bench mark
Andhra Pradesh	Srikakulam	Field crop + dairy (1 cow)	0.8	Rice-green gram-Sesame, fruit orchard (0.2 ha), Cow, BYP (25 no's), nutritional kitchen garden, Vermi composting	312
Assam	Kamrup	Field crops + Cow(2)+ Poultry(10)+ Pig(2)	0.77	1. Replacement of local Poultry with improve Breeds (Bonraja -10 nos) 2. Replacement of local breeds of pigs with improved ones (Hampshire) 3. Mineral mixture to cows 4. Deworming in Cow and Pig	65
Chhatt-isgarh	Kawardha	Field crops (0.80 ha) + Dairy (cow 1-2)	0.8	Pigeonpea in bunds, vegetable (tomato chilli, beans) in bunds + Goat + poultry(30) + vermicomposting + Kitchen garden + mushroom + fruit tree in boundary	61
Gujarat	Mehsana	Field crops (0.65 to 0.70 ha) & for Dairy 0.25-0.30 ha land 2-3 Buffalo/cow & Buffalo or cow	0.98	**Crops Intensification** -Hy. Castor + Lucern (F+S) Broadcasting -Hy. Castor+Chicory (f) Broadcasting - Hy. Cotton + Hy. Castor -Mustard + Luceern (S) **Diversification** -Hy. Castor-Fennel/chilly Wheat –Rabi fennel F jowar-F bajara Animals: Supply of Green fodder Mineral mixture dewarming **Product diversification** Vermicompost, enrichment of wheat straw, Kitchen gardening, chilly powder.	14
Gujarat	Panchmahal	Field crops (0.65 to 0.70 ha) & for Dairy 0.25-0.30 ha land 2-3 Buffalo/cow & Buffalo or cow	0.98	**Crops Intensification** Maize—Maize Paddy (UL)—Maize **Diversification** Guar/Bt cotton Mineral mixture dewarming **Product diversification** Vermicompost, enrichment of wheat straw, Kitchen gardening, chilly powder.	21
J&K	Samba	Field crop(0.59) + dairy(cow/Buffalo 1)	0.59	High yielding variety of maize(kanchan) +Blackgram(1:1)-Wheat, Rice-wheat, Balance nutrition (NPK& Znso4), Feed supplement through mineral mixture to animal, Back yard Poultry (Vanraja), Button & oysters Mushroom, NKG (Broccoli, palak,garlic, onion etc.	???
Jharkhand	Pakur	Crop+Pig	0.83	Rice-Wheat+Mustard(8:2)-Pig	37

State	District	Recommended farming systems	Area (ha)	Suggested interventions	% Improvement in production on equivalent basis over bench mark
Karnataka	Kolar	Field crops (0.96 ha) + Buffalo/cow (2-3)	0.96	Improved varieties in Finger millet, Redgram and Maize + Use of micronutrients and Biofungicides+ enrichment of FYM before application+ improved breed of Backyard poultry birds Swarnadara+ Sheep (Bannur) + Azolla+ Vermicomposting unit + Multipurpose tress+ Improved varieties of fodder+ Cowmat + chuffcutter+ Kitchen garden kit+ Sericulture kit+ Trainings	33
Karnataka	Gadag	Field crop (0.84)+ Buffalo/cow (1-2)	0.8	Green gram+ Cotton(2:1) Groundnut +Cotton(2:1) + poultry(10 birds)+ Hybrid Napier on bunds + mineral mixture+ bio composting +value addition to milk	30
Kerala	Pathanamthitta	Crop (0.2 ha) + Horticulture (0.27 ha) + Dairy (1 no.)	0.47	Rice (var.Uma) + Coconut (Mineral nutrition with Mg & K at 1 & 2 kg respectively) + Banana (intercrop)+ Dairy (mineral mixture) + Nutritional Kitchen garden	54
Madhya Pradesh	Dindori	Field crops (0.76 ha) + Dairy (cow/Bufalo 1-2)	0.76	Soybean-lentil, Green fodder (MP Chari and Berseem), Mineral Mixture and De –Worming , AI	59
Madhya Pradesh	Katni	Field crops (0.73 ha) + Dairy (cow/Bufalo 1-2)	0.73	Paddy-Wheat/Gram, Green fodder (MP Chari and Berseem), Mineral Mixture and De – Worming, A.I	43
Mahar-ashtra	Pune	Field crops (0.53 ha) + Buffalo/cow (1-2)	0.53	Soybean-onion, Paddy - Wheat, Pearl millet-Chickpea/ Hybrid Napier in bunds, Goat (1)/Poultry(10)	16
Mahar-ashtra	Amravati	Field crops (0.76 ha) + Buffalo/cow (1-2)	0.76	Soybean + Pigeonpea (4:2) Chickpea + linseed (5:1) – Summer sesamum + Goat (1) +Hybrid Napier in bunds + Ber Budding + compost with bio decomposers + Kitchen garden	27
Mahar-ashtra	Palghar	Crop + Dairy	0.4	Rice – cluster bean, buffalo(1)/cow(2),goat (1), poultry bird(2), forage grass/crop, mineral mixture, vermicompost, value addition of food grain and milk, trainings on crop and livestock management	52
Odisha	Angul	Crop + Dairy	0.8	Hybrid maize for green cobs & green fodder + off-season cauliflower and tomato +pruning of fruit trees + dual purpose poultry bird breed *Chhabro* + Azolla cultivation +Mineral mixture, deworming, preventive vaccination to cows	48

State	District	Recommended farming systems	Area (ha)	Suggested interventions	% Improvement in production on equivalent basis over bench mark
Rajasthan	Udaipur	Field crop (0.57 ha) + Buffalo/Cow (2 no.)	0.57	Maize- wheat crop sequence, growing of vegetables namely tomato, brinjal, chilli , okra, onion, bottle gourd, ridge gourd etc. cultivation (in 0.2 ha area) + mineral mixture, deworming and cut fodder (dry and green) to cattles + 20 no. of Pratapdhan poultry + vermicompost preparation	101
Tamil Nadu	Sivagangai and Pudukkottai	Field crops (0.8 ha) + Cow (2-3)+ poultry (4-5)	0.8	Rice (SRI) – Groundnut (VRI 7)+Blackgram (VBN 5) + Cumbu Napier hybrid (0.02 ha) + Mineral mixture (40 gm/animal/day) + Giriraja poultry (8+2) +Cleaning and grading of grains + vermicomposting + Kitchen garden + training	41
Telangana	Warangal	Crop+ Diary (Field crop + Buffalo (2-3)	0.9 ha	Green gram-Rice-zero tillage maize Cotton + red gram (4:1/6:1) Improved desi birds, APBN-1 perennial fodder and Lucerne, Nutritional kitchen gardening, vermi composting, selling of milled fine rice and Azolla production	65
Uttara-khand	Nainital	Crops (0.2 ha) + Local cow (1-2) +Goatry(2)+Poultry (20)	0.2	High value vegetables like coriander, chilli, pea, onion, cucurbits & papaya +Hybrid Napier on bunds, maize+cowpea-egyptian clover-maize+cowpea + vermin-compsting, organic Kitchen garden & grading & packing of vegetables before marketing	108
West Bengal	South 24 Parganas	Field crops (0.34 ha) + dairy (1-2) + fishery	0.34	Onion /Okra+ poultry with vaccination and azolla feeding + mineral mixture feeding and vaccination with deworming of cow + cultivation of mixed carp with proper ratio and fertilization	55

9. APPENDICES

APPENDIX I: INITIAL SOIL PARAMETERS FOR ON-STATION EXPERIMENTAL SITES DURING 2015-16

Name of CSR centre	Expernment no	PH	EC (m mhos/cm)	O.C. (% g^{-1} kg^{-1})	Available nutrient (kg/ha)		
					N	P	K
Rajendranagar	1(a)	7.72	0.27	0.51	210	32.0	288
Maruteru	1(a)	-	-	0.9	-	38.0	314
	2(a)	5.1	0.38	0.9	-	38.0	344
Rudrur	1(a)	6.68	0.55	0.46	-	39.6	305
Sabour	1(a)	7.5	0.13	0.63	213	23.6	226
	2(a)	7.4	0.23	0.46	246	23.6	155
Hisar	1(a)	7.8	0.21	0.46	170	12.7	292
Palampur	1(a)	5.6		0.99	293	63.1	11
	2(a)	5.5		0.60	667	21.9	221
Ranchi	1(a)	6.0		0.38	225	20.0	115
	2(a)	6.5		0.42	260	19.5	195
S.K.Nagar	1(a)			0.33	195	15.9	198
Navsari	1(a)			0.59	194	18.2	153
Kathalagere	1(a)	6.1	0.20	0.60		22.0	211
Jabalpur	1(a)	7.7	0.48	0.68	266	9.2	448
Powarkheda	1(a)	7.6	0.55	0.66	260	9.0	300
Rewa	1(a)	7.7	0.53	0.65	260	9.0	500
Indore	1(a)	7.5	0.45	0.34	150	8.0	480
Karjat	1(a)	7.0	0.30	0.97	217	18.4	245
Bhubaneswar	1(a)	6.7	0.27	0.69	212	15.7	210
Chiplima	1(a)	6.1	0.41	0.58	315	16.0	185
Ludhiana	1(a)	7.8	0.40	0.38	242	47.5	101
	2(a)	8.2	0.32	0.31	143	11.2	140
Durgapura	1(a)	8.2	0.28	0.22	NR	38.1	190
Kanpur	1(a)	8.1	0.18	0.45	NR	11.5	170
	2(a)	8.1	0.18	0.24	NR	10.4	186
Faizabad	1(a)	7.3	0.11	0.51	142	18.0	355
Kalyani	2(a)	7.4	0.59	0.92	110	12.1	93
	OF	7.1	0.46	0.62	129.8	11.9	NR

APPENDIX II A: WEATHER PARAMETERS (MONTHLY AVERAGES RAINFALL) AT DIFFERENT CROPPING SYSTEM CENTERS DURING 2015-16

Name of CSR centre	July	August	Sept	Oct	Nov	Dec	Jan	Feb	Mar	April	May	June
Akola	88.1	72.1	320.1	164.3	0.0	0.0	0.0	0.0	0.0	0.0	0.0	146.5
Bhubneswar	220.5	297.8	156.4	75.5	8.3	14.8	158.0	0.0	4.5	0.0	163.4	228.5
Bichpuri	88.2	69.2	36.0	61.3	5.6	0.0	5.0	0.0	10.0	0.0	46.0	61.0
Chiplima	207.0	342.9	72.3	0.0	21.0	0.0	241.0	0.0	17.4	3.1	34.1	96.4
Coimbatore	5.1	28.1	66.2	65.2	191.3	24.1	0.2	0.0	0.0	4.2	64.4	34.2
Durgapura	163.8	27.2	6.6	25	0	0	0.0	3.8	0.0	0.0	9.0	18.0
Faizabad	238.4	134.6	15.2	0.0	0.0	0.0	0.0	1.2	4.6	12.1	10.2	93.3
Goa	934.3	512.9	255.2	55.2	0.4	0	0	0.8	0	0.2	0.6	1089.6
Hisar	156.1	54.4	19.8	7.0	2.9	0.0	0.0	5.3	25.2	0.0	44.4	91.1
Indore	557.5	317.3	61.8	4.5	0	0	0	0	0	0	30.9	215.7
Jabalpur	390.8	366.6	109.4	40.0	0.0	0.0	12.2	0.0	44.1	0.0	45.2	116.2
Jammu	413.1	169.2	136.4	33.4	3.8	28.4	11.8	15.6	79.9	3.2	10.2	93.6
Jorhat	344.8	307.3	257.2	46.8	10.2	35.7	35.2	6.6	93.6	401.1	363.5	389.8
Junagadh	282.4	16.4	214.3	10.4	0.0	0.0	0.0	0.0	0.0	0.0	0.0	62.0
Kalyani	29.1	30.4	29.9	29.1	25.1	20.7	18.9	24.4	28.1	33.0	30.2	30.4
Kanpur	79.9	123.3	99.0	19.3	0.2	25.8	11.0	2.8	10.1	0.0	49.6	113.4
Karmana	164.3	49.3	229.6	279.6	300.7	242.8	0.0	0.3	1.0	67.6	369.3	0.0
Kathalagere	85.0	71.1	188.5	47.3	56.3	0.0	0.0	0.0	0.0	4.3	49.4	226.2
Kota	421.5	283.2	24.7	0.0	0.0	0.0	0.0	0.0	0.0	0.0	4.2	47.5
Ludhiana	256.1	165.6	85.4	16.4	9.4	1.7	19.4	8.8	41.1	0.0	25.2	86.0
Maruteru	124.6	339.8	217.4	152.6	135.4	2.2	0.0	0.0	0.0	0.0	146.2	310.4
Palampur	22.9	22.5	21.2	18.9	15.3	10.7	10.2	12.5	16.0	21.2	23.8	38.9
Parbhani	13.6	83.2	183.9	1.8	0.0	0.0	0.0	0.0	21.8	7.6	0.0	75.1
Patna	296.6	260.9	29	7.4	0	0	3.4	0	3.1	0	124.8	53.7
Powarkheda	414.2	109.2	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0

Contd..../-

Name of CSR centre	July	August	Sept	Oct	Nov	Dec	Jan	Feb	Mar	April	May	June
Rahuri	32.3	12.0	86.6	21.0	26.0	0.0	0.0	10.0	0.0	0.0	59.0	18.4
Raipur	214.7	224.5	213.8	0	0.0	13.8	0	0	3.5	18.2	20.8	108
Rajendranagar	25.2	126.8	168.2	36.4	17.3	1.4	0.0	0.0	3.0	2.6	157.4	90.0
Ranchi	170.5	274.3	31	115.1	0	3.2	7.3	3.1	32.9	69.7	38.7	215.4
Rewa	296.6	266.8	6.0	81.0	0.0	0.0	34.4	0.0	40.0	0.0	11.0	0.0
Rudrur	242.09	214.21	203.46	41.59	14.47	0.86	1.92	4.46	26.64	21.59	14.8	157.8
Sabour	271.7	340.3	213.7	11.4	0.0	0.0	24.4	3.4	2.4	23.2	106.0	116.2
Siruguppa	18.3	57.2	167.2	136.2	3.2	0.0	29.2	0.0	0.0	0.4	91.9	151.7
SK Nagar	839.5	40.0	17.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	8.9
Umiam	230.9	692.4	491.8	230.5	94.5	0.2	23.4	2.6	74.5	174.2	302.50	422.30
Varanasi	417.6	226.6	11.9	23.0	0.0	0.8	7.7	2.4	35.4	0.0	10.6	97.4

APPENDIX II B : MAXIMUM AND MINIMUM TEMPERATURE (^{0}C) (JULY 2015 TO JUNE 2016)

Name of CSR centre	Temperature (^{0}C)																							
	Jul		Aug		Sep		Oct		Nov		Dec		Jan		Feb		Mar		Apr		May		June	
	max.	min.	max.	min.	max.	min.	max.	min.	max.	min.	max.	min.	max.	min.	max.	min.	max.	min.	max.	min.	max.	min.	max.	min.
Rajendranagar	33.6	23.8	31.2	22.8	31.0	22.4	32.3	19.7	30.5	17.7	30.9	14.9	29.6	13.7	33.6	17.4	36.2	20.5	40.3	24.1	38.0	24.2	32.9	23.2
Maruteru	33.8	27.9	31.2	26.9	31.2	26.5	31.5	26.0	29.0	22.2	29.4	21.3	29.0	20.5	30.3	22.1	32.1	23.6	33.9	25.6	35.8	27.5	31.9	26.7
Rudrur	36.7	27.8	33.3	26.5	34.5	26.3	35.1	23.0	34.4	20.9	34.2	19.5	33.5	17.9	36.9	20.2	39.8	19.3	38.9	23.1	42.5	22.0	37.6	20.6
Sabour	34.4	25.2	31.8	25.6	32.6	24.8	31.4	20.7	28.7	15.1	23.5	9.9	22.4	7.5	29.7	18.5	32.4	16.1	38.6	21.4	35.2	23.1	34.1	25.5
Raipur	36.0	22.4	34.0	22.5	34.0	23.2	35.2	18.0	33.0	14.4	33.0	7.0	32.8	5.4	35.8	10.8	40.0	17.3	44.4	21.5	44.5	21.5	44.0	24.0
SK Nagar	35.4	26.8	32.7	25.7	33.2	24.7	37.7	20.5	33.5	16.1	28.3	11.5	28.1	12.8	29.4	15.6	35.6	17.9	37.4	20.4	41.9	24.9	39.7	27.1
Junagadh	32.7	26.0	32.5	25.1	33.2	24.0	37.1	22.4	34.8	17.9	31.2	12.4	30.6	12.6	33.1	16.1	37.2	21.0	38.9	23.1	39.9	25.7	36.6	25.8
Navsari	30.7	26.2	30.6	25.3	31.0	23.4	35.5	23.1	34.1	20.3	31.3	13.1	30.6	15.1	30.2	14.0	35.5	18.7	35.6	22.1	34.4	26.7	33.8	27.3
Hisar	34.5	26.0	34.7	26.1	35.8	22.6	34.3	18.5	27.8	12.3	22.4	6.0	19.6	7.1	23.8	7.2	29.7	13.6	37.8	18.4	41.4	24.6	39.5	27.4
Palampur	26.6	19.1	26.6	18.4	26.9	15.5	25.2	12.5	21.7	8.8	17.2	4.2	16.6	3.7	19.1	5.8	22.2	9.7	28.0	14.4	30.5	17.0	29.5	18.8
Jammu	34.5	25.3	33.8	25.2	33.5	21.9	30.3	17.0	25.8	10.8	20.6	5.6	17.2	5.4	23.5	7.2	26.8	12.7	33.7	15.5	38.4	21.0	38.3	25.1
Ranchi	29.6	20.3	30.2	32.2	21.2	21.6	29.0	18.9	27.0	13.7	23.1	9.1	23.4	6.6	27.5	11.9	32.6	16.1	33.0	21.2	37.6	24.5	35.2	23.9
Kathalagere	29.0	24.0	29.0	23.0	29.0	22.0	31.0	22.0	29.0	22.0	31.0	20.0	31.0	17.0	34.0	20.0	36.0	23.0	39.0	26.0	38.0	26.0	28.0	24.0
Karmana	30.3	28.5	24.4	22.5	30.7	27.8	24.6	22.1	30.4	22.2	30.7	25.8	31.0	22.8	31.5	23.2	32.9	25.2	33.2	26.7	32.2	25.2	NR	NR
Jabalpur	31.6	24.2	30.9	23.8	32.4	23.0	33.4	18.4	30.3	15.2	26.1	8.1	25.2	8.0	28.4	10.6	32.9	15.5	39.8	20.5	41.2	25.2	38.9	26.0
Powarkheda	32.4	22.5	32.3	23.3	33.2	21.4	36.3	19.0	37.7	17.6	33.7	19.0	31.7	6.1	35.6	8.9	39.4	15.5	42.8	25.0	46.6	20.0	44.4	22.8
Rewa	32.9	23.8	32.8	23.7	34.5	22.6	34.5	17.7	30.6	14.2	25.6	7.4	24.4	6.9	27.7	10.6	32.4	15.0	40.2	19.2	41.5	25.9	39.4	26.0
Indore	29.9	25.5	28.8	22.6	31.7	22.6	33.7	20.7	30.4	19.6	26	12.5	27.32	10.42	30.14	16.07	35.05	23.77	40.03	27.38	40.15	30.13	37.75	28.85
Rahuri	32.7	23.2	32.1	22.2	32.2	22.3	33.8	19.7	31.8	16.9	31.0	13.0	30.7	11.3	33.9	16.3	36.6	18.2	39.4	21.4	39.2	24.4	33.4	23.2
Bhubaneswar	33.5	25.0	32.8	25.1	33.1	25.0	33.3	23.6	31.1	20.4	28.8	17.3	29.8	15.4	34.5	21.1	36.6	23.2	40.8	26.6	38.8	26.2	34.4	26.3
Chiplima	32.2	24.0	31.9	24.7	33.2	23.4	32.8	20.4	28.9	15.5	26.3	8.3	26.6	10.4	29.7	13.9	34.5	17.9	37.1	20.8	39.0	23.1	38.5	26.5
Parbhani	35.5	24.6	31.8	23.0	32.4	22.2	35.1	19.5	33.2	17.1	32.5	14.6	31.4	11.3	35.4	16.4	37.5	19.7	41.6	23.5	42.3	26.2	38.0	25.5
Karjat	30.6	23.8	30.3	23.1	32.3	22.4	35.0	22.2	35.0	18.6	34.5	13.9	34.0	11.9	35.4	14.3	39.2	18.3	40.1	22.0	39.4	25.1	34.5	24.9
Ludhiana	33.5	27.2	33.4	25.2	33.2	24.2	31.3	19.0	26.9	12.6	21.3	7.3	17.2	7.4	23.0	9.0	31.7	16.0	40.6	20.4	39.6	24.6	39.8	28.5
Jaipur	32.9	24.9	32.3	24.8	35.4	25.1	34.8	21	29.7	16.4	24.3	9.1	24.3	9.4	26.6	12.3	32.5	19.3	38.0	23.9	41.3	27.2	40.9	29.2
Coimbatore	32.2	22.9	32.2	23.2	33.0	23.8	31.6	23.3	28.6	22.0	29.0	21.5	30.2	19.5	33.4	21.5	35.7	24.0	37.3	25.5	34.8	24.6	31.8	23.9
Thanjavur	37.6	27.5	35.8	27.7	35.6	26.9	33.8	25.7	29.7	23.5	29.3	23.9	30.6	21.2	33.4	21.8	35.8	24.6	37.2	28.8	36.6	28.2	35.7	27.3

Contd..../-

Name of CSR centre	Temperature (^{0}C)																							
	Jul		Aug		Sep		Oct		Nov		Dec		Jan		Feb		Mar		Apr		May		June	
	max.	min.	max.	min.	max.	min.	max.	min.	max.	min.	max.	min.	max.	min.	max.	min.	max.	min.	max.	min.	max.	min.	max.	min.
Kanpur	34.4	24.1	34.2	23.5	35.3	22.0	33.6	16.8	30.1	11.6	23.5	7.0	22.7	8.5	26.5	12.1	32.5	16.7	40.0	22.2	39.0	25.5	37.8	27.3
Varanasi	32.3	26.5	33.3	26.6	30.9	26.1	32.1	20.4	40.2	25.6	23.0	10.6	22.9	10.1	27.5	13.6	32.2	17.6	40.0	23.6	39.1	26.0	37.9	27.7
Bichpuri	35.2	26.9	35.2	26.5	37.2	24.8	35.3	21.4	29.6	15.1	23.3	8.4	22.1	8.6	26.7	11.3	33.5	17.6	40.3	23.0	41.5	26.6	40.5	28.7
Pantnagar	33.6	23.8	33.4	24.9	34.1	21.4	32.9	13.9	29.0	11.3	24.6	4.6	23.6	4.1	28.8	8.3	33.5	13.4	39.0	16.5	38.7	21.3	35.3	24.5
Kalyani	32.3	25.9	34.2	26.5	34.0	25.8	33.4	24.7	31.3	18.8	26.3	15.0	25.8	11.9	30.7	18.0	34.3	21.8	39.4	26.6	35.4	25.0	34.2	26.5
Faizabad	33.4	26.6	34.7	27.0	36.1	24.6	32.0	18.6	30.9	12.3	25.0	7.1	22.7	6.9	28.1	9.7	32.9	14.7	40.3	22.5	38.6	26.2	NR	NR
Jorhat	34.0	25.3	32.0	24.9	32.3	24.6	31.1	21.0	27.5	15.1	22.9	10.9	22.3	9.9	24.2	13.3	27.3	16.3	27.4	20.0	29.5	22.4	32.6	25.4
Siruguppa	35.0	24.0	33.8	23.4	32.5	22.9	32.4	21.7	29.1	20.9	31.5	17.8	30.7	16.8	34.6	19.6	37.9	22.8	40.9	26.8	38.5	25.4	33.2	23.8
Kota	33.3	26.5	32.5	26.1	35.8	25.9	35.6	23.2	30.5	19.1	25.3	6.4	24.1	7.8	28.3	10.5	33.8	15.7	39.2	21.6	42.6	27.7	40.5	28.7
Patna	32.2	26.7	32.9	26.7	33.6	26.2	32.7	21.8	29.3	16.5	23.0	10.9	22.2	8.7	27.3	13.4	32.7	18.3	39.1	23.5	35.1	24.2	36.1	27.9
Goa	30.4	23.1	30.1	23.4	31.4	23.8	34.4	23.9	35.0	22.7	35.0	22.2	34.2	18.5	34.0	20.3	34.9	23.0	35.1	24.2	35.7	25.2	30.6	21.5
Umiam	29.0	19.2	27.2	19.0	27.8	17.9	27.4	14.7	24.5	9.7	20.7	5.6	19.8	5.1	23.5	8.6	27.4	13.3	28.6	16.7	27.0	15.9	28.6	18.6

APPENDIX III: CENTRE-WISE STAFF POSITION

1. AAU JORHAT (ASSAM)

Main Centre, Jorhat

Chief Agronomist	Dr. Ajit Baishya
Jr. Agronomist	Mrs. J.R. Hazarika
Jr. Soil Scientist	Mr. B. Gogoi
Asst.Jr.Economist	Mrs. M. Borah
Technical Asstt.	Mr. B. Dutta
Field assistant	Mr. T. Gogoi
Field assistant	Mr. J.C. Dutta
Jr. Steno/UDC	Mr. A.B. Rajkonwar
Messenger	Mr. B. Kalita

On-Farm Centre, Karimganj

Agronomist	Mr. Ajoy Sankar Bora
Field assistant	Mr. R. Borah
Field assistant	Mr. D. Sarma
Field assistant	Mr. L. Khaund
Field assistant	Mr. A.K. Borthakur
Field assistant	Mr. B. Barman
Field assistant	Mr. Priyanku Dutta
Jr.Stenographer	Mrs. H. Kalita
Driver	Sri Suresh Boro
Watchman	Sri Bishnu Rabha

2. ANGRAU, HYDERABAD (A.P.)

Sub Centre, Maruteru

Agronomist	Dr. M. Srinivas
Technical Asstt.	A.S. Saibaba Reddy
Field assistant	Md.Khaja Babu
Field assistant	K. Viswanadham
LDC/Typist	M. Neelima

On-Farm Centre, Seetampet

Agronomist	Dr.K.Tejeswara Rao
Field assistant	Mr. T. Ramjogi/ Mr. N. Murali Mohan Rao
Field assistant	Mr. B.V.A. Satyanarayana
Field assistant	Mr. A.V. Ramana
Field assistant	Mr. K.Gopi
Field assistant	Mr. K. Jaganmohan Rao
Field assistant	Mr. T.D.M. Murthy
Jr.Stenographer	Vacant
Driver	Vacant
Watchman	Vacant

3. BAU, SABOUR (BIHAR)

Main Centre, Sabour

Chief Agronomist	Dr. S.K. Pathak
Jr. Soil Scientist	Sri Anupam Das
Jr. Agronomist	Dr. Sushant
Technical Asstt.	Mr. K.R. Raman
Field assistant	Vacant
Field assistant	Mr. Rajeev Kumar
Jr. Steno/UDC	Mr. A.P. Yadav
Watchman	Mr. Ganesh Ram

On-Farm Centre, Patna

Agronomist	Dr. D.K. Mahto
Technical Asstt.	Vacant
Field assistant	Mr. Gautam Prasad
Field assistant	Vacant
Field assistant	Vacant
Field assistant	Vacant
Field assistant	Vacant
Field assistant	Vacant
Jr. Steno/UDC	Vacant
Driver	Mr. Surendra Kumar
Watchman	Mr. Gajendra Mandal

4. IGKV, RAIPUR (CHHATISSGARH)

Main Centre, Raipur

Chief Agronomist	Dr. M.C. Bhambri
Jr. Soil Scientist	Mr. Anup Kumar Singh
Jr. Agronomist	Mr. Sunil Kumar
Technical Asstt.	Mr. B.K.Chandrakar
Field assistant	Mr. Dilip Kumar Verma
Field assistant	Vacant
Jr. Steno/UDC	Shri Gopal Yadu
Messenger	Shri Shivcharan yadav

On-Farm Centre, Kawardha

Agronomist	Dr. Chandresh Kumar Chandrakar
Technical Asstt.	Mr. Sanjeev Kumar Singh
Field assistant	Mr. D D Singh
Field assistant	Kanhaiya Jaiswal
Field assistant	Abhishek Patel
Field assistant	Omprakarh Patel
Field assistant	Vacant
Field assistant	Vacant
Jr. Steno/UDC	Vacant
Driver	Mr. Prasant Kumar Choure
Watchman	Mr. Gaindlal Nirmalkar

5. SDAU, S.K. NAGAR (GUJRAT)

Chief Agronomist	Dr. A.M. Patel
Jr. Soil Scientist	Mr. P.K. Patel
Jr. Agronomist	Shri A.K. Saini
Agril. Officer	Dr. Kunjal M Patel
Agril. Supervisor	Shri B.B. Patel
Agril. Supervisor	Shri M.G. Patel
Field assistant	Mr. C.B.Patel
Field assistant	Vacant
Sr. Clerk	Shri. K.R. Patel
Sr. Clerk	Shri. D.P. Patel
Messenger	Shri P.B. Fof

On-Farm Centre, Jagudan

Agronomist	Dr. S.K. Patel
Jr. Sci.(Eco)	Dr. R.R. Patel
Field assistant	Mr. A.K. Goswami
Field Assistant	Mr. A.G. Patel
Field Assistant	Mr. L.S. Chaudhary
Field Assistant	Mr. D.P. Parekh
Field Assistant	Mr. J.H. Chaudhary
Field Assistant	Mr. S.S. Patel
Jr. Stenographer	Mr. P.B. Joshi
Driver	Vacant
Watchman	Mr. G.K. Chaudhary

6. JAU, JUNAGADH (GUJARAT)

Sub Centre, Junagadh

Agronomist	Dr. B.M. Dabhi
Technical Asstt.	Shri R.B. Rakholia
Field assistant	Mr. C.T. Dalwadi
Field assistant	Vacant
Jr. Steno/UDC	Vacant

7. NAU, NAVSARI (GUJRAT)

Sub Centre, Navsari

Agronomist	Dr. L.J. Desai
Technical Asstt.	Vacant
Field assistant	K.G. Parmar
Field assistant	K.M. Patel
Jr. Steno/UDC	Vacant

8. AAU, ANAND (GUJRAT)

On-Farm Centre,Thasra

Agronomist	Vacant
Field assistant	Mr. R.S. Rana
Field assistant	Mr. M .M. Mori
Field assistant	Mr. S.S. Rathava
Field assistant	Mr. K.B. Raval
Field assistant	Mr. D.J. Gohil
Field assistant	Mr. V.H. Rathva
Jr. Stenographer	Vacant
Driver	Vacant
Watchman	Vacant

9. CCS HAU, HISAR (HARYANA)

Main Centre, Hisar

Chief Agronomist	Dr. R.K. Narwal
Asstt. Agronomist	Dr. Shweta
Sr. Soil Scientist	Dr. M.K. Sharma
Technical Asstt.	Vacant
Technical Asstt.	Vacant
Agriculture Inspector	Sh. Rajbir
Agriculture Inspector	Sh. Bajrang
Jr. Steno/UDC	Mr. M.L. Wadhwa
Messenger	Vacant

OFR Centre

Agronomist	Dr. Anil Mehta
Jr. Scientist (Ag. Econ.)	Vacant
Agriculture Inspector	Mr. Mahinder Singh
Agriculture Inspector	Sh. Sadhi Lal
Agriculture Inspector	Sh. Hariom
Agriculture Inspector	Mr. Sube Singh
Agriculture Inspector	Mr. Sat Narain
Agriculture Inspector	Sh. Gaya Lal
Clerk	Vacant
Driver	Vacant
Watchman	Vacant

10. CSK HPKVV, PALAMPUR (H.P.)

Main Centre, Palampur

Chief Agronomist	Dr. S.C. Negi
Jr. Soil Scientist	Vacant
Scientist	Dr. Pawan Pathania
Technical Asstt.	Mr. Deep Raj
Technical Asstt.	Sh. Manohar Lal
Field assistant	Sh. Bikram Singh
Field assistant	Mr. Bikram Singh
Jr. Steno/UDC	Vacant

On-Farm Centre, Kangra

Agronomist	Dr. S.K. Sharma
Field assistant	Sh. Ramesh Chand
Field assistant	Sh. Gurmeet Singh
Jr. Steno/UDC	Mr. Saran Das
Driver	Sh. Ashok Kumar
Messenger	Vacant

11. SKUAST, JAMMU (J&K)

Main Centre, Chatta, Jammu

Chief Agronomist	Prof. Dileep Kachroo
Jr. Soil Scientist	Dr. N.P. Thakur
Jr. Agronomist	Dr. Vijay Khajuria
Technical Asstt.	Mr. Mahesh Kumar
Technical Asstt.	Mr. Parshotam kumar
Field assistant	Mr. Bishan Lal
Field assistant	Mr. Ramesh Lal
Jr. Steno/UDC	Mrs. Rajni Bharti
Messenger	Mr. Tarsem Singh

OFR Centre, Jammu

Agronomist	Dr. A.K. Gupta
Field assistant	Kuldeep Sharma
Field assistant	Dheeraj Rajwal
Field assistant	Mr. A.W. Katoch
Field assistant	Mr. Ashwani Sharma
Field assistant	Mr. Ghulam Mohd.
Field assistant	Mr. Jai Krishan Baru
Jr. Steno/UDC	Mrs. Pardeep Kour
Driver	Mohd. Saleem
Watchman	Mohd. Yaqoob

12. BAU, RANCHI (JHARKHAND)

Main Centre, Ranchi

Chief Agronomist	Dr. M.S. Yadava
Jr. Soil Scientist	Mr. A.N. Puran
Jr. Agronomist	Mr.R.P. Manjhi
Technical Asstt.	Mr. Rakesh Mitra
Field assistant	Mr. M. Munda
Field assistant	Mr. Raju Gari
Jr. Steno/UDC	Mr. S.S. Jha
Messenger	Mrs. Deomani Devi

On-Farm Centre, Pakur

Agronomist	Mr. W. Aind
Technical Asstt.	Mr. Rakesh Kumar Sinha
Field assistant	Sh. K. Kalindi
Field assistant	Sh. S. Baitha
Field assistant	Sri D.S.K. Soy
Field assistant	Sh. Sakiullah
Field assistant	Sh. K. Oraon
Field assistant	Sh. B.L. Singh
Jr. Stenographer	Mr. Dinesh Toppo
Driver	Mr. Krishun Kujur
Watchman	Mr. Sarif Ansari

13. UAHS, SHIVAMOGA

Main Centre, Kathalelgere

Chief Agronomist	Dr. Kumara O.
Jr. Soil Scientist	Vacant
Jr. Agronomist	Mr. H.G. Sannathimm-appa

Technical Asstt.	Vijay S. Danaraddi
Technical Asstt.	Vacant
Field assistant	Vacant
Field assistant	Mr. P. Maheshwarappa
Jr. Steno/UDC	Vacant
Messenger	Vacant

14. UAS, BANGALORE (KARNATAKA)

On-Farm Centre, Bangalore

Agronomist	Dr. M.T. Sanjay
Jr.Scientist	Vacant
Field assistant	Mr. Manjunatha. N
Field assistant	Mr. Puttaswamy
Field assistant	Mr. Basavaraja
Field assistant	Mr. Nagaraja. B
Field assistant	Vacant
Field assistant	Vacant
Jr. Steno/UDC	Vacant
Driver	Vacant
Watchman	Vacant

15. UAS, RAICHUR (KARNATAKA)

Main Centre, Siruguppa

Chief Agronomist	Dr. Basavarajappa M.A.
Jr. Soil Scientist	Dr. Ashok Kumar Gaddi
Jr. Economist	Dr. Prabhuling Tewari
Technical Asstt.	Mr. Erappa Yankannvar
Technical Asstt.	Mr. Bhimanna Hugar
Field assistant	Mr. Somanagouda H.
Field assistant	Mr. Gangadhar Swami S.

16. UAS, DHARWAD (KARNATAKA)

On-Farm Centre, Gadag (Karnataka)

Agronomist	Dr. S.M. Hiremath
Field assistant	Mr. V.H. Jamadar
Field assistant	Mr. V.K. Hiremath
Field assistant	Mr. V.D. Kalawad
Field assistant	Mr. V.G. Chickmath
Field assistant	Mr. Anand Gouda Patil
Field assistant	Mr. Manoj Nandikolmath
Jr. Steno/UDC	Mr. R.N. Vagole
Driver	Mr. A.R. Mutalik Sir Desai
Watchman	Mr. A.M. Harinath

17. KAU, THRISSUR (KERALA)

Main Centre, Karmana (Thiruvandrum)

Chief Agronomist	Dr. P. Sukumari/ Dr. Jacob John
Jr. Soil Scientist	Dr. B. Rani
Jr. Agronomist	Dr. B. Jacob John
Technical Asstt.	Mr. Hirosh Kumar
Technical Asstt.	Sri. Thulaseedharan
Field assistant	Mr. Tomy Abraham
Field assistant	Mrs. K.S. Sujatha
Jr. Steno/UDC	Mrs. P.S. Sindhu
Messenger	Mr. K. Maniyan

On-Farm Centre, Thiruvella

Agronomist	Dr. Thomas Mathew / Dr. D. Jacob
Jr. Soil Scientist	Dr. D. Jocob
Field assistant	Mr. P.S. Sanal Kumar
Field assistant	Mr. K.O. Shahul Hamed
Field assistant	Mr. A.R. Venu
Field assistant	Sri. K.M. Eldo
Field assistant	Mr. Mathew Thomas.C
Field assistant	Vacant
Jr. Steno/UDC	Mr. Aneesh Kumar. M.
Driver	Vacant
Messenger	Mr. K.G. Pushpakumari

18. JNKVV, JABALPUR (M.P.)

Main Centre, Jabalpur

Chief Agronomist	Dr. V.K. Shukla
Jr. Soil Scientist	Vacant
Scientist Agronomy	Dr. R.P. Sahu
Technical Asstt.	Dr. S.K. Vishwakarma
Field assistant	Vacant
Field assistant	Vacant
Jr. Steno/UDC	Vacant
Messenger	Mr. N.L. Bhumiya

Sub Centre, Rewa

Agronomist	Dr. B.M. Mouya
Tech. Assistant	Vacant

Field assistant	Vacant
Field assistant	Vacant
Jr. Steno/UDC	Mr. S.K. Upadhyay

Sub Centre, Powerkheda

Agronomist	Dr. V.K. Singh
Tech. Assistant	Sh. P.S. Yadav
Field assistant	Vacant
Field assistant	Mr. Sudhir Dubey
Jr. Steno/UDC	Mrs. Sushila Jhariya

On Farm Centre, Dindori

Agronomist	Mr. D.N. Shriniwas
Jr. Economist	Vacant
Field assistant	Mr. V.R. Ghorke
Field assistant	Mrs. Jaya Kori
Field assistant	Vacant
Field assistant	Vacant
Field assistant	Vacant
Field assistant	Vacant
Jr. Steno/UDC	Vacant
Driver	Vacant
Watchman	Vacant

On Farm Centre, Katni

Agronomist	Dr. B.D. Ghode
Technical Asstt.	Vacant
Field assistant	Shri M.S. Prajapati
Field assistant	Vacant
Field assistant	Vacant
Field assistant	Vacant
Field assistant	Vacant
Field assistant	Vacant
Jr. Steno/UDC	Vacant
Driver	Vacant
Watchman	Vacant

19. RMVRSUA&T, GWALIOR (M.P.)

Sub Centre, Indore

Agronomist	Dr. S.K. Choudhary
Tech.Assistant	Mr. N.K. Sinha
Field assistant	Mr. R.K. Tamere
Field assistant	Mr. L.K. Pandey
Jr. Steno/UDC	Mr. N.K. Bangre

20. MPKV, RAHURI (MAHARASHTRA)

Main Centre, Rahuri

Chief Agronomist	Dr. B.S. Raskar
Jr. Agronomist	Vacant
Jr. Soil Scientist	Dr. V.S. Patil
Tech. Assistant	Mr. A.B. Dhage
Field Assistant	Mr. B.K. Jadhay
Field Assistant	Mr. K.T. Thorat
Jr.Stenographer	Mr. A.M. Chavan
Messenger	Vacant

On Farm Centre, Ganeshkhind (Pune)

Agronomist	Prof. M.M. Desai
Jr. Economist	Prof. Y.C. Sale
Tech. Assistant	Vacant
Field Assistant	Mr. S.P. Kahar
Field Assistant	Mr. R.P. Gangurde
Field Assistant	Mr. N.S. Kudal
Field Assistant	Mr. R.H. Rathod
Field Assistant	Mr. A.B. Nikrad
Field Assistant	Vacant
Jr. Stenographer	Miss. Chaskar
Driver	Vacant
Watchman	Vacant

21. DPDKV, AKOLA (MAHARASHTRA)

Main Centre, Akola

Chief Agronomist	Dr. N.D. Parlawar / Dr. (Mrs.) Mangala R. Ghanbahadur
Jr. Agronomist	Mr. B.S. Morwal
Jr. Soil Scientist	Mr. O.S. Rakhonde
Jr. Res. Assistant	Mrs. P. N. Kalane
Field Assistant	Mr. M.M. Deshmukh
Field Assistant	Vacant
Jr. Stenographer	Mr. B.W. Ahir
Messenger	Mrs. L.P. Ingle

Sub Centre, Hiwara

Agronomist	Dr. Varsha V. Tapre
Technical Assistant	Mr. A.B. Thakare
Field Assistant	Mr. S.D. Kadam
Field Assistant	Mr. R.S. Ghorpade

Field Assistant	Miss. Jyoti G. Khillare
Field Assistant	Miss Sharda G. Bunde
Field Assistant	Vacant
Field Assistant	Vacant
Driver	Vacant
Jr. Stenographer	Mrs. N.M. Akhatkar
Watchman	Mr. Y.S. Ghonmode

22. MAU, PARBHANI (MAHARASHTRA)

Main Centre, Parbhani

Chief Agronomist	Dr. W.N. Narkhede
Jr. Economist	Vacant
Jr. Soil Scientist	Mr. R.N. Khandare
Jr. Stenographer	Vacant
Tech. Assistant	Vacant
Field Assistant	Mr. G.Y. Sonwane
Field Assistant	Vacant
Messenger	Vacant

On Farm Centre, Aurangabad

Agronomist	Prof. S.B. Pawar (Additional charge)
Tech. Assistant	Dr. D.P. Deshpande
Field Assistant	Vacant
Field Assistant	Mr. S.K. Choudhari
Field Assistant	Mr. B.N. Ambad
Field Assistant	Mr. R.P. Kerai
Field Assistant	Mr. B.S. Kakade
Field Assistant	Mr. S.S. Mundhe
Jr. Stenographer	Vacant

23. DBS KKV, DAPOLI (MAHARASHTRA)

Main Centre, Karjat

Chief Agronomist	Dr. L.S. Chavan
Jr. Soil Scientist	Dr. D.G. Jondhale
Jr. Agronomist	Dr. N.V. Mhaskar
Technical Asstt.	Shri. A.B. Gaikwad
Technical Asstt.	Shri. D.J. Shet
Field assistant	Shri. N.P. Patil
Field assistant	Shri. J.P. Hambir
Jr. Steno/UDC	Shri. R.L. Bivalkar
Messenger	Shri. L.N. Hambir

On Farm Centre, Palghar

Agronomist	Dr. S.B. Bhagat
Field Assistant	Shri. S.V. Kamble
Field Assistant	Shri. V.S. Daphal
Field Assistant	Shri. N.H. Paradhi
Field Assistant	Shri. S.D. Phale
Field Assistant	Shri. S.R. Iware
Field Assistant	Shri. B.L. Shanwar
Jr. Stenographer	Shri. K.P. Malche
Driver	Vacant
Messenger	Mr. V.D. Zagade

24. OUAT, BHUBNESWAR (ORISSA)

Main Centre, Bhubaneswar

Chief Agronomist	Dr. Dilip Kumar Bastia
Jr. Agronomist	Dr. Alok Kumar Patra
Jr. Soil Scientist	Dr. Kshitiendra Narayan Mishra
Tech. Assistant	Mr. Dilip Kumar Rout
Tech. Assistant	Mr. Mahendra Kumar Dash
Field Assistant	Mr. Trinatha Rautaray
Field Assistant	Mr. Somonath Sahoo
Jr. Stenographer	Mr. Samir Kumar Mallick
Messenger	Mr. Gandharba Mahabhoi

Sub Centre, Chiplima

Agronomist	Mr. Jayadev Haldar
Tech. Assistant	Mr. Prafulla Kumar Mohanty
Field Assistant	Mr. Jaikrushna Behera
Field Assistant	Mr. Brajabandhu Chhanda
Jr. Stenographer	Vacant

On Farm Centre, Angul

Agronomist	Dr. Tushar Ranjan Mohanty
Jr. Economist	Vacant
Field Assistant	Mr. Kasinath Mallick
Field Assistant	Mr. Basanta Kumar Dash

Field Assistant	Mr. Biranchi Pradhan
Field Assistant	Mr. Dinesh Kumar Pattanayak
Field Assistant	Mr. Sujoy Kumar Dhir
Field Assistant	Vacant
Jr. Stenographer	Mr. Fulendu Kumar Behra
Driver	Mr. Baidhar Behra
Watchman	Mr. Purna Chandra Barik

On Farm Centre, Kendrapara

Agronomist	Dr. Susant Kumar Swain
Field Assistant	Mr. Trilochan Sahoo
Field Assistant	Mr. Ashok Kumar Kar
Field Assistant	Mr. Udaya Nath Mishra
Field Assistant	Mr. Kanhu Charan Lenka
Field Assistant	Mr. Ananda Chandra Sahu
Field Assistant	Vacant
Jr. Stenographer	Mr. Basant Kumar Nayak
Driver	Mr. Kailash Candra Mallick
Watchman	Mr. Dibakar Mallick

25. PAU, LUDHIANA (PUNJAB)

Main Centre, Ludhiana

Chief Agronomist	Dr. Sohan Singh Walia
Agronomist	Dr. C.S. Aulakh
Jr.Soil Scientist	Dr. Roopinder Singh
Tech. Assistant	Mr. Surender Kumar Sharma
Field Assistant	Mr. Balbir Singh
Field Assistant	Mr. Baljit Singh
Field Assistant	Mr. Prem Prakash
Jr.Stenographer	Mr. Ram Ji Dass
Watchman	Mr. Jagmohan Singh

On Farm Centre, Amritsar

Agronomist	Dr. Harpreet Singh
Field Assistant	Mr. Amrik Singh
Field assistant	Mr. Tarseem Dass
Field assistant	Mr. Gurdip Singh
Field assistant	Mr. Sukhdev Singh
Field assistant	Vacant
Field assistant	Mr. Harjit Singh
Jr.Stenographer	Mrs. Sukhdeep Kaur
Driver	Mr. Avtar Singh
Watchman	Mr. Danial

26. AU, KOTA

Sub Centre, Kota

Agronomist	Dr. J.P. Tetarwal
Tech. Assistant	Vacant
Field Assistant	Dr. Revati Singh Jatav
Field Assistant	Vacant
Jr. Stenographer	Sh. Abdul Salim

27. MPUAT, UDAIPUR (RAJASTHAN)

On Farm Centre, Udaipur

Agronomist	Dr. S.K. Sharma
Jr.Economist	Mr. Hari Singh
Field Assistant	Mr. N.S. Jhala
Field Assistant	Mr. Ramji Lal
Field Assistant	Mr. Madan Lal
Field Assistant	Mr. A.S. Rathore
Field Assistant	Vacant
Field Assistant	Vacant
Jr. Stenographer	Mr. Vishal Ajmera
Driver	Mr. Yogesh Chandra Damami
Watchman	Mr. Shanker Lal Nagda

28. SKNAU, JOBANER, (RAJASTHAN)

Main Centre, Durgapura

Chief Agronomist	Dr. A. K. Gupta / Dr. R. Sammauria
Jr. Agronomist	Dr. O.P. Meena
Technical Asstt.	Shri Ram Lal Nehra
Field assistant	Vacant
Field assistant	Sh. Nonand Singh
Jr. Steno/UDC	Vacant
Messenger	Vacant

On-Farm Centre, Fatehpur (Sikar)

Sr. Agronomist	Vacant
Agri Supervisor	Mr. Banwari Lal
Agri Supervisor	Mr. Chaju Ram Jat
Agri Supervisor	Vacant
Agri Supervisor	Vacant
Agri Supervisor	Vacant
Agri Supervisor	Vacant
Driver	Vacant
Jr. Steno/UDC	Vacant
Watchman	Vacant

29. PJTSAU, RAJENDERNAGAR, HYDERABAD

Main Centre, Rajendranagar

Chief Agronomist	Dr. M. Venkata Ramana
Jr. Agronomist	Dr. K. Suresh
Jr. Soil Scientist	Dr. S. Sridevi
Technical Asstt.	Vacant
Field assistant	Vacant
Field assistant	Vacant
Jr. Steno/UDC	Vacant
Messenger	Mr. G. Saibaba

Sub Centre, Rudrur

Agronomist	Smt. Firdoz Shahana
Technical Asstt.	M. Shekar
Field assistant	Vacant
Field assistant	Vacant
LDC/Typist	Vacant

On-Farm Centre, Warangal

Agronomist	Dr. Md. Lateef Pasha
Jr. Economist	Vacant
Field assistant	Mr. K.V. Subramanyam
Field assistant	Sh. P. Yadagiri
Field assistant	Vacant
Field assistant	Vacant
Field assistant	Vacant
Field assistant	Vacant
Jr. Stenographer	Mr. T. Laxmi
Driver	Sh. Shaik Shabbir
Watchman	Vacant

30. TNAU, COIMBATORE (TN)

Main Centre, Coimbatore

Chief Agronomist	Dr. K. Siddeswaran/ Dr. E. Somasundaram
Jr. Soil Scientist	Dr. K. Sathiya Bama
Jr. Agronomist	Dr. P.M. Shanmugam
Jr. Economist	Dr. V. Sarvanakumar
Tech. Assistant	Vacant
Field Assistant	Mr. A. Gowthaman
Field Assistant	Vacant
Jr. Stenographer	Mrs. K. Suguna
Messenger	Mrs. M. Vijayalakshmi

Sub Centre, Thanjavur

Agronomist	Dr. R. Marimuthu
Tech. Assistant	Vacant
Field Assistant	Ms. S. Chitra Devi
Field Assistant	M. Palanisamy
Jr. Stenographer	Mr. Mahalingam

On farm, Chettinad

Agronomist	Mr. P. Kathirvelan
Tech. Assistant	Vacant
Field Assistant	Mr. M. Baskarapandian
Field Assistant	Mr. P. Sakthivel
Field Assistant	Mrs. M. Punitha
Field Assistant	Mr. M. Periyasamy
Field Assistant	Mr. A.R. Sivamani
Field Assistant	Mr. M.K. Rajendran
Jr. Stenographer	Mr. S. Nagarajan
Driver	Mr. M. Radha
Messenger	Vacant

On farm, Paiyur

Agronomist	Dr. S. Vijayabaskaran
Tech. Assistant	Vacant
Field Assistant	Mr. A. Murugan
Field Assistant	Mr. D. Gnanandurai
Field Assistant	Mr. K. Mohandass
Field Assistant	Mr. R. Solai
Field Assistant	Mr. A. Ravichandran
Field Assistant	Mr. G. Mahalingam
Jr. Stenographer	Mr. R. Chitra

Driver	Mr. K. Murugesan
Messenger	Mr. C. Murugesan

31. CSAUAT, KANPUR (U.P.)

Main Centre, Kanpur

Chief Agronomist	Dr. Karam Husain
Jr. Soil Scientist	Dr. U.S. Tiwari
Jr. Agronomist	Dr. Y.K. Singh
Technical Asstt.	Mr. U.S. Yadav
Field assistant	Sri. Virendra Singh
Field assistant	Mr. Anil Kumar Singh
Jr. Steno/Sr. Clerk	Sh. Krishan Prakash
Messenger	Mr. Vijay Bahadur

On Farm Centre, Daleep Nagar

Agronomist	Vacant
Field Assistant	Mr. Sudhir Pratap Singh
Field Assistant	Mr. Jagdish Chandra
Field Assistant	Mr. R.B. Yadav
Field Assistant	Vacant
Field Assistant	Vacant
Field Assistant	Vacant
Jr. Stenographer	Vacant
Driver	Mr. Vijay Kumar
Watchman	Sh. Maan Singh

Main Centre, Faizabad

Chief Agronomist	Dr. N.B. Singh
Jr. Soil Scientist	Dr. Alok Kumar
Jr. Agronomist	Dr. R.A. Yadav
Technical Asstt.	Mr. Ishwar Nath
Technical Asstt.	Vacant
Field assistant	Mr. A. P. Singh
Field assistant	Mr. R. A. Pandey
Jr. Steno/UDC	Vacant
Messenger	Mr. Jag Jeevan

On Farm Centre, Ambedkar Nagar

Agronomist	Vacant
Field Assistant	Mr. A.N. Pandey
Field Assistant	Mr. P.C. Tripathi
Field Assistant	Mr. Tilak Ram
Field Assistant	Mr. V.B. Singh
Field Assistant	Vacant
Field Assistant	Vacant
Jr.Stenographer	Mr. Ram Lal
Driver	Mr. J.P. Yadav
Watchman	Mr. S.P. Singh

33. BHU, Varanasi (UP)

Sub Centre, Varanasi

Agronomist	Dr. J.S. Bohra
Tech. Assistant	Mr. Manoj Kumar Singh
Field Assistant	Vacant
Field Assistant	Vacant
Jr. Stenographer	Mr. Mohan Ram

34. RBS COLLEGE, BICHPURI (AGRA)

Agronomist	Dr. S.B. Singh
Tech. Assistant	Dr. Rahul Pundir
Field Assistant	Vacant
Field Assistant	Dr. Susheel Kumar Singh
Jr. Stenographer	Dr. Bhumi Raj Singh

35. GBPUAT, PANTNAGAR (UTTARAKHAND)

Main Centre, Pantnagar

Chief Agronomist	Dr. Rohitashav Singh
Jr. Soil Scientist	Dr. Ajeet Pratap Singh
Jr. Agronomist	Dr. Sumit Chaturvedi
Jr. Scientist	Dr. Devendra Singh
Tech. Assistant	Mr. Y.S. Khokar
Field Assistant	Mr. A.K. Tiwari
Field Assistant	Mr. M.P. Singh
Jr. Stenographer	Vacant
Messenger	Mr. Lalloo Singh

On Farm Centre, Jeolikot (Nainital)

Agronomist	Dr. D.K. Singh
Field Assistant	Mr. Gulsher Ahmed
Field Assistant	Mr. Virendra Singh
Field Assistant	Vacant
Field Assistant	Vacant
Jr.Stenographer	Vacant
Driver	Vacant
Messenger	Mr. Panjabi Mahato

36. BCKV, KALYANI

Main Centre, Kalyani

Chief Agronomist	Dr. Swapan Kumar Mukhopadhyay
Jr. Soil Scientist	Dr. Sushanta Saha
Technical Asstt.	Dr. Dilip Saha
Technical Asstt.	Mr. Basudeb Datta
Field assistant	Mr. Bipul Chandra Pal
Field assistant	Vacant
Jr. Steno/UDC	Smt. Sonali Rakhit
Supporting staff	Smt. Kanak Prava Biswas

On-Farm Centre, Kakdwip

Agronomist	Dr. Manabendra Ray
Jr. Economist	Dr. Soumitra Chatterjee
Field assistant	Mr. A.K. Bhaumik
Field assistant	Mr. K. Maiti
Field assistant	Mr. N. Das
Field assistant	Vacant
Field assistant	Vacant
Field assistant	Vacant
Jr. Steno/UDC	Mr. Nilanjan Mukherjee
Driver	Vacant
Supporting staff	Vacant

APPENDIX IV: SOIL FERTILITY STATUS AND NUTRIENT UPTAKE (2015-16)

Table A :Soil fertility status-Organic carbon (%) and available N,P and K (Kg/ha) after kharif/rabi/summer season in Exp No. 1(a)

Name of CSR centre	Season	Nut/treat	T1	T2	T3	T4	T5	T6	T7	T8	T9	T10	T11	T12
Rajendranagar	*Kharif*	OC%	0.61	0.63	0.55	0.59	0.58	0.62	0.65	0.62	0.59	0.58	0.55	0.62
		N	201.5	211.2	203.3	212.7	205.0	225.3	223.3	195.9	198.2	205.7	202.0	193.2
		P	29.2	39.2	27.0	39.7	31.7	34.0	31.5	33.3	35.6	29.1	29.9	35.9
		K	247.1	261.7	266.6	263.6	261.7	291.6	297.2	261.5	293.1	275.5	282.2	295.5
	Rabi	OC%	0.63	0.64	0.56	0.61	0.60	0.61	0.63	0.64	0.61	0.60	0.57	0.64
		N	189.4	198.6	209.4	223.3	211.1	232.0	230.0	201.7	204.1	197.5	208.0	199.0
		P	26.5	36.2	29.1	36.5	32.7	35.1	32.4	34.3	36.6	30.0	30.8	37.0
		K	259.5	274.8	279.9	276.8	274.8	306.2	285.4	253.6	307.7	289.3	296.4	301.2
Rudrur	*Rabi*	OC%	0.52	0.55	0.58	0.61	0.5	0.64	0.6	0.57	0.61	0.49	0.62	0.58
		N	221.5	205.8	188.5	189.4	215.5	197.9	187.8	179.7	181.5	228.9	197.2	201.6
		P	36.6	37.3	44.6	42.8	35	43.6	36.6	38.3	43.9	39.2	37.6	45.5
		K	473	457	507.4	389	359.1	401.7	408.7	427.7	418.3	464.7	436.6	407.3
Jammu	Summer	OC%	5.4	6.4	6.4	6.0	6.0	5.8	6.0	6.2	6.0	6.2		
		N	207.0	232.0	238.0	209.0	204.0	218.0	210.0	220.0	222.0	220.0		
		P	21.0	25.5	23.5	19.9	20.0	22.2	20.4	20.8	22.1	20.5		
		K	115.0	122.0	124.0	116.0	118.0	123.0	118.0	115.0	117.0	121.0		
Navsari	Summer	OC%	6.6	5.9	6.4	6.5	6.4	6.2	6.7	6.3	6.3	6.4		
		N	267.3	271.7	267.7	269.7	268.0	269.8	274.3	271.0	266.7	273.7		
		P	36.8	35.1	35.0	34.2	39.3	38.2	40.9	38.7	38.2	37.5		
		K	227.3	240.1	212.1	201.3	180.5	233.0	271.0	263.7	214.0	256.0		
Jorhat	Summer	OC gram/kg	6.33	6.33	6.75	6.75	6.89	5.7	6	7.17	6.72			
		N	255.33	281.03	270.01	279.31	285.3	294.92	279	311.37	296.52			
		P	7.68	7.54	8.21	8.74	9.04	9.4	8.72	10.56	9.35			
		K	83.5	75.33	76.67	81.74	80.62	84.42	85.18	95.48	89.53			
Karamana	*Summer	OC %	1.01	1.15	1.47	1.41	1.21	1.35	1.33					
		N	167.25	211.16	188.16	183.98	194.43	217.43	177.71					
		P	23.79	31.08	34.24	32.45	33.83	36.58	38.5					
		K	114.65	136.15	149.97	142.58	146.94	139.25	157.55					
Hisar	*Kharif*	OC%	0.5	0.4	0.5	0.5	0.4	0.5	0.4					
		N	163.3	147.0	158.7	161.0	151.7	154.0	147.0					
		P	18.0	18.7	18.0	18.7	19.3	20.3	17.3					
		K	213.7	238.9	222.3	272.7	249.9	230.3	237.7					

Contd..../-

Name of CSR centre	Season	Nut/treat	T1	T2	T3	T4	T5	T6	T7	T8	T9	T10	T11	T12
	Rabi	OC%	0.4	0.4	0.4	0.5	0.5	0.4	0.4					
		N	154.0	161.0	168.0	172.7	163.3	168.0	170.3					
		P	15.3	13.3	14.7	16.0	14.0	16.0	14.7					
		K	251.0	257.6	248.3	255.2	266.9	266.0	254.4					
	Summer	OC%			0.5	0.5		0.5						
		N			158.7	172.7		175.0						
		P			11.3	14.0		13.3						
		K			253.7	265.1		253.1						
Palampur	*Kharif*	OC%	1.2	1.2	1.3	1.5	1.3	1.3	1.4	1.5				
		N	163.8	326.4	270.4	219.4	299.4	306.1	218.5	228.8				
		P	71.2	49.9	66.7	89.4	76.2	67.5	76.4	73.6				
		K	152.7	85.2	105.6	114.4	105.6	192.7	130.1	115.2				
Parbhani	Summer	OC%												
		N	180.0	184.8	182.4	180.9	186.65	176.5	170.2	163.9				
		P	13.8	14.5	13.3	13.4	14.5	12.3	13.1	11.8				
		K	363.7	370.4	364.6	364.9	372.5	366.9	351.2	362.5				
Bhubneswar	Summer	OC%	0.8	0.8	0.7	0.7	0.8	0.7	0.7	0.7	0.8	0.8		
		N	305.7	302.5	296.7	284.1	293.6	285.9	295.3	291.6	296.9	297.9		
		P	14.0	13.7	13.8	13.0	13.5	12.3	13.6	12.5	13.9	13.8		
		K	134.4	136.7	131.7	127.5	132.9	129.1	132.4	128.7	134.8	135.2		
Chiplima	Summer	OC%	0.8	0.9	0.8	0.7	0.8	0.7	0.8	0.8	0.8	0.8		
		N	297.3	294.6	299.1	279.7	295.4	275.3	290.1	275.9	295.5	296.1		
		P	13.4	13.3	14.6	12.4	13.4	12.3	13.5	12.7	13.7	13.9		
		K	145.3	138.6	150.0	134.1	138.3	130.7	137.7	133.9	145.5	147.0		
		K	366	394	382	369	359	376	367	381	386	366		

Table B : Nutrient uptake N P and K kg/ha in exp no1(a)

Name of CSR centre	Season	Nut/treat	T1	T2	T3	T4	T5	T6	T7	T8	T9	T10	T11	T12
Rajendranagar	*Kharif*	N	83.9	43.6	87.4	42.6	97.7	82.3	100.7	99.6	68.8	94.1	32.3	79.6
		P	23.5	5.9	29.0	5.5	26.1	6.8	24.9	7.2	5.3	6.5	7.0	5.4
		K	77.3	39.3	83.3	38.4	82.7	49.1	82.8	50.8	26.1	50.2	43.7	40.2
	Rabi	N	30.1	43.2	61.3	82.4	46.1	78.9	54.8	40.3	42.7	13.9	61.1	115.5
		P	5.3	5.9	6.4	9.6	5.9	9.0	6.6	7.7	6.4	2.3	8.0	23.6
		K	11.7	47.2	19.6	29.0	51.3	26.1	23.1	70.9	56.7	6.0	24.6	89.1
Rudrur	*Kharif*	N	67.82	119.69	123.22	138.1	93.31	164.01	95	186.75	121.38	186.26	118.36	183.92
		P	15.99	36.43	24.8	8.64	8.32	16.55	7.49	24.6	30.89	19.65	23.84	21.37
		K	64.74	109.48	112.96	94.12	37.64	115.41	33.36	138.64	130.61	111.49	102.52	128.34
	Rabi	N	59.81	114.56	63.21	63.05	109.82	99.64	38.55	21.76	71.55	69.52	44.16	58.71
		P	14.3	20.4	12.6	7.34	18.9	12.7	5.94	4.51	11.1	13.8	18.45	7.34
		K	59.64	52.33	60.65	30.64	53.02	33.05	26.93	9.28	41.73	84.18	63.53	28.75
Navsari	*Kharif*	N	66.4	61.6	65.6	62.9	63.8	62.7	67.7	66.9	67.3	73.6		
		P	13.9	12.2	12.7	13.8	14.2	14.1	13.1	13.5	15.3	15.2		
		K	62.8	53.2	58.6	60.7	67.2	67.6	65.8	65.3	65.3	71.4		
	Rabi	N	15.5	53	69.6	45.1	54.6	61.9	0	21.9	23.8	59.2		
		P	1.6	11.7	12.7	4.5	6.3	21	0	3.9	5.9	9.5		
		K	3.4	87.3	34.4	6.9	10.5	82.2	0	30.2	23.3	69.1		
	Summer	N	0	28	47.8	29.8	0	0	82.9	56.2	69.1	11.1		
		P	0	4.6	6.9	4	0	0	10.4	7.6	8.1	1.8		
		K	0	19.5	32.5	42.9	0	0	29	33.6	51.9	10.2		
Jorhat	K+R	N	44.23	112.59	138.85	129.19	178.48	392.73	206.44	345.4	384.23			
		P	11.45	17.91	14.94	42.36	30.63	72.54	47.12	68.61	79.89			
		K	18.21	95.53	31.64	54	113.21	240.14	195.22	234.21	350			
Hisar	*Kharif*	N	93.38	124.68	98.75	Crop failed		103.9	71.69					
		P	20.62	15.27	22.22			23.78	17.69					
		K	164.81	145.02	174.96			188.26	149.07					
	Rabi	N	125.81	146.78	78.95	89.12	110.76	63.66	125.5					
		P	24.17	58.12	16.2	18.25	27.56	12.04	22.29					
		K	160.19	164.06	150.98	164.5	123.33	117.38	145.79					
	Summer	N			15.48	70.63		23.62						
		P			2.58	17.11		2.58						
		K			16.55	52.12		22.25						
Palampur	*Kharif- Rabi*	N	208.06	664.79	739.41	639.88	679.55	374.8	484.83	288.38				
		P	75.16	114.27	182.83	144.53	177.34	206.91	143.54	81.51				
		K	63.48	190.06	338.48	283.05	168.01	219.42	131.73	114.84				

Contd..../-

Name of CSR centre	Season	Nut/treat	T1	T2	T3	T4	T5	T6	T7	T8	T9	T10	T11	T12
Bhubaneshwar	*Kharif*	N	59.27	60.89	62.89	58.93	67.8	58.9	69.67	58.48	64.59	57.9		
		P	17.33	18.89	19.19	16.56	20.93	17.29	20.76	16.52	19.73	17.9		
		K	69.77	75.67	76.43	70.01	82.58	73.08	81.39	70.47	78.9	70.4		
	Rabi	N	81.8	87.99	98.08	232.84	68.56	198.29	34.74	517.96	543.82	142.38		
		P	9.43	11.51	11.8	42.13	11.92	34.97	4.53	67.58	61.14	25.43		
		K	23.61	38.91	29.55	212.25	52.67	208.84	56.65	395.31	379.37	139.36		
	Summer	N	0	24	227.21	98.85	152.78	35.51	222.69	22.84	189.27	159.3		
		P	0	2.75	17.44	21.56	11.39	7.95	15.91	1.74	14.06	11.32		
		K	0	8.9	114.27	116.21	75.48	15.74	111.99	18.77	93.02	79.35		
Chiplima	*Kharif*	N	58.71	56.39	65.52	57.2	63.4	53.74	63.65	56.76	65.78	59.79		
		P	18.03	17.47	19.95	17.26	19.77	16.64	19.36	17.83	20.66	19.16		
		K	73.55	71.23	79.9	71.25	82.99	68.24	80.8	76.26	86.23	81.12		
	Rabi	N	110.02	122.07	114.81	355.46	53.03	29.16	35	178	53.23	49.03		
		P	12.83	14.74	13.99	85.21	32.43	3.87	4.16	33.28	10.51	8.37		
		K	30.17	101.55	33.36	351.48	70.63	45.98	53.69	208.25	110.93	56.55		
	Summer	N	0	52.12	40.93	28.63	43.9	59.33	43.42	41.89	27.76	25.53		
		P	0	19.24	7.89	9.09	7.17	26.34	9.53	9.19	5.03	11.77		
		K	0	13.54	22.16	34.04	17.22	33.77	23.84	26.82	10.2	15.59		

ANNEXURES

Annexure I

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Annexure-II

PRICES (RS./Q) & CALORIE PER 100 GM FOR 2016-17

Crops	Price (Rs. q^{-1}) 2015-16	Price (Rs. q^{-1}) 2016-17	Cal./ 100 gm
All Fodders	150	165	16
All green manuring	250	275	16
Amaranthus	1250	1375	49
Arhar/Pigeonpea/ Redgram	**4625**	5560	335
Ashwagandha	**12500**	13750	45
Baby Corn	**2000**	2200	125
Barley	**1225**	1325	336
Beetroot	**1700**	1890	25
Berseem (seed)	**12500**	13750	344
Bitter Gourd	**500**	550	25
Blackgram/Urad	**4625**	5000	347
Bottle gourd (Lauki)	**725**	810	12
Brinjal	**1150**	1275	24
Broccoli	**3500**	3800	45
Bt. cotton			332
Buck Wheat			346
Cabbage	**725**	825	27
Capcicum	**2200**	2400	24
Carrot	**700**	770	48
Cassava	**1350**	1480	134
Castor	**3500**	3850	440
Cauliflower	**820**	900	66
Chandrasur	**2275**	2480	300
Chillies(green)	**2400**	2600	29
Clusterbean / Gaur	**1375**	1440	35
Coleus	**1800**	1980	86
Coriander(S)	**4200**	4400	288
Coriander(L)	**1325**	1460	49
Cotton(F-4/1180)	**3860**	3860	332
Cotton (H-1380)	**4160**	4160	332
Cowpea/Lobia(S)	**2400**	2600	323

Crops	Price (Rs. q^{-1}) 2015-16	Price (Rs. q^{-1}) 2016-17	Cal./ 100 gm
Cowpea (Veg.)pod	**1400**	1540	48
Cucumber	**1300**	1430	13
Cumin/SiyaZeera	**4600**	4800	356
Dolichosbean(pod)/ LabLab	**2220**	2420	48
EFY(Kalyani)	**1800**	1980	79
Fennel grain	**6400**	6800	31
Fennugreek (seed)	**4300**	4750	333
Fennugreek leaves/ spinach	**1200**	1320	49
Field bean	**2400**	2600	48
Fieldpeas/Veg.peas	**1500**	1650	93
Frenchbeans	**2400**	2640	26
Garlic	**4300**	4780	145
Ginger			67
Gram/Chickpea/ Bengalgram	**3500**	4000	360
Greengram/Moong	**4850**	5225	334
Groundnut	**4030**	4220	567
Guar			93
Horsegram	2850	3100	321
Indian bean			26
Isabgol	8500	9400	124
Jute stalk**	**2500**	3500	350
Kalongi			656
Kasni	**2550**	2750	33
Knolkhol	**875**	960	43
Ladyfinger	**1300**	1430	35
Lentil /Masur	3400	3950	343
Linseed	**3475**	3780	530
Lucerne grain			23
Maize(Grain)		1365	342
Maize (green cobs)	0.80/cob or 300/q	0.90/cob or 310/q	125

Crops	Price (Rs. q^{-1}) 2015-16	Price (Rs. q^{-1}) 2016-17	Cal./ 100 gm
Maize Sweet Corn	**1450**	1590	342
Marigold	**2100**	2310	4
Mentha			48
Methi			333
Mothbean			334
Rapeseed& Mustard	**3350**	3700	541
Gobi sarson/Hayola	**2275**	2475	541
Niger Seed	**3900**	3925	515
Oat	**1260**	1380	374
Onion (big)	**1175**	1290	50
Pea	**2650**	2850	315
Pea (veg.)	**1500**	1700	93
Pearlmillet/Bajra	**1330**	**1330**	361
Potato	**525**	750	97
Pumpkin	**875**	920	25
Radish (White)	**370**	410	17
Ragi/Fingermillet	**1650**	1725	328
Rajgira	**4275**	4850	319
Rajmash/Rajmah	**3025**	3320	346
Rice(coarse)*	**1410**	1470	346

Crops	Price (Rs. q^{-1}) 2015-16	Price (Rs. q^{-1}) 2016-17	Cal./ 100 gm
Ricebean fodder	**170**	180	16
Ridge /Round gourd	**1450**	1530	17
Safflower	**3300**	3700	356
Sesamum/Gingely/ Til	**4700**	5000	563
Sorghum/Jowar	**1570**	1625	349
Soyabean (b)	**2575**	2775	432
Soyabean (y)	**2600**	2775	432
Sugar beat	**625**	650	48
Sugarcane*	**230**	255	34
Summer Squash	**1125**	1250	16
Sunflower	**3800**	3950	620
Rice Basmati	**2800**	3200	346
Sweet Potato	**900**	1100	120
Tomato (green)	**1000**	1200	23
Toria/Raya/Ridgeguard	**3350**	3500	541
Turmeric	**2750**		349
Wheat	**1525**	1625	346
White gingely	**6500**	6700	563
Yam	**1700**	1825	79
Yardlong/Asaparagus bean	**1625**	1750	85

*** Fair and remunerative price**
Prices in bold are minimum support prices (MSP)

Annexure-III

BOTANICAL AND HINDI NAMES OF DIFFERENT CROPS BEING GROWN AT AICRP-IFS CENTRES IN DIFFERENT EXPERIMENTS

S.N.	Common name	Botanical name	Hindi Name
1	Ajwain/ Ajowan/ caraway	*Trachyspermum copticum*	Ajwain
2	Ashwagandha/ Indian Ginseng	*Withania somnifera* (L.) Dunal	Ashwagandha
3	Barley	*Hordeum vulgare L.*	Jau
4	Black caraway/ Fennel flower	*Nigella sativa* Sumac	Kalongi
5	Black gram	*Phaseolus mungo* L.	Urd/ Urd bean
6	Bottle gourd	*Lagenaria siceraria (Mol.)/ L. vulgaris* L.	Lauki
7	Brinjal/ Egg plant	*Solanum melongena*L.	Baigan
8	Broccoli	*Brassica oleracea (L.) var.* italica	Hari Phool Gobhi
9	Cabbage	*Brassica oleracea* (L.) var. capitata	Band gobhi/ Patta gobhi
10	Castor	*Ricinus communis* L.	Arandi
11	Cauliflower	*Brassica oleracea* L. var. botrytis	Phool Gobhi
12	Chickpea	*Cicer arietinum* L.	Chana
13	Chickpea/ Bengal gram	*Cicer arietinum* L.	Chana
14	Chicory	*Cichorium intybus* L.	Kasni
15	Chilli	*Capsicum annum* L.	Mirch
16	Cluster bean	*Cyamopsis tetragonoloba* L. Taub.	Guar/ Guar bean
17	Coriander	*Coriandrum sativum L.*	Dhania
18	Cotton	*Gossypium hirsutum* L.	Kapaas
19	Cowpea	*Vigna unguiculata* (L) Walp.	Lobia
20	Cumin	*Cuminum cyminum* L.	Jeera
21	Egyptian clover	*Trifolium alexandrinum* L.	Berseem
22	Fenugreek	*Trigonella foenum-graecum L.*	Methi
23	Finger millet	*Eleusine coracana (L.) Gaertn.*	Ragi/ Mandua
24	Garden Cress/ Water Cress	*Lepidium sativum L.*	Chandrasur
25	Garlic	*Allivum sativum L.*	Lahsun
26	Garlic	*Allium sativum* L.	Lehsun
27	Green gram	*Phaseolus radiatus (L.) Wilczek.*	Moong/ Moong bean
28	Groundnut	*Arachis hypogea* L.	Moongfali
29	Hyacinth bean/ indian bean	*Dolichos lablab* L./ *D. purpureus/ Lablab purpureus*	Seim
30	Indian Mustard	*Brassica juncea Coss.*	Sarson/ Raya
31	Indian rape	*Brassica campestris* L. var. Toria	Toria

S.N.	Common name	Botanical name	Hindi Name
32	Lady's finger/ Okra	*Abelmoschus esculantus*Moench.	Bhindi
33	Lentil	*Lens culinaris* Medikus	masoor
34	Linseed/ Flax/ Flax seed	*Linum usitatissinum L.*	Alsi
35	Maize/ Corn	*Zea mays* L.	Makka
36	Marigold	*Calendula officinalis* L.	Gainda
37	Mustard	*Brassica campestris* L. var. Yellow sarson/ Brown sarson	Sarson
38	Oat	*Avena sativa* L.	Jaee
39	Onion	*Allium cepa* L.	Pyaz
40	Pearl millet	*Pennisetum americanum L.*	Bajra
41	Pea/ Vegetable Pea	*Pisum sativum* L.	Matar
42	Pigeon pea	*Cajanus cajan* (L) Milsp.	Arhar/ Tuar
43	Potato	*Solonum tuberosum* L.	Aloo
44	Psyllium	*Plantago ovata* Forssk.	Isabgol
45	Pumpkin	*Cucurbita pepo* Duch.	Kaddu
46	Radish	*Raphanus sativus* L.	Mooli
47	Rape/ Oilseed rape	*Brassica napus* var. napus	Gobhi Sarson
48	Red/ Purple Amaranth	*Amaranthus cruentus* L.	Chaulai/ Ramdana/ Rajgira
49	Rice/ Paddy	*Oryza sativa* L.	Dhan
50	Ridge gourd/ Sponge gourd	*Lufa acutangula/ L. aegyptica/ L. cylindrica*	Torai
51	Sesame	*Sesamum indicum* L.	Til
52	Sorghum	*Sorghum bicolor (*L.) Moench.	Jowar
53	Soybean	*Glycine max* L. (Merr.)	Soybean
54	Spinach	*Spinacia oleracea* L.	Palak
55	Sugar beet	*Beta vulgaris* L.	Chukander
56	Sugarcane	*Saccharum officinarum* L.	Ganna
57	Sunflower	*Helianthus annus* L.	Surajmukhi
58	Sunhemp	*Crotolaria juncea* L.	Sanai
59	Sweet potato	*Ipomoea batatas (*L.*)* Lam.	Sakarkand
60	Tomato	*Solanum lycopersicum L./ Lycopersicon esculantum/ L. lycopersicum*	Tamatar
61	Turmeric	*Curcuma longa* L.	Haldi
62	Wheat	*Triticum aestivum* L. emend. Fiori & Paol.	Gehun

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