MANUAL ON INTEGRATED FARMING SYSTEMS

(Proceedings of the Launching Workshop of Integrated Farming Systems-cum- Group Meeting of Scientists of AICRP on IFS held at Thiruvananthapuram, Kerala, from 6th to 9th March, 2010)

EDITORS

Dr. B. GANGWAR
Project Director, PDFSR, Modipuram

Dr. KURUVILLA VARUGHESE
Chief Agronomist
AICRP on IFS (KAU)

Dr. JACOB JOHN
Associate Professor (KAU)

Dr. B. RANI
Associate Professor (KAU)

Dr. M. VIJAYAN
Professor (KAU)

Dr. THOMAS MATHEW
Associate Professor-ECF(KAU)

KERALA AGRICULTURAL UNIVERSITY
CROPPING SYSTEMS RESEARCH CENTRE
Karamana, Thiruvananthapuram- 695 002
&
PROJECT DIRECTORATE FOR FARMING SYSTEMS RESEARCH
Modipuram, Meerut- 250 110

This publication is funded by NABARD

Publishers :

Kerala Agricultural University (CSRC, Karamana)
Thiruvananthapuram - 695 002, Kerala
and Project Directorate for Farming Systems Research
Modipuram, Meerut - 250110, U.P.

Layout & Printing :

St. Joseph's Press
Thiruvananthapuram - 695 014
Ph : 0471-2322888

K.R. Viswambharan
Vice Chancellor
Kerala Agricultural University
Vellanikkara, KAU P.O., Thrissur - 680 656

FOREWORD

Land being a limiting factor under smallholder farming conditions, the farmer cannot depend on a single crop or commodity to maximize productivity from his holding. It is for these populous small holders that integrated farming practices are becoming increasingly important. Integrated farming systems with a high degree of diversity are likely to be more stable and give the farmer more security, provided the components are chosen well. Functional diversity can be achieved by combining plant and animal species that have complementary characteristics and are involved in positive, synergistic interactions. In small holdings, enterprises like cattle, goat rearing, poultry, fisheries, mushroom and sericulture can add to the pool of income and organic residues. Dynamic equilibrium amongst these can sustain the system.

In many countries, developmental activities and extension work still focus mainly on single crops instead of using the integrated or whole-farm or systems approach needed for the complex and diverse farming systems. The objective should be to improve whole farm productivity through integration of mutually beneficial productive elements/subsystems, enhance recycling of all agricultural wastes directly or through composting, minimize the use of external farm inputs especially pesticides, adopt integrated management of pests, weeds and diseases, maximize the use of local or locally adapted seeds/breeds etc. and associated knowledge systems, and ensure food and nutritional securities for farm households.

In this context, this "Manual on Integrated Farming Systems "will be of immense use to the scientists and development personnel involved in the analysis and development of integrated farming systems throughout the nation.

I appreciate the efforts of the All India Coordinated Research Project on Integrated Farming Systems and the scientists under it in bringing out this Manual which will serve as an effective guide in undertaking multidisciplinary research and developing integrated farming systems in India. I congratulate all the scientists who contributed to this scientific publication and wish them all success.

31/8

K.R. Viswambharan

PREFACE

The Manual on Integrated Farming Systems is a congregation of concepts and approaches in Integrated Farming Research that had evolved during the Launching Workshop of All India Coordinated Research Project on IFS organized by the Project Directorate for Farming Systems Research (ICAR), Modipuram, Meerut, and hosted by the Kerala Agricultural University at Trivandrum from 6th to 9th March 2010.

AICRP on Integrated Farming System has been looked forward to, for some time, and was approved by the Expenditure Finance Committee of the Department of Agricultural Research and Education, Government of India. This mode of research can be achieved by AICRP by reorienting research in its ongoing project on Cropping System as a plan scheme during the XIth Plan period with the aim of attaining economic and ecological sustainability in agriculture.

The inauguration of this workshop was done by the Hon'ble Minister for Agriculture, Government of Kerala, Shri. Mullakkara Ratnakaran in the presence of Dr. A.K. Singh, Deputy Director General (NRM) ICAR, Vice-Chancellor of SAUs, Directors of Research of SAUs, Directors of ICAR Institutes and invited delegates from all parts of the country.

The technical programmes on Integrated Farming System submitted by centres were critically examined by the expert committee and discussed in the house in relation to the specific situation of their respective region. The finalized technical programme for each centre finds a place in this manual.

Policy and methodological issues of IFS were highlighted by Dr. I.C. Mahapatra, former Vice-Chancellor of BAU, Ranchi and OUA & T Bhubaneswar in the inaugural session. He had vividly explained the roadmap and strategy for IFS that has to be followed in its planning and research. Dr. J.P. Singh and Dr. S.P. Singh of PDFSR, Modipuram has contributed thought provoking inputs.

The organizers of the workshop express a deep sense of gratitude to the Vice-Chancellor of Kerala Agricultural University Shri. K.R. Viswambharan, who is a towering spirit and has enabled us to organize this workshop under a short notice in a befitting manner. We are also thankful for his kind foreword offered for this publication. The help received from the staff of Kerala Agricultural University is also acknowledged. Special thanks are due to Dr. D. Alexander, the then Director of Research, and Dr. P. Sivaprasad, Zonal Associate Director of Research, Kerala Agricultural University for their co-operation and guidance.

This event was sponsored by a number of Agencies involved in the development of agriculture. Special thanks are due to NABARD for the full financial assistance in bringing out this publication. The substantial financial assistance from Kerala State Horticulture Mission is also deeply acknowledged.

Trivandrum
31.08.2010

EDITORS

भारतीय कृषि अनुसंधान परिषद
कृषि अनुसंधान भवन-II, पूसा, नई दिल्ली 110 012

INDIAN COUNCIL OF AGRICULTURAL RESEARCH
KRISHI ANUSANDHAN BHAVAN-II, PUSA, NEW DELHI - 110 012

डॉ. अनिल कुमार सिंह
उप महानिदेशक (प्रा सं प्रा)

Dr. Anil Kumar Singh
Deputy Director General (NRM)

Ph.: 91-11-25848364 (O), 25843496, 25849786 (R)
Fax: 91-11-25848366
E-mail: aksingh@icar.org.in; aks_wtc@yahoo.com

MESSAGE

The present day agriculture in the country is at crossroads with new challenges and opportunities. Unchecked population growth, urbanization and industrialization, are resulting in a decline in per capita availability of vital agricultural resources, degradation of natural resources and fragmentation of farm holdings making them operationally uneconomic. Majority of our farmers (>80%) belong to the category of marginal to small landholders. Improving household food security has been an issue of supreme importance to them who constitute 71.2 million marginal (1.0 ha), 21.6 million small (1.0-2.0 ha) and 14.3 million semi-medium (2.0-4.0ha) farm holdings making together 92.6 per cent of the 155.6 million operational holdings. The process of marginalization of land holdings is likely to continue due to various socio-economic constraints.

Improvement in productivity, input efficiency, reducing cost of cultivation and creating opportunities for gainful employment of rural masses have to be necessarily competitive. To meet these challenges and fulfill the requirements of adequate healthy and nutritious food, feed, fodder and other commodities vis-a-vis resource sustainability and improvement of farmers' economy, it will be imperative to pursue research in farming system mode. Optimization of various agriculture components and their integration for multi-enterprise farming systems under diverse farming situations and farm categories will be of paramount importance. Moreover, our national scenario is clearly indicative of the fact that normally, a farming family maintains multi-enterprises systems, depending upon his/her family requirements, knowledge base, socioeconomic setup, agro-climatic conditions and available farm resources. However, to have a systematic integration of multi enterprise systems in a scientific manner, components need to be chosen in such a manner that product or by-product of one component becomes the input for other, becoming complementary and are organically well interlinked to each other without wastage. Farming systems approach for agricultural research may be one alternative to harness the complementarities and synergies among different enterprises and augment the total productivity, profitability and gainful rural employment.

To deliberate on all these issues and to finalize the road map and strategies for IFS research under AICRP on IFS, a 'Brain Storming Session - cum - launching workshop of Integrated Farming Systems Programme' was convened by PDFSR at Thiruvananthapuram on 6-7 March, 2010. I am happy that the proceedings of this meeting are being published in a book form with financial support of NABARD, which would serve as a guide to all the scientists involved in the IFS research, planners and institutions involved in agricultural development through farming system perspective. Dr. Kuruvilla Varughese, Chief Agronomist AICRP-IFS centre, Karamana (Trivandrum) and Dr. B. Gangwar, Project Directior, PDFSR, Modipuram deserve a special word of appreciation for their sincere effort and I wish all success to them in their endeavour.

(A.K. Singh)

30 August 2010

NABARD

MESSAGE

I am extremely happy to learn about the National Level Workshop organized by the Kerala Agricultural University on Integrated Farming Systems.

An integrated approach to farming as compared to existing monoculture approaches has several distinct advantages. Agricultural systems that integrate livestock and crop production could provide answers to food and nutritional security issues. I am happy that Kerala Agricultural University has organized a workshop on the subject to share research findings, to standardize protocols and prompt loud thinking on the subject.

NABARD has been supporting Kerala Agricultural University in their research efforts which have direct and immediate bearing on farming practices.

I appreciate the efforts at documenting the proceedings of the workshop and hope that learning points from the workshop will eventually translate into improved farming practices at the field level.

K C Shashidhar
Chief General Manager
NABARD
Kerala Regional Office

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CHAPTER - 1

INTRODUCTORY SPEECH

B. Gangwar, Project Director

Project Directorate for Farming Systems Research, Modipuram, Meerut-250 110

Hon'ble Chief Guest and Minister for Agriculture, Government of Kerala, Shri Mullakkara Ratnakaran, respected Deputy Director General (NRM), ICAR, Dr A.K. Singh, respected Vice Chancellor of Kerala Agricultural University Shri K.R. Viswambharan, Dr I.C. Mahapatra, Dr G.B. Singh, Hon'ble Vice Chancellors and Directors of Research from different Universities, Directors of participating ICAR Institutes, other dignitaries in the hall, Chief Agronomists of AICRP on Integrated Farming Systems, representatives of Press and Media and Ladies and Gentlemen;

First of all, I would like to take this opportunity to welcome you all to this very important event taking place in the history of AICRP on Integrated Farming Systems. We consider this as a formal beginning point of a long cherished dream of Coordinated Research on Integrated Farming Systems under National Agricultural Research System, which was overdue. In fact, originally this event was supposed to be organized some time during 2009 but, due to one or the other reason it was postponed several times. Finally, we are here at Trivandrum to discuss the key issues involved and to decide the road map for AICRP on Integrated Farming Systems. For this I would like to express my deep sense of gratitude to our respected Director General, Dr S. Ayyappan, who was kind enough to extend his consent to chair this brainstorming session, but due to the on-going parliament session his presence at headquarters is unavoidable and so he is not personally able to grace this occasion. However, his hearty blessings are with us. In fact, he has lot of expectations from our Directorate in general, and AICRP on IFS in particular. I am sure that with the able guidance and blessings of our DG and DDG (NRM) Dr A.K. Singh, we will be able to achieve our goals in a meaningful manner. I am also thankful to the respected Vice Chancellor of Kerala Agricultural University, Shri K.R. Viswambharan, for agreeing to our proposal to host these two events at such a short notice. Most of you are aware that this brain storming session is a sequel to a recommendation of last 'Annual Conference of Vice Chancellors of SAUs' held during 24-25 February 2009, which was based on a presentation on 'Integrated Farming Systems Research' by our respected Deputy Director General (NRM), Dr A.K. Singh.

For the information of the house, I would like to mention that the Expenditure Finance Committee of the Department of Agricultural Research and Education, Govt. of India, did approve the AICRP

on Integrated Farming Systems by reorienting the on-going project of AICRP on Cropping Systems, as a plan scheme during XIth Plan period. Under the revised scheme, a total of 31 centres have been approved to undertake IFSR programme. Out of these 31 centres, 25 centres were already operational at different SAUs as main centres of Cropping Systems Research, whereas one sub-centre at BHU, Varanasi has also been assigned the responsibility of IFS research without any extra posts of scientific or technical staff. The remaining five centres are located at ICAR Institutes without any regular posts. Under the scheme 11 on-station research sub-centres and 32 on-farm research centres would continue, for the time being, to work on cropping systems research. However, in a phased manner, we would like to take up research in farming system mode at all these centres also. The objectives of IFS research would be:

- Characterization of 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 relative efficiencies of the IFS models in terms of economics, resource use and energy.
- To optimize individual components of IFS in regional perspective
- Capacity building of stakeholders in Integrated Farming Systems through appropriate trainings.

Many a times a question has been raised: Why integrated farming systems research? In this regard it will not be out of place to mention that currently, agriculture in the country is experiencing new challenges and opportunities. Phenomenon of unchecked population growth, urbanization and industrialization are leading to decline in per capita availability of vital agricultural resources and also fragmentation of farm holdings, making them operationally uneconomic. Majority of our farmers at national level (82%) belong to the category of marginal and small categories. Improving household food security has been an issue of supreme importance to them who constitute 71.2 million marginal (< 1.0 ha) and 21.6 million small (1.0-2.0 ha) farmers.The process of marginalization of land holdings is likely to continue further due to various demographic reasons. The per capita arable land has decreased from 0.34 ha in 1950-51 to 0.15 ha in 2000-01 and is expected to shrink to 0.08 ha in 2025. On the other hand, with more intensive agriculture, there has been a rising stress on natural resources in several parts of the country. Intensified agriculture, coupled with indiscriminate use of irrigation water and non-judicious fertilizer application, especially in irrigated areas of the country has led to various kinds of physical and chemical degradation of the soils. While depletion in soil fertility status, as characterized by emergence of multi-nutrient deficiencies, continues to be the most significant soil related problem, other important ones are spread of area under salinity, alkalinity and water logging.

Improvement in productivity, input use efficiencies, reducing cost of production and creating opportunities for gainful employment of rural masses have become essential to be competitive. To meet these challenges and fulfill the requirements of adequate healthy and nutritious food, feed, fodder and other commodities vis-a-vis resource sustainability and improvement of farmers' economy, it will be imperative to pursue research in farming system mode. Optimization of various agricultural components and their integration for multi-enterprise farming systems, development of sustainable farm practices for enhanced soil health, water and nutrient-use-efficiencies under diverse farming situations and farm categories will be of paramount importance.

On the other hand, our national scenario is clearly indicative of the fact that normally a farm family maintains multi-enterprise systems, depending upon his/her family requirements, knowledge base, socioeconomic setup, agro-climatic conditions and available farm resources. However, to have a

systematic integration of these multi-enterprise systems in a scientific manner, components need to be chosen in such a way that the product or by-product of one component becomes the input for the other, are complementary and are organically well interlinked to each other without wastage.

It is in this context that the present IFS Research programme is being taken up. However, I should emphasize here that farming system research approach requires an inter-disciplinary dedicated team with a mix of enterprises as they exist. As many of my colleagues may be knowing, the present scheme is being implemented within the existing framework of erstwhile scheme of 'AICRP on Cropping Systems' spread all over the country. Now, for the successful execution of the programme, each center will constitute multi-disciplinary team (5-6 members), under the leadership of a Chief/ Senior Agronomist and would comprise of scientists of crop husbandry, agricultural economics, soil science, horticulture (floriculture/ pomology/ olericulture), livestock production management (piggery/ goatery/ rabbitry/ poultry/ quails/ turkey/ duckery/ fishery) etc. In addition, I would urge upon the Hon'ble Vice Chancellors of all the concerned Universities to associate some additional scientists in other critical areas like veterinary science, plant pathology, post-harvest technology, food technology or any other need-based discipline on voluntary basis to facilitate the successful execution of the project.

As far as the progress made so far is concerned, I would like to inform this august house that:

- Proposed Technical Programme from all the 31 centers has been received and scrutinized at PDFSR. It will be discussed, fine-tuned, finalized and modalities of implementation will be worked out in the launching workshop tomorrow.
- While finalizing the technical programmes we have to decide that the number of major components would not be more than 3-4 locally practiced enterprises. However, to improve upon the household incomes, some new components may be required to be introduced into the existing farming systems in modular manner. But it would be ensured that the suggested new modules are farmer-friendly, cost-effective and socially acceptable to them.
- To improve upon the value addition and post harvest aspects of produce, strong linkages are being developed with the CIPHET, Ludhiana, and the Coordinator of AICRP on Post Harvest Technology, Dr S.K. Nanda, is here to help us in the programme.

With these few thoughts, I wish to once again thank everyone and request, whosoever is present here to contribute for the noble cause of shaping and fine-tuning our Farming Systems Research Programme at the National level. There should not be any doubt that Farming Systems Research would become a major focus for research in India and other developing countries during the years to come and this particular event will prove to be a milestone in this direction.

Thank you

CHAPTER - 2

POLICY AND METHODOLOGICAL ISSUES

Road Map and Strategy for Integrated Farming Systems Research in India

I.C. Mahapatra

Founder Vice Chancellor Birsa Agricultural University, Ranchi, Former Vice Chancellor, Orissa University of Agriculture, & Technology, Bhubaneswar and Chairman, RAC, PDFSR, Modipuram (ICAR)

Introduction

To meet the multiple objectives of poverty reduction, food security, environmental soundness and sustainability, especially for small and marginal farmers in developing countries, "farming systems research" has been widely recognized as the agricultural production strategy. A farming system is the result of complex interactions among a number of inter-dependent components, where an individual farmer allocates certain quantities and qualities of four factors of production, viz. land, labour, capital and equipments to which he has access (Mahapatra, 1994). Farming System Research is considered a powerful tool for natural and human resource management in developing countries such as India. This is a multidisciplinary whole-farm approach and very effective in solving the problems of small and marginal farmers. The approach aims at increasing income and employment from small-holdings by integrating various farm enterprises and recycling crop residues and by-products within the farm itself (Behera and Mahapatra, 1999).

The Indian economy is predominantly rural and agricultural, and the declining trend in size of land holding poses a serious challenge to the sustainability and profitability of farming. In view of the decline in per capita availability of land from 0.5 ha in 1950-51 to 0.15 ha by the turn of the century and a projected further decline to less than 0.1 ha by 2020, it is imperative to develop strategies and agricultural technologies that enable adequate employment and income generation, especially for small and marginal farmers who constitute more than 80% of the farming community. "The crop and cropping system" based perspective of research needs to make way for "farming systems" based research conducted in a holistic manner for the sound management of available resources by small farmers (Jha, 2003). With the gradual shrinking of land holding, it is necessary to integrate enterprises like livestock, dairy (fishery, poultry, duckery) apiary, field and horticultural crops, etc. within the bio-physical and socio-economic environment of the farmers to make farming more profitable and

dependable. No single farm enterprise is likely to be able to sustain the livelihood of small and marginal farmers without resorting to integrated farming systems (IFS) for the generation of adequate income and gainful employment year round (Mahapatra, 1992; 1994). Farming system approach, therefore, is a viable approach to address the problems of sustainable economic growth for farming communities in India.

The basic aim of IFS is to derive a set of resource development and utilization practices which lead to substantial and sustained increase in agricultural production. There exists a chain of interactions among the components within the farming systems and it becomes difficult to deal with such inter-linking complex systems. This is one of the reasons for slow and inadequate progress in the field of farming systems research in the country. This problem can be overcome by construction and application of suitable whole farm models. However, it should be mentioned that inadequacy of available data from the whole farm perspective currently constrains the development of whole farm models.

Integrated farming systems are often less risky and, if managed efficiently, benefit from synergisms among enterprises, diversity in produce, and environmental soundness. On this basis, IFS models have been suggested by several workers for the development of small and marginal farms across the country (Rangaswamy et al., 1996; Behera and Mahapatra, 1999; Singh et al., 2006).

"Farming System" is a complex inter-related matrix of soil, plants, animals, implements, power, labour, capital and other inputs controlled in parts by farming families and influenced to varying degrees by political, economic, institutional and social forces that operate at many levels" (Mahapatra, 1992). "The household, its resources and resource flows and the interactions at the individual farm levels are together referred to as a farming system" (FAO, 2001).

Why Farming Systems Research

During the last 4-5 decades of agricultural research and development in India, major emphasis has been given to component and commodity based research projects for developing crop varieties, animal breeds and farm implements etc, mostly conducted in isolation and at the institute level (Behera *et al.*, 2004). This component, commodity and discipline based research has proved largely inadequate in addressing the multifarious problems of small farmers (Jha, 2003). Due to such approaches, several ills have appeared in Indian farming, such as decreasing factor productivity, resource use efficiency and declining farm profitability and productivity (Sharma and Behera, 2004). Environmental degradation including ground water contamination and entry of toxic substances into the food chain has become a significant problem. To tackle such problems, farming systems approaches to research has been widely recognized.

Farming system refers to particular arrangement of enterprises that are managed in response to physical, biological and socio-economic environmental factors and in accordance with farmer's goals, preferences and resources. In farming system approach to research the whole farm rather than single farm enterprise is taken into consideration, while decisions are taken for technology adoption and production activities. In this approach the whole farm is viewed as a system and interactions among the various components are taken in to consideration (Mahapatra and Behera, 2004).

Major Focus in Farming Systems

FSR integrates the following key activities and concepts into a coherent research process designed to overcome the perceived weaknesses in main stream agricultural research.

- It is problem solving
- FSR is farmer oriented
- FSR is system oriented
- FSR is inter disciplinary
- FSR complements mainstream commodity and disciplinary agricultural research
- On Farm Research is central to FSR approach

Determinants of Farming Systems

Key determinants are

- Natural resources (climate, soil, biodiversity)
- Natural calamities (Floods, drought, cyclones)
- Science & Technology
- Trade liberalization
- Market development
- Farm size
- Farm resources
- Policies
- Institutions
- Public goods
- Human capital
- Indigenous Technical Knowledge
- Consolidation of holding
- Land tenure system
- Storage & transport
- Road connectivity
- Pricing policy
- Supply & Services
- Credit input & Technology delivery systems

Components of Integrated Farming System

- Crops and Cropping Systems
- Food, Fodder, Fibre, Fuel
- Pulses, Oilseeds
- Fruits, Vegetables, Flowers
- Medicinal & Aromatic plants
- Commercial crops (Sugarcane, Spices, Tea, Coffee, Rubber)
- Livestock (Cattle, Buffaloes, Goat, Sheep and Pigs)
- Dairy
- Poultry
- Duckery
- Fishery
- Agroforestry
- Apiary

- Sericulture
- Mushroom
- Biogas

Methodology of IFS Research

- Whole farm approach as against piece-meal approach
- Multiple Criteria Decision Making Techniques for designing IFS under a given set of conditions
- Optimization Techniques through
  - Linear Programming
  - Compromise programming for resource allocation under various constraints.
- Traditional Farming Systems for biodiversity conservation and climate change adaptation & mitigation.
- Interrelationship among various components of IFS.
- On Farm Adaptive Research (OFAR) on IFS in all the Zonal Research Centers and farmer's fields in collaboration with KVKs & SAUs.
- Policy interventions for small and marginal farmers.

IFS Models for Tribal Farming Systems in Hills / Mountains

- Globally Important Agricultural Heritage
- Biodiversity, Bioresources and Biotechnology in relation to IFS
- Conservation of bioresources
- Community management of Medicinal & Aromatic Plants
- Livelihood enhancement of tribal poor through sustainable NRM & Capacity Building
- Forest Food Plant Conservation
- Mangrove Conservation and Management, IFS in Mangrove Swamps

IFS models for important Agro-ecosystems in India

- Irrigated
- Rainfed / dryland
- Coastal
- Hill & mountain
- Desert

Objectives of OFAR

- To reduce the yield gap between the experimental stations and farmers' fields
- To measure the impact of technology under varying biophysical and socio-economic constraints.
- To identify the key components of technology which can help increase farm income.
- To characterize and quantify the factors responsible for yield gap.
- To measure the extent of acceptability of technology by the farmers.
- To study the applicability of the technology under wide range of conditions.
- To study the stability in production and profitability from a given technology.
- To determine the scale neutrality of the technology.
- To refine the technology suiting to the local conditions.

- To identify and resolve location specific problems through diagnostic survey.

Steps in OFAR

So far, in the formulation of research programme either for 'On Station' or 'On Farm' trials, there has been a "top-down" approach. But the strategy for "On Farm Adaptive Research" (OFAR) has to be a "bottom-up" approach. In the OFAR the following four steps are involved:

- Description and diagnosis of production constraints in the existing cropping system / farming system of the target area.
- Design (relevant technology)
- Testing
- Extension

Out put of OFAR

- Quantifying the factors responsible for yield gap at a location.
- Identifying the key components of technology which can help to increase farm income.
- Refining the technology suited to the local conditions.
- Applicability of the technology under wide range of conditions.
- Measuring the extent of acceptability by the farmers.
- Measuring impact under varying bio-physical and socio economic constraints

Extensive / Massive IFS demonstrations

- In recent years transfer of technology is one of the major bottlenecks in enhancing the agricultural productivity in India. According to recent National Sample Survey Organization's report, even after 62 years of independence, 60% of the farmers have no accesses to technology not withstanding extension work of ATMA, mass media, extension net work, Kissan Call Centres, KVKs and Agricultural Clinics.
- In case of Orissa State, 75% of the farmers have no access to modern agricultural technology. Out of 25% of the farmers who have been marginally benefited by the various agencies, the VLWs (village level workers) have contributed to 6.3%, Radio (6.0%), Television (6.3%), Newspapers (3.9%), others like, input dealers/progressive farmers (3.1%). Things are really bad for the country as a whole and more so in Orissa. The role of VLWs and Extension Officers of all the State Government Line Departments and that of Krishi Vigyan Kendra (KVKs) should be thoroughly reviewed.
- KVKs are primary links to inform farmers about the latest Agricultural Technologies and their application. Several soil-testing laboratories have been sanctioned for the KVKs under SAUs. Cultivation of electronically mediated knowledge and skill revolution is a highly potential strategy to reach the farming community with the speed, the goals of productive, profitable, stable and competitive agriculture. There is need for a well developed dynamic information infrastructure and effective agricultural innovation system. Neglect of agricultural sector shall jeopardize economy.
- The agricultural extension system needs to be revamped because it has collapsed. This is too serious an issue. The knowledge of Extension Workers needs to be up-dated through On Farm Adaptive Research (OFAR), mini but many single factor demonstrations on the farmer's fields and fixing targets and accountability to increase agricultural productivity at all levels.
- Right type of Multipurpose Extension Agents must be employed to transfer the technology. For example in tribal dominated areas, the women farmers play a key role. In such cases

female extension agents knowing tribal languages shall be more useful. They should be given orientation training in crop husbandry, animal husbandry, fishery, dairy, poultry etc.

- Integrated Farming System is going to be the real challenge not only for the extension agents but all the line departments of the State Government. Because of rapid decline in percapita availability of land, no single land based enterprise is going to sustain the small and marginal farmers of the country.
- Promoting innovative ideas on cropping system / Farming System management where profit from high-value low-acerage crops trickle down to low-value high-acerage crops leading to overall growth and fertility maintenance, assume importance.
- Empowering farmers through proper training and by supporting co-operative organizations that help in resource generation and utilization would be important.
- Improving content, quality and dissemination modes of scientific information and its easy accessibility to the farmers would be necessary.

International Collaboration

The International Agricultural Research Centers (IARCs) and a small number of national institutions have pioneered the development of FSR. The institutionalization of FSR was a necessary and welcome development in Asia & Africa. There is a general trend worldwide towards adoption of a systems approach as a philosophical framework for dealing with complex problems, not as a "panacea" but as a realistic and pragmatic way of seeking solutions.

Since the major review in 1978 by the Consultative Group on International Agricultural Research/ Technical Advisory Committee (CGIAR/TAC), practitioners of FSR have been more confident about the relevance of the principles and methodologies of FSR. Despite the progress made in defining FSR and justifying its methodologies, the IARCs, which play a vital role in providing training and support for national programs, have not taken all possible steps to eliminate uncertainties about FSR or to strengthen it on a continuing basis. Among the actions they might take are (a) to minimize the limitations on FSR posed by the IARCs' mandates, possibly by establishing linkages with universities or with national institutions; (b) to institutionalize FSR on a more permanent, rather than temporary basis; (c) to provide training in FSR as part of general agricultural training, more intensive training for specialists in disciplines relevant to FSR, and "in-service" training; and (d) to assure the professional advancement of persons engaged in FSR.

Recommendations

- Sustainability of smallholder agriculture should be investigated with horizontal and vertical diversification involving few high yielding, high income generating ecofriendly crop and noncrop enterprises.
- Research efforts should be concentrated on export oriented crops like fruits, vegetables, flowers, and noncrop enterprises like livestock, dairy, poultry, fishery etc.
- Substantial investment may be required for research on agricultural policy formulations and human resource development involving training of scientists, extension workers and farm leaders on the needs and methods for planned agricultural diversification.
- Development of appropriate technology for small farmers for field and horticultural crops with low gestation period would help farmers to attain diversity.
- Development and transfer of technology viz. bio-fertilizer, bio-pesticides and organic farming would be helpful for small farm diversification because of their cost-effectiveness.
- Strong industry-agriculture linkage through development of agro-processing units and contract

farming would be required to help promote small farm diversification.

- Institutional facilities of credits by banks, co-operatives and agri-business consortium would be necessary for small diversification.
- Development of marketing facilities and ensuring remunerative prices are keys to success of the programme.
- Cold storage facilities for the perishable agriculture produce is a must for economic upliftment of the poor farmers.
- Road connectivity and transport facilities from the production centers to regulated markets/ Krishak Bazar are of prime necessity.
- Dynamic price and crop insurance polices should be adopted without further delays.
- Consolidation of holdings should be completed in rainfed and irrigated lands without further delay.
- Development of agri-business and agro-processing would be necessary conditions for small farm diversification.
- The Gram Panchayats which are already statutory bodies should be recognized as cooperatives and empowered to jointly process and market the produce of the small farmers.
- In each Gram Panchayat there must be a full time multipurpose Agricultural extension worker equipped with latest knowledge to transfer the technology. An extension agent must be effective in communicating the best available technology with low risk to the farmers.
- Farmers training programmes should be strengthened focusing on Integrated Farming System involving crop husbandry, animal husbandry, dairy, poultry, fishery, agro-forestry etc.
- There must be mini but many demonstrations on farmer's fields to familiarize, demonstrate and evaluate new technology by the farmers themselves.

Farming System Credibility

Major problem for farming systems research is that, because of its youthful nature, a conventional methodology is still emerging at the same time that donor agencies are pouring millions of dollars into FSR programs and developing country governments are rushing ahead with plans to establish FSR units.

Herein lies the dilemma. On the one hand, funding agencies perceive the farming systems approach and FSR in particular, as potentially time-and cost-efficient means of developing technologies and policies that are relevant to limited-resource farming families. To obtain credibility with donors and ensure continued long-term funding, FSR teams need quick results. On the other hand, FSR's credibility with technical scientists in international and national agricultural research institutes, with national policymakers and extension services, and most important, with farmers depends more on the suitability of a recommended practice (technology) than on whether it was developed in one or two seasons-although even FSR's farmer clients will lose interest if tangible, relevant results take too long.

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CHAPTER - 3

SCENARIO OF FARMING SYSTEMS IN DIFFERENT AGRO CLIMATIC ZONES

J.P.Singh

Principal Scientist and Programme Facilitator (IFS),
Project Directorate for Farming Systems Research, Modipuram, Meerut

Consequent to the council's (ICAR, New Delhi) approval for the XIth Plan EFC Memo of the Project Directorate including AICRP on Cropping Systems, the new network project "All India Coordinated Project on Integrated Farming Systems" with it's head quarters at PDFSR, Modipuram, Meerut-250110, U.P. was launched in the workshop held at KAU, Thiruvanathapuram, Kerala, during 6-9 March, 2010. The project constitutes 31 centers including 26 SAUs and 5 ICAR Institutes spread in all the 15 Agro Climatic Regions throughout the country. The present paper include the objectives of the project, preliminary efforts made in the direction of the start of the project, steps to get the set objectives and bench mark information highlighting the present scenario of agriculture in respective Agro Climatic Regions wherein all the 31 identified centers of AICRP on IFS are located , in a very brief and precise manner.

Objectives

- Characterization of 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 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 stakeholders in Integrated Farming Systems through appropriate trainings.
- Post harvest management and value addition.

Efforts made (Till the date of brain storming session)

- The XIth Plan EFC Memo of the Project Directorate including AICRP on Cropping Systems

has been approved by the ICAR under a re-modeled Technical Programme and the AICRP on Cropping Systems has been re-named as AICRP on Integrated Farming Systems.

- Besides Cropping System activities as in past, a network project on Integrated Farming Systems has been initiated and in all, 31 centers (26 in SAUs and 5 in ICAR institutes) have been identified.
- To maintain uniformity and get the set objectives, general guidelines were prepared by the Project Directorate and circulated to all the 31 centers and Technical Programmes of Proposed IFS Models were invited. Project Proposals from all the 31 centers have been received and scrutinized.
- The modalities / Road map for implementation of the new IFS Project and Technical Programmes of respective centers were thoroughly discussed and finalized in presence of Hon'ble Deputy Director General (NRM), ICAR , Dr. I.C. Mahapatra, Chairman RAC and the Vice – Chancellors of concerned Universities in two days Brain Storming Session cum Launching Workshop held at KAU, Thiruvanathapuram, Kerala during 6-7 March, 2010.
- To coordinate the programme at national level, besides Project Director, PDFSR, the National Coordinator of the IFS Project, Dr. Kamta Prasad (Principal Scientist) as Programme Facilitator (Coordinating Unit) and Dr. J.P.Singh (Principal Scientist) as Programme Facilitator (Technical Matters of AICRP on IFS), have been nominated at Modipuram, the Head Quarters of the Project Directorate.

Steps to achieve set objectives

- Identification of a Multi-Disciplinary Team of Scientists At Each Centre
  (Action–All VCS/Directors of Concerned Universities / Institutes)
- Allocation of Farm Land and other Farm Resources
  (Action–All VCS/ Directors of Concerned Universities / Institutes)
- Appointment of RA/SRFS
  (Action – Chief Agronomists/ PIS)
- Human Resourse Development in the Field of Farming System Research
  (Action – All Participating SAUS/ Institutes)
- Characterization of Existing Farming Systems In Different Agro-Climatic Zones
  (Action – All the Centers of AICRP on IFS)
- On-Station Development of Farming System Modules as per Approved Technical Programme
  (Action – All the Centers of AICRP On IFS)
- Submission of Annual Progress Report of Project
  (Action – All the Centers of AICRP On IFS)
- Mid Term Appraisal of the Programme after Two Years
  (Action – PDFSR, MODIPURAM
- Review of Results on Annual Basis
  (Action – PDFSR, MODIPURAM)
- Identification of Efficient Modules, their On-Farm Validation and Refinement
  (Action – All the Centers of AICRP on IFS)
- Development of IFS Models using Different Modelling Techniques
  (Action- PDFSR, MODIPURAM)

- Impact Analysis and Publication of Results
  (Action – PDFSR, MODIPURAM)

Present Status of Marginal and Small Farm Holders and On-Farm Farming Systems in Different Agro Climatic Zones

a) State wise average size of land holdings (ha) and number of farm families (%) under small farm holders

State/UT	Land holding (Marginal)	Number of families (% of total)	Land holding (Small)	Number of families (% of total)	Average Holding size (All Holdings)	Total number of Farm families (000,Number) (India)*
1	2	3	4	5	6	7
Andhra Pradesh	0.44	60.9	1.42	21.8	1.25	11532
Arunachal Pradesh	0.50	14.0	1.32	18.6	3.69	107
Assam	0.39	59.0	1.26	21.9	1.20	2603
Bihar	0.30	84.0	1.21	9.2	0.58	11574
Chhattisgarh	0.44	53.6	1.42	21.9	1.60	3255
Goa	0.32	81.2	1.26	10.0	0.84	64
Gujarat	0.53	29.4	1.46	30.1	2.35	4135
Haryana	0.45	46.0	1.43	19.2	2.32	1528
Himachal Pradesh	0.41	67.2	1.40	19.0	1.07	914
Jammu & Kashmir	0.37	81.3	1.40	12.3	0.67	1444
Karnataka	0.46	45.9	1.44	26.9	1.74	7078
Kerala	0.14	95.6	1.32	3.4	0.24	6657
Madhya Pradesh	0.49	38.5	1.45	26.6	2.22	7360
M.P.+Chattisgarh			43.1	25.1		10614
Maharashtra	0.48	47.3	1.42	28.1	1.57	13259
Manipur	0.53	50.3	1.29	32.8	1.15	149
Meghalaya	0.55	53,7	1.45	26.6	1.30	214
Mizoram	0.64	44.7	1.28	36.8	1.24	76
Nagaland	0.52	3.4	1.19	6.25	7.28	144
Orissa	0.50	56.4	1.39	27.3	1.25	4068
Punjab	0.63	12.3	1.40	17.3	4.03	997
Rajasthan	0.48	31.7	1.44	20.7	3.65	5819
Sikkim	0.43	53.8	1.40	23.0	1.57	52
Tamil Nadu	0.37	74.3	1.40	15.5	0.89	7859
Tripura	0.31	84.5	1.37	11.4	0.56	480
Uttaranchal	0.39	70.6	1.39	17.7	0.95	889
Uttar Pradesh	0.40	-76.8	76.6	1.41	-14.2	14.3
U.P+Uttaranchal	0.83			-	21668	22557
West Bengal	0.51	80.4	1.59	14.8	0.82	6790
A & N Islands	0.39	33.3	1.38	25.0	2.00	12
Chandigarh	0.39	100.0	1.42	0.0	1.44	1.0
Dadar & Nagar Haveli	0.52	50.0	1.32	28.5	1.48	14
Daman & Diu	0.29	83.3	1.37	16.6	0.59	6
Delhi	0.42	57.1	1.38	21.4	1.52	28
Lakshadweep	0.19	100.0	1.27	0.0	0.27	10
Pondicherry	0.29	81.5	1.42	10.5	0.70	38
All-India*	0.40	63.0	1.41	18.8	1.32	120821

1. * No data available for Jharkhand
2. Includes institutional holdings also.

Source: Agricultural Census Division, Ministry of Agriculture, New Delhi.

b) General condition of marginal and smallholder farmers in the country

Farmer	Farm Land	Institutions
Marginal -63% (Owing 34% land) Small-18.8% (Owing 24% land) Financially weak (31% below poverty line) Resource poor (Depend on others) Most of them are illiterate	Small Land Holdings (Av. Land 0.4 ha in case of marginal to 1.4 ha in case of small land holders) Not ideal for mechanized farming Low Soil Fertility Scattered Undulated Fields	Lack of technical know how High rate of Agriculture loans Lack of market facilities No price support

c) Agro - Climatic Regionwise locations of 31 IFS Centers

Agro-Climatic Regions	Centres/State	Agro-Climatic Regions	Centres/State
Western Himalayan	Pantnagar - Uttarakhand Palampur - H.P. Chatha - J&K	Western Plateau & Hills	Akola - Maharashtra Rahuri - Maharashtra Parbhani - Maharashtra
Trans Gangetic Plains	Ludhiana - Punjab Hisar - Haryana	Southern Plateau & Hills	Rajendranagar - A.P. Coimbatore - T.N. Hebbal - Karnataka Kathalragere- Karnataka Siruguppa - Karnataka
Upper Gangetic Plains	Modipuram - U.P. Kanpur - U.P.	East Coast Plain & Hills	Bhubaneshwar - Orrisa
Middle Gangetic Plains	Kumarganj - U.P. Varanasi - U.P. Sabour - Bihar Patna - Bihar	West Coast Plain & Hills	Goa Karjat - Maharashtra Karmana - Maharashtra
Lower Gangetic Plains	Kalyani - W.B.	Gujarat Plain & Hills	Sardarkrushinagar- Gujarat
Eastern Himalayan	Umiam - Meghalaya Jorhat - Assam	Western Dry Region	Durgapura - Rajasthan
Eastern Plateau & Hills	Raipur - Chattisgarh	Island (A&N)	Portblair - A&N
Central Plateau & Hills	Jabalpur - M.P.		

d) Dominent On-Farm Farming Systems in different Agro Climatic Regions of the country

Sl. No.	Agro Climatic Region	States	AICRP centres located in the region/State	Most dominate Farming Systems in the region
1	Western Himalayas	J&K, H.P. and Uttarakhand	Chatha(J&K) Palampur (H.P.) Pantnagar (Uttranchal)	1. Crops+Dairy 2. Agri-horti system
2	Eastern Himalayas	Assam Meghalaya	Jorhat (Assam) Umiam (Meghalaya)	1. Crops+Fish+Cattle+Piggery 2. Monocropping of Rice and Maize + pigs+ Backyard poultry+ 2-3 cow
3.	Trans Gangetic Plain	Punjab Haryana	Ludhiana (Punjab) Hissar (Haryana)	Crops+Dairy
4	Upper Gangetic Plain	Uttar Pradesh	Modipuram (U.P.) Kanpur (U.P.)	Crops+Dairy
5	Middle Gangetic Plain	Uttar Pradesh Bihar	Kumarganj (U.P.) Varanasi (U.P.) Sabour (Bihar) Patna (Bihar)	1. Crops+Dairy 2. Crops+Fishery
6	Lower Gangetic Plain	West Bengal	Kalyani (W.B.)	Crops+Dairy Crop+ Dairy + Poultry+Duckery
7	Eastern Plateau & Hills	Chhattisgarh and Jharkhand	Raipur (Chhattisgarh) Ranchi (Jharkhand)	1. Crops+Dairy 2. Crops+Backyard poultry+Fish
8	Central Plateau & Hills	Jabalpur (M.P.)	Jabalpur (M.P.)	Crops+Dairy
9	West Plateau & Hills	Maharashtra	Akola (Maharashtra) Rahuri (Maharashtra) Parbhani (Maharashtra)	1. Crops+Dairy 2. Crops+Goatery 3. Crop+Horticulture
10	Southern Plateau & Hills	Andhra Pradesh, Tamilnadu Karnataka	Rajendranagar(A.P.) Coimbatore (T.N.) Kathalagere (Karnataka) Siruguppa (Karnataka)	1. Crops+Dairy, 2. Crops+Hort. 3. Crops+Dairy+ Horticulture
11	East Coast Plain & Hills	Orissa	Bhubaneshwar (Orissa)	1. Crops +Dairy 2. Crops+Dairy+Fish
12	Western Coast Plain & Hills	Maharashtra Kerala Goa	Karjat (Maharashtra) Karamana (Kerala) Old Goa (Goa)	1. Crops+Dairy 2. Coconut based Homestead Farming 3. Rice based farming system
13	Western Dry Region	Rajasthan	Durgapura(Rajasthan)	Crop+Dairy
14	Gujarat Plain and Hills	Gujrat	S.K.Nagar (Gujrat)	Crop+Dairy
15	island	Andaman and Nicobar	Port Blair (A&N)	1. Plantation Crops+Pig 2. Crops+ Cattle+fish

e) Important crops and cropping systems prevailing in different parts of the country

Sl. No.	Agro Climatic Region	Name of the centre	Important crops	Important cropping systems
1	Western Himalayas	Chatha (J&K)	Rice,wheat,maize,mustard,fodder crops sorghum,berseem,oats.	Rice-wheat Maize-wheat
2		Palampur (H.P.)	Wheat, rice, maize, potato, onion, berseem,oats, sorghum and bajra	Maize-wheat Rice-wheat
3		Pantnagar (Uttarakhand)	Rice,wheat,sugarcane, vegetable pea, rapeseed/mustard, pulses and fodder crops	Rice- wheat Rice-toria/veg.pea-sugarcane-ratoon-wheat Rice-toria-wheat Rice-veg.pea-summer rice
4	Eastern Himalayan	Jorhat (Assam)	Greengram,Rajmah, Ridgegourd, arhar, vegetables, cowpea, winter rice, toria, blackgram, oats, potato, spices garlic, maize fodder, cowpeafodder, wheat, lentil,	
5	Trans Gangetic Plain	Umiam (Meghalaya)	Rice and maize	Rice-fallow Maize-fallow
6		Ludhiana (Punjab)	Rice, wheat,cotton,maize, berseem	Rice-wheat Cotton-wheat Maize-wheat
7		Hissar (Haryana)	Bajra, wheat, mustard, cotton	Cotton-wheat Bajra-wheat Bajra-mustard
8	Upper Gangetic Plain	Modipuram (U.P.)		
9		Kanpur (U.P.)	Rice, wheat, maize, potato, mustard	Rice-wheat Maize-wheat Maize-mustard-onion Maize-potato-vegetable
10	Middle Gangetic Plain	Kumarganj (U.P.)	Rice,wheat,pigeonpea, mustard, Fodder sorg hum & berseem	Rice-wheat Pigeonpea+urd/moong/ sesame/jowar
11		Varanasi (U.P.)		
12		Sabour (Bihar)	Rice, wheat, winter maize, gram, lentil, blackgram, rai, fodder sorghum, berseem and oats	Rice-wheat Rice-pulses
13		Patna (Bihar)	Rice, wheat, maize,fodder crops sorghum, cowpea,ber seem,maize & oats	Rice-wheat Rice-maize
14	Lower Gangetic Plain	Kalyani (W.B.)	Winter rice, potato, mustard, sesame, jute, summer rice	Winter rice-summer rice Winter rice-mustard-jute Winter rice-potato-jute
15	Eastern Plateau & Hills	Raipur (Chhattisgarh)	Rice, soybean,wheat, chickpea, linseed, berseem & sorghum fodders	Rice-wheat/chickpea/ Lathyrus-greengram Soybean-wheat/linseed

16		Ranchi (Jharkhand)		
17	Central Plateau & Hills	Jabalpur (M.P.)	Rice, wheat, gram, soybean, maize, potato, tomato and ginger	Rice-wheat Rice-chickpea Soybean-wheat
18	Western Plateau & Hills	Akola (Maharashtra)	Cotton, soybean, pigeonpea, sorghum, greengram, blackgram, wheat, gram, safflower, sunflower	*Rainfed:* Sole cropping of cotton, soybean, green/black gram, sorghum,sunflower Intercropping of soybean+tur, cotton+tur, cotton+soybean/ blackgram, cotton+sorghum +tur Crop Sequences Soybean-chickpea, Soybean-saflower, greengram-saflower, blackgram-saflower. Green gram/blackgram-gram *Irrigated:* Soybean-saflower, Soybean-wheat-summer groundnut, sorghum-wheat, maize -chickpea Intercropping and Mixed Cropping Wheat+ mustard, Chickpea+ mustard, wheat+chickpea
19		Rahuri (Maharashtra)	Soybean, pearlmillet, wheat, chickpea, cotton, maize, pigeonpea, blackgram, Lucerne, hybrid napier grass	Soybean-wheat Cotton-wheat Soybean-onion Maize-onion
20		Parbhani (Maharashtra)	Soybean, cotton,sugarcane, greengram, sorghum,pigeonpea,wheat,banana, sweat lime	Soybean-rabi sorghum Soybean-wheat Soybean+pigeonpea (4:2) Bt. Cotton-summer groundnut Greengram-rabi sorghum Soybean-sugarcane-ratoon-summer groundnut
21	Southern Plateau & Hills	Rajendranagar (A.P.)	Rice, castor, maize, cotton,redgram, jowar, groundnut and vegetables	Rice-rice Rice-maize Sorghum/maize+ redgram Rice-groundnut/ sunflower
22		Coimbatore (Tamil Nadu)	Maize, Cotton, sunflower, pulses, sugarcane, vegetables, fodder crops	Vegetables chilly/brinjal-sunflower -cowpea Maize-cotton-bhindi
23		Kathalagere-Hebbal (Karnataka)	Paddy, sugarcane, maize, groundnut, grain cowpea, fingermillet, cotton, fodder jowar, cowpea, napier grass	Rice-rice Rice-maize Rice-groundnut Rice-pulses Rice-vegetables Sugarcane-ratoon-rice
24		Siruguppa (Karnataka)	Rice,maize,cotton,sunflower, redgram, chilli, bengalgram , bajra	Rice-rice Maize-bengalgram

25	East Coast Plain & Hills	Bhubaneshwar (Orissa)	Rice, groundnut, vegetables	Rice-rice Rice-groundnut-fallow Rice-vegetables-vegetables Rice-toria-greengram
26	Western Coast Plain & Hills	Karjat (Maharashtra)	Rice, vegetables,pulses cowpea& greengram, oilseeds, groundnut&mustard, fodder maize, hybrid napier, guinea grass	Rice-vegetables Rice-pulses Rice-oilseeds
27		Karamana (Kerala)	Coconut, blackpepper, banana, tuber crops(cassava, yam), pine apple, fodder crops, rice, vegetables.	*1.Coconut based farming systems* Coconut+blackpepper Coconut+banana+black pepper Coconut+banana+pineapple +pepper Coconut+tuber crops+Fodders *2. Rice based farming systems* Rice-rice-fallow Rice-rice-vegetable Rice-cassava Rice-banana
28		Goa	Cashew nut, rice, coconut, pulses , vegetables	-
29	Western Dry Region	Durgapura (Rajasthan)	Pearlmillet, clusterbean, greengram, cowpea,groundnut, cabbage,pea, cauliflower, tomato, wheat, barley, mustard, gram	Pearlmillet-wheat Clusterbean-wheat
30	Gujarat Plain and Hills	S.K.Nagar (Gujrat)	Pearlmillet, green gram , castor, cotton, sorghum fodder, mustard, wheat, potato	Pearlmillet-mustard Green gram-mustard pearlmillet Castor alone Cotton alone
31	Island	Port Blair (A&N)	Rice, maize, vegetables, coconut, clove, nutmeg, pineapple	Rice+vegetable+flower(BBF system) Fodder-rice-fodder Coconut+nutmeg&clove +pineapple

f) Yield gap (%) in major growing crops at different centers of AICRP on IFS

Centres	Paddy	Wheat	Centres	Paddy	Wheat	Centres	Paddy	Wheat
Chatha	55	41	Varanasi	71 (Maize 37)	47 (Mustard 50)	Rajendernagar	73 (137 Maize)	NR
Palampur	56 (44 Maize)	42	Sabour	63 (18	48 Maize)	Coimbatore	30 (Maize)	-
Pantnagar	40-50	30-50	Patna	50-60	40-50	Katthalgere	25-30	37-40
Jorhat	75	Toria(60)	Kalyani	25	34	Siruguppa	20-28	20-25
Umiam	23(45 Maize)	25	Raipur	150	67	Bhubneshwar	200	175
Ludhiana	25	11	Kanke	100	75 (Maize-100)	Karjat	58	NR
Hissar	35 (80 Bajra)	30	Jabalpur	51 (16 Maize)	42	Karamana	40	NR
Modipuram	55	41	Akola	60 (Sorghum)	40	Goa	67	46 (Barley)
Kanpur	97 (99 Maize)	153	Rahuri	64 (Bajra)	107	Durgapura	66 (Bajra)	NR
Kumarganj	48	38	Parbhani	35 (Sorgh)	31	S.K.Nagar	54 Bajra (Moong 31-64)	35 (Mustard 40)
-	-	-	-	-	-	Port Blair	58	NR

g) Profitability under different cropping systems in different part of the country

State	Cropping Systems	Net Profit (Rs./ha)
H.P.	Rice-wheat Rice-toria-potato	41296 59149
Punjab	Rice-wheat Rice-mustard-moong	62352 65210
Haryana	Bajra-wheat Guar-wheat	32972 44350
U.P.	Jowar-wheat Til-pea	21512 24886
Rajasthan	Bajra-wheat Guar-wheat	32972 44350
Gujarat	Rice-wheat Rice-cabbage	33563 73112
Bihar	Rice-wheat Rice-potato-sunflower Rice-maize+Coriander	37939 69483 41335
Karnataka	Green gram-jowar Maize-bengal gram Cotton-GM	15263 28775 39874

Assam	Rice-toria Rice-pea Rice-toria-rice	14594 19201 44347
Tamilnadu	Rice-rice Rice-rice-ladyfinger Rice-rice-groundnut	49816 50939 68821

h) Important farm enterprises (other than crops) being practiced and are integral part of dominant On – farm farming systems in different parts of the country

Sl. No.	Agro Climatic Region	Name of the centre	Additional enterprises included	Prod./year	Average prod. of dairy animals (Litre/year/ animal
1	WHR	Chatha (J&K)	Dairy (Cow2+Buff.2) Fishery Poultry Apiary (10 boxes)	10800 liter 150 kg 7500 eggs 150 kg	2700***
2		Palampur (H.P.)	Dairy (Cows-2) Poultry (25 birds) Fishery	4240 kg 70 kg 200 kg	2120*
3		Pantnagar (Uttranchal)	Dairy (Cows-2) Poultry (12 birds) Apiary (10 boxes)	5940 liter 2700 eggs 35 kg	2970*
4	HER	Jorhat (Assam)	Dairy (Cows-2) Fishery Apiary	400 kg 350 kg 60 kg	200
5		Umiam (Meghalaya)	Dairy (Cows-2) Poultry (150 birds) Pig (2) Mushroom	3800 liter 202 kg 160 kg NA	1900*
6	TGPR	Ludhiana (Punjab)	Dairy (Cows-2) Apiary (10 boxes)	10600 liter 150 kg	5300*
7		Hissar (Haryana)	Dairy (Cow1 + Buff.2) Vermicompost	7500 liter 10-15 ton	2500***
8	UGPR	Modipuram (U.P.)	Dairy (Cow-1+ Buff.1) Apiary (10 boxes) Fishery (5000 fingerlings) Mushroom (Crop room 20 feet x 20.5 feet)	5300 liter 150 kg 600 kg 900 kg	2650***
9		Kanpur (U.P.)	Dairy (Cow 1+Buff.1) Poultry (20+1) Apiary (5 boxes) Mushroom	5300 liter 150 kg 75 kg NA	2650***
10	MGPR	Kumarganj (U.P.)	Dairy (Cow 1+ buffalo1) Apiary (10 boxes) Mush room	4500 liter 150 kg NA	2250***
11		Varanasi (U.P.)	Dairy (Cows-3) Poultry (200 birds)	7950 liter 1920 kg	2650*

			Fishery Apiary Mushroom	480 kg 120 kg 400 kg	
12		Sabour (Bihar)	Dairy (Cows-2) Fishery (1000) Poultry (50 birds) Duckery (50 birds) Goat (10+1) Apiary (5 boxes) Mushroom Biogass plant Silviculture	5300 800 12500 eggs (80 kg) 15000 eggs (110 kg) 750 kg 75 kg	2650*
13		Patna (Bihar)	Dairy (Cows-3) Fishery Poultry (50 birds) Duck (35 birds) Goat (200 Apiary (10 boxes)	6360 liter 500 kg 400 kg 7000 eggs 600 kg 150 kg	2120*
14	LGPR	Kalyani (W.B.)	Dairy (Cows-4) Apiary (5 boxes) Goatery (10+1) Fishery Poultry (20 hens) Duckery (20+5) Mushroom	10600 liter 75 kg - 1200 kg 400 eggs 4500 10,000	2650*
15	EPHR	Raipur (Chhattisgarh)	Dairy (Cows-2) Fishery Poultry (50 birds) Apiary (10 boxes) Mushroom	4240 9.5 kg fry 14000 eggs 150 kg 405 kg	2120*
16		Kanke /Ranchi (Jharkhand)	Dairy (Cows-2) Apiary (10 boxes) Mushroom	4240 liter 150 kg NA	2120*
17	CPHR	Jabalpur (M.P.)	Dairy (Cows-3) Fishery (300) Poultry (300)	6720 kg 1350 kg 3600 kg	2240*
18	WPHR	Akola (Maharashtra)	Dairy (Cows-2) Poultry Mushroom	4000 kg NA NA	2000*
19		Rahuri (Maharashtra)	Dairy (Cows-2) Poultry (50 birds)	6360 liter 270 kg	3180*
20		Parbhani (Maharashtra)	Dairy (Cow1+Buffalo 1)	5300 liter	2650***
21	SPHR	Rajendranagar(A.P.)	Dairy (Buff.-2) Poultry (18+2) Goat (5+1)	3520 kg 1350 kg 275 kg	1760**
22		Coimbatore (Tamilnadu)	Dairy (Cows-3) Fishery (800) Turkey (40) Mushroom (750)	9000 40000 24000 52500	3000*

23		Kathalagere (Karnataka)	Dairy (Cow 1+Buffalo 2) Mushroom	7685 kg NA	2561***
24		Siruguppa (Karnataka)	Dairy (Cow 1+ Buff.1) Fishery (200 fingerlings)	3200 liter 500 kg	1600***
25	ECPHR	Bhubaneshwar (Orissa)	Dairy (Cow1+ Buff.1) Fishery Poultry (100 birds) Apiary (10 boxes) Duckery (50 birds) Mushroom	5300 - 720 kg 150 kg 5000 kg NA	2650***
26	WCPHR	Karjat – Raigarh (Maharashtra)	Dairy (Cow1+Buff.1) Poultry (100 birds)	3710 liter 875 kg	1855***
27		Karamana (Kerala)	Dairy (Cows-2) Fishery Duckery (400 birds) Apiary (10 boxes) Prawn	6360 375 kg - 150 kg 50 kg	3180*
28		Goa	Dairy Fish Poultry Pig		
29	WDR	Durgapura (Rajasthan)	Dairy (Cow-1+Buff.-1) Poultry Goat (9+1)	4240 liter 7500 2880 kg	2120***
30	GPHR	S.K.Nagar (Gujarat)	Dairy (Buffalo-2)	4860 liter	2430**
31	Island	Port Blair (A&N)	Dairy (Cows-2) Pig (Male1+Female 3) Fishery Poultry (25 birds) Duck (20 birds) Azolla	3180 kg 224 kg 756 kg 2125 kg 400 kg 50 kg	1590*

Dairy Unit:

* Cow alone – 2612 litre/year,

** Buffalo alone –2095 litre/year ,

*** Cows + Buffalo – 2380 litre/year,

i) Per cent contribution of important component enterprises in existing On-Farm Farming systems

Sl.No.	Agro Climatic Regions	Name of Centres	Crops	Dairy	Hort.	Fish
1	Western Himalayas	Chatha (J&K)	60-70	25-35	-	-
2		Palampur (H.P.)	70-80	20-30	-	-
3		Pantnagar (Uttarakhand)	70-80	10-May	25-30	-
4	Eastern Himalayan	Jorhat (Assam)	60-70	20-Oct	-	20-30
5		Umiam (Meghalaya)	30-40	10-May	-	-
6	Trans Gangetic Plain	Ludhiana (Punjab)	70-80	20-30	-	-
7		Hissar (Haryana)	80-85	15-20	-	-
8	Upper Gangetic Plain	Modipuram (U.P.)	55-60	40-45	-	-
9		Kanpur (U.P.)	70-80		-	-
10	Middle Gangetic Plain	Kumarganj (U.P.)	65-75	25-35	-	-
11		Varanasi (U.P.)	70-75	15-20	10-May	-
12		Sabour (Bihar)	70-75	25-30	-	-
13		Patna (Bihar)	50-60	20-25	-	25-30
14	Lower Gangetic Plain	Kalyani (W.B.)	80	8-May	-	-
15	Eastern Plateau & Hills	Raipur (Chhattisgarh)	75-85	15-25	-	-
16		Kanke-Ranchi (Jharkhand)	70-80	20-30	-	-
17	Central Plateau & Hills	Jabalpur (M.P.)	65-75	25-35	-	-
18	Western Plateau & Hills	Akola (Maharashtra)	70-80	20-30	-	-
19		Rahuri (Maharashtra)	60-70	30-40	-	-
20		Parbhani (Maharashtra)	85	15	10	-
21	Southern Plateau & Hills	Rajendernagar (A.P.)	70-80	20-30	-	-
22		Coimbatore (Tamilnadu)	70-80	20-30	-	-
23		Kathalagere (Karnataka)	75-80	20-25	10-May	-
24		Siruguppa (Karnataka)	70-80	20-30	-	-
25	East Coast Plain & Hills	Bhubaneshwar (Orissa)	60-70	20-30	-	10
26	Western Coast Plain & Hills	Karjat (Maharashtra)	55	26	-	-
27		Karamana (Kerala)	55-60	40-45	-	-
28		Goa	60-70	30-40	-	10-May
29	Western Dry Region	Durgapura (Rajasthan)	60-65	35-40	-	-
30	Gujarat Plain and Hills	Sardarkrushinagar (Gujarat)	67	33	-	-
31	Island	Port Blair (A&N)	55-60	40-45	-	-

j) Major production constraints identified

Bio Physical constraints

- Undulating topography and poor water harvesting techniques, heavy soil and water loss, moisture deficit even in high rainfall regions.
- Deep water level, poor quality of underground water – Haryana, Punjab, Rajasthan, Assam, W.B., Bihar, Eastern U.P., Gujarat and Maharashtra having the problems of salinity , alkalinity, arsenics, nickel etc.
- Lack of irrigation facilities, erratic and untimely rainfall and frequent failures of rain.
- Poor inherent soil fertility.

Social constraints

- Poor economic status of the farmers, illiteracy and lack of knowledge is responsible for traditional farming and use of low quality seeds and planting material. Frequent non availability of inputs adds to the problem.
- Small and fragmented land holdings.
- Lack of organized cooperative societies, cold storages and market facilities are major hurdles for fruits, vegetables and dairy enterprises.
- Less care/importance given by the farmers towards post harvest technologies.
- Non availability of green fodder mainly in summer months, is a common problem throughout the country.

Technical/Technological constraints

- Alternate bearing in mango, citrus canker, gummosis, die back, ear cockle, rotting, black tip etc.
- Indigenous breeds with low yield, infertility and repeat breeding in milch animals particularly in buffaloes. In some parts of Gujarat and hilly regions, improper chaff cutting and malnutrition
- Technologies are given in piecemeal and not as a package.
- Poor transfer of technology and lack of farmer participation.
- Poor water management in scanty, high and even assured irrigated areas.

k) Integrated Farming System Models proposed to be developed and implemented at different centres of AICRP on IFS

Sl. No.	Name of Centre	Proposed Integrated Farming System model
1	Akola	Crop + Dairy + Fruit/Vegetable + Fodder + Fishery + Forestry + Vermicompost
2	Bhubaneswar	Crop + Horticulture + Apairy + Dairy + Mushroom
3	Chathu	Crop + Dairy + Fish cum Poultry + Hort. Unit + Apairy unit + Composting
4	Coimbatore	Crops + Hort.+ Dairy + Goatrearing + Biogas
5	Durgapura	Crop + Dairy + Hort + Gaetry + Composting
6	Hisar	Crop + Dairy + Vermicompost + Social Forestry
7	Jabalpur	Crops + Dairy + Vermicompost + Poultry + Fishry
8	Jorhat	Crop + Hort. + fishry + Dairy + Apairy
9	Kalyani	Crops + Hort. + Dairy + Pond unit + Duckery + Vermicompost
10	Kanke, Ranchi	Crop + Dairy + Fishry + Hort.+ Apairy + Mushroom + Vermicompost
11	Kanpur	Crops + Dairy + Hort. + Apairy + Vermicompost + Common Uses
12	Karamana	1) Coconut based intercropping systems + Fresh water prawn. 2) Rice based cropping systems + Dairy+Mushroom 3) Rice based cropping systems + Banana + Duck + Fish
13	Karjat	Crops + Dairy + Hort. + Poultry +Vermicompost
14	Kathalagere	Crops + Dairy + Hort. + Rabbit rearing + Vermicompost
15	Kumarganj	Crops + Dairy + Hort. + Apiary + Mushroom unit + Vermicompost
16	Ludhiana	Crops + Dairy + Hort. + Fish + Apiary + Mushroom unit
17	Modipuram	Dairy + crops including fodder crops + banana/vegetables
18	Old Goa	1) Plantation Crops + Goattery + Fishery + Duckery + Apiary + Vermicompost 2) Field Crops + Horticulture + Dairy + Poultry + Mushroom Production + Rice – cum – fish culture + Biogas Production + Vermicompost Unit + Fodder Cultivation
19	Palampur	Crops + Dairy + Horticulture unit + Composting + Fishery + Poultry + Land for common Uses
20	Pantnagar	Crops + Agroforestry/Hort. + Dairy + Composting + Apiary unit + Land for common Uses
21	Parbhani	Crops + Dairy + Hort. + vermicompost
22	Patna	Crops + Dairy+Hort. + Fish + Duckery + Poultry + Apiary+ Mushroom + Vermicompost + Goattry + Land for common use
23	Port Blair	Crops + Pig meat unit +Poultry + Duck + Fish + Vermicomost + m Azola
24	Rahuri	Crops+Dairy + Hort +Poultry+Vermicompost+ Land for common use
25	Raipur	Crops + Dairy +Fish + Mushroom
26	Rajendranagar	Crops + Dairy + Hort. + Goat + Poultry + Vermicompost + Poultry
27	Sabour	Crops + Dairy + Hort. + Poultry + Fish + Apiary + Mushroom
28	Siruguppa	Crops + Dairy + Hort. + Compost +Fish
29	S. K Nagar	Crops + Dairy + Hort.+ Vermicompost + Boundary Plantations
30	Umiam	Crops + Dairy + Hort. +Compost + Mushroom
31	Varanasi	Crops + Dairy + Poultry + Horti. + Fishery + Apiary + Mushroom + Composting

l) Economic viability of proposed Integrated Farming System Models (Estimated values)

Sl. No.	Agro Climatic Regions	Name of the centre	Gross Returns (Rs./ha)	Family consumption (Rs.)	Surplus Produce (Rs.)
1	Western Himalayas	Chatha (J&K)	489239	139763	349476
2		Palampur (H.P.)	415300	145975	269325
3		Pantnagar (Uttranchal)	318547	91213	227334
4	Eastern Himalayan	Jorhat (Assam)			
5		Umiam (Meghalaya)	281501	110341	171160
6	Trans Gangetic Plain	Ludhiana (Punjab)			
7		Hissar (Haryana)	301923	127621	174302
8	Upper Gangetic Plain	Modipuram (U.P.)	371550	141337	230213
9		Kanpur (U.P.)			
10	Middle Gangetic Plain	Kumarganj (U.P.)	256550	90000	166550
11		Varanasi (U.P.)			
12		Sabour (Bihar)	591205	119535	471670
13		Patna (Bihar)	540135	117850	4,22,285
14	Lower Gangetic Plain	Kalyani (W.B.)	531660	147641	384019
15	Eastern Plateau & Hills	Raipur (Chhattisgarh)	457434	116993	340441
16		Ranchi (Jharkhand)			
17	Central Plateau & Hills	Jabalpur (M.P.)	282816	96606	186210
18	Western Plateau & Hills	Akola (Maharashtra)	360359	87243	273116
19		Rahuri (Maharashtra)	284920	44295	240625
20		Parbhani (Maharashtra)	160427	53662	106795
21	Southern Plateau & Hills	Rajendernagar(A.P.)	232150	88680	143470
22		Coimbatore (Tamilnadu)	230200	27650	202550
23		Kattalagere (Karnataka)	258188	97374	160814
24		Siruguppa (Karnataka)	179525	75515	104010
25	East Coast Plain & Hills	Bhubneshwar (Orissa)	496100	134439	361661
26	West Coast Plain & Hills	Karjat (Maharashtra)	211625	55140	156485
27		Karmana (Kerala)	417148	90204	326944
28		Goa			
29	Western Dry Region	Durgapura (Rajasthan)	463916	110410	353506
30	Gujarat Plain and Hills	S.K.Nagar (Gujrat)	387220	94558	292662
31	Island	Port Blair (A&N)	306343	93015	213328

Note; The figures included in the table are simply estimates calculated based on previous results of IFS studies conducted in respective regions/states and also achievable yields under optimum growing conditions and not real values. The actual figures can only be produced after successful completion of the project..

Conclusion

Marginal and small farmholders in India represent more than 80 percent of farming families and live in risk prone diverse conditions. Most of them are resource poor and illiterate. Cultivated lands are scattered in small plots and soils are lacking in macro and micro nutrients. Because of poverty and illiteracy, they are lacking in risk bearing capacity and are bound to adopt traditional farming practices. There is a big gap in farmer yield and achievable yields in most of the farm enterprises including crops and dairy animals. The link between farmers and extension agencies is very weak and even after great efforts of state and central governments the level of transfer of technologies is ranked below 30-40%. Research and extension efforts made in isolation, mainly single commodity as well as single departmental approaches has been the major factor responsible for this. Integrated Farming System, involving multi-enterprises and multi-disciplinary approach, practised and tested at different locations through out India and elsewhere, not only increased the production and profits of the smallholder farmers besides ensuring livelihoods of the family but also helped in maintaining agricultural sustainability and environmental safety. IFS provides regular income and increases (200% or more) employment, too. The new project on Integrated Farming Systems will serve as region specific demonstration units for respective districts/regions in the first stage and dissemination of knowledge in later stages.

CHAPTER - 4

CHARACTERIZATION AND EVALUATION OF EXISTING FARMING SYSTEMS IN INDIA

S.P. Singh

Project Directorate for Farming Systems Research, Modipuram, Meerut, U.P. 250 110

Introduction

With the rising population, declining land-man ratio and increasing mechanisation in farm operations, agriculture alone is not able to provide adequate income and employment to households in India. Integration of farm enterprises provides better livelihood in terms of increased food production, higher net income, improved productivity, and reduces income imbalance between rural agricultural labourer and urban factory worker. Introduction of appropriate farming systems has been proposed as one of the approaches to achieve better growth in agriculture and livelihood (National Commission on Farmers, 2005). Increase in non-farm employment has also become essential for improving income and living standard of rural population. Other farming activities may comprise any one or a combination of mono or multiple cropping; horticultural crops, agro-forestry, livestock, poultry, fishery, goat/sheep-rearing, etc. The present study will help policy makers, as to how to actualise the vast untapped growth potential of Indian agriculture, strengthen rural infrastructure to support faster agricultural development, promote value addition, accelerate the growth of agribusiness, create employment in rural areas, secure a fair standard of living for the farmers and non farm household and their families, discourage migration to urban areas and face the challenges arising out of economic liberalization and globalisation. It will also give feedback to the research workers and extension agencies to suggest alternative enterprises. The study will also be useful not only to the financing agencies advancing loans to cultivators, but also to other input suppliers in developing the needed supply system. The study will be useful to policy maker; research workers and farmers for preparing agricultural development plan for respective area. The study is being undertaken with the following objectives:

1. To identify and characterize the farming systems across eco-system and size groups.
2. To analyze the productivity and viability of farming systems and
3. To determine the factors contributing for farming systems.

Technical Programme

Sampling plan

As per the discussion in the brain storming held at Trivandram and with Scientists of IASRI New Delhi, all agro-climatic regions of each state will form the base for study. Thirty per cent districts from each zone, two representative blocks from each district and three village panchyats from each block will be selected by following multistage random sampling. Twelve farmers from each village panchayat consisting four each of marginal and small and two each of medium and large farmers will be interviewed on random basis to fill up the pre tested schedule and questionnaire.

Observations to be recorded

Primary data on socio- economic parameters of the household, farm size, infrastructural facilities, existing and emerging farming systems on the sample households, information on cost of cultivation and yield of different crops, price received by the farmers, and qualitative and quantitative factors responsible in planning of farm business will be collected and used to develop optimum farm plan in the existing conditions and available resources. Information from non-farm household on their income and consumption pattern will also be collected

Survey Team

PDFSR Modipuram Meerut

- Dr. S.P. Singh, Programme Facilitator SDD
- Dr. N.D. Shukla Sr. Scientist(Agril. Econ)
- Two other Scientists and Technical Staff

AICRP-IFS Center

- Chief Agronomist
- ECF Agronomist
- Economist/Statistician
- Six field staff of ECF center
- KVK staff of respected area

Training to staff

The staff will be imparted training to fill up schedule and questionnaire before starting of survey in the respective zone.

Road Map

The survey programme will be undertaken as follows:

1. Maharastra State: Akola, Rahuri, Parbhani and Karzat: Jan-Feb 2010
2. Bihar: Sabour and Patna: May –June 2010
3. U.P. : Kumarganj and Varanasi: Nov- Dec. 2010
4. West Bengal: Kalyani : April- May 2011
5. A&N Island: Port Blair: April- may 2011
6. Orissa: Bhubaneshwar: Oct. –Nov. 2011
7. Meghalaya: Umiam : Oct –Nov. 2011
8. Jorhat: Assam: Oct –Nov 2011
9. J& K : Jammu: April-May 2012

10. H.P. Palampur: April-May 2012
11. Uttaranchal: Pantnagar : Oct-Nov 2012
12. Punjab: Ludhiana: Oct-Nov 2012
13. Haryana: Hissar: April- May 2013
14. Chhattisgarh: Raipur: Oct-Nov 2013
15. M.P.: Jabalpur : April-May 2014
16. Gujarat: S.K. Nagar: April-May 2014
17. Rajasthan: Durgapura: Oct-Nov 2014
18. Goa: Oct-Nov 2014
19. Kerala: Karamana April-May 2015
20. Chhattisgarh: Raipur: Oct-Nov 2015
21. A. P.: Rajendra Nager: April-May 2015
22. Tamil Nadu: Coimbatore: Oct-Nov 2015
23. Karnataka: Kathalagere and Shriguppa: April-May 2015

Data Analysis

Tabular as well as suitable statistical/econometric/linear programming tools will be used for objective wise data analysis with special focus on small and marginal farmers. Some of the data analysis techniques among others are given below.

Farming systems will be identified based on the major contribution to income of farm enterprises. Education of the household will be measured by following education index as used by Singh S.P. *et al.* as follows= $\sum$wifi / Σfi, i= 0 1, 2, 3....6. Education attained i.e. illiterate=0, primary=1,

Middle=2, metric= 3, twelfth = 4 graduate=5 and post graduate=6, wi= weights (0 to 6) and fi= No. of family members

Measurement of crop diversification

Harfindahal index, as a diversification measure, will be used in the following form.

$$HI = \sum_{i=1}^{n} Pi^2$$

Where, $Pi = Ai / \sum_{i=1}^{n} Ai$, i= 1, 2, 3..... Number of crop enterprises.

Pi is the proportion of area under crop; Ai is the area under ith crop and ΣAi gross cropped area of the farm. The value of Harfindahal index varies from zero to one, where, one indicates complete specialization and zero perfect diversification i.e. it has inverse relationship with diversification.

The level of crop diversification can also be measured by using Simpson Index of diversity as follows (Joshi 2002): (Joshi et. al, 2002):

Simpson index of diversity: $Ii = 1 - (\sum_i S_i^2) / (\sum_i S_i)^2$

Where S_i is the share of crop 'i' in gross crop area. A high Simpson index indicates greater crop diversity, while a low index reflects more specialization.

Cost: benefit analysis

For measuring the production efficiency, benefit: cost ratio can be worked out as follows:

$$\text{Benefit : cost ratio} = \frac{\text{Gross return from sale of output}}{\text{Total cost of input used}}$$

Farm business income will be computed by deducting from the gross returns the cost incurred on seeds, fertilizer, plant protection chemicals, hired human labour, farm machinery and implements, taxes, cess, water charges, interest on working capital and expenditure on livestock maintenance such as feed and fodder, mineral mixture, medicine and depreciation of owned farm machinery, buildings and animals.

Resource productivities

To analyze the resource productivity of different farming systems for improving the economic conditions of the farmers and to measure the contribution of specific factor in combination with other factors which are responsible for the change in the level of output, production function analysis will be used. The general form of the function is given below

$$Y = f(X_1, X_2 \ldots\ldots X_n)$$

where, Y is the output and X_1 to X_n are the inputs

Factors affecting farm diversification

Multiple regressions will be tried in the form of linear regression

$$Y = b_0 + b_1X_1 + b_2X_2 + \ldots\ldots b_nX_n$$

where, Y= Diversification index , b_0= Constant, X_1 = Crop diversification index, X_2 = Farm size, X_3= Education index of the family, X_4= Employment per year on the farm and so on.

Identification of constraints

To identify constraints faced by marginal and small farmers in farming systems diversification the weighted indices for constraints faced by the farmers will be calculated as per the formula given below.

$$CI = \sum_{i=1}^{n} wifi / \Sigma fi, \quad i = 1, 2, 3\ldots\ldots \text{ Number of crop enterprises.}$$

CI = index of constraints

wi = weights and fi= frequency of constraints

It may be noted that if CI is higher, the more severe the constraint.

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CHAPTER - 5

PROCEEDINGS OF BRAIN STORMING SESSION-CUM-LAUNCHING WORKSHOP

Inaugural Session

Proceedings of inaugural session started with University choir of KAU. It was followed by a formal welcome by Dr D. Alexander, Director Research, Kerala Agricultural University. On this occasion he mentioned that KAU has developed a very successful IFS model for Kuttanad lands. Adoption of this model can lead to enhanced yields and profitability.

Dr B. Gangwar, Project Director, PDFSR Modipuram, then delivered the introductory remarks, highlighting the objectives and scope of the meeting, spread of AICRP on IFS centres, national agricultural scenario and importance of IFS in present day context. He further emphasized that improvement in productivity, input use efficiencies, reducing cost of production and creating opportunities for gainful employment of rural masses have become essential. To meet these challenges and fulfill the requirements of adequate healthy and nutritious food, feed, fodder and other commodities vis-a-vis resource sustainability and improvement of farmers' economy, it will be imperative to pursue research in farming system mode. Optimization of various agricultural components and their integration for multi-enterprise farming systems, development of sustainable farm practices for enhanced soil health, water and nutrient-use-efficiencies under diverse farming situations and farm categories will be of paramount importance. However, to have a systematic integration of these multi-enterprise systems in a scientific manner, components need to be chosen in such a manner that product or by-product of one component becomes the input for the other, they are complementary and are organically well interlinked to each other without wastage. Further, one inter-disciplinary team of 5-6 scientists would be required at each centre.

Subsequently, Shri K.R. Viswambharan, Vice Chancellor, Kerala Agricultural University, delivered the presidential address, wherein he highlighted the fact that KAU has been maintaining very high standards in the areas of teaching, research and extension whereby several awards including ICAR award for best University have been received. He also mentioned that Kerala state is a pioneer as far as adoption of multi-enterprises farming systems are concerned and that Shri Mullakkara Ratnakaran, Agriculture Minister of Kerala is a staunch supporter of IFS programme.

Diversity is the key issue and judicious mix of crops/livestock/ horticulture/ agro-forestry/cottage

industry is very important for desired benefits. Shri Mullakkra Ratnakaran, Agriculture Minister, Govt. of Kerala inaugurated the Brain Storming Session-cum-Launching Workshop. In his inaugural address he raised the issue of suicides by farmers due to abject poverty and urged upon the scientists to design new farming system models for improving their livelihood security.

Dr A.K. Singh, Deputy Director General (NRM), in his keynote address, highlighted that FSR would require a paradigm shift from conventional approach of discipline-oriented research to system-based research. In this approach, livelihood security of small and marginal farm families will remain the focus of the programme. We have to ensure some income on regular basis like a salaried class person. He hoped that, if implemented in letter and spirit, it would be a flagship project of ICAR. Dr A. Anil Kumar, Executive Member, Kerala Agricultural University, offered felicitations.

The session ended with a vote of thanks proposed by Dr Kuruvilla Varughese, Chief Agronomist (AICRP-IFS) of Karamana Centre under KAU.

Technical Session-I

Chairman : Dr G.B. Singh, Former DDG (NRM), ICAR, New Delhi/ Dr I. C. Mahapatra, Former Vice Chancellor, OUAT Bhubneshwar

Rapporteurs : Dr S.S. Pal and Dr A.K. Nayak, Principal Scientists, PDFSR, Modipuram.

For Technical Session-I, three papers were scheduled. Out of these three, the first paper on "Roadmap and Strategies for Farming Systems Research in India" was presented by Dr I.C. Mahapatra. In the beginning, he briefly explained about the AICRP on Cropping Systems and the concept of farming system, including its general definition, scope, research methodology etc. In the present agricultural scenario, he stressed upon the need for Farming Systems Research to address the complex agricultural problems faced by the small and marginal farmers. In his presentation, he explained the various determinants and components of Integrated Farming Systems Research. While elaborating the methodology for IFS, he explained the holistic approach for farming system research where different components are to be integrated judiciously. The integration of different enterprises is to be achieved through appropriate techniques like linear programming and multi-criteria decision programming. He was of the firm view that FSR should be undertaken as farmer's participatory on-farm research only and on-station FSR has no meaning. However, in the present context of AICRP-IFS, it may essentially be carried out in two steps. In the first three years, the technology should be generated through on-station research and subsequently it has to be evaluated and refined through on-farm adaptive research. Integrated Farming Systems Research model, developed at each research centre should be region-specific and on-farm adaptive research (OFAR) is required to be continued for determining the yield gap and impact analysis of technology for its further refinement to address location specific problems. The steps to carry out OFAR and problems associated while conducting OFAR were also highlighted. He also emphasized that there is a need for revamping extension agencies/ mechanisms, as more than 60 per cent farm families do not have access to the newer farm technologies. He also highlighted some of the researchable issues under IFS.

Subsequently, Dr A.K. Singh, D.D.G. (NRM), ICAR apprised the house about the philosophy behind undertaking IFS research project and also added his critical observations on the approaches and key issues involved in IFSR. He stressed upon the need for quantification of outflow-inflow of materials, soil nutrients, water, farm-wastes and by-products, energy and finance among different components for optimum allocation of resources for each component.

The remaining two papers were presented after lunch. As Dr G.B. Singh was busy with some other

pressing assignment, the remaining part of technical session-I was chaired by Dr I.C. Mahapatra.

The second paper was on "Approaches and Methodology for Integrated Farming Systems Research by Dr B. Gangwar, Project Director. In his presentation, Dr Gangwar highlighted the current agricultural scenario in India and emphasized the need for Integrated Farming Systems Research as the only viable solution to address food, nutrition and livelihood security of poor and marginal farmers. He also highlighted the objectives of Integrated Farming Systems Research in the above context which needs reorienting the ongoing programmes under erstwhile AICRP on Cropping Systems. He also highlighted some important researchable issues like characterization of existing farming systems in various agro-ecological zones, identifying the potential farming systems and identification of constraints for further improvement of system productivity. He briefly explained new integrated farming system models developed through research carried out by earlier workers under NARS and also deliberated on the employment generation potential of such systems. Finally, he explained the possible approach for carrying out research on Integrated Farming System under AICRP-IFS. This was thoroughly discussed by the house and the road map approved point-wise is as follows:

1. Major focus should be on small and marginal farmers of different agro-ecological sub-zones of the country.
2. A 'predominant farming system' would be considered only if it has greater than 50 percent contribution to the total income of farm household.
3. Number of enterprises is to be limited to two or three.
4. Each participating centre has to identify three prominent farming systems in their region so as to offer alternative choices for the stake holders.
5. Initial investment limit is to be assigned to the IFS model proposed to be developed.
6. Average farm-family size should be assumed as 'five members' for estimation of food and other requirements and livelihood analysis.
7. Define the major constraints and do the constraint analysis.
8. For identification and optimization of various modules, interactive effects (complimentary and supplementary) among them, should be assessed and considered critically.
9. Value addition component is to be included in the project proposal at all the centres
10. Economists/Statisticians should be involved from the beginning for sound evaluation of IFS models developed in the project.
11. Multi-criteria decision programming/ Linear programming for identification of most fit model.
12. The projected monetary benefit from each component is to be analyzed and presented in terms of both net and gross returns.
13. The cost component of each enterprise is required to be quantified.
14. A comprehensive project document, including year-wise activity schedule, milestones and observations to be recorded, is to be prepared by each centre for effective implementation.
15. On the basis of project documents of each centre, a detailed manual would be prepared at PDFSR to maintain the uniformity in implementation of the treatments/ recording of observations and conversion of data into the information over time and space.

16. Biophysical characterization of each project area is to be done before inception of the project and important characteristic features are to be mentioned in the project document.
17. Quantification of inflow and outflow of resources from each enterprise is mandatory.
18. Net incremental income from each component is to be calculated

He also explained the execution part of the project, highlighting the team composition, budget and monitoring mechanism. The following monitoring mechanism was approved by the house. For effective concurrent monitoring, each centre is to submit monthly report to PDFSR along with weekly field visits scheduled in case of ECF districts in the prescribed coloured formats. Formation of 5-6 monitoring teams at PDFSR for western, northern, central, southern and eastern India are to be identified every year comprising of main scientist from PDFSR, one chief agronomist from the concerned region and one ECF agronomist. The schedule of the visit would be fixed preferably during September-October for Kharif season and during January-February for Rabi season. Strengthening of proposed HRD component will be alone by imparting training to conduct IFS related research activities and ECF component.

The third presentation was made by Dr S.P. Singh, on "Methodology for Characterization of Existing Farming System". The house deliberated in an elaborative manner on the sampling technique/ data acquisition methodology and monitoring protocol. Finally, it was decided that the sampling technique is to be revised/ reframed in consultation with National Sample Survey officials, National Centre for Agriculture Economics and Policy Research and scientists of IASRI, New Delhi.The questionnaire is to be uploaded on the PDFSR website and the feed back is to be obtained from participating centres for further revision. Moreover, a copy will be mailed to all centres and some experts for feedback. The survey work should be completed within the same benchmark year by different centres with local manpower under overall supervision of PDFSR. Standard data analysis tool is to be developed/ decided so that the same can be used by all the participating centres. A sampling methodology should be developed and circulated among the participating centres.

The session was concluded with vote of thanks to the Chair, by Project Director PDFSR, Modipuram.

Technical Session-II (Workshop)
(Presentation and Finalization of Technical Programme of IFS)

Chairman	:	Dr A.K. Singh, Deputy Director General (NRM), ICAR, New Delhi
Co-chairman	:	Dr M.L. Choudhary, Vice Chancellor, RAU, Pusa, Samastipur, Bihar
Rapporteurs	:	Dr Kamta Prasad, Principal Scientist, PDFSR, Modipuram Dr A.G. Wani, Chief Agronomist, MPKV, Rahuri

The session was started with welcome of chairman, co-chairman and other delegates by Dr B. Gangwar, Project Director PDFSR followed by the presentation of the technical programme of IFS from different centres. A total of five presentations could be made during this session. These were for Modipuram, Sabour, Palampur, Pantnagar and Jammu.

First of all Dr J.P. Singh, Programme leader of IFS at Modipuram centre presented the background of IFS models of all the 31 centres located in 15 agro-climatic zones. Thereafter he presented the proposed IFS model of Modipuram in which crops + dairy is the predominant farming system. He proposed IFS model on crops + dairy + horticulture + apiary + mushroom + vermicompost on a one hectare area. Dr A.K. Singh DDG (NRM) reiterated to record the observations on micronutrient, input-output parameters, energy balance and other input parameters. He also suggested that focus

should be given on high value crops by marking the market survey and goatery should be included in the IFS programme. However, Dr M.L. Choudhary, was of the view that unless market is assured for horticulture crops they should not be taken as a component in IFS. For example, marigold may act nicely as a trap crop for many insects but it is not always profitable as a commercial crop. He further suggested taking Glyricidia as a boundary crop which fixes nitrogen in the soil as well as acts as a wind break. Dr I.C. Maharpatra, former Vice Chancellor, OUAT Bhubaneshwar, suggested recording of observations on all important aspects of each component. He was of the views that as far as possible a model should be self sustainable. For example, to meet the feed requirements of poultry component, maize crop should be introduced and for fishery, groundnut crop should be included as per the climatic conditions. Dr G.B. Singh, former DDG (NRM), ICAR, suggested to compare the proposed IFS model with farmer's existing model as a control. In this context a decision was taken that each centre will compare the proposed IFS model with farmer's existing IFS model as control, by keeping it as a bench mark, on record.

Dr R.P. Sharma, Chief Agronomist, Sabour (Bihar) presented his technical programme with 11 components in IFS model for 1.00 ha land. These components were: field crops (0.5 ha) + horticulture crops (0.14 ha) + dairy (2 cross breed cows) + goatery (10+1) + backyard poultry (50 birds) + fishery (0.05 ha area) + apiary (8 boxes) + mushroom + biogas + vermi-compost and planting of drumsticks on boundaries of the farm. He also presented a general estimation of the production potential of different components of proposed IFS model and their impact on livelihood security of farm family of 5 members. According to him, the proposed IFS model can earn gross value of Rs.4,18,270 per year/ ha besides household consumption of different items of farm family within values of Rs.1,82,735. Dr Mahapatra, wanted to know the production of vermicompost from a suggested unit in IFS model. He also suggested that horticultural crops like papaya and banana should be included for year round production. Dr Gangwar suggested that IFS model should be according to farmer's situations.

Dr A.K. Bhardwaj, Chief Agronomist, Pantnagar presented the technical programme for Tarai region of Uttarakhand area. He proposed an IFS model of 1.0 ha area with components of crops + dairy + vermicomposting + poultry + agro-forestry + apiary for a family size of five. Among cropping systems he included (i) rice- toria-sugarcane ratoon-wheat-mung, (ii) rice-mustard-sugarcane ratoon, (iii) rice-vegetable-summer rice, (iv) rice-wheat-cowpea and (v) rice-wheat-sesbania/sunhemp, while, in dairy the components were : cows + back yard poultry (10 birds) + horti-agri- pastoral (litchi, guava, papaya) + vegetables + apiary (2 boxes). Boundary plantation will be with lime, poplar and karonda.

Dr S.C. Negi, Chief Scientist Palampur (H.P.), presented the IFS model for Palampur centre. The predominant farming system (almost 90%) in the area is crops + dairy. Out of this, crops contribute about 70-80% and dairy 20-30% of gross income. Emerging profitable enterprises are fishery, poultry and improved crossbred cows which may be included in the IFS model. Based on this information he proposed a model which included cereals, pulses, oilseeds (0.67 ha), fodder crops (0.10 ha), horticultural crops (0.175 ha), livestock (2 cows), poultry (25 birds), fish pond (300 sq m) and vermi-compost unit (0.0025 ha). Dr A.K. Singh, DDG (NRM), suggested to include value addition in different products of IFS model as one of the components. Dr S.S. Pal, suggested to develop the IFS model for hilly areas also. Dr B. Gangwar, Project Director, explained the problem of scientific staff at Palampur centre to the DDG and he took serious note of it and suggested, to communicate the same to the Vice Chancellor of the university.

Dr Daleep Kachroo, Chief Agronomist, Chatha (Jammu) presented technical programme of IFS model for sub-tropical zone of J & K. The existing cropping system under irrigated conditions is rice-wheat (30-40% area) and maize-wheat under rainfed conditions. The predominant farming system is crop + dairy (70-75%). He proposed a 1.50 ha model of IFS including crops + dairy (2 cows + 2 buffaloes) + backyard poultry (100 birds) + multi-storied horticulture unit (fruit+ vegetables) + agroforestry + medicinal plants + mushroom production + apiary (5 boxes) + vermicomposting. Dr A.K. Singh, DDG, suggested a reduction in some of the components in the IFS model, and Dr G.B. Singh (Former DDG), pointed out that IFS model should be according to the resources available. Dr N.P. Singh, Director ICAR-RC- Goa, suggested use of credit facilities available through banks for purchase of animals.

Technical Session-II (continued----)
(Presentation and Finalization of Technical Programme of IFS)

Chairman : Dr B. Gangwar, Project Director, PDFSR, Modipuram

Co-chairman : Dr M.L. Choudhary, Vice Chancellor, RAU, Pusa, Samastipur, Bihar

Rappoteurs : Dr J.P. Singh, Principal Scientist, PDFSR, Modipuram
Dr R.P. Sharma, Chief Agronomist, RAU, Pusa Bihar

The presentation of IFS modules proposed by different centres and suggestions made on the presentations continued during this session. The proposal and suggestion made are summarized hereunder.

Sl. No.	Name of the centre	IFS Module suggested/ proposed	Remarks/ Suggestions mode
1	Ludhiana (Punjab)/ Dr S.S. Walia, Chief Agronomist	Field crops + dairy + horticulture + fish + mushroom + apiary + poultry + vermicompost + agro-forestry + medicinal plants + boundary plantation (11 components)	It was suggested that the project proposal may be prepared as per guidelines circulated by PDFSR and resubmitted. Cost of production, net profit and family requirements may also be incorporated.
2	Hisar (Haryana)/ Dr Pawan Kumar	Field crops + dairy + vermicompost + boundary plantation	Similar to Ludhiana, Haryana center has also prepared and presented the proposal as per guidelines of the PDFSR. The proposal may be submitted as per the discussion as made in the brain storming session.
3	Kanpur (U.P.)/ Dr M.P. Yadav, Chief Agronomist	Field crops + dairy + horticulture + poultry + apiary + mushroom + vermicompost	The whole technical programme may be revised as per guidelines of PDFSR and the suggestions given in brain storming session. Yield gaps as reported in rice and wheat may be verified. The quality of slides was very poor and should be improved in future presentations.
4	Faizabad (U.P.)/ Dr S.P. Singh, Agronomist	Crops + dairy + horticulture + apiary + mushroom + vermicompost	Dr G.B. Singh, Ex-DDG (NRM), ICAR suggested that atleast one intervention on the reclamation of soils should be taken keeping in view a large area under problem soils in Kanpur and Faizabad regions. Ratio of cow dung and waste materials (residues etc) in vermicompost preparation should be reported.

5	Varanasi (U.P.)/ Dr J.S. Bohra, Agronomist	Crops + dairy + fishery + apiary + poultry + mushroom	Complete economics, including cost of production, gross profit and net profit should be given in the proposal of IFS. Dr Mahapatra raised the question of including vermi compost and NADEP at the same time and asked to included the one which is more suitable.
6	Kalyani (W.B.)/ Dr Manbendra Rai, Agronomist	Crops + dairy + horticulture + fish + poultry + apiary + mushroom + vermicompost	Number of milch animals may be reduced.
7	Umiam (Meghalaya)/ Dr A.S. Panwar	Field crops+ dairy + pig + horticulture + poultry + mushroom + vermicompost	The project proposal submitted by the centre was found sound and complete except economics (cost of production and net profits) not included.
8	Jorhat (Assam)/ Dr Ajit Baishya, Chief Agronomist	Field crops + dairy +piggery + poultry	The relevance of rearing low yielding milch cows with average production of 2.0 litre per day was questioned and it was advised to explore the possibility of raising the present level of milk production by either changing the breed of animals and/or by nutritional intervention.
9	Raipur (Chattisgarh)/ Dr S.K. Sarawagi	Crops + dairy + horticulture + fish + mushroom + apiary + poultry + vermicompost	Risk factor, mainly mortality due to diseases, may also be considered when calculating productivity and profitability in case of animals.
10	Ranchi (Jharkhand) Dr M.K. Singh, Chief Agronomist	Field crops + dairy + fish+ mushroom + vermicompost + apiary + nutritional garden	Concept of nutritional garden of horticultural crops - fruits and vegetables was appreciated. The centre has not considered labour when calculating gross and net returns and was advised to include the same.
11	Jabalpur (M.P.) Dr V.B. Upadhyay Chief Agronomist	Field crops + dairy + poultry + fish + vermicompost	Poor slide preparation and presentation was viewed seriously by the chairman and adviced not to repeat it in future.
12	Akola(Maharastra) Dr B.V. Saoji, Chief Agronomist	Field crops + horticulture + dairy + poultry + mushroom + vermicompost	Only one final combination to be reported in place of separate 4 combinations. Models for different situations are not planned properly. The proposal in totality needs to be discussed at university level and resubmitted. Presentation quality to be improved in future.
13	Rahuri (Maharashtra)/ Dr A.G. Wani, Chief Agronomist	Field crops + horticulture + dairy + poultry + vermicompost	Cropping system Lucerne – Lucerne - Lucerne may be written as lucerne only and one more crop may be accommodated in the sequence. Check and correct all the calculations given in the proposal including cow dung production.
14	Parbhani (Maharashtra)/ Dr W.N. Narkhede, Chief Agronomist	Field crops + horticulture + dairy + vermicompost + food processing unit	In orchards only one intercrop (soybean) is taken during kharif season. One more crop during rabi season may also be accommodated to increase the overall profit from the unit. Dr B. Gangwar, Project Director advised inclusion of high value crops in IFS models. Root crops may also be given due consideration

			particularly in orchards.
15	Rajendranagar (A.P.)/ Dr V.B. Bhanumurthy, Chief Agronomist	Field crops + horticulture + dairy + goat + poultry + vermicompost + food processing unit	Dr Mahapatra suggested that in addition to Sesbania some more species may also be identified for boundary plantations in consultation with IGFRI, Jhansi. However, Glyricidia may be more appropriate .
16	Coimbatore (T.N.) Dr K. Siddheswaran, Chief Agronomist	Field crops + dairy + biogas unit + vermicompost	The proposal was found correct.
17	Kathalgere (Karnataka)/ Dr H. Chandarappa, Chief Agronomist	Crops + horticulture + dairy + sheep + poultry + vermicompost + mushroom + biogas unit	In place of high yielding exotic breeds of cows, the inclusion of indigenous good breeds should be encouraged.
18	Karamana (Kerala)/ Dr Kuruvilla Varughese Chief Agronomist	Crops + dairy + fish and prawn + ducks + mushroom + vermicompost + apiary + chips making unit	Dr B. Gangwar advised that instead of one hectare model, 3 to 4 models of 0.2 hectare land may be formulated and all the farming situations may be represented. Dr B. Gangwar further informed that funds can only be increased by 10-20%
19	Siruguppa (Karnataka)/ Dr A. Basavaneppa, Chief Agronomist	Crops + dairy + horticulture + fish + vermicompost	Only one species of fish, katla will not be ideal and a mix of 3-4 species should be taken for higher productivity and profits.
20	Portblair (A & N)/ Dr N. Ravishanker (PI)	Coconut + pig +poultry + fish Rice+ veg. + dairy + fish in BBF system	Dr B. Gangwar, the chairperson of the session showed his concern on not including horticulture scientist in the team of scientists as the Institute is mandated for the cause of horticulture. Inclusion of scientist from horticulture discipline in the programme was suggested. He also advised to plan an organic based farming system model as organic agriculture has a very good scope in that area.
21	Bhubaneshwar (Orissa)/ Dr L.M. Garnayak, Chief Agronomist	Field crops + dairy + horticulture + apiary + mushroom + fish + poultry + ducks + vermicompost	The PI was advised to prepare IFS model for 1.2 hectare land in place of 1.5 hectare and revise the proposal accordingly.
22	Ela (Goa) Dr S. Subramaniam (PI)	Field crops + horticulture + dairy + fish + pig + poultry + mushroom + vermicompost + biogas unit	As there were confusion with regard to execution of IFS activities, it was advised that the project proposal of the centre is to be discussed separately. The PI may discuss the proposal in scientific forum of his institute and resubmit the proposal as early as possible.
23	Karjat (Maharashtra)/ Dr L.G. Panwar, I/C Chief Agronomist	Field crops + horticulture + dairy + poultry + vermicompost	In horticulture component, other intercrops may also be included.
24	S.K. Nagar (Gujarat)/ Dr B.S. Patel, Chief Agronomist	Field crops + dairy + horticulture + vermicompost + value addition + boundary plantation	Core team may be constituted separately and informed to the PDFSR in writing. As Gujarat is considered to be dominated by animal based farming systems it was suggested that the model

			may be formulated accordingly. Need of diagnostic survey before finalization of the proposal was also felt.
25	Durgapura, Jaipur (Rajasthan)/ Dr O.P. Gill, Chief Agronomist	Field crops + horticulture + dairy + goat + poultry + vermicompost	The proposal was found correct.
26	Patna (Bihar) Dr M.A. Khan, Director		IFS model should be realistic and only 1-2 additional enterprises, into the prevailing farming system should be included. Information on water, energy flow should be recorded. More emphasis needs to be put on RCTs and on-farm value addition.

In between these presentations, Asst. General Manager, NABARD, Trivandrum, informed the house that NABARD acknowledges the need for promoting IFS models in various regions of the country to benefit small and marginal farmers of the country.

Various cost effective IFS models can be developed by taking into account cost of cultivation aspects (including cost of establishment of irrigation source) and calculating net incremental income with time values of money into consideration.The IFS models being developed must include energy flow chart and complimentary energy recharge among various enterprises of the model.

Dr I.C. Mahapatra showed his concern over non-availability of credit to poor and small farmers and all the benefits are being taken away by large farmers in the name of small and marginal farmers. He requested to NABARD representative that rural agriculture graduates may be identified and given loans for custom hire services in villages.

Subsequently, on request, the scientist from UAS Raichur was also permitted to present IFS programme for rainfed and irrigated conditions. The Project Director advised him to send a separate request as a voluntary centre and the matter of inclusion will be considered at later stage on merit basis.

During deliberations on various presentations, following issues emerged for consideration:

1. The House was of the view that the number of enterprises to be integrated into farming system model of the area be kept minimum, in view of limited resources and poor economic conditions of the marginal and small farmers.
2. Input and output in IFS may be quantified in terms of energy in addition to productivity and profitability.
3. IFS model should be planned keeping in view the physiography, climate, natural resources and other limitations (infrastructure/ social/ economical etc.) observed by the farmers of the area.
4. On-farm post harvest value addition should be given due priority.
5. For multistoried cropping, root crops and leguminous crops may be preferred over others, particularly in newly established fruit orchards.
6. For on-farm validation of IFS model, farmers' representatives should be involved from the

very first phase of planning and in all decision-making processes at later stages. Similarly, women play an important role in farming system and hence should be a part of planning and given due recognition in IFSR.

7. Critical observations on each and every component of IFS should be undertaken and analyzed with special reference to input and output flow.
8. Agriculture related allied occupations or cottage industries, such as making and selling of woolen cloths by hill women, may contribute a lot in IFS.
9. Potential of harvestable runoff water/ rain water and its recycled use for different enterprises be critically analyzed, particularly in rainfed and low rainfall hilly areas.
10. Characterization of on-farm farming systems should be restricted to the surrounding areas of the research centre.

Recommendations

- The Integrated Farming Systems Research is to be carried out in two steps. As a first step (initial three years), the suitable modules should be standardized and integrated systems designed in 'on-station research' mode and subsequently they should be validated and refined through on-farm interventions under AICRP-IFS. Under 'on-station research' mode more than one farming situation (such as irrigated & rainfed or small & marginal farm household) may be considered for model development.
- Socioeconomic profile and nutritional security (as per WHO standards) of the farmers and micro-credit and insurance policies of the government should be taken into consideration before we initiate research on IFS.
- Constitution of multi-disciplinary teams of scientists, which may work cohesively, and appropriate inter-institutional linkages, should be ensured at each centre.

The road map for IFSR, as approved by the house is as follows:

- The major focus should be on small and marginal farmers of different agro-ecological sub-zones of the country as 82% of farmers belong to this category.
- The predominant farming system is to be decided based on the component (s) which contribute (s) more than 50% share in terms of total production or monetary returns.
- The major constraints and options available to address the constraints need to be identified.
- The resource allocation should be decided based on the household need of about 5 member family (or average size of farm family as existing in the zone/ district)
- In general, only cost effective most appropriate pre-tested modules need to be integrated in the farming system model. However, to improve upon the household incomes, some new components may be required to be introduced into the existing farming systems but it would be ensured that suggested new modules are farmer-friendly, cost-effective and socially acceptable to farmers.
- For deciding the inclusion of any enterprise or module the SWOT analysis needs to be carried out.
- Approach for finalization of most fit model for different locations needs to be considered in special meetings. For analysis and synthesis of IFS data linear programming and multi-criteria

decision programming is considered to be the suitable approach. However, special efforts have to be made to develop and refine the methodology for farming systems research model for synthesis of results.

- Each participating centre has to identify three prominent farming systems in their region so as to offer alternative choice for the stake holders.
- A comprehensive project document along with the year-wise activity schedule and milestones is to be prepared by each centre.
- For effective and regular monitoring, every year 5-6 monitoring teams would be formed well in advance at PDFSR; one each for eastern, western, northern, southern and central parts of India; with the following composition:

  One senior level scientist from PDFSR
  One chief agronomist/ PI of the region
  One OFR agronomist/Economist of the region

(These teams would visit all the IFSR/ CSR/ OFR centres located in the respective parts normally during kharif (September-October) and rabi (January-February) every year and submit their specific observations/ recommendations in prescribed format to the Project Director, PDFSR, for further necessary action.)

For characterization of existing farming systems it was agreed upon that:

- The sampling technique should be revised in consultation with the officials/ scientists of Survey Design and Research Division of National Sample Survey Organization (Ministry of Statistics and Plan Implementation), Kolkata, National Centre for Agriculture Economics and Policy Research, New Delhi, and IASRI, New Delhi.
- The questionnaire is to be displayed on the PDFSR website and the feedback is to be obtained from participating centres for further modifications.
- The survey work should be completed within the same benchmark year by different centres with local manpower under the supervision of PDFSR.
- Standard data analysis tool is to be developed/ identified by PDFSR in consultation with IASRI, so that the same can be used by all the participating centres.
- Appropriate monitoring mechanism is to be developed by PDFSR for elimination of spurious data.
- A comprehensive manual should be developed and circulated to all the participating scientists/ centres. The manual should contain detailed instructions, including relevant procedures, observations to be recorded, sampling methods and data sheet formats etc. to maintain the uniformity in conduct of experimentation and recording of observations across the centres.
- Quantification of outflow-inflow of materials, soil nutrients, water, farm-wastes and by-products, energy and finance among different components is necessary for optimum allocation of resources for each component.
- Information on month-wise distribution of income, labour requirement, fodder requirement vis-à-vis production, should be generated on regular basis.
- To the maximum extent possible latest production technologies for growing crops and raising animals, such as micro-irrigation techniques and composite fish culture, should be integrated in the system while developing the model.

- Adequate provision should be kept for allocation of farm land for different enterprises, including land required for production of feed/ fodder for livestock/ poultry/ fish etc.
- The component of value addition/ post-harvest processing needs to be given due importance at all the centres.
- For expeditious exchange of information all the Chief Agronomists/ PIs may be allowed to subscribe one wireless internet connection with one time connection cost of approximately Rs. 4000/- and monthly subscription of Rs. 500/- and expenditure may be met out of sanctioned grant under the Head 'Recurring Charges' and Sub-Head 'Contingencies'.

CHAPTER - 6

APPROACH AND GENERAL GUIDELINES FOR "DEVELOPMENT AND VALIDATION OF ON-STATION INTEGRATED FARMING SYSTEM MODEL"

PART-1: OBJECTIVES AND APPROACH

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 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 stakeholders in Integrated Farming Systems through appropriate trainings.

Approach:

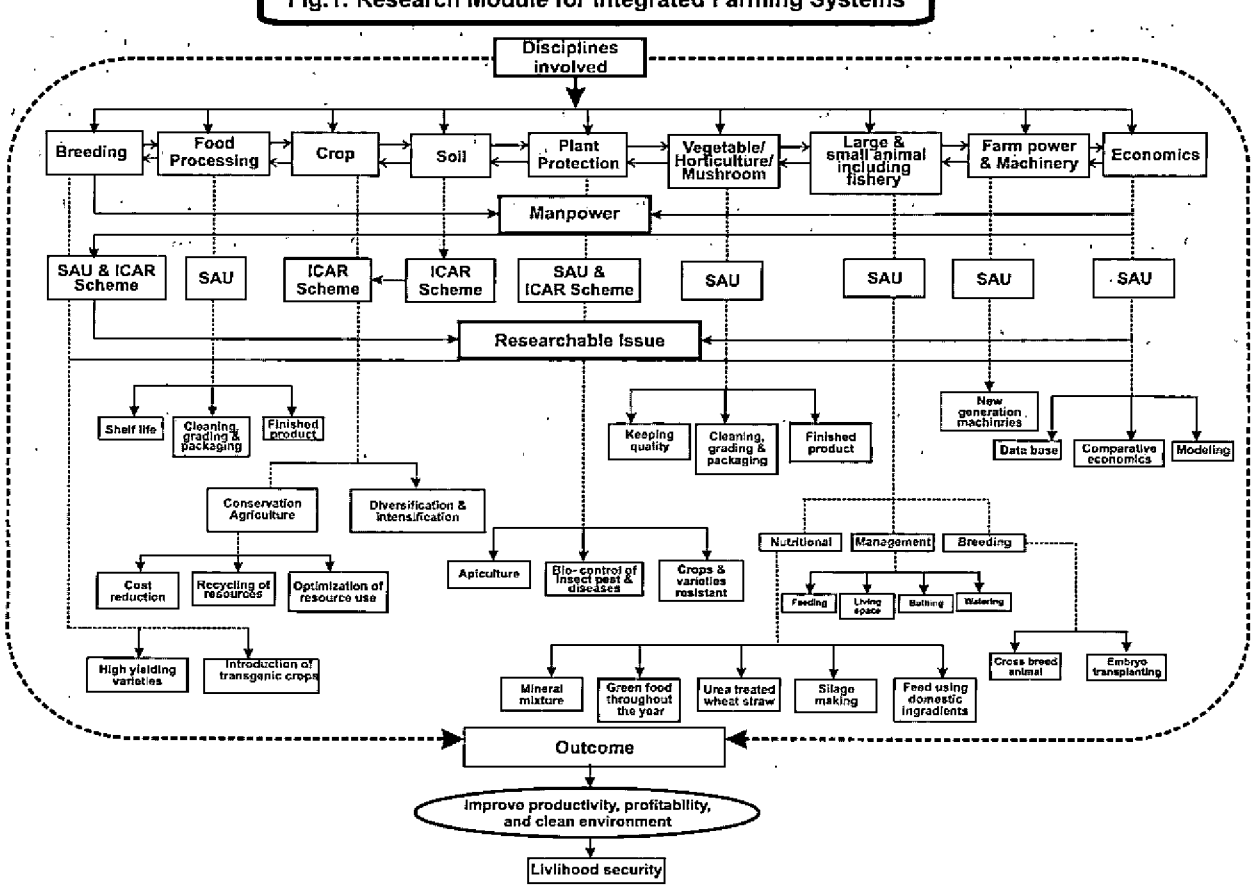
Exploding population, urbanization and industrialization, are leading to decline in per capita availability of vital agricultural resources and also fragmentation of farm holdings, making them operationally uneconomic. Majority of our farmers belong to the category of marginal to small landholders. The process of marginalization of land holdings is likely to continue due to various demographic reasons. The per capita arable land decreased from 0.34 ha in 1950-51 to 0.15 ha in 2000-01 and is expected to shrink to 0.08 ha in 2025. There are 115 million numbers of operational holdings in India. Small (1ha size of holdings), marginal (2 ha) and semi-medium (4 ha) comprise about 80% of such farm holdings. Such farm families have certain basic needs including food (cereal, pulses, oilseeds, milk, fruit, honey, fish, meat, egg etc.) feed, fodder, fibre, employment, etc. To fulfill these, farmers have been doing their own farming system for a long time.

At national (ICAR and State Agricultural Universities) level, lot of efforts have been made for the last four decades, aiming at increasing the productivity of different components of farming system like crop, dairy, livestock, poultry, piggery, goat keeping, duck keeping, apiculture, sericulture, vegetable

production, horticulture, mushroom culture, sericulture, etc. But, our national scenario is clearly indicative of the fact that normally, a farming family maintains multi-enterprise systems, depending upon his/her family requirements, knowledge base, socioeconomic setup, agro-climatic conditions and available farm resources. However, to have a systematic integration of multi-enterprise systems in a scientific manner, components need to be chosen in such a manner that product or by-product of one component becomes the input for other, becoming complementary and are organically well interlinked to each other without wastage. For example, by-product and waste material generated from cultivating many crops is used as raw material for many industrial uses or as fuel or as feed/ fodder to the cattle of the farm. The animal dung may also be used as fuel or a mix of dung, urine and crop residues may be used for production of compost/ farmyard manure that is applied to crops and fishpond. The silt deposited at the bottom of a fishpond can again be utilized as manure to crops. The FYM can substitute about 25% of recommended NPK for crops. Crops like mustard serve as a good source of nectar for honeybees, besides providing edible oil for human and cake for animal feed. The crop residues can substitute 12% of recommended NPK. If fispond embankment is used for cultivating fodder/flower/fruit/vegetable crops, it provides extra output either for human or animal.

Farming systems approach of agricultural research is one venture to harness the complementarities and synergies among different enterprises and augment the total productivity, profitability and gainful rural employment. Unlike commodity research, where the focus is on increasing productivity/ profitability of individual crop/ animal, under farming system approach, it is the farm household that remains the focus of the research programme. A Schematic representation of the inter relationships of different components contemplated are furnished in the fig-1.

Fig.1: Research Module for Integrated Farming Systems



PART-2: GUIDELINES AND FORMAT

(Please note that during its first phase – XI Plan Period – it would be taken up as 'on-station research' programme only)

Guidelines:

A. Selection of Area: Select a contiguous piece of land measuring 1.0-1.5 ha, to represent small and marginal farmers of the region. The yardstick for defining small and marginal farmers may vary among the states and accordingly area selected for the project may also vary.

B. Selection of Enterprise (Module): There is no thumb rule for selecting a specific number of enterprises and allocation of area to different enterprises. It would largely depend upon the common logic of household requirements of an average farm-family of the region, especially in respect of food, feed, fodder, fuel, fiber and reasonable cash. In farming system approach we have to ensure that output from the individual farm unit (IFS Project Area in our case) fulfils aforementioned requirements for a normal size family (size to be specified) along with its farm animals/ fish etc. Moreover, general agro-ecological situations, infrastructure availability, government policies and social acceptability have to be duly considered. As far as possible, select the farming system enterprises, which may fit in a modular format, i.e., they may be developed as self-contained components of the farming system as a whole, with well-defined interface(s) so that they can easily be connected to or disconnected from the system. Based on our previous knowledge (primarily collected through resource characterization surveys under AICRP-CS programme), predominant farming system of that region should form the base model. It should be further diversified with additional components with well-defined objectives and principles of farming systems approach.

C. Selection of Crops/ Cropping Systems/ Animals: Within each component, identify crops and their most suited varieties to be grown, cropping systems to be adopted, type and number of animals to be raised, species/ breeds of livestock/ fish/ honeybees to be raised. Allocate optimum area under each unit. This should also be taken care in accordance with above mentioned criteria.

D. Technologies to be adopted: Latest available production technologies for different production/ processing units have to be adopted with optimum levels and should be specified in technical programme.

Format for Research Project Proposal:

PART-A. Summary of Proposed Technical Programme for IFS Experiment (*Annual crops, including vegetables and fodder crops (pure & intercropped); **Including area under sheds/ ponds/ boxes etc; @Perennial fruit trees/ shrubs/ plantation crops (pure & multistoried); #Area required for other activities such as dwelling unit, tube-well, permanent irrigation channels, store house etc)

Name of the Centre	Modules/ Enterprises identified	Number	Net area (ha) allocated**	Treatments/ Remarks
	Crops*			Cropping Systems:
	Horticulture			1.
	Livestock			2.
	• Cattle			3.
	• Buffaloes			4.
	• Sheep			5. ------ and so on.
	• Goat			
	• Pig			
	• Rabbits			
	• Others (Specify pl.)			
	Poultry			
	• Fowls (Cocks & hens)			
	• Ducks (Ducks & Drakes)			
	Fishery			
	Apiary			
	Sericulture			
	Mushroom production unit			
	Biogas unit			
	Vermi-compost unit			
	Food processing/ Value addition unit			
	Area under supporting activities			
	TOTAL			

PART-B. Model Format (For general guidance)

Sl. No.	Item	Details
1	Name of the center and it's location	
2	Name of the University/ICAR institute	
3	i) Ecosystem under which centre falls	Arid/ Semi-Arid/ Sub-Humid/ Humid/ Coastal
	ii) Agro Climatic Region (based on classification by Planning Commission of India)	
	iii) NARP Zone (As per classification under NARP. Please give full name)	
4	Predominant Farming Systems (not more than 2) and percentage of the farm families adopting these farming systems.	
5	Important crops (including horticultural crops) and cropping systems of dominated farming system/ systems.	a) Important crops: b) Important cropping systems:

6	Per cent contribution of individual enterprises in the economy of dominant Farming Systems.	
7	Yield gaps (Farmer yield V/s Achievable yields) for important enterprises.	
8	Available low cost technologies to overcome these gaps (for each crop/ animal/ other component)	
9	Promising low-investment enterprise(s), which may be integrated profitably to diversify the existing dominated farming system of small and marginal farms (as given above).	Livestock (buffalo/ cattle/ sheep/ goat/ rabbit/ pig), Apiary (including honey production, processing and packing)/ Mushroom production and packaging unit/ Multistoried horticulture orchards/ Fresh water aquaculture/ Backyard poultry including ducks/ Biogas unit/ Vermi-compost unit/ Farm forestry/ Sericulture/ Food processing and value addition unit/ Any other (please specify)
10	Annual food (cereals, pulses,oilseeds, milk, meat etc.), fodder (green and dry) and feed (concentrates) requirements of an average size family (vary from 5 to 7 members) to secure the livelihood of small and marginal farmers.	Please see Annexure -2 for guidance.
11	Area allocation under different components of the IFS Model keeping in mind the minimum annual requirements of a family first and create sufficient additional income to meet the cost on inputs and other social liabilities of a family. This may be based on the achievable yields or production capacities of crops, fruit plants, milch animals and other enterprises proposed to be integrated into the model and scope of integration of new enterprises.	Pease see Annexure-1 for guidance.

C. AN EXAMPLE

Project Proposal for On-Station IFS Research at PDFSR, Modipuram

a) Location of the centre and present agricultural scenario in the Region

Sl. No.	Item	Details
1	Name of the center and it's location	Modipuram, Meerut, Uttar Pradesh.
2	Name of the University/ICAR institute	PDFSR, Modipuram (An ICAR Institute)
3	i) Ecosystem under which centre falls ii) Agro Climatic Region (based on classification by Planning Commission of India) iii) NARP Zone (As per classification under NARP. Please give full name)	Semi-arid Upper Gangetic Plain Region Western Plain Zone (UP-3)
4	Predominant Farming Systems (not more than 2) and percentage of the farm families adopting these farming systems.	Crops + Dairy (90%)
5	Important crops (including horticultural crops) and cropping systems of dominated farming system/ systems.	a) Important crops: Sugarcane, wheat, rice and fodder crops sorghum, berseem and oats. b) Important cropping systems: i. Sugarcane –S.cane ratoon-wheat ii. Sorghum (F) -rice-wheat
6	Per cent contribution of individual enterprises in the economy of dominant Farming Systems.	Crops – 60 to 70% Dairy - 30 to 40%

7	Yield gaps (Farmer yield V/s Achievable yields) for important enterprises.	Crops: i)Sugarcane Plant crop - 103% Ratoon - 75.7% ii) Wheat - 41.3% iii) Rice - 54.8% Milk : i) Buffalo - 129.9% ii) Cow - 161.7%
8	Available low cost technologies to overcome these gaps	Sugarcane – • Advancing sugarcane planting (for each crop/ animal/ other component) through simultaneous cropping. • Balanced nutrition through INM. • IPM for weed and pest management. Wheat – • Recommended varieties for respective sowing time (Timely /delayed). • Balanced nutrition through INM. • Chemical control of weeds. Rice – • Use of hybrid basmati varieties. • Control lodging and diseases /pests by application of INM and IPM technologies. • Harvest the crop at proper moisture. Milk – • Rear local high yielding breed of cows and buffaloes. • Ensure year round supply of green fodder. • Fed with balanced ration, salt and mineral mixtures. • Use of high quality and fresh semen and inject (AI) at proper heat for avoiding repeated breeding, a common phenomenon.
9	Promising low-investment enterprise(s), which may be integrated profitably to diversify the existing dominated farming system of small and marginal farmers.	i) Apiary – Orchard and forestry dominated areas small and marginal farmes (as given above). ii) Mushroom- Ideal low cost enterprise for all the small and marginal farmers. iii) Multistoried fruit and vegetable orchards – Small and medium categories of the farmers having comparatively more cultivated land can practice this for increased year round income and more employment per unit area per unit time. iv) Freshwater fish production – In low lying and riverbed areas and also in assured water supply, fish production has also been found an economic enterprise even on small land holdings. v) Backyard poultry and ducks – To utilize home stead wastes and have the environment clean these two birds have been found to be promising enterprises to turn the farm wastes into economic returns. vi) Vermicompost – All the cowdung, urine and farm waste may be utilized for preparation of high nutrient containing vermicompost rather than poorly decomposed FYM with low nutrient content

		and contaminated with huge colonies of termite. vii) Farm forestry/boundary plantations – All field boundaries may be utilized for plantation of perennial fruit trees and waste lands for useful fuel and timber plantations. Karonda (*Carisa carendis*) , citrus, aonla, bel, jackfruit etc. can safely be planted.
10	Area allocation under different components of the IFS Model keeping in mind the minimum annual requirements of a family first and create sufficient additional income to meet out cost on inputs and other social liabilities of a family. This may be based on the achievable yields or production capacities of crops, fruit plants, milch animals and other enterprises proposed to be integrated in to the model and scope of integration of new enterprises.	Please see Annexure-1 (Technical Programme (Enterprise/Enterprises detail and allotment of land)
11	Annual food (cereals, pulses,oilseeds, milk, meat etc.), fodder (green and dry) and feed (concentrates) requirements of an average size family (vary from 5 to 7 members) to secure the livelihood of small and marginal farmers.	Please see Annexure-2 (Details of different enterprises, family needs and their impact on livelihood of a household).

Technical Programme (Enterprise/Enterprises detail and allotment of land for 1 ha)

1. Land allotted to animal shed, threshing floor/apiary/mushroom/ vermi-compost unit, backyard poultry , kitchen gardening, compost pit and common uses = 880 sq.m.
2. Area under cereals, pulses, oilseeds and fodder crops for meeting household's food, feed and fodder demand = 7,200 sq.m. (Net)
3. Multistoried horticultural unit with fruits and vegetables = 1,920 sq.m. (Net)

A. CROP PRODUCTION

a. Crops and crop sequences to be followed and area allotted under different sequences

Crop sequence	Area (Net) allotted (m^2)
1. Paddy-potato –sugarcane (Feb.) –sugarcane ratoon –wheat – moong	1600
2. Kharif sorghum-sugarcane(Oct./Nov.)+mustard–sugarcane ratoon –wheat	1200
3. Paddy – mustard- summer sorghum	1200
4. Summer sorghum- black gram – wheat	800
5 Maize + pigeon pea – wheat	800
6. Paddy– berseem + mustard- moong	800
7. Maize –toria - oats	800
Total	**7200**

b) Average expected annual production and income from crop production

Farm produce	Gross area total	% of annual production (kg)	Expected (Rs./year)	Gross returns (Rs./year)
Crop production (Net area = 7200 sq.m.)	-	72	-	-
i) Cereals (Paddy, maize, wheat)	6390 sq.m.	41.1	3337	33370
ii) Pulses (Green gram, Pigeonpea, Black gram)	2130 sq.m.	13.7	373	6714
iii) Oilseeds (Toria & mustard)	2000 sq.m.	7.7	316	5888
iv) Sugar crop (Sugarcane)	2100 sq.m.	13.5	13600	16320
v) Green fodders (Sorghum,berseem, oats)	3730 sq.m.	24	27700	20775
vi) Dry fodders (Wheat & rice straw, maize stover, sugarcane tops etc.)	-	-	14000	42000
Total A	**16,350 sq.m.**	**-**	**-**	**125067**

B. DAIRY (Milk Production)

Expected production from the dairy unit (Two milch animals - one cow + one buffalo)

a) Milk

One buffalo with Av. Yield of 8.0kg/day x 265 days = 2120 kg

One cow with Av. Yield of 12.0 kg/day x 265 days = 3180 kg

Total milk production per year = 5300 kg

Total value of milk = 5300kg x Rs.15/kg = Rs.79500/-

b) Cow dung

Total production of cow dung = 30 tons

Total value of cow dung = 30 tons x Rs.125/ton = Rs.3750/-

c) Sale of young calves

Two number of young ones sold @ Rs.3000/ each = Rs.6000/-

Gross income from dairy:Rs.79500 + Rs.3750 + Rs.6000 = Rs.89250/-

C. APIARY (Bee Keeping)

As this enterprise does not require additional land and also needs few running expenditure in subsequent years it can be started with a marginal money (Rs.5000/- per box). A unit of 5-10 bee boxes will be an ideal apiary unit for marginal and small farmers. To encourage the farmers, free training and subsidized loan facilities are given by different departments in each district. With farmer level of management, an apiary unit with 10 bee boxes will produce more than 150 kg of honey per year with gross return of Rs.15000/year. This production can be further enhanced with better management particularly shifting of bee boxes to other outer locations where flowers are available when no such crops are grown in the project area.

D. HORTICULTURE (A multistoried fruit and vegetable unit)

a) Area covered under horticultural crops: – 48mx40m (1920 sq.m.)

b) Fruit species and their number:-

Main fruit tree guava – 30; Filler fruit plant papaya – 69

Boundary fruit trees (kagji nimboo) – 22; karonda – 154

Papaya, a short duration fruit cum vegetable plant as intercrop fruit

c) Intercrops under canopy cover:-

Seasonal vegetables including field pea, tomato, cabbage and brinjal etc.

d) Average production and expected income from horticultural unit.

Fruits/vegetables	Number /area	Productivity (kg/unit)	Production (kg)	Market whole sale price/kg (Rs.)	Total produce Value (Rs.)
1. Fruits**					
i) Guava	30	75/tree	2250	10	22500
ii) Papaya	69	60/plant	4140	8	33120
iii)Kagji nimboo	22	20/tree	440	15	6600
iv) Karonda	154	5/bush	770	15	11550
Total A	-	-	7600		73770
2. Vegetables					
i) Brinjal	960 sq.m.	125q/ha	1200	8	9600
ii) Tomato	960 sq.m.	125q/ha	1200	8	9600
iii)Cabbage	960 sq.m.	150q/ha	1440	8	11520
iv) Veg.pea	960 sq.m.	35q/ha	335	8	2688
Total B	-	-	4175	-	33408
Gross returns	-	-			107178

** *Income from fruits is expected from third year onward.*

E.VERMICOMPOSTING UNIT

Two milch animals along with their young ones produce more than 30.0 tons of raw cow dung per year. The farmers besides making dung cakes for fuel, use rest of the cow dung for preparing Farm Yard Manure. The FYM prepared by the farmers is of very poor nutritional status (0.4% - 0.7%N) and cause large scale infestation of termites which when added to the soil, permanently create a serious problem damaging all the crops at all the stages and many times results in complete crop failure. Preparation vermicompost from all the available cow dung not only solves the problem of termite but save in costly nutrients to a great extent. Farmers can produce 10-15 tons of vermicompost annually. For this a small unit of 150 sq.m. will be established and all the cowdung will be used for vermicomposting. This practice will enhance the market value of raw cowdung when converted into vermicompost 10 times i.e., from Rs.3750/year (value of raw cow dung) to Rs.30,000/year (value of vermicompost).

F. MUSHROOM PRODUCTION UNIT

For landless and resource poor farmers, mushrooms can be a good source of additional income. As per an estimate, around Rs.30,000/- of net annual income can be generated from a small crop room of size 20'x20'. Further, comparatively lesser water requirement for mushroom production will be best eco-friendly practice of food production under changing climatic scenario. Availability of abundant quantity of agricultural residues, varied agro-climatic zones, cheaper and abundant labour, large domestic market, being a vegetarian food, availability of various mushroom species for year round production and an extensive network of R&D sector provide strong base for extensive mushroom cultivation in our country.

G. FARM BOUNDARY PLANTATIONS

All along the farm boundary nutritionally rich fruit species like jackfruit, bael, aonla, jamun etc.

will be planted at proper plant to plant spacing ranging from 5.0 to 8.0 meter. This will not only create additional fruits but will act as wind-breaks.

Livelihood security through integrated farming system approach

The production potential of different farm components integrated into an IFS model and their impact on livelihood security of normal-sized farm family of small and marginal category is summarized in table below.

Farm produce	Gross area,m^2/ Unit size	Expected annual production (kg)	Estimated requirement of a Family (7 members)	Value of household consumption (Rs)	Surplus for sale (kg)	Gross value of surplus (Rs.)
A. Crop production						
i) Cereals (Paddy, maize, wheat)	6390	3337	1541	15410	1796	17960
ii) Pulses (Green gram, pigeon pea, black gram)	2130	373	200	3600	173	3114
iii) Oilseeds (Mustard)	1200	216	170	3060	46	828
iv) Sugar crop (Sugarcane)	2100	13600	1600	1920	12000	14400
v) Green fodders (Sorghum, berseem, oats)	3730	27700	27375	20531	Negl.	-
vi) Dry fodders (Wheat & rice straw, maize stover, sugarcane tops etc.)	-	14000	13700	41100	Negl.	-
Total A	**15550 m2**	-		**85621**		**36302**
B. Dairy (Milk) unit Two milch animals	1 buffalo + 1 cow	5300	1124	16860	4176	62640
C. Horticulture Unit Fruits Vegetables (intercrop)	1920 m^2 -	7600** 4175	168 900	1680 7200	7432 3275	74320** 26200
D. Apiary Unit Honey	10 boxes	150	15	1500	135	13500
E. Mushroom	40 m^2	-	-	-	-	30,000
F. Composting Vermicompost	150 m^2	15000	10000	20000	5000	10000
G. Land for common uses such as; Animal sheds, stores, dwelling unit, threshing floor, tube-well etc.	730 m^2	-	-	-		
Total						**1,78,642**

** *Fruit production and income thereof will start from 3rd' year and onward.*

*** *4th' year and thereafter.*

CHAPTER - 7

MULTI - DISCIPLINARY TEAM OF SCIENTISTS AT DIFFERENT CENTRES OF AICRP ON IFS

Multidisciplinary team of scientists associated with IFS programme at different centres of AICRP on IFS

	Agron.	Soil Sci.	Animal Sci.	Hort.	Fishery	Ag. Engg.	Plant Prot.	Forestry	Micro.	Ag. Eco.	Others
Western Himalayan Region											
Chatha	-	-	*	*	-	-	*	*	-	*	-
Palampur	*	*	*	-	*	-	-	-	-	*	*
Pantnagar											
Eastern Himalayan Region											
Jorhat	*	-	-	*	-	*	-	-	-	*	*
Umiam	*	*	*	*	*	-	*	-	-	-	*
Trans Gangetic Plain Region											
Ludhiana											
Hisar	*	-	*	-	-	-	-	*	-	*	*
Upper Gangetic Plain Region											
Modipuram	*	*	*	*	*	-	*	-	-	-	*
Kanpur											
Middle Gangetic Plain Region											
Kumarganj	-	-	*	*	-	-	*	*	*	-	-
Varanasi	*	-	*	*	-	-	*	-	*	*	-
Sabour	*	-	*	*	*	-	*	-	-	*	-
Patna	*	*	*	-	*	-	*	-	-	*	*
Lower Gangetic Plain Region											
Kalyani	*	*	*	*	*	-	-	-	-	*	-
Eastern plateau and hills											
Raipur	*	*	*	*	*	-	*	-	*	*	-
Kanke, Ranchi	-	*	*	*	*	-	*	-	-	-	-

Multidisciplinary team of scientists associated with IFS programme at different centres of AICRP on IFS

Central plateau and hills											
Jabalpur	*	*	-	*	-	*	*	-	-	*	-
Western plateau and hills											
Akola	*	*	*	*	*	*	*	*	*	-	
Rahuri	*	*	*	*	-	-	*	-	-	*	-
Parbhani	*	*	*	*	-	-	*	-	-	*	-
Southern plateau and hills											
Rajendranagar	*	*	-	-	-	-	-	-	-	-	-
Coimbatore	*	-	*	*	-	-	-	-	-	*	-
Kathalagere	*	*	*	*	-	-	*	-	-	-	*
Siruguppa	*	*	*	*	-	-	-	-	-	-	-
East Coast plain and hills											
Bhubaneswar											
Western Coast Plain and hills											
Karjat											
Karamana	*	*	*	*	*		*			*	*
Old Goa	*	*	*	*	*	-	-	-	-	-	*
Western dry region											
Durgapura	*	*	-	*	-	-	*	-	-	-	*
Gujarat plain and hills											
S.K. Nagar	*	*	-	*	-	-	-	*	-	*	-
Island Port Blair	*	*	*	*	*	*	-	-	-	*	-

CHAPTER - 8

LOCATION OF THE CENTRES, PRESENT AGRICULTURAL SCENARIO IN RESPECTIVE AGRO-CLIMATIC REGIONS AND TECHNICAL PROGRAMME TO BE EXECUTED AT DIFFERENT CENTRES OF AICRP ON IFS

Centre name: Chatha (J&K) - Western Himalayan Region

A. Location of the centre and present scenario of agriculture in the region

Sl. No.	Particulars	Details
1	Name of the centre and it's location	Chatha, Jammu (J&K)
2	Name of the University/ICAR institute	SKUAST-Jammu
3	i) Ecosystem under which centre falls	Hill Ecosystem
	ii) Agro Climatic Region	Western Himalayan Region
	iii) NARP Zone	Sub tropical Zone
4	Predominant Farming Systems and percentage of the farm families adopting these farming systems.	Crops + Dairy (80%)
5	Important crops (including horticultural crops) and cropping systems of dominated farming system/ systems.	a) Important crops: Rice, Wheat, Maize, Mustard and fodder crops sorghum, berseem and oats. b) Important cropping systems: i. Rice-Wheat ii. Maize-Wheat
6	Percent contribution of individual enterprises in the economy of dominant Farming Systems.	Crops – 60 to 70% Dairy - 25 to 35%
7	Yield gaps (Farmer yield V/s Achievable yields) for important enterprises.	Crops: i) Wheat - 41.3% ii) Rice - 54.8% Milk : i) Buffalo - 129.9% ii) Cow - 161.7%

8	Available low cost technologies to overcome these gaps (for crops/ animal/ other component)	Maize: • Use of hybrid varieties. • Balanced nutrition through INM. • Weed and pest management. Wheat: • Recommended varieties for respective sowing time • Balanced nutrition through INM. • Chemical control of weeds. • Planting method Rice: • Recommended varieties/hybrid varieties. • Control of lodging and INM and IPM technologies. • Harvest the crops at proper moisture. Milk: • Rear local high yielding breed of cow and buffalo. • Ensure year round supply of green fodder. • Feed with balanced ration, salt and mineral mixtures. • Use of high quality and fresh semen and inject (AI) at proper heat.
9	Promising low-investment enterprise(s), which may be integrated profitably to diversify the existing dominated ones.	• Apiary: Orchard and forestry dominated areas and also areas growing flowering crops viz., mustard, chickpea, farming system of small and marginal farms with floricultural crops. • Mushroom: Ideal low cost enterprise for all the small and marginal farmers. • Multistoried fruit and vegetable orchards: Small and medium categories of the farmers having comparatively more cultivated land, can practice this for higher income and employment. • Freshwater fish production: In low lying and riverbed areas and also in areas with assured water supply, fish production has been found an economic enterprise. • Backyard poultry: To utilize homestead wastes and to clean the environment • Vermicompost: Cowdung, urine and farm waste may be utilized for preparation of high nutrient containing vermicompost rather than poorly decomposed FYM with low nutrient content. • Farm forestry/boundary plantations: All field boundaries may be utilized for plantation of perennial fruit trees and waste lands for useful fuel and timber plantations. Karonda (*Carisa carendis*), Leucaena leucocephala,*Alibizia ordoratisima*, aonla, etc. can safely be planted.

B. Technical Programme (Enterprise/Enterprises details and land allocation:

Enterprise/Enterprises details	Gross area, m²/ Unit size
A. Crops production (11000 m²) i) Cereals (Paddy, maize, wheat) ii) Pulses (Green gram, pigeon pea, black gram) iii) Oilseeds (Mustard) iv) Green fodders (Sorghum, berseem, oats) vi) Dry fodders (Wheat & rice straw, maize stover, sugarcane tops etc.) vii) Diversified cropss (Potato, Onion, French bean, Garlic, Sweet corn and Marigold)	 13000 3800 3000 5500 - 5700
B. Dairy unit (Milch animals)	1 buffalo+2 cow
C. Fish cum Poultry (600 m²) Poultry Fish	 25 birds 500
D. Horticulture Unit (2025 m²) Fruits Vegetables (intercrops)	 2025 -
E. Apiary Unit (Honey production)	 5 boxes
F. Mushroom Unit	200
G. Composting (Preparation of Vermicompost)	150 (3 times /year)
H. Land for common uses (Animal sheds, stores, dwelling unit, threshing floor, tube-well etc.)	1025

Centre name: Palampur (H.P.) - Western Himalayan Region

A. Location of the centre and present scenario of agriculture in the region

Sl. No.	Particulars	Details
1	Name of the Centre and its location	Palampur, Himachal Pradesh
2	Name of the university/ICAR institute	CSK H.P.K.V. Palampur
3	i) Ecosystem under which falls	Sub-humid
	ii) Agro Climatic Region	Western Himalayan Region
	iii) NARP zone)	NARP-zone II (mid hills zone)
4	Predominant Farming Systems and percentage of farm families adopting these farming systems.	Crops + Dairy (90%)
5	Important crops (including horticultural crops) and cropping systems of dominated farming system	Important crops: Wheat, rice, maize, potato, onion, berseem, oats, sorghum and bajra. Important cropping systems: Maize-wheat and rice-wheat.
6	Per cent contribution of major farming enterprises in the economy of dominant farming system	Crops: 70-80% Dairy: 20-30%
7	Yield gaps (Farmers yield V/s achievable yields for different enterprises)	Crops: Rice: 56% ,Wheat:42%,Maize:44%, Potato: 30%, Milk: (cow): 60%

8	Available low cost technologies to overcome these gaps (for cropss/animal/other component)	Rice– • Use of Hybrid rice seed • control of lodging and disease/insect-pest infestation by INM and IPM, • Harvesting and threshing at proper time/moisture using paddy thresher, and • Shattering resistant varieties for hailstorm areas. Wheat – • Recommended varieties for respective sowing time • Balanced nutrition through INM, and • Integrated weed management. Maize – • Balanced nutrition through INM approach, • Timely weed control and • Use of Maize hybrid Potato– • Balanced nutrition • Integrated insect-pest and disease management Milk– • High yielding cross-bred cows, • Ensure year the round supply of green fodder and • Balanced feed and mineral mixture.
9	Promising low-investment enterprise(s) which may be integrated profitably to diversify the existing dominated farming system of small and marginal farms per unit (as given above)	Multistoried Fruit and vegetable orchards – i) For increased year round income and more employment area per unit time ii) Fish Production – Fish production has been found economic even on small land holdings. iii) Poultry – Rearing few poultry birds on the bund will not only supplement fertility requirement for plankton production for fish but also enhance farmers' income to a considerable extent. iv) Vermicompost – The cow dung and farm waste may be utilized for preparation of vermicompost. v) Farm Forestry/ boundary plantation – The field boundaries and bunds and terrace risers may be utilized for plantingperennial fruit trees, fodder and fuel plantations to strengthen the resource base.

B. Technical Programme (Enterprise/Enterprises details and land allocation:

Enterprise/Enterprises details	Gross area, m²/ Unit size
A. Crops production (7500 m2)	
Cereals	10400
Pulses	2600
Oilseeds	3900
Green fodder	2250
Dry fodder (by-products of Cereals, pulses and oilseeds)	-
B. Dairy	2 cows
C. Horticultural unit (fruits and vegetables as intercrops)	1750
D. Composting (Vermicompost)	25
E. Fishery and Poultry	
Fish	300
Poultry	25 birds
F. Land for common uses	
(Animal sheds, stores, dwelling units, threshing floor, tubewells etc)	725

Centre name: Pantnagar (Uttarakhand) - Western Himalayan Region

A. Location of the centre and present scenario of agriculture in the region

Sl. No.	Item	Details
1	Name of the centre and it's location	Pantnagar, U.S. Nagar (Uttarakhand)
2	Name of the University/ICAR institute	G.B. Pant University of Agric.& Tech., Pantnagar
3	i) Ecosystem under which centre falls	Sub-Humid
	ii) Agro Climatic Region	Western Himalayan Region (North)
	iii) NARP Zone	Agro-ecological region of 9 and 14 of Uttarakhand
4	Predominant Farming Systems (not more than 2) and percentage of the farm families adopting these farming systems.	Crop + Trees (60%) Crops + Dairy (30 %)
5	Important crops (including horticultural crops) and cropping systems of dominated farming system/ systems.	Important crops: Rice, Wheat, Sugarcane, Veg. Pea, Rapeseed/Mustard, Fodder & Pulse crops. Important cropping systems: Rice- Wheat Rice-Toria/Pea- Sugarcane-Ratoon-Wheat Rice-Toria-Wheat Rice-Vegetable Pea-Summer Rice Important farming systems: ⏲ Trees (Poplar and Eucalyptus) + Crops ⏲ Horticulture + Crops + Dairy ⏲ Crops + Vegetables ⏲ Crops + Dairy + Vegetables
6	Percent contribution of individual enterprises to the economy of dominant Farming Systems.	Crops- 70-80% Agroforestry/Horti -25-30% Dairy/Poultry etc. 5-10%

7	Yield gaps (Farmer yield V/s Achievable yields) for important enterprises.	Crops: i) Sugarcane : • Plant crop : 30-40% • Ratoon : 40-50% ii) Wheat : 30-40% iii)Rice : 40-50% Milk: i) Buffalo : 50-60% ii) Cow : 40-50%
8	Available low cost technologies to overcome these gaps (for crops/ animal/ other component)	Sugarcane: • Advancement of sugarcane planting through simultaneous cropping. • Balanced nutrition through INM. • IPM for weed and pest management. Wheat: i) Recommended varieties for respective sowing time (Timely/delayed). • Balanced nutrition. • Chemical control of weeds • Zero tillage technology Rice: • Use of hybrid/basmati varieties. • Control of lodging, diseases/pests control by INM and IPM Milk: • Rear local high yielding breed of cows and buffaloes. • Ensure year round supply of green fodder. • Fed with balanced ration, salt and mineral mixtures. • Use of high quality and fresh semen and inject (AI) at proper heat Agroforestry: • Availability of quality planting material. • Recommended silvicultural practices.
9	Promising low-investment enterprise(s), which may be integrated profitably to diversify the existing dominated farming system of small and marginal farms (as given above).	i) Apiary: In orchard and forestry dominated areas growing flowering crops viz., mustard, chickpea, and floricultural crops round the year. ii) Mushroom: Ideal low cost enterprise for all the small and marginal farmers. iii) Multistoried fruit and vegetable orchards: Small and medium categories of the farmers having comparatively more cultivated land can practices this for increased income and more employment. iv) Boundary Plantations with MPTS- All field boundaries may be utilized for plantation of multipurpose fast growing tree species for timber, fuel, fodder, food etc. v) Vermicompost- Cow dung, urine and farm waste may be utilized for preparation of high nutrient containing vermicompost.

B. Technical Programme (Enterprise/Enterprises details and land allocation:

Farm produce	Gross area, m^2/ Unit size
A. Crop production (6400 m^2)	
i) Cereals (Paddy, maize, wheat)	8400
ii) Pulses (Green gram, pigeon pea, black gram)	3650
iii) Oilseeds (Mustard)	3500
iv) Sugar crop (Sugarcane)	1600
v) Green fodders (Sorghum, berseem, oats)	2000
vi) Dry fodders (Wheat & rice straw, maize stover, sugarcane tops etc.)	-
B. Agroforestry /horticulture i) Agro- forestry ii) Timber iii) Fruits and Vegetables (intercrops)	 800 300 1920
C. Dairy (Milk) unit Two milch animals	02 cows
D. Composting (Vermicompost)	50 (3 times/year)
E. Apiary Unit (Honey production)	10 boxes
F. Land for common uses (Animal sheds, stores, dwelling unit, threshing floor, tube-well etc.)	480

Centre name: Jorhat (Assam) - Eastern Himalayan Region

A. Location of the centre and present scenario of agriculture in the region

Sl. No.	Item	Details
1	Name of the Centre and its location	Jorhat, Assam
2	Name of the University/ICAR Institute	Assam Agricultural University, Jorhat
3	i) Ecosystem under which centre falls	Humid
	ii) Agro-climatic Region	Eastern Himalayan Region (Zone 2)
	iii) NARP Zone	Upper Brahmaputra Valley Zone
4	Predominant Farming System and percentage of farm families adopting this	Crop + Fishery + Dairy (25%)
5	Important crops (including horticultural crops) and cropping systems of dominated farming system/systems	a) Important crops: Rice, Toria, Pulses, Sugarcane, Jute, Assam lemon, Banana, Arecanut, Guava, Fodder crops like Oats, Setaria, Hybrid Napier b) Important cropping systems i)Rice-Rice, ii) Rice-Toria, iii) Rice-Vegetables
6	Per cent contribution of individual enterprises	Crops: 60 to 70%, Fishery: 20-30%, Dairy: 10-20%
7	Yield gaps (Farmer yield V/s Achievable yield) for important enterprises	Crop Milk Fishery i) Rice : 75% Cow: 300% Fish: 130% ii) Toria : 60% iii) Veg. : 30-40%

8	Available low cost technologies to overcome these gaps (for each crop/fishery/animal)	Rice: i)Replacement of low yielding local varieties with improved varieties ii)Balanced nutrition through INM Toria:i)Replacement of low yielding varieties with improved varieties ii) Balanced fertilizer application Veg. : i) Use of hybrid/high yielding varieties and agro chemicals. ii) Proper use of irrigation water. Fishery: i) Semi intensive composite fish culture, use of fish feed ii) Integration of cattle with fish and use of cowdung in pond. Cattle: i) Rearing of cross bred jersey cow ii) Year round supply of GF iii) Feed with balanced ration, salt and mineral mixture.
9	Promising low investment enterprise (s) which may be integrated profitability to diversify the existing dominated farming system of small and marginal farms (Crop + Fishery + Cattle)	Apiary: In Orchard and areas growing flowering crops viz., Toria, flowering crops round the year, Fodder and fruit production on embankment of pond helps to improve net return. Vermicompost: Cowdung, urine and farm wastes may be utilized for high nutrient containing vermicompost rather than poorly decomposed FYM with low nutrient content. Boundary plantations: All field boundaries may be utilized for plantation of fodder crops, arecanut, Assam lemon, and pineapple.

B. Technical Programme (Enterprise/Enterprises details and land allocation

Enterprise/enterprises	Gross area(m^2) /unit size
A. Crop production	
(i) Cereals (Rice)	3846
(ii) Oilseed (Toria)	2386
(iii) Pulses (Green gram, Black gram	1726
(iv) G.F.(Oat, Cowpea, Maize, Setaria, Hybrid napier)	3700
(v) Dry fodder (Rice and wheat straw)	-
B. Horticultural Unit	1450
C.RSBS: Rice+Vegetable+Fish production from Raised + Sunken Bed System	1850
Raised bed (net area= 620 sqm) Cowpea (F)-Pulses-Potato	1860
Sunken bed (net area =700sq.m.)	1400
Water body with 3ft depth (net area=420sq.m.)	420
D. Multistoried cropping in the embankment	950
E. Fishery	500
F. Diary	Two milch cows + 2 heifers
G. Apiary unit (Honey production)	5 boxes
H. Land for common use: (Animal shed, dwelling unit, threshing floor, tubewell etc.)	1050

Centre name: Umiam (Meghalaya) - Eastern Himalayan Region

A. Location of the centre and present scenario of agriculture in the region

Sl.No.	Particulars	Details
1	Name of the centre and it's location	Barapani, Shillong, Meghalaya
2	Name of the University/ICAR institute	ICAR Research Complex for NEH Region, Umroi Road, Umiam, Meghalaya
3	i) Ecosystem under which centre falls	Humid – High rainfall
	ii) Agro Climatic Region	Eastern-Himalayan Region
	iii) NARP Zone	Sub Himalayan Region
4	Predominant Farming Systems (not more than 2) and percentage of the farm families adopting these	Rice and Maize based mono-cropping system with one or two pigs with some farmers. The farmers are also rearing cows and poultry birds in backyard
5	Important crops (including horticultural crops) and cropping systems of dominated farming system/ systems.	a) Important crops Rice, Maize, Ginger and Turmeric b) Important cropping systems: Rice- fallow and Maize – fallow
6	Per cent contribution of individual enterprises	Crops – 30 to 40 % Dairy – 5 to 10 %
7	Yield gaps (Farmer yield V/s Achievable yields) for important enterprises.	Crops: Rice:5–23 %, Ginger 87 % Maize: 25–45%, Turmeric:106 %, French bean : 26.73 % Pig : 120 – 150 % Poultry: 110 – 145 %
8	Available low cost technologies to overcome these gaps (Crops/ animal/ other component)	1. Rice – • Use of high yielding varieties. • Control lodging and diseases /pests by adopting of INM and IPM technologies. • Rice + Azolla dual cropping for lowland only • Harvesting at proper moisture and post harvest handling 2. Maize – • Use of high yielding varieties. • Application of INM and IPM technologies. • Harvesting at proper moisture and post harvest handling 3. Ginger and Turmeric- • Use of high yielding varieties. • Application of INM and IPM technologies. • Harvesting at proper moisture and post harvest handling 4. Meat (Pig & poultry) – • Rear high yielding pigs, and poultry breed • Ensure year round feed and balance ration
9	Promising low-investment enterprise(s), which may be integrated profitably to diversify the existing dominated farming system of small and marginal farms	(i) Mushroom- Ideal low cost enterprise for all the small and marginal farmers. ii) Multistoried fruit and vegetable orchards - Sutaible for small and medium categories of the farmers having comparatively less cultivated land iii) Backyard poultry and piggery – To utilize homestead wastes and have environment clean. iv) Vermicompost – At least one-third of the cow dung, urine and farm waste may be utilized insted of poorly decomposed FYM for preparation of high nutrient containing Vermicompost v) Farm forestry/boundary plantations with perennial fruit trees and waste lands for useful fuel and timber plantations.

B. Technical Programme (Enterprise/enterprises and allocation of area)

Enterprise/enterprises	Gross area(m^2) /unit size
A. Crop production	
i) Cereals (Paddy, maize)	4500
ii) Pulses (black gram, green gram)	800
iii) Oilseeds (Soybean, Mustard, groundnut)	4300
iv) Grasses	4000 r .mt.
B. Horticulture Unit	
i) Fruits	2400
ii) Vegetables	5600
C. Animal (meat) unit	
(i) Pigs	3
(ii) Poultry	150
D. Mushroom Unit	144
E. Composting (Vermicompost)	150
F. Land for common use (Animal sheds, stores, dwelling unit, threshing floor, water harvesting pond etc.)	650

Centre name: Ludhiana(Punjab) - Trans Gangetic Plain Region

A. Location of the centre and present scenario of agriculture in the region

Sl. No.	Particulars	Details
1	Name of the centre and it's location	PAU, Ludhiana, Punjab
2	Name of the University/ICAR institute	Punjab Agricultural University, Ludhiana
3	i) Ecosystem under which centre falls	Sub tropical Semi-Arid
	ii) Agro Climatic Region	Indo-Gangetic Alluvial Plains
	iii) NARP Zone	Central plain zone (III)
4	Predominant Farming Systems and percentage of the farm families adopting these farming systems.	Crops + Dairy (85 %)
5	Important crops (including horticultural crops) and cropping systems of dominated farming system/ systems.	Important crops: Rice, wheat, fodder crops berseem Important cropping systems: Rice-wheat, cotton-wheat, maize-wheat
6	Per cent contribution of individual enterprises in the economy of dominant Farming Systems.	Crops-70-80 % Dairy- 20-30 %
7	Yield gaps (Farmer yield V/s Achievable yields) for important enterprises.	Crops: i) Rice- 25 % ii) Wheat- 15% Milk: i) Buffalo- 25 % ii) Cow- 50 %
8	Available low cost technologies to overcome these gaps (crops/ animal/ other component)	Maize: • Use of hybrid varieties • Management of lodging and diseases /pests by INM and IPM Rice: • Use of hybrid varieties • Control lodging and diseases /pests by application of INM and IPM technologies.

		• Harvest the crop at proper moisture. Wheat: • Recommended varieties for respective sowing time (Timely/delayed) • Balanced nutrition through INM • Chemical weed control . Sugarcane: • Advancing sugarcane planting through simultaneous cropping • Balanced nutrition through INM • IPM for weed and pest management.
9	Promising low-investment enterprise(s), which may be integrated profitably to diversify the existing dominated farming system of small and marginal farms (as given above).	i) Crop component: Recommended agronomic practices and improved crop varieties will be used for raising different field crops. Crop component under IFS will receive part of nutrients through nutrient recycling from farming system components after proper quantification in lab. ii) Dairy: Two improved cross bred cows. An area of 0.02 ha can accommodate two cows and two calves. iii) Fishery: Five hundred polyculture fingerlings will be reared in 0.1 ha ponded water. Rohu, Katla and Mrigal species will be used to efficiently utilize the water column. The waste from other farming enterprises will be used for feeding the fish and silt obtained from the pond during summer will be applied in the field as manure and consequently it will save the fertilizer N. The pigs will be reared on the embankment of fish pond. The five ducks will be reared and these will protect the fish from other birds. iv) Apairy: Bee keeping by growing flowering crops round the year. v) Mushroom production: a small room of size 20 × 20m will be kept for mushroom production and other area for storing the rice residues and wheat straw. vi) Horticulture plantation: The citrus plantation will be planted around the field area Agro-forestry: Fifteen poplar trees will be planted to raise the farm income. The waste of one component will be efficiently recycled in the other enterprise.

B. Technical Programme (Enterprise/enterprises and allocation of area)

Enterprise/enterprises	Gross area(m2) /unit size
A. Crop Production: Cereals (paddy, maize, wheat)	5600
Pulses (Summer mungbean)	1600
Oilseeds (Groundnut, Sarson)	1600
Sugar crop (Sugarcane)	1600
Green fodder (bajra, cowpea, berseem)	2800
Dry fodders (rice, wheat, maize stover. Sugarcane tops etc.)	-
Turmeric	800
Vegetables (Potato, onions)	3200+800
B. Horticulture Unit (Guava, Nimboo, Kinnow)	1900
Vegetables (intercrops)	-
C. Apiary unit	5 boxes
D. Mushroom unit	200
E. Dairy	200
F. Fishery	1000

Centre name: Hisar (Haryana) - Trans Gangetic Plain Region

A. Location of the centre and present scenario of agriculture in the region

Sl. No.	Particulars	Details
1	Name of the centre and it's location	Department of Agronomy, Hisar, Haryana
2	Name of the University/ICAR institute	CCS Haryana Agricultural University, Hisar.
3	i) Ecosystem under which centre falls	Semi-arid
	ii) Agro Climatic Region	Trans Gangetic Plain Region
	iii) NARP Zone	N8D2 (Northern plain and central high lands including parts of Gujarat plains)
4	Predominant Farming Systems and percentage of the farm families adopting these farming systems.	Crops + Dairy (80%)
5	Important crops (including horticultural crops) and cropping systems of dominated farming system/ systems.	Important crops: Bajra, wheat, mustard, cotton Important cropping systems: Cotton-wheat , Bajra-wheat and Bajra-mustard
6	Per cent contribution of individual enterprises	Crops – 80 to 85% Dairy - 15 to 20%
7	Yield gaps (Farmer yield V/s Achievable yields) for important enterprises.	Crops: i) Bajra – 40%, ii) Mustard – 40% iii) Wheat - 30%, iv) Rice - 35% v) Cotton – 45% Milk : i) Buffalo - 25%, ii) Cow - 30%
8	Available low cost technologies to overcome these gaps (for crops/ animal/ other component)	Wheat – i) Recommended varieties for respective sowing time (Timely /delayed). ii) Proper preparation of seed bed iii) Balanced nutrition through INM. iv) Control of weeds. v) Timely sowing and vi) Priming of seed

		Bajra – • Correct plant population. • Follow crop rotation in disease infested areas. • Sowing may be done by bed planter where moisture availability is limited and • Timely disease management. Raya – • Prepare the seed bed well. • Select higher yielding and cold and disease escaping varieties. • Timely sowing may be followed and more care should be taken when mustard is sown under conserved moisture and • Timely harvesting to avoid shattering of seeds. Milk – • Rear local high yielding breed of cows and buffaloes. • Ensure year round supply of green fodder. • Feed with balanced ration, salt and mineral mixtures and • Use of high quality and fresh semen and inject (AI) at proper heat.
9	Promising low-investment enterprise(s), which may be integrated profitably to diversify the existing dominated	i) Vermicompost – In Haryana 70% animal dung is utilized in making cakes and it has ample scope in the farming systems of small and marginal farms Cowdung, urine and farm waste may be utilized for preparation of high nutrient vermicompost rather than poorly decomposed FYM with low nutrient content and contaminated with huge colonies of termite ii) Farm forestry/boundary plantations – All field boundaries may be utilized for plantation of perennial trees like poplar. iii) Vegetable growing – Vegetable growing may be remunerative to farmers and farm material like vermicompost can be utilized for higher productivity. The cultivation may be done with assured water supply.

B. Technical Programme (Enterprise/enterprises details and allocation of land)

Enterprise/enterprises	Gross area, m²/ Unit size
A. Crop production	
i) Cereals (Bajra, wheat)	11700
ii) Pulses (Green gram,chickpea/lentil)	1300
iii) Oilseeds (Mustard)	1800
iv) Fibre crop (Cotton)	1800
v) Green fodders (Sorghum, berseem, oats, bajra)	3400
vi) Dry fodders (Bajra, wheat, moong, lentil straw)	-
B. Vegetables	2000

C. Horticultural crop	600
(Intercrops in horticultural crops)	1200
D. Dairy (Milk) unit	850
Three milch animals and their calves	
E. Vermicompost	150
F. Social forestry	300

Centre name: Modipuram (U.P.) - Upper Gangetic Plain Region

A. Location of the centre and present scenario of agriculture in the region

Sl. No.	Particulars	Details
1	Name of the centre and it's location	Modipuram, Meerut, Uttar Pradesh.
2	Name of the University/ICAR institute	PDFSR, Modipuram (An ICAR Institute)
3	i) Ecosystem under which centre falls	Semi-arid
	ii) Agro Climatic Region	Upper Gangetic Plain Region
	iii) NARP Zone	Western Plain Zone (UP-3)
4	Predominant Farming Systems and percentage of the farm families adopting these farming systems.	Crops + Dairy (90%)
5	Important crops (including horticultural crops) and cropping systems of dominated farming system/ systems.	Important crops: Sugarcane, wheat, rice and fodder crops sorghum, berseem and oats. Important cropping systems: Summer planted sugarcane – ratoon – wheat and Summer sorghum (F) -rice-wheat
6	Per cent contribution of individual enterprises	Crops – 60 to 70% and Dairy - 30 to 40%
7	Yield gaps (Farmer yield V/s Achievable yields) for important enterprises.	Crops: i) Sugarcane Plant crop – 103% Ratoon - 75.7% ii) Wheat - 41.3% iii) Rice - 54.8% Milk: i) Buffalo - 129.9% ii) Cow - 161.7%
8	Available low cost technologies to overcome these gaps (for each crop/ animal/ other component)	Sugarcane – • Advancing sugarcane planting through simultaneous cropping • Balanced nutrition through INM • IPM for weed and pest management. Wheat – • Recommended varieties for respective sowing time (Timely /delayed) ii) Balanced nutrition through INM iii) Chemical control of weed Rice – • Use of hybrid basmati varieties • Control lodging and diseases /pests by application of INM

		and IPM technologies • Harvest the crop at proper moisture. Milk – • Rear local high yielding breed of milch animals • Ensure year round supply of green fodder • Fed with balanced ration, salt and mineral mixtures iv) Use of high quality and fresh semen and inject (AI) at proper heat.
9	Promising low-investment enterprise(s), which may be integrated profitably to diversify the existing dominated farming system of small and marginal farms	i) Apiary – Orchard and forestry dominated areas and also areas growing flowering crops viz.,mustard chickpea, floricul tural crops round the year. ii) Mushroom- Ideal low cost enterprise for all the small and marginal farmers. iii) Multistoried fruit and vegetable orchards – Small and medium categories of the farmers having comparatively more cultivated land can practice this for increased year round income and more employment per unit area per unit time iv) Freshwater fish production – In low lying and riverbed areas and also in areas with assured water supply, fish production has been a good economic enterprise. v) Vermicompost – Cowdung, urine and farm waste may be utilized for preparation of high nutrient containing vermicompost rather than poorly decomposed FYM with low nutrient content and contaminated with huge colonies of termite vi) Farm forestry/boundary plantations – All field boundaries may be utilized for plantation of perennial fruit trees and waste lands for useful fuel and timber plantations. Karonda (*Carisa carendis*), citrus, aonla, bel, jackfruit etc. can safely be planted.

B. Technical Programme (Enterprise/enterprises and allocation of land)

a) Marginal farmers (Dairy based farming system)

Enterprise/enterprises	Net Area allotted (m^2)
A. Dairy unit	Buffaloes(3) + Cow (1) and their young ones
B. Crops including green fodders/ Cropping system	
Sorghum (S)- rice-wheat	1400
Rice-berseem – maize+cowpea	800
Maize (G.Cobs)+ arhar - oats	800
Sorghum (K)-mustard-maize+cowpea	1200
C. Horticulture (Vegetables, fruits and flowers)	
Vegetable based cropping system	800
Banana var. dwarf cavendish	2000
Kinnow var. mandarin	2000
D. Boundary plantation (North and west side boundary of farm)	120 plants of Guava spp. Allahabadi safed and Sardar
Total area under cultivation	**9000**

b) Small farmers (Maximization of productivity and profitability of existing farming system)

Enterprise/enterprises	Area allotted (m^2)
Crops and cropping systems	
Sugarcane based system-1	6400
Sugarcane based system-2	4800
Rice –potato-wheat – greengram	2400
Dairy (Green fodder crops)	
Sorghum –berseem and Maize + cowpea-late sorghum-oats	1400

Suggested Interventions to bridge the yield gaps for maximization of crop and milk yields

Farming System Components	Suggested technological interventions
A. Crops and cropping systems **Cropping system -1** S.Cane(Summer) -ratoon-wheat	Sugarcane(Late sown) i) Advancing planting date of sugarcane by 10-15 days in existing system itself through dry sowing of cane ii) Treating cane sets with Begalol-6. iii) Site specific nutrient management (SSNM) iv) Pre-em. spray of Atrazine followed by post eme.spray of 2,4-D at 30 DAS. v) Balanceed use of NPK in ratoon sugarcane + uniform spread of dry leaves of cane. vi) Earthing up & tying the crop at proper time vii) Need based plant protection measures Wheat(late sown) i) Use of latest recommended variety for late sown conditions ii) Use of 25% high seed rate than normal sowing iii) Seed treatment with Azotobactor & PSB iv) Line sowing by seed cum ferti drill v) Site specific nutrient management (SSNM) vi) Chemical weed control (Post emergence spray of Sulphasulphuron , 25-30 DAS) vii) Timely irrigation at all the critical stages
Cropping system -2 S.Cane (Spring) -ratoon-wheat - sorghum –mustard	Sugarcane: i) Planting paired row of sugarcane in trenches and green gram on broad beds. ii) Treating cane sets with Begalol-6 or Emisan-6 iii) Site specific nutrient management (SSNM) iv) Earthing up & tying the crop at proper time v) Balanced use of NPK in ratoon sugarcane + uniform spread of dry leaves of cane vi) Need based plant protection measures Wheat : As in cropping system-1 Mustard : i) Timely sowing in first fortnight of October ii) Use of latest pest resistant variety iii) Proper crop geometry iv) Rec. dose of NPK, Zinc & Sulphur v) Need based plant protection measures
Cropping system -3 (Rice-potato-wheat-greengram)	Rice: i) Use of high yielding hybrid variety (RH-10) ii) Planting two plant per hill at recommended geometry under flooded condition iii) Control of weeds by pre-em. application of Butachlor. iv) Site specific nutrient management (SSNM) v) Biological pest control vi) Need based irrigation -drying and wetting **Potato** i. Selection of high yielding , early maturing and blight resistant varieties ii) Seed treatment with mercurial fungicides

	iii) Use of recommended NPK iv) Timely irrigation v) Timely control of early & late blights vi) Earthing at proper stage for more yield and to check greenliness of seed potato Wheat - As in cropping system 1 Green gram i) Selection of pest resistant and early maturing variety ii Use of recommended NPK iii) Timely picking
Dairy –Milch animals (Buffaloes and cows)	Buffaloes and Cows i) Selection of animal breeds Murrah in case of buffalo and crossbred H.F cow ii) Round the year green fodder availability iii) Use of balanced nutrition as below; A mix of Oil cakes + bran + grain+ Mineral mixture+ salt in 32:35:30:2:1 ratio @ 5 kg/animal per day during period of 265 days of milk @ 2kg / animal /day during dry period of about 100 days iv) De-worming all the animals twice a year v) Artificial insemination at proper time and by some reliable/authorized veterinary doctor. vi) Proper care and feeding of young ones

Centre name: Kanpur (U.P.) - Upper Gangetic Plain Region

A. Location of the centre and present scenario of agriculture in the region

Sl.No.	Particulars	Details.
1	Name of the centre and its location	Kanpur (U.P)
2	Name of the University/ICAR institute	C.S.Aazad University of Agriculture and Technology, Kanpur (U.P.208002.
3	Eco-system under which centre falls	Semi –arid
	(1) Agro climatic region	Upper Gangetic Plain zone
	(2) NARP zone	Central Plain Zone (U.P-5)
4	Predominant Farming Systems and percentage of the farm families adopting these farming systems.	Crop + Dairy (90%)
5	Important crops (including horticultural crops) and cropping systems of dominated farming system/systems.	Important Crops : Rice,Wheat,Maize, Potato, Mustard. Important Cropping Systems: i) Rice-wheat ii) Maize-wheat, iii) Maize-mustard-onion, iv) Maize-Potato-Vegetable .
6	Per cent contribution of individual enterprise in economy of the household	Crops-70-80% Dairy-20-30%
7	Yield gaps (Farmer yield V/s achieveable yields)for important enterprises.	Crops : Rice-97.2%, Wheat-153.5%, Potato-6.7%, Maize-98.8%, Mustard-32.5% (Milk :Buffaloes 140%, Cow 150%)

8	Available low cost technologies to overcome these gaps (Crops / animals, other component)	Rice : • Use of hybrid varieties • Diseases/ pest resistant varieties through IPM approach. • Balanced nutrition through INM and SSNM Wheat : • Use of HYV according to sowing time • Chemical control of weeds/ disease. • Balanced application of nutrient. • Line sowing in north-south direction Potato : • Use of HYV having good keeping quality. • Use of treated seeds & resistant varieties. • Balance nutrition by INM.and SSNM. • Adoption of intercropping for higher return. Dairy : • Rearing high yielding local breeds • Year round assured supply of green fodder • Balanced nutrition through concentrate, salt & mineral mixture. • Remunerative price of milk at co-operatives
9	Promising low investment enterprise (s), which may be integrated profitably to diversify the exising dominated farming system of small and marginal farms.	Poultry : i) Rearing high egg laying local breeds. ii) Best use of degraded grains of crops and homestead waste iii) Mushroom : Ideal lowcost enterprise fetch higher return iv) Vermi composting : The urine and cow dung produced in the farm may be utilized for preparation of nutrient rich vermicompost.

B. Technical Programme (Enterprise/enterprises and allocation of area)

Enterprises/enterprises	Gross area m²/unit size
A. Crop production	
(i)Cereals (Paddy maize, wheat)	6500
(ii) Pulses (Black gram green gram)	2200
(iii)Oilseeds Sunflower, mustard)	2000
(iv)Vegetable crop (Potato, onion garlic)	2000
(v) Green fodder (Berseem,Sorghum)	3000
(vi) Dry fodder (rice, wheat, straw, maize stoves etc.)	-
B. Dairy (milk) unit two milch animals	1buffaloes+ 1 cow
C. Horticulture unit-fruits.	1920
D. Apiary unit-Honey	5 boxes
E. Mushroom unit	40
F. Vermi Composting	150
G. Poultry Unit	20 hens & cocks
H. Common uses	570
(Threshing floor,tubewell store & future use)	

Centre name: Kumarganj (U.P.) - Middle Gangetic Plain Region

A. Location of the centre and present scenario of agriculture in the region

Sl. No.	Item	Details
1	Name of the centre and it's location	Kumarganj, Faizabad, Uttar Pradesh
2	Name of the University	N.D.U.A.&T.,Kumarganj, Faizabad, U.P. (State University)
3	i) Ecosystem under which centre falls ii) Agro Climatic Region iii) NARP Zone	Sub-humid Middle Gangetic Plain Region Eastern Plain Zone (UP-8)
4	Predominant Farming Systems and percentage of the farm families adopting these farming systems.	Crops + Dairy (90%)
5	Important crops (including horticultural crops) and cropping systems of dominated farming system/ systems.	Important crops: Rice, wheat, pigeonpea, mustard and fodder der crops (sorghum, berseem). Important cropping systems: Rice-wheat and Pigeonpea+urd/moong/sesame/jowar
6	Per cent contribution of individual enterprises in the economy of dominant Farming Systems.	Crops - 65 to 75% Dairy - 25 to 35%
7	Yield gaps (Farmer yield V/s Achievable yields) for important enterprises.	Crops: i) Rice - 48.0%, ii) Wheat- 38.0%, iii) Pigeon pea - 42% Milk : i) Buffalo - 100.0% and ii) Cow - 110.0%
8	Available low cost technologies to overcome these gaps (for each crop/ animal/ other component)	Wheat – • Recommended varieties for respective sowing time (Timely /delayed) • Balanced nutrition through INM • Chemical control of weeds. Rice – • Use of hybrid/basmati varieties • Control of weeds and diseases /pests by application of IWM and IPM tech nologies • Harvest the crop at proper moisture. Milk – • Rear local high yielding breed of cows and buffaloes • Ensure year round supply of green fodder • Feeding with balanced ration, salt and mineral mixtures iv) Use of high quality and fresh semen and inject (AI) at proper heat .
9	Promising low-investment enterprise(s), which may be integrated profitably to diversify the existing dominated farming system of small and marginal farms	i) Apiary – Orchard and forestry dominated areas and also areas growing flowering crops viz., mustard, chickpea, floricultural crops round the year. ii) Mushroom- Ideal for all small and marginal farmers. iii) Multistoried fruit and vegetable orchards – Ideal for small and medium categories of the farmers having comparatively more cultivated land for increased income and more employment per unit area per unit time. iv) Vermicompost – Cowdung, urine and farm waste may be utilized for preparation of high nutrient containing vermicompost. v) Farm forestry/boundary plantations – All field boundaries may be utilized for plantation of perennial fruit trees and waste lands for useful fuel and timber plantations. Citrus aonla, bel, etc. can safely be planted.

B. Technical Programme (Enterprise/enterprises and allocation of land)

Enterprise/enterprises	Gross area m^2/unit size
A. Crop production (7200 m^2)	
i) Cereals (Paddy, maize, wheat)	8200
ii) Pulses (Green gram, pigeon pea, black gram)	5000
iii) Oilseeds (Mustard)	1400
iv) Potato	1200
v) Green fodders (Sorghum, berseem, oats)	4000
vi) Dry fodders (Wheat & rice straw, maize stover, sugarcane tops)	-
Total A	**19800**
B. Dairy (Milk) Unit (Two milch animals)	1 buffalo + 1 cow
C. Horticulture Unit (Fruits and vegetables as intercrops in between the fruit trees))	2000
D. Apiary Unit (Honey production)	10 boxes
E. Mushroom Unit	40
F. Composting (Vermicompost)	150
G. Land for common uses : (Animal sheds, stores, dwelling unit, threshing floor, tube-well etc.)	730

Centre name: Varanasi (U.P.) - Middle Gangetic Plain Region

A. Location of the centre and present scenario of agriculture in the region

Sl.No.	Item	Details
1	Name of the centre and its location	Varanasi
2	Name of the University / ICAR institute	BHU
3	Echo system under which centre falls	Arid/ Semi - Arid/ sub - Humid/ Humid/ Coastal
	Agro Climatic Region (based on classification by Planning Commission of India)	Eastern Plain and Vindhyan Region.
	NARP Zone (As per classification under NARP. Please give full name)	North –eastern Plain Zone
4	Predominant Farming Systems (not more than 2) and percentage of the farm families adopting these farming systems.	Crop + Dairy (70%) Crop + Vegetables (20%)
5	Important crops (including horticulture crops) and cropping systems of dominated farming system / systems.	♦ Important crops: Rice, wheat, maize, pigeon pea, gram, mustard, field pea, table pea, potato, cabbage, cauliflower, brinjal ♦ Important cropping systems: Rice-wheat Rice vegetables
6	Per cent contribution of individual enterprises in the economy of dominant Farming Systems.	Crops: 70 – 75% Dairy: 15 – 20% Vegetables: 5 – 10%

7	Yield gaps (Farmer yield V/s Achievable Yields) for important enterprises.	Crops: Rice - 71.1% Wheat - 46.9% Maize - 37.1% Pigeon pea - 57.1% Mustard - 50% Potato - 25% Milk: Cow - 120% Buffalo - 87.5%
8	Available low cost technologies to overcome these gaps (for each crop/ animal/ other component)	Rice: • Timely transplanting • Use of medium duration fine grain hybrid. • Balanced nutrition through INM. • Pest control with emphasis on weed management. Wheat: • improved varieties viz. HUR 468 (timely sowing) and HUR 234 (delayed sowing) • Balanced nutrition based on INM and system approach. • Irrigation particularly at CRI and grain filling stages. Maize: • Use of high yielding composite and hybrids. • Balanced nutrition through INM. • Earthing up/bed planting during kharif. Pigeon pea: • Use of high yielding varieties viz. Malviya 13 and Bahar. • Bed planting particularly in fields having poor drainage. • Balanced nutrition and insect pest control especially against pod borer. Mustard: • Timely sowing of improved varieties. • Optimum plant population by timely thinning • Balanced nutrition. • Insect pest and disease management particularly against mustard saw fly, aphid and Alternaria blight. Potato: • Use of high yielding varieties. • Balanced nutrition through INM. • Timely irrigation. • Diseases management particularly against early and late blights. Dairy: • Rearing of high yielding breeds of cow and buffalo. • Vaccination against FMD and HS, and proper health care. • Ensuring year round supply of green fodder. • Feeding with balanced ration, salts and mineral mixture. • Ensuring A.I. at proper heat of the cattle with good quality fresh semen.
9.	Promising low - investment enterprise (s), which may be integrated profitably to diversify the existing dominated	i) Livestock: Three crossbred Jersey cow. ii) Fishery : Fish pond of 0.1 ha with 800

	farming system of small and marginal farms	fingerlings (Katla, Rohu and Nain in the ratio of (40:30:30). iii) Poultry : Eight cycle of 200 broilers. iv) Mushroom production and packaging unit: Button mushroom up to 400 kg/annum. v) Apiary including honey production, processing and packing: Ten boxes can be maintained. vi) Multistoried horticulture orchards: vii) Vermicompost and NADEP unit.

B. Technical Programme (Enterprise/enterprises and allocation of land)

• Crop component	Net area allotted (m^2)
Crop sequence (7700 m^2)	
Rice - wheat - maize (baby corn)	1400
Rice – wheat - green gram	1200
Rice - barley - green gram	1000
Rice-mustard - black gram	800
Maize-toria-sunflower	800
Pigeon pea + pearl millet (1:1) - sudan chari + cowpea (F)	800
Sudan chari - berseem + Mustard (F) + maize + cowpea (F)	800
Okra – cabbage - sponge gourd	300
Cowpea – potato - okra	300
Bottle gourd - onion	300
• Fishery	1000
• Orchard	500
• Mushroom	40
• Composting	100
• Dairy 3 milch animal	
• Poultry 200 birds	
• Apiary 10 boxes	610
Total	10,000

Centre name: Sabour (Bihar) - Middle Gangetic Plain Region

A. Location of the centre and present scenario of agriculture in the region

Sl. No.	Item	Details
1	Name of the centre and it's location	Sabour, Bhagalpur, Bihar
2	Name of the University/ICAR institute	Rajendra Agricultural University, Pusa, Samastipur
3	i) Ecosystem under which centre falls	Sub- humid
	ii) Agro Climatic Region	Middle Gangetic Plain Region
	iii) NARP Zone	South Bihar Alluvial Plain, Zone III (a)
4	Predominant Farming Systems and percentage of the farm families adopting these farming systems.	Crops + Dairy (85%)
5	Important crops (including horticultural crops) and cropping systems of dominated farming system/ systems.	a) Important crops: Rice, wheat, winter maize, gram, lentil, urd bean, rai, mango, litchi and vegetable crops b) Important cropping systems: i. Rice-Wheat ii. Rice –Pulses
6	Per cent contribution of individual enterprises in the economy of dominant Farming Systems.	Crops – 70 to 75% Dairy - 25 to 30%
7	Yield gaps (Farmer yield V/s Achievable yields) for important enterprises.	Crops: i) Rice - 52.6% ii) Wheat - 43.8% iii) Winter maize - 18.6 % iv) Pulses - 44.6 % Milk : Cow - 172% Meat : i) Goat - 168% ii) Poultry - 158% Fishery - 148%
8	Available low cost technologies to overcome these gaps (for each crop/ animal/ other component)	Rice – • Direct sowing by zero till drill or drum seeder • Use of hybrid or high yielding quality seeds. • Control lodging and diseases /pests by application of INM and IPM technologies. • IWM, line transplanting + use of rotatory rice weeder between the lines + chemical weed control • Popularization of SRI method of rice transplanting Wheat – • Recommended varieties for respective sowing time (Timely /delayed). • Use proper planting method (spacing, seed rate, line sowing), fertilizer application behind furrow efficient utilization. • Balanced nutrition through INM. • Chemical control of weeds. Maize – • Use of hybrid varieties with yield potential of 10.0 t / ha.. • Balanced nutrition through INM • Weed/disease/pest control using IWM and IPM • Irrigation at proper time.

		Milk – • Rear high yielding breed of cow • Ensure year round supply of green fodder of maize, sorghum and legumes and making silage at low cost. • Fed with balanced ration, salt and mineral mixtures. • Use of high quality and fresh semen and AI at proper time for avoiding repeat breeding, a common phenomenon. Goat and poultry rearing • Availability of improved breed of chicks and goat for egg and meat purpose. • Proper feeding according to age and body weight. • Timely vaccination, deworming and arrangement for fresh drinking water
9	Promising low-investment enterprise(s), which may be integrated profitably to diversify the existing dominated farming system of small and marginal farms	i) Apiary – Orchard dominated areas and also areas growing flowering crops viz., mustard, chickpea and floricultural crops round the year. ii) Mushroom- Ideal low cost enterprise for all the small and marginal farmers. iii) Fruit and vegetable orchards – Small and medium categories of the farmers can practice this for increased year round income and more employment per unit area per unit time. iv) Freshwater fish production – In low lying, areas fish production has also been found an economic enterprise. v) Poultry and ducks – To utilize homestead wastes and have the environment clean these two birds have been found promising enterprise. vi) Vermicompost – Cow dung, urine and farm waste will be utilized for preparation of vermicompost rather than poorly decomposed FYM with low nutrient content. vii) Farm boundary plantations – Farm boundaries may be utilized for plantation of 100 nos.of Subabu (Leucaena leu cocephala) and 30 nos. of Drum stick (Moringa oleifera) trees to meet the requirement of fodder, timber and vegetable for cattle and farm family.

B. Technical Programme (Enterprise/enterprises detail and allocation of land)

Enterprises/enterprises	Gross area m^2/unit size
A. Crop production (6900 m^2)	
i) Cereals (Paddy, maize, wheat)	11,800
ii) Pulses (Moong)	2900
iii) Oilseeds (mustard)	1000
iv) Tuber (potato)	2000
v) Green fodders	6000
vi) Dry fodders	
vii) Concentrate	-
B.Horticulture	1400
i) Fruits	500
ii) Vegetables	600
iii) Floriculture	300
C.Dairy unit	2 cows
	2 calves
D. Goat unit for Meat	10+1
E. Poultry layer birds	50 Nos.
F. Fishery	1000
1000 fingerlings	
G. Apiary	5 boxes
H. Mushroom unit	20
(2.0 kg/ day)	
I. Vermicompost unit	110
J. Animal sheds, stores	600

Centre name: Patna (Bihar) - Middle Gangetic Plain Region

A. Location of the centre and present scenario of agriculture in the region

Sl. No.	Item	Details
1	Name of the centre and it's location	ICAR Research Complex for Eastern Region, Patna (Bihar)
2	Name of the University/ICAR institute	ICAR Research Complex for Eastern Region, Patna (An ICAR Institute)
3	i) Ecosystem under which centre falls	Sub-humid
	ii) Agro Climatic Region (based on classification by Planning Commission of India)	Middle Gangetic Plain Region
	iii) NARP Zone (As per classification under NARP. Please give full name)	South Bihar alluvial plain (Bihar-3)
4	Predominant Farming Systems (not more than 2) and percentage of farm families adopting these	Crops + Dairy (70%)

	farming systems.	Crop + Fishery (20 %)
5	Important crops (including horticultural crops) and cropping systems of dominant farming system/ systems.	a) Important crops: Rice, wheat, maize and fodder crops like sorghum, cowpea, berseem, maize and oats. b) Important cropping systems: i. Rice-wheat ii. Rice –maize
6	Per cent contribution of individual enterprises in the economy of dominant Farming Systems.	Crops – 50-60% Dairy - 20 -25% Fisheries- 25-30%
7	Yield gaps (Farmer yield V/s Achievable yields) for important enterprises.	Crops: i) Rice - 50-60% ii) Wheat - 40-50% Milk : i) Cow - 25.9 % ii) Buffalo - 27.7 %
8	Available low cost technologies to overcome these gaps (for each crop/ animal/ other component)	Wheat – • Use of recommended varieties and their respective sowing time (early/timely /delayed). • Balanced nutrition through INM. • Chemical control of weeds. Rice – • Use of HYV and high value scented varieties. • Lodging/disease/pest control using INM and IPM. • Water management (follow 3 DAD of ponded water) Dairy/Milk – • Rear local high yielding/cross bred breed of cows • Ensure year round supply of green fodder. • Balanced ration, salt and mineral mixtures. • Maintenance of hygienic condition in the shed. Goatry/Meat: • Rear local breed like Black Bengal which is suitable to this area • Fenced and limited grazing • Proper space for roaming • Kid production
9	Promising low-investment enterprise(s), which may be integrated profitably to diversify the existing dominated farming system of small and marginal farms.	i) Freshwater fish production – In low lying and riverbed areas and also in assured water supply, fish production has also been found an economic enterprise even on small pond of 100sq.m. area. ii) Mushroom- Year round mushroom production is an ideal low cost enterprise for the small and marginal farmers. • Straw mushroom: March- September • Oyster/button mushroom: October-February iii) Fruit and vegetables – Small and marginal categories of the farmers having comparatively less cultivated land can cultivate vegetables and fruits viz. guava, banana and lemon etc. for increased year round income and for more employment. The dikes of the pond can be also used for vegetable and fruit cultivation. v) Backyard poultry and ducks – To utilize homestead wastes and have a clean environment these birds have been found a promising enterprise to turn the farm wastes in to economic returns. Duck acts as biological aerator and weeder. vi) Vermicompost – Cowdung, urine and farm waste may be utilized for preparation of high nutrient containing vermicom-post.

		vii) FYM/Compost: FYM is a good source of all the major and micronutrients with moderate nutrient content and is widely used from ancient time in Indian agriculture. All the farm wastes can be better utilized by converting it to compost. viii) Apiary – Honey is a rich source of fructose which is very delicious in taste and known as healthy food. Honey bees move around 2-4km area from their hives and thus collect nectar/pollens which is converted to honey. Mustard and some flower crops should be grown near the area. ix) Boundary plantations – All field boundaries may be utilized for plantation of perennial trees which can be utilized as fodder, food and fuel. On field boundaries, cucurbits can be successfully grown all around the year. Sesbania can also be grown all around the boundaries which can be used as manure crop as well as fodder.

B. Technical Programme (Enterprise/enterprises detail and allocation of land)

Enterprise/enterprises detail	Gross area, m^2/ Unit size
A. Crop production i) Cereals (Paddy, maize, wheat) ii) Green fodders (Sorghum, berseem, oats, maize) iii) Dry fodders (Wheat & rice straw, maize stover, etc.)	 12000 3400
B. Dairy (Milk) unit (2 acre) Three milch animals Goatery (1 acre)	 3 cows + 3 calves 20 female + 1 male
C. Fishery (2 acre) Duckery (2 acre) Poultry (1 acre)	1200 35 50 birds/72
D. Horticulture Unit Fruits (Vegetables as intercrops)	 3120
E. Apiary Unit Honey (1 acre)	10 boxes
F. Mushroom Unit (1 acre)	81
F. Composting/FYM Vermicompost (I + II)	 450
G. Land for common uses (Animal sheds, stores, dwelling unit, threshing floor, tube-well etc	 730

Centre name: Kalyani (W.B.) - Lower Gangetic Plain Region

A. Location of the centre and present scenario of agriculture in the region

Sl. No.	Item	Details
1	Name of the centre and it's location	Kalyani Centre, Dist. Nadia, West Bengal
2	Name of the University/ICAR Institute	Bidhan Chandra Krishi Viswavidyalaya
3	i) Ecosystem under which centre falls	Sub-Humid
	ii) Agro Climatic Region (based on Classification by Planning Commission of India)	Lower Gangetic Plain Region
	iii) NARP Zone (As per classification under NARP. Please give full name)	New Alluvial Zone (West Bengal-4)
4	Predominant Farming Systems (not more than 2) and percentage of the farm families adopting these farming systems.	Crop + Diary – 32.08%, Crop + Poultry + duckery + dairy-19.58%
5	Important crops (including horticultural crops) and cropping systems of dominated farming system/systems.	a) Important crops: Winter rice, potato, mustard, sesame, jute, summer rice b) Important cropping systems: i) Winter rice – summer rice ii) Winter rice-mustard-jute iii) winter rice – potato – jute
6	Per cent contribution of individual enterprises in the economy of dominant Farming Systems.	i) Crop-dairy FS: - Crop – 85 to 90%, dairy – 10 to 15% ii) Crop+poultry+duckery+dairy: Crops – 80 to 85% Poultry – 7 to 9% Duckery – 2 to 3% Dairy - 5 to 8%
7	Yield gaps (Farmer yield V/s Achievable yields) for important enterprises.	Crops : (i) Winter rice - 7.29 q/ha (ii) Potato - 7.19 t/ha (iii) Mustard - 3.38 q/ha (iv) Summer rice - 19.4 q/ha (v) Jute - 3.48 q/ha (vi) Sesame - 4.0 q/ha Milk - 1570 l/yr./animal Egg - 80 eggs/year/bird (Poultry & Duckery unit)
8	Available low cost technologies to overcome these gaps (for each crop/animal/other component)	Winter rice – • Use of recommended doses of NPK and Zn along with manure • Suitable HYV selection • IPM for weed and pest management Summer rice – • SRI method of cultivation • Balanced nutrition through INM Potato – • Use of late blight resistant variety • Timely earlier planting of tuber • IPM for disease and pest management Mustard : • Use of recommended N, P, K and S along with manure • Timely early sowing

		Jute : • Use of suitable variety • Timely sowing, thinning and weeding Milk : • Use of improved local breeds • Feed with balanced ration, salt, mineral mixture along with green fodder (at least 10% of ration daily) • Practice of AI technique Birds : • Use of Improved breeds of poultry birds and ducks. • Proper sanitation in dwelling place • Use balanced feed with proper health care
9	Promising low-investment enterprise(s), which may be integrated profitably to diversify the existing dominanated farming system of small and marginal farms .	(i) Fresh water fish production – In low laying (bill) area and also in homestead small pond with assured water supply fish culture is an economic enterprise. (ii) Vermicompost- High nutrient content, soil health rejuvenating, multipurpose (manure, organic fish culture, rooting media for nursery, feed of poultry birds) organic manure can be produced by farm women/self help group having potential of commercialization. iii) Duckery : Duckery is a traditional enterprise existing in the small and marginal farm family. The income from this can be enhanced by using feed from byproducts of cereals, pulses, etc. iv) Farm forestry / boundary planting : All field boundaries, surroundings of pond may be utilized for plantation of perennial fruit trees (Papaya, jackfruit, banana, lemon, coconut, arecanut (+ black pepper), timber trees (teak, neem, gamar) and bamboo.

B. Technical Programme (Enterprise/enterprises detail and allocation of land)

Enterprise/enterprises	Gross area m^2/unit size
A. Crop production (net area=4400 m^2)	
(i) Cereals (paddy, maize, wheat)	4000
(ii) Pulses (greengram, lentil and pigeonpea)	1600
(iii) Oilseeds (mustard, sesame & groundnut)	1200
(iv) Green fodder (napier, ricebean, berseem)	1000
(v) Dry fodder (wheat & rice straw, maize stover) grain husk of pulses	-
(vi) Vegetables (amaranthus, cauliflower, brinjal, radish, french bean)	2100
B. Horticulture unit - Fruits & Vegetables (intercrop)	900
C. Dairy	(2 milch animals)
D. Pond unit (Fishery)	900
Zinger	50
Turmeric	50
Limbu	15 nos
Arecanut	15 nos.
Vegetable (Sweet potato+gourd+drumstick)	Bund
E. Duckery	10
F. Farm composting/ vermicompost	10
G. Land for common uses (cow shed, store, threshing floor etc.)	300

Centre name: Raipur (Chhattisgarh) - Eastern plateau and hills

A. Location of the centre and present scenario of agriculture in the region

Sl.No.	Item	Details
1	Name of the centre and its location	Raipur (CG)
2	Name of the University	Indira Gandhi Krishi Vishwavidyalaya, Raipur (CG)
3	(i) Ecosystem under which centre falls	Sub-humid
	(ii) Agro climatic region	Eastern Plateau and Hill Region (VII)
	(iii) NARP Zone	Chhattisgarh Plain Zone (MP-1)
4	Predominant farming system (not more than 2) and percentage of the farm families adopting these farming system	Crops + Dairy (> 90%) Crops in backyard + Poultry + Fish (60%)
5	important crops (including horticultural crops) and cropping system of dominated farming system/systems.	(a) Important crops : Rice, Soybean, Wheat, Chickpea, Linseed and Fodder crops like Berseem, Sorghum etc. (b) Important Cropping Systems: (i) Rice-Wheat/ Chickpea/ Lathyrus – Greengram (ii) Soybean-Wheat/Linseed
6	Percentage contribution of individual enterprises in the economy of dominant farming systems.	Crops- 75-85% Dairy- 15-25%
7	Yield Gaps (Farmer yield V/s Achievable yields) for Important Enterprises.	Crops: i) Rice (Kharif) 150% ; ii) Rice (Rabi) 130.8%; iii) Wheat 66.6%; iv) Lathyrus 50%; v)Linseed 52.8%; vi) Chickpea 58.3% . Milk: Cow 177.3%
8	Available low cost technologies to overcome these gaps (for each crop/animal/other component) dominated farming system of small and marginal	• Rice : Recommended agronomic practices, use of HY and hybrid varieties and balanced nutrition through INM. • Wheat : Use of recommended varieties suitable after short, medium and late duration rice and balanced nutrient through INM. Chemical control of weeds • Chickpea: Use of recommended varieties suitable after short, medium and late duration rice) IPM for weed and pest manage ment use of Rhizobium/PSB/VAM • Soybean : Use of suitable/recommended varieties • chemical control of weeds • use of Rhizobium/PSB/VAM • Milk: Rear cross breeds of cow • Ensure year round supply of green fodder • Feed with balanced concentrates along with fodder. • Fish: Rear polyculture of Rohu, Katla and Mrigal.
9	Promising low-investment enterprise(s), which may be integrated profitably to diversify the existing farms.	i) Dairy: Small farms must adopt livestock integration with crops ii) Fisheries: Ponds serves various useful purposes like domestic requirement of water, supplementary irrigation to adjacent crop fields, and pisciculture. iii) Mushroom: It is also a good supplementary enterprise in a farming system which provides employment. iv) Apiary : This is a very good supplementary enterprise in a

		farming system. Investment required is very low. Orchard and forestry dominated areas and also areas growing flowering crops viz., mustard, chickpea, floricultural crops round the year is bust suited. v) Backyard poultry : To utilize homestead wastes and have a clean backyard environment. vi) Vermicompost : Cowdung, urine and farm waste may be utilized for preparation of high nutrient containing vermicompost rather than poorly decomposed FYM with low nutrient content and contaminated with huge colonies of termite. vii) Boundary plantation : All field boundaries may be utilized for plantation of perennial fruit trees and waste lands for useful fuel and timber plantations. Karonda, aonla, etc. can safely be planted.

B. Technical Programme (Enterprise/enterprises detail and allocation of land)

Enterprise/enterprises	Gross area, m^2/ Unit size
(A) Crop production Net area = 7000m^2	
Cereal	8400
Pulses	5500
Oilseed	2500
Sugarcane	1400
Green fodder	2400
Vegetable (onion)	800
Dry fodder	-
(B) Dairy unit (2 cow)	2 cows
(C) Fish Unit	750
(D) Mushroom unit	20
(E) Horticultural unit	1360
(F) Apiary unit	10 boxes
(G) Composting	80
(H) Poultry unit	(50 hen)
(I) Land for common use (Animal sheds, stores, threshing floor, tube well etc.)	740

Centre name: Kanke-Ranchi (Jharkhand) - Eastern plateau and hills

A. Location of the centre and present scenario of agriculture in the region

Sl. No.	Item	Details
1	Name of the centre and it's location	Birsa Agricultural University, Kanke, Ranchi, Jharkhand
2	Name of the University ICAR institute	Birsa Agricultural University, Kanke, Ranchi
3	i) Ecosystem under which centre falls	Sub humid
	ii) Agro Climatic Region	VII. (Eastern plateau and hill region)
	iii) NARP Zone	V. Central and North eastern plateau
4	Predominant Farming Systems (not more than 2) and percentage of the farm families adopting these farming systems.	Crops + Goatery + Poultry (60%) unorganized Crops + Dairy + Poultry
5	Important crops (including horticultural crops) and cropping systems of dominated farming system/ systems.	a) Important crops: Rice, Ragi, Wheat, Pigeon- pea, Chick pea, Maize, Mustard, Field pea, Lentil, Okra, Potato, Tomato, Cab bage, Cauliflower, French been b) Important cropping systems: i. Rice – fallow ii, Rice- wheat iii. Rice/ Maize - lentil/ mustard iv. Rice - potato/ vegetables
6	Per cent contribution of individual enterprises in the economy of dominant Farming Systems.	Crops - 70 - 80% Goatery - 10 -20% Dairy - 20 - 30 %
7	Yield gaps (Farmer yield V/s Achievable yields) for important enterprises.	Crops: (q/ha) % increase i) Rice 100% ii) Wheat 75% iii) Maize 100% iv) Black gram 40% v) Lentil 25% vi) Mustard 40% vii) Ground nut 50% viii) Soybean Dairy: 40%
8	Available low cost technologies to overcome these gaps (for each crop/ animal/ other component)	Rice – • Varietal replacement: Traditional with HYV/hybrid Balanced nutrition through INM. • IPM • Adoption of SRI technique. Wheat – • Recommended varieties (Timely /delayed) Recommended/ balanced fertilization. . Chemical control of weed. • Irrigation scheduling as per availability of water Maize- • Use of hybrid varieties in place of composite. • Balanced nutrition through INM. Pulses- • Use of HYV/hybrid varieties in place of old ones • Integrated nutrient management

		• Use of Rhizobium Culture • Liming @ 3q/ha • Integrated pest management • Irrigation – 2 at critical stages Oil seed – • Replacement of local varities by improved varieties • Recommended fertilization (NPKS) • Irrigation-2-3 at critical stage Vegetable– • Use of hybrid varieties • Integrated nutrient management • Integrated pest management • Water Management: Irrigation will be scheduled at critical growth stages and by using micro-irrigation system (sprinkler). Dairy – • Rear cross bred of cow • Ensure year round supply of green fodder. • Fed with balanced ration, salt and mineral mixtures. • Timely deworming and vaccination • Artificial insemination with quality semen at proper heat for avoiding • repeat breeding, a common phenomenon.
9	Promising low-investment enterprise(s), which may be integrated profitably to diversify the existing dominated farming (as given above).	(i) Apiary - Orchard and forestry dominated areas and also areas system of small and marginal farms growing flowering crops viz., mustard, chickpea, floricultural crops round the year (ii) Mushroom- Ideal low cost enterprise for all the small and marginal farmers. (iii) Vegetable orchards/ Nutritional garden – Small and medium categories of the farmers can adopt this enterprise to meet year round need of vegetable and fruits of their family and to enhance their income and employment per unit area per unit time also. (iv) Fishery - Fish production can be taken to enhance income and water productivity. (v) Boundary plantation- The boundary around the path and bunds can be utilized by growing fruits plants, floriculture and subabul to support IFS enterprises. (vi) Live stock – (cattle)- The sale of milk provide regular income and their dung and urine are utililized in the preparation of vermicom post which reduces the fertilizer input requirement and also maintains the sustainability of the system. (vii) High density Orchards - Regular bearing variety i.e. Amprapali can be planted at high density to generate more income per unit area of land. (viii) Vermicompost - Cowdung, urine and farm waste may be utilized for preparation of high nutrient containing vermicompost rather than poorly decomposed FYM with low nutrient content and contaminated with huge colonies of termite.

B. Technical Programme (Enterprise/enterprises detail and allocation of land)

Farm produce	Gross area(m^2)
A. Crop Production (Net area 8000 m^2)	
(i) Cereals (Paddy, maize, wheat)	8000
(ii) Pulses (Lentil, black gram)	2000
(iii) Oil seed (Mustard, G. round nut, Soybean)	3000
(iv) Green fodders (Maize, Cow pea, Berseem, Mustard)	3,000
(v) Dry fodder (Paddy & Wheat Straw, Maize Stover etc.)	-
B. Dairy (Milk) 2 cross bred Cow	50
C. Fishery	1000
D. Horticulture (Fruits and Vegetables as intercrops)	300
E. Apiary	5 boxes
F. Mushroom	45
G. Vermicompost	100

Centre name: Rahuri (Maharashtra) - Western plateau and hills

A. Location of the center and present scenario of agriculture in the region

Sl.No.	Item	Details
1.	Name of the centre and location	RAHURI, MAHARASHTRA
2.	Name of the University/ ICAR institute	Mahatma Phule Krishi Vidyapeeth, Rahuri-413 722 Dist. Ahmednager
i) ii) iii)	Ecosystem under which centre falls Agro Climatic Region NARP Zone	Semi – arid Western Plateau ACZ – 6 (Scarcity Zone)
4	Predominant Farming System and percentage of the farm families adopting these farming systems.	Crop + Dairy (85%)
5	Important crops (including horticultural crops) and cropping systems of dominant farming system/systems.	a)Important crops:- Soybean, Pearlmillet, Wheat, Chickpea, Cotton, Maize, Pigeonpea, Black gram, Luceme and Hybrid Napier grass b) Important Cropping Systems i) Soybean- Wheat ii) Cotton – Wheat III) Soybean- Onion iv) Maize – Onion
6	Percentage contribution of individual enterprises in the economy of dominant Farming Systems.	Crops : 60 – 75 % Dairy : 25 – 40 %
7	Yield gap (Farmer yield V/s Achievable yields) for important enterprises.	Crops : 1) Soybean – 30% 2) Wheat – 32 % 3) Pearl millet – 40% 4 Chick pea – 35% 5) Black gram – 38% Dairy: i) Cow – 32 %

8 Available low cost technologies to overcome these gaps (for each crop/ animal/ other component)	Soybean: • Timely sowing with IPM. • Use of IPM for the control of Spodoptera Wheat: • Line sowing with improved cultivars. • Irrigation at critical growth stages. Pearlmillet: •Use of pearlmillet hybrids with seed treatment • Intercropping of pearlmillet hybrid with pigeonpea (2:1). Black gram / Chickpea: • Use of IPM for pest control • Seed treatment with bio - fertilizers and bio – pesticides • Lucerne and/Hybrid Napier Grass : • Use of improved cultivars of Lucerne. • Use of new hybrids of Napier grass. Dairy: • Cows • Introduction of new triple cross breed Phule Triveni in place of local breed. • Ensure the balanced ration with mineral mixtures Ensure availability proteinous green fodder.
9 Promising low- investment enterprise(s), this may be integrated profitably to diversify the existing dominant farming system of small and marginal farms (as given above).	(i) Mango Orchard In the existing orchards of mango, fruit crops like Sapota, Aonla and Custard apple will be planted for high density plantation and getting maximum returns. (ii) Multistoried vegetable gardens Introduction of short duration new cultivars of vegetables in Multisto ried gardens. (iii) Poultry By keeping-fifty meat purpose birds for getting higher returns. Vermicompost / Vermiwash : (iv) All the farm and dairy waste will be utilized to produce nutrient rich vermicompost. (v) Farm waste / boundary plantations: All the fields boundaries will be planted at specific distance by drumstick, custard apple, ber, curry leaf etc.

B. Technical Programme (Enterprise/enterprises details and allocation of land)

Farm produce	Gross area, m²
A. Crop production 7200 m² (Net)	
i) Cereals (pearl millet, maize, wheat)	6000
ii) Pulses (Chickpea, black gram)	2000
iii) Oilseeds(Soybean)	3000
iv) Green fodder (Lucerne and Hybrid Napier Grass)	
v) Dry fodder (Pearl millet, Wheat straw & maize etc.)	
B. Dairy (Milk) unit	
Two milch animals	2 cows
C. Poultry	50
D. Horticulture Unit	
Fruits	2000
Vegetables (intercrop)	8000
E. Composting (Vermicompost)	150
F. Land for common uses	800
(Animal shed,store, dwelling unit,threshing floor,tube-well etc.)	

Centre name: Parbhani (Maharashtra) - Western plateau and hills

A. Location of the centre and present scenario of agriculture in the region

Sl. No.	Item	Details
1	Name of the centre and it's location	AICRP on Integrated Farming Systems, Marathwada Agricultural University,Parbhani – 431 402 (MS)
2	Name of the University	Marathwada Agricultural University, Parbhani – 431 402 (MS)
3	i) Ecosystem under which centre falls	Semi-Arid Tropics
	ii) Agro Climatic Region	Western Plateau and Hill Region No. 9
	iii) NARP Zone	Central Maharashtra Plateau Zone No.7
4	Predominant Farming Systems and percentage of the farm families adopting these farming systems.	1. Crop + Dairy 15.5% 2. Crop + Horticulture 10.2%
5	Important crops (including horticultural crops) and cropping systems of dominated farming system/ systems.	A. Important crops: Soybean, Cotton, Sugarcane, Greengram, Sorghum, Pigeon pea, Wheat, Banana, Sweet lime B. Important cropping systems: 1. Soybean – Rabi Sorghum 2. Soybean – Wheat 3. Soybean + Pigeon pea intercropping (4:2) 4. Bt. Cotton- Summer Groundnut 5. Greengram – Rabi Sorghum 6. Soybean-Sugarcane-Ratton Sugarcane-Summer Groundnut

6	Per cent contribution of individual enterprises in the economy of dominant Farming Systems.	Crop : 80 % Enterprises: Dairy 15 % Horticulture 05%
7	Yield gaps (Farmer yield V/s Achievable yields) for important enterprises.	Soybean – 25 % Wheat – 31.% Rabi Sorghum - 35.4 % Sugarcane – 44.5 % Cow Milk – 31 % and buffaloes 28 %
8	Available low cost technologies to overcome these gaps (for each crop/ animal/ other component)	Soybean • Balanced fertilization through INM • Optimum seed rate. • Control of pests through IPM. • Right time of harvest. Wheat • Optimum sowing time. • Recommended variety. • Seed rate / ha. • Balanced fertilization through INM. • Optimum irrigation. • Right time of weeding Rabi Sorghum • Recommended variety. • Balanced fertilization through INM. • Seed treatment with biofertilizer. • Timely irrigation. Cow and buffalow Milk production • Palatability of available dry fodder will be increased through salt treatment. • Balanced feeding ration with mineral mixture. • Artificial insemination for cows Jersey and HF at proper heat time.
9	Promising low-investment enterprise(s), which may be integrated profitably to diversify the existing dominated farming system of small and marginal farms (as given above).	Enterprises : (i) Dairy (ii) Horticulture (iii) Vermicompost

B. Technical Programme (Enterprise/enterprises detail and allocation of land)

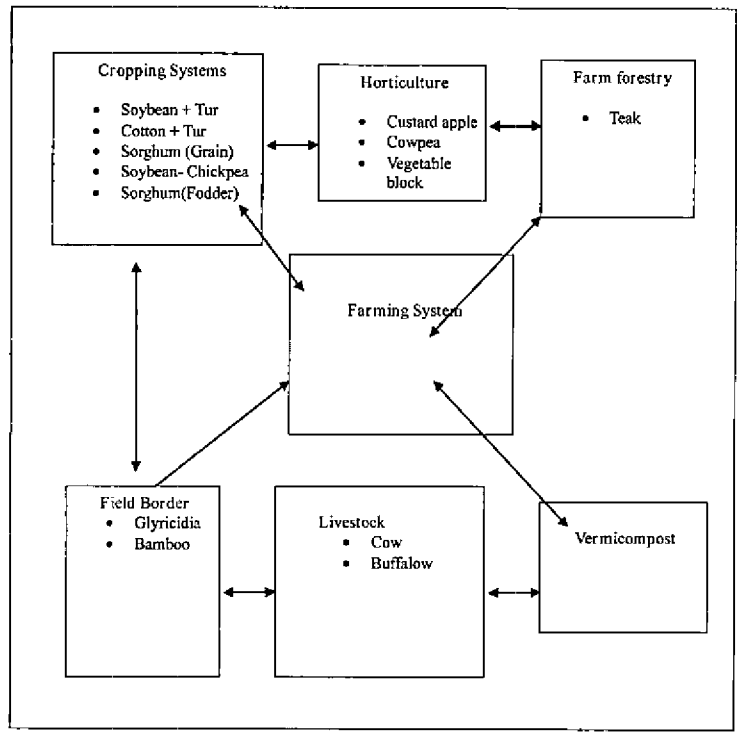
Enterprise/enterprises	Gross area, m^2/ ha/ Unit size
A. Crop production (7600m m^2)	
i. Cereals–	
• Sorghum	0.1
• Wheat	0.1
• Soybean	0.3
• Ginger	0.1
• Green gram	0.16
• Onion	0.1
Green fodders–	0.15
Anjan tree leaves	0.025
Dry fodder	
Soybean bhusa	0.3
Rabi sorghum	0.1
Wheat bhusa	0.1
Greengram bhusa	0.1
Total A	
B. Dairy (Milk) unit	1 buffalo + 1 cow
C. Horticulture unit	
• Fruits 0.20 ha.	
• Vegetables–	
Brinjal	0.16
Cabbage	0.20
Drum stick	0.025
D. Composting	
• Vermicompost	150

Centre name: Akola (Western Plateau & Hills)

Technical Programme (Enterprise/enterprises detail and allocation of land)

Enterprise/ enterprises	Farming System Module (Area = 2.90 ha.) Crop + Dairy + Fruit + Veg + Fodder + Farm pond + Forestry + V.compost + Farm structure	
A	1	0.40 ha Soybean + Pigeonpea (5:1)
	2	0.40 ha. Cotton + Pigeonpea (6:2)
	3	0.20 ha Sorghum (Grain)
	Total	**1.00 ha area**
B	4	0.40 ha Soybean – Chickpea
	5	0.40 ha Fruit crop (Custard apple + Urid)
	6	0.20 ha Sorghum (Fodder)
	7	0.20 ha Vegetable (Cowpea)
	8	0.10 ha Farm pond (20 m X 20 m X 3 m)
	Total	**1.30 ha area**
C	9	0.40 ha Farm forestry (Teak)
	10	0.20 ha Farm structure
	Total	**0.60 ha area**
	11	Milch animals (Cow and Buffalo) 1 each
	12	Border 725 m length = Plantation of Glyricidea and bamboo

Rainfed research module on IFSR with integration of subsystems for sustainable farming system



Centre name: Rajendranagar (A.P.) - Southern plateau and hills

A. Location of the centre and present scenario of agriculture in the region

Sl. No.	Item	Details
1	Name of the centre and it's location	AICRP on Integrated Farming Systems, Rajendranagar, Hyderabad
2	Name of the University/ICAR institute	ANGR Agricultural University
3	i) Ecosystem under which centre falls	Semi-Arid
	ii) Agro Climatic Region	Southern Plateau and hills region
	iii) NARP Zone	Southern Telangana Zone (AP 5)
4	Predominant Farming Systems (not more than 2) and percentage of the farm families adopting these farming systems.	Crops+ Dairy (60%) Agriculture +Horticulture (30%)
5	Important crops (including horticultural crops) and cropping systems of dominated farming system/ systems.	• Important crops: Rice, castor, maize, cotton, redgram, jowar, groundnut and Vegetables • Important cropping systems: Rice-Rice, Rice-maize, Sorghum/Maize + Redgram, Rice-Groundnut/Sunflower
6	Per cent contribution of individual enterprises in the economy of dominant Farming Systems.	Crops: 70-80% Dairy : 20-30%
7	Yield gaps (Farmer yield V/s Achievable yields) for important enterprises.	Kharif rice-73% ; Rabi rice -32% Maize- 137% ; Castor-200% Cotton -180%; Tomato -69% Green Chillies- 153%; Orchards- 100% Milk production-142%
8	Available low cost technologies to overcome these gaps (for each crop/ animal/ other component)	Rice : • Use of high yielding short duration blast resistant varieties • Green manuring and balanced nutrition including zinc • Timely pest control Castor: • Cultivating the crop during rabi to overcome botrytis problem and for higher productivity Maize: • Maintaining optimum plant population • Balanced fertilization • Cultivation under zero tillage after rice Redgram : • Use of wilt resistant varieties • IPM for Heliothis management Dairy: • Artificial insemination for the upgradation of local breeds • Ensuring year round supply of green fodder • Feeding with balanced ration Vegetables: • Effective management of viral diseases through IPM

		Orchards: (Guava/ Sweet Orange) • Efficient water management through micro irrigation • Correction of micronutrient disorders
9	Promising low-investment enterprise(s), which may be integrated profitably to diversify the existing dominated farming system of small and marginal farms (as given above).	i. Back yard poultry with improved breeds ii. Vermicomposting iii. Boundary plantation with *Sesbania sesban* iv. Increasing the cropping intensity in orchards with fruit and vegetable crops. v. Goatery vi Seed production of green manure crops

B. Technical Programme (Enterprise/enterprises detail and allocation of land)

Farm produce	Gross area, m²/ Unit size
A. Crop production : 7,000 m² Net i) Cereals (Rice, maize) ii) Pulses (Green gram, pigeon pea) iii) Oilseeds (Sunflower, Groundnut, Castor) iv) Green manure Seed production v) Green fodders Napier, Lucerne Cowpea vi) Dry fodders (Rice straw, maize etc.)	 6500 3000 3500 3000 1000 1000
Total A 18000	
B. Dairy unit (Two milch animals): Milk Sale of young calves	 400
C.Goat/Sheep rearing*5+1 Unit Meat	 150
D. Horticulture Unit Fruits** Vegetables (intercrop)	 2000
E. Back yard poultry (2+18) Eggs Meat	 –
F. Composting. Vermicompost	 150
G. Land for common uses such as; Animal sheds, stores, dwelling unit, threshing floor, tube-well etc.	300

Centre name: Coimbatore (Tamil Nadu) - Southern plateau and hills

A. Location of the centre and present scenario of agriculture in the region

Sl. No.	Particulars	Details
1	Name of the centre and it's location	Department of Agronomy,TNAU, Coimbatore
2	Name of the University/ICAR institute	Tamil Nadu Agricultural University, Coimbatore
3	i) Ecosystem under which the centre falls	Semi-arid
	ii) Agro Climatic Region	Southern Plateau and Hills Region
	iii) NARP Zone	Western Zone (TN- 3)
4	Predominant Farming Systems (not more than 2) and percentage of the farm families adopting these farming systems.	Crops + Dairy : 60 % Crops + Goat rearing : 40%
5	Important crops (including horticultural crops) and cropping systems of dominated farming system/ systems.	a) Important crops: Maize, cotton, sunflower, pulses, sugarcane, vegetables, fodder crops b) Important cropping systems: • Fallow – Cotton – Sorghum/ maize/ sunflower • Pulses/green manure - Cotton – Maize/ tomato • Chillies / okra – Maize/sunflower – Pulses
6	Per cent contribution of individual enterprises in the economy of dominant Farming Systems.	Crops – 70 to 80% Dairy - 20 to 30%
7	Yield gap (Farmer yield V/s Achievable yield) for important enterprises.	Crops: i. Maize : 30% ii. Cotton : 65% iii. Sunflower : 40% iv. Pulses : 50% v. Sugarcane : 35% vi. Vegetables : 40% vii. Fodder crops : 20% Animal husbandry: i. Dairy (Cow) : 40 % ii. Goat rearing : 60 %
8	Available low cost technologies to overcome these gaps (for each crop/ animal/ other component)	Maize: • Hybrids in the place of varieties. • Balanced nutrition through INM Cotton: • Use of Bt cotton, IPM and INM • Drip fertigation Sunflower: • Use of hybrids • Balanced fertilizer application through INM • Erecting nets to control bird damage Pulses: • Use of designer seed • Foliar nutrition and timely sowing with improved varieties • Harvesting at proper time and storage Sugarcane: • Advancing sugarcane planting through simultaneous cropping • Balanced nutrition through INM • IPM for pest management

		Vegetables: • Improved varieties, INM, IPM, IWM • Reducing harvest losses, grading and packing milk Crossbred cows and buffaloes: • Ensure year round supply of green fodder • Fed with balanced ration, salt and mineral mixtures
9	Promising low-investment enterprise(s), which may be integrated profitably to diversify the existing dominated farming system of small and marginal farms	Horticulture: • Separate area for fruit crops like banana, guava, sapota and aonla in the cropping programme • Drip fertigation for fruit crops • Inclusion of vegetable crops in the cropping systems • Nutritional garden to supply year round supply of vegetables to farm family. Dairy: • Ideal low cost enterprise for all the small and marginal farmers • Inclusion of perennial fodder in the cropping programme • Recycling voids into biogas plant for fuel and production of vermi compost Goat rearing: • Ideal low cost enterprises for the small and marginal farmers • Rearing of stall fed high milk yielding Tellicherry goats in the place of local goats which needs grazing • Year round income and high profit • Recycling voids and wastes provide fuel (bio gas) and enriched manure (vermicompost) Biogas: • Bio gas produced by recycling animal voids meets the fuel requirement for cooking and energy for lighting farm house • Nutrient enriched slurry value added further by converting into vermicompost Vermicompost: Animal voids, farm wastes and crop residues will be converted into nutrient rich vermicompost rather than poorly decomposed FYM with low nutrient content and contaminated with huge colonies of termite, becoming a serious problem.

B. Technical Programme (Enterprise/enterprises detail and allocation of land)

Enterprise/enterprises	Gross area, m²/ Unit size
A. Crop production (Net area =10,200 m²)	
1. Cereals : Maize	6000
2. Pulses : Cowpea	2000
3. Oilseeds :	4500
Sunflower	
4. Fibre crop : Cotton	2500
5. Vegetables	
Okra	2000
Chillies(green)	2000
Tomato	2000
Cowpea	2500
B. Horticulture Unit	
1. Fruits	1400
2. Vegetables	200
C. Dairy (2 cows with calves)	20
D. Goat rearing	20
E. Bio gas	10

Centre name: Kathalagere (Karnataka) - Southern plateau and hills

A. Location of the centre and present scenario of agriculture in the region

Sl. No.	Particulars	Details
1	Name of the centre and it's location	MCCSR, ARS Kathalagere, Davanagere district , Karnataka
2	Name of the University/ICAR institute	UAS Bangalore
3	i) Ecosystem under which centre falls	Semi-Arid, AEZ – 8.2
	ii) Agro Climatic Region	Southern Plateau and Hills
	iii) NARP Zone	Southern Transitional Zone of Karnataka - Zone-7
4	Predominant Farming Systems (not more than 2) and percentage of the farm families adopting these farming systems.	Crop + Dairy - 60% (Rain fed) Crop + Dairy + Horticulture - 40% (Irrigated)
5	Important crops (including horticultural crops) and cropping systems of dominant farming system/systems.	a) Important crops: Paddy, Sugarcane, Maize, Groundnut, Grain cowpea, Finger millet, Cotton, Fodder jowar, Fodder maize, Cowpea, Napier grass b) Important cropping systems: Paddy – Paddy, Paddy – Maize, Paddy – Groundnut Paddy – Pulses Paddy – Vegetables Sugarcane – Ratoon – Paddy, (3 year)
6	Per cent contribution of individual enterprises in the economy of dominant Farming Systems.	Crop = 75 - 80% Dairy = 20 – 25% Crop =70 - 75%

		Dairy = 15 - 20% Horticulture = 5 – 10%
7	Yield gaps (Farmer yield V/s Achievable yields) for important enterprises.	Paddy : 25-30% Sugarcane : 5-10% Sugarcane ratoon : 10-15% Maize : 37-40% Groundnut : 25-30% Pulses : 30-35% Ragi : 10-15% Cotton : 10%
8	Available low cost technologies to overcome these gaps (for each crop/animal/other component)	Paddy: • Timely sowing and planting • Seed treatment • Maintenance of plant population • Adoption of INM and IPM • Use of improved varieties Maize: • Timely sowing • Use of hybrids and resistant varieties to Downy mildew • Crop rotation with pulses Groundnut: • Timely sowing • Use of HYV • Seed treatment • Application of Gypsum, Zinc sulphate and Borax • Adoption of IPM Pulses: • Use of improved varieties • Seed treatment • P management • Use of bio-fertilizers Dairy: • Use of cross breed cows and Buffaloes • Feeding of mineral mixture to meet the balance ration • Ensure years round supply of green fodder through staggered harvest of forages Horticulture: • Rejuvenation of coconut garden through FYM and potash • Use of neem cake • Adoption of IPM • Introducing intercrops
9	Promising low-investment enterprise(s), which may be integrated profitably to diversify the existing dominated farming system of small and marginal farms (as given above)	(i) Sheep rearing: To utilize byproducts of crop husbandry and to meet the manure requirement and meat. (ii) Back yard poultry: To utilize and recycle home waste from debris and farm waste and provide economic returns through meat and egg. (iii) Vermi composting: Dung, urine and farm waste may be utilized to compost and produce high nutrient content organic manure. (iv) Farm Forestry: All farm boundaries may be utilized for planting perennial trees which are used for the purpose of fruit, timber, fuel, green leaf and fodder.

B. Technical Programme (Enterprise/enterprises detail and allocation of land)

Enterprise/enterprises	Gross area (m^2)
A. Crop production (Net area 8000 m^2) (i) Cereals (Paddy, Maize, Jowar)	12500
(ii) Pulses (Greengram, Cowpea)	1250
(iii) Oil seeds (Groundnut)	1250
(iv) Green fodder (Napier/Jowar/Cowpea)	500
(v) Dry fodder (Paddy)	-
Total	15500
B. Dairy unit (Milk)	1 buffalo + 2 cow
C. Horticulture (Coconut, Areca nut, Banana and vegetables)	4000
D. Composting and Vermi composting	200
E. Land for common uses such as Animal shed, stores, dwelling unit etc.	500

Centre name: Siruguppa (Karnataka) - Southern plateau and hills

A. Location of the centre and present scenario of agriculture in the region

Sl. No.	Item	Details
1	Name of the centre and it's location	Agricultural Research Station, Siruguppa – 583 121 Karnataka
2	Name of the University/ICAR institute	University of Agricultural Sciences, Raichur
3	i) Ecosystem under which centre falls	Arid
	ii) Agro Climatic Region	Southern Plateau Region
	iii) NARP zone	Northern Dry Zone (Zone-3)
4	Predominant Farming systems (not more than 2) and percentage of the farm families adopting these farming systems.	Crops + Dairy (80%)
5	Important crops (including horticultural crops) and cropping systems of dominated farming system / systems	1) Important crops: Rice, Maize, Cotton, Sunflower, Red-gram, Chilli Bengal gram and Bajra 2) Important cropping Systems: i) Rice-Rice ii) Maize-Bengal gram
6	Per cent contribution of individual enterprises in the economy of dominant Farming Systems.	Crops: 70-80 % Dairy: 20-30 %
7	Yield gaps (Farmer yield V/s Achievable yields) for important enterprises.	Crops: Rice : 20-28 % Maize : 20-25 % Cotton : 13-15% Sunflower : 20-22 % Bengal-gram : 25-30 % Milk: Buffalo : 100 % Cow : 80 %

8	Available low cost technologies to overcome these gaps (for each crop/ animal / other component)	Rice: • Use of improved varieties like SIRI-1253, Gangavati sona instead of BPT 5204 • Balanced fertilization through INM • Timely control of pests and diseases by INM and IPM technologies • Timely harvest of crop i.e. at physiological maturity Maize: • Use of high yielding varieties • Use of INM and micronutrients • Bengal-gram: Use of improved varieties like JG-11 and BGD 103 instead of A-1 • Seed treatment with bio-fertilizers like Rhizobium and Trichoderma • Foliar spray of 2 % urea at the peak flowering stage. Milk: • Rear locally available breeds of either cows or buffaloes. • Continuous supply of green fodder • Fed with nutritent rich feed. • Avoid use of inbred cows or buffaloes • Timely insemination
9	Promising low-investment enterprise(s), which may be integrated profitably to diversify the existing dominant farming system of small and marginal farms	(i) Livestock (buffalo/ cattle / sheep), (ii) Multistoried horticulture orchards/ Freshwater aquaculture/ Backyard (iii) Poultry, Vermi-compost unit/ Farm forestry

B. Technical Programme (Enterprise/enterprises detail and allocation of land)

Enterprise/enterprises	Gross area (m^2)
A. Crop Production (Net area = 6500 sq.m.)	
i) Cereals (Paddy and maize)	7000
ii) Pulses (Bengal gram and Pigeon pea)	2000
iii) Oilseeds (Sunflower and sesamum)	2000
v) Green fodders (Maize: SA tall and Guinny grass)	1000
vi) Dry fodders (Rice straw, maize Stover, Bengal bussa etc.)	
Total A	12000
B. Dairy (Milk) unit: Two milch animals	1 buffalo + 1 cow
C. Fishery	200 numbers
D. Horticulture Unit: Fruits and vegetables (intercrop)	2000
E. Composting: Vermi-compost	30
F. Land for common uses such as animal sheds, stores, dwelling unit, threshing floor, tube-well etc.	470

Centre name: Bhubaneswar (Orissa) - East Coast plain and hills

A.Location of the centre and present scenario of agriculture in the region

Sl. No.	Particulars	Details
1	Name of the Centre and it's location	OUAT, Bhubaneswar, (Orissa)
2	Name of the University/ICAR institute	Orissa University of Agriculture and Technology, Bhubaneswar
3	i) Ecosystem under which centre falls	Sub-Tropical
	ii) Agro Climatic Region (based on classification by Planning Commission of India)	East and South Eastern Coastal Plain Zone
	iii) NARP Zone (As per classification under NARP. Please give full name)	East Coast Plains and Hills (Zone-11)
4	Predominant Farming Systems (not more than 2) and percentage of the farm families adopting these farming systems.	Crops + Dairy (80%) Crops+ Dairy+ Fishery (20%)
5	Important crops (including horticultural crops) and cropping systems of dominated farming system/ systems.	a) Important crops: Rice, Pulses, Groundnut, Vegetables b) Important cropping systems: • Rice- Groundnut/greengram- Fallow • Rice- Rice • Rice-Vegetables- Vegetables • Rice- Toria- Green gram
6	Per cent contribution of individual enterprises in the economy of dominant Farming Systems.	Crops - 60 to 70% Dairy - 20 to 30% Fishery - 05 to 20%
7	Yield gaps (Farmer yield V/s Achievable yields) for important enterprises.	Crops: Rice - 40% Maize - 40% Mung/Urd - 60% Groundnut - 33% Vegetables - 30% Milk : Cow - 55%
8	Available low cost technologies to overcome these gaps (for each crop/ animal/ other component)	Rice : • Use of HYV • Balanced fertilization through INM Adoption of IPM • Use of implements Pulses: • Use of HYV and seed inoculation • Liming and FYM application • P fertilisation • IPM • Storage Groundnut: • Use of HYV and seed inoculation • Liming and gypsum application • Use of herbicides • Harvesting at proper soil moisture • Storage for seed • Use of thresher

		Vegetables: • Use of good quality seeds • INM and IPM Dairy: • Rearing local high yielding breed of cows • Promotion of AI • Ensuring year round supply of green fodder • Encouraging concentrate feeds • Sanitation & medication Fishery: • Composite pisciculture • Proper stocking density • Use of appropriate fish feeds • Pond fertilisation • Maintenance of water quality • Growth monitoring, aeration Backyard Poultry and Duckery: • Use of dual purpose birds • Supplementary feeds • Vaccination • Marketing at proper growth stage
9	Promising low-investment enterprise(s), which may be integrated profitably to diversify the existing dominated farming system of small and marginal farms (as given above).	i) Apiary – Orchard and forestry dominated areas and also areas growing floricultural crops round the year. ii) Mushroom- Ideal low cost enterprise for all the small and marginal farmers. iii) Multistoried fruit and vegetable orchards – Small and me dium categories of the farmers having comparatively more cultivated land can practice this for increased year round income and more employment per unit area per unit time. iv) Freshwater fish production – In low lying and river bed areas and also in areas with assured water supply, fish production has been found to be an economic enterprise even on small holdings. v) Backyard poultry and ducks – To utilize homestead wastes and to have a clean environment. vi) Vermicompost – Cowdung, urine and farm waste may be utilized for preparation of high nutrient containing vermicompost rather than poorly decomposed FYM with low nutrient content and contaminated with huge colonies of termite. vii) Farm forestry/boundary plantations – All field boundaries may be utilized for planting of perennial fruit trees, and waste lands for useful fuel and timber planta tions. viz. *Acacia mangium*, coconut trees, *Leucaena leucocephala*, etc. can safely be planted.

B. Technical Programme (Enterprise/enterprises detail and allocation of land)

Enterprise/enterprises	Gross area in m² (Unit size)
A. Crop production = 7100 m² (Net)	
i) Cereals –	
- Paddy	8100
- Maize	1000
ii) Pulses	2100
iii) Oilseeds	1000
iv) Green fodder	1100
v) Dry fodder	–
vi) Vegetables	7000
B. Hort Culture Unit • Fruit • Lemon • Banana • Vegetables • Ginger • Coconut	1500
C. Apiary Unit	10 boxes
D. Mushroom Unit	400 sq.ft
E. Dairy unit	2 cows
F. Vermicompost	150
G. Poultry (100 birds)	100 sq.ft
H. Duckery (50 birds)	100 sq.ft
I. Pisciculture	2000
J. Land for other uses	500

Centre name: Karjat (Maharashtra) - Western Coast Plain and hills

A. Location of the centre and present scenario of agriculture in the region

Sl.No.	Particulars	Details
1	Name of the centre and it's location	Regional Agril. Research Station, KARJAT 410 201, Dist. Raigad (M.S.)
2	Name of the University/ICAR institute	Dr. Balasaheb Sawant Konkan Krishi Vidyapeeth, Dapoli 415 712, Dist. Ratnagiri (M.S.)
3	i) Ecosystem under which centre falls ii) Agro Climatic Region iii) NARP Zone	Hot-humid North Sahyadri and Konkan West coast plain zone No.12 North Konkan Coastal Zone (MH-2)
4	Predominant Farming Systems (not more than 2) and percentage of the farm families adopting these farming systems	Crops + Dairy
5	Important crops (including horticultural crops) and cropping systems of dominant farming system/systems.	a) Important crops- Rice, Vegetables (brinjal, chilly, cucur bits, okra), pulses (cowpea, green gram), oilseeds (groundnut, mustard), fodder crops (maize, hybrid napier, guinea grass) b) Important cropping systems- i. Rice-vegetables ii. Rice-pulses iii) Rice-Oilseeds
6	Per cent contribution of individual enterprises in the economy of dominant Farming systems.	a) Crops – 55% b) Dairy - 26%
7	Yield gaps (Farmer yield V/s Achievable yields) for important enterprises.	Rice : +58 % Brinjal : + 191 % Chillis : + 33 % Groundnut : + 87 %
8	Available low cost technologies to overcome these gaps (for each crop/animal/other component)	• Rice : Use of HYV's, timely transplanting of seedlings balanced fertilizer dose and its placement. • Brinjal : Use of HYV's and balanced fertilizer dose. • Chillis : Use of HYV's and balanced fertilizer dose. • Groundnut : Maintaining optimum spacing and improved technology.
9	Promising low-investment enterprise(s), which may be integrated profitably to diversify the existing dominated farming system of small and marginal farms (as given above).	i) Fruit crops & vegetables : Small farmers having compara tively less cultivable land can bring additional non-cultivated hilly area under fruit crops which can provide year round income and employment. ii) Poultry : To provide year round work and subsidiary income to farm family.

B. Technical Programme (Enterprise/enterprises detail and allocation of land)

Enterprise/enterprises	Gross area m²/ Unit size
A. Crop production (Net area 6000 m²)	
i) Cereals:	5500
Paddy,	4000
Nagli,	500
Maize -Sweet corn)	1000
ii) Pulses:	1300
Cowpea	1000
Green gram	300
iii) Oilseeds:	1500
Groundnut	500
Mustard	1000
iv) Green Fodder:	2000
Fodder Maize	1500
Guinea grass	250
Hybrid Napier	250
Sweet corn green fodder	1000
v) Vegetables:	1600
Brinjal	500
Chillies	500
Okra	300
Cucumber	100
Ridge gourd	100
Bitter gourd	100
vi) Tuber crops:	200
Yam	50
Karanda	50
Ghorkand	50
Colocacea (vadicha Alu)	50
vii) Green leafy vegetables:	200
Spinach	100
Coriander	50
Amaranthus	50
viii) Dry Fodder:	
Rice straw	(5000)
B. Dairy (Milk) Unit	1 buffalo
Two milch animals	+ 1 cow
C. Horticultural fruit crops:	8000
Mango	
Cashew	4000
Sapota	500
Aonla	1500
Jamun	1000
Pineapple	300
Coconut +	100
Black paper	600
D. Poultry Unit	100 birds x 7 batches
E. Vermicompost	-
F. Land for common uses such as; Animal shed, poultry shed, vermin-compost shed, Threshing floor/Tube wells/ Farm roads, bunds, drains, etc.	1000

Centre name: Karmana (Kerala) - Western Coast Plain and hills

A. Location of the centre and present scenario of agriculture in the region

Sl.No.	Item	Details
1	Name of the centre and its location	Karamana, Thiruvananthapuram Kerala
2	Name of the University/ICAR Institute	Kerala Agricultural University
3	(i)Ecosystem under which centre falls (ii) Agroclimatic Region (iii) NARP Zone	Coastal Ecosystem West Coast Plains & Ghat Region Southern Zone
4	Predominant Farming System (not more than 2) and the percentage of the farm families adopting these farming systems.	1. Coconut Based Homestead Farming Systems (CBHFS) 2. Rice Based Farming Systems (RBFS)
5	Important crops (including horticultural crops) and cropping systems of dominant farming system/systems	(a) Important crops: 1 CBHFS : Coconut, Black pepper, Banana, Tuber crops (Cassava & Yam), Pineapple, Fodder crops 2. RBFS : Rice- Vegetable crops Cassava-Banana (b) Important cropping systems CBHFS: 1. Coconut + Black pepper 2. Coconut + Banana + Pepper 3. Coconut +Banana + Pineapple + Pepper 4. Coconut + Tuber crops + Green fodder crops RBFS: 1. Rice-Rice-Fallow 2. Rice-Rice-Vegetable crop(s) 3. Rice- Cassava 4. Rice-Banana (2 year)
6	Per cent contribution of individual enterprisess in the economy of dominant farming systems	Crops (including Horticultural crops) 55 to 60% Animal components (including fish) 40 to 45%
7	Yield gaps (Farmer yield V/s Achievable yields) for important enterprises	Crops (i) Rice 35 to 40% (ii) Banana 30 to 40% (iii) Cassava 40 to 45% (iv) Vegetable crops 40 to 50% Animal component (1) Cow 35 to 40% (2) Fish 45 to 50% (3) Duck 40 to 45% (4) Poultry 35 to 40%
8	Available low cost technologies to overcome these gaps (for each crop/animal/other component)	Rice: • Grow green manure crops like daincha in April-May in areas where first crop is normally transplanted. • Puddle and level the field thoroughly. This will help to reduce the cost of weed control and loss of water and nutrients. • Maintain optimum plant density per unit area ie. 50 hills/m^2 for medium duration and 67 hills/m^2 for short dura tion varieties.

		• Adopt integrated nutrient and pest management. Coconut: • Use high yielding disease resistant varieties of regular bearing habit. • Moisture conservation through husk burial. • Intercropping. Comprehensive coconut care:- • Integrated Nutrient Management and Plant Protection measures. Banana: • Strict field sanitation prophylactic and curative control of insect pests (pesudostem weevil, rhizome weevil) and diseases. Milk: • Rear high yielding cross breed cows of Jersey and Hol stein Friesian • Ensure year round supply of green fodder • Balanced food ration with mineral mixture Fish: • Polyculture fingerlings of Rohu, Katla and Mrigal species for efficient utilization of water • Fresh water prawn in the trenches of coconut where the root zone act as its natural habitat • Efficient feed and disease management Duck • Broiler duck viz Khaki Campbell in the areas of fish farming. • Balanced diet for quick attainment of body weight. • Efficient feed and disease management
9	Promising low investment enterprises which may be integrated profitably to diversify the existing the dominant farming system of small and marginal farms (as given above)	(i) Mushroom : A suitable low cost enterprise for farms near peri-urban areas where marketing facilities are adequate. Rice straw is the best substrate for such vertical crop diversification. (ii) Vermicompost : Farm waste(banana), cowdung and urine may be utilized by high quality compost. (iii) Apiary – Depending on the volume of nectar in the flowers of coconut, banana etc colonies of *Apis mellifera* can be established. During lean season provide sugar syrup (1:1) @ 200 g sugar per colony per week. Copious flow of extra floral nectar available on rubber tree during January-April can be exploited by shifting bee colonies to these plantations during the flowering period. (iv) Chips unit: Banana cv. Nendran is excellent for chips and through Self Helf Groups. The banana produced can be converted to chips and marketed with low investment. (v) Rice Panicle ("Ayyar"): Rice panicles can be arranged like boquet known as "Ayyar" and can be marketed. It remains for a long period and people consider it as auspicious.

B. Technical Programme (Enterprise/enterprises detail and allocation of land)

Enterprise/enterprises	Gross area m^2/unit size
A. Crop production 1. Cereals(Rice)	6875
2. Pulses (Black gram)	625
3. Tuber Crops (Cassava & Sweet potato)	1250
4.Vegetable Crops (Bhindi & Veg. cowpea)	1875
5. Fruit crops (i) Banana (ii) Pineapple	 1250 52.5
6. Oil seed (Coconut) 7. Black pepper	1650
8. Green fodder	1250
9. Dry fodder	-
B. Dairy/Animal component Unit-Two milch animal	2 cross breed cow
C.Fish	1875
D.Prawn	625
E.Apiary Unit	10 Boxes
F.Cottage Industries (i)Mushroom (ii)Chips unit	 40 20
G. Vermicompost (High quality)	100

B. 01 Technical Programme (Enterprise/enterprises detail and allocation of land for models for 0.2 ha area 4 models)

(Homestead based farming systems for 0.2 ha)

Enterprise/enterprises	Gross area m²/unit size	Actual Area
(A) Tree crops		
i. Coconut (20 Nos)		980
ii. Other crops for house hold needs in border and interspace between coconut. Boundary planting, Teak, Wild Jack, Ailanthus, Subabul, Mango (Depending on the space the number will be determined)	Inter space between coconut and additional area	100
B. Multistoried cropping Pepper 20 Nos and also in other tree crops 20 Nos (Total 40 Nos)	Inter space between coconut and additional area	80
C. Other components in the multistoried cropping (i) Banana- 20 nos (ii) Pineapple 100 nos (iii) Pappaya 5 nos (iv) Sapota 2 nos (v) Guava 2 nos (vi) West Indian Cherry 1no (vii) Curry leaf 1 no. (viii) Clove 2 nos (ix) Rose apple etc., 1 no.	Inter space of tree crops and Additional area	100
D. Poultry cage		50
E. House & court yard (vermicompost unit)		590
F. Water harvesting		100
G. Terrace garden vegetable crop (150 m)		
Total		2000

(The actual area for all the crops required is 3000 sq.m area. However due to the utilization of inter-space all the components are accommodated in an area of 2000 sq, mts.)

B.02 Technical Programme (Enterprise/enterprises detail and allocation of land)

(Coconut based IFS for upland 0.1 ha +wet land 0.1 ha = 0.2 ha)

Enterprise/enterprises	Gross area m²/unit size	Actual area
A. Upland		
Crops 1. Coconut (10 Nos)		500
2. Border planting tree viz. Teak, Wild Jack and Jack (15 Nos.)		400
3.Multistoried cropping Pepper, Banana, Tuber crops, Animal component	Interspace of coconut (300)	
4.Cow (1+1)	Inter space of tree crops and additional area	100
	(1300)	1000

B. Raised wel net land		Actual area
i. Coconut in partially raised wet land (20 nos)		980
ii.Multitier cropping of fruit crops (Banana/pineapple) tuber crops (cassava/.yam) and fodder crops	Interspace and additional area (300)	20
iii. Fresh water prawn (Trenches available and root system of coconut will act like a natural habitat (water filled inter space of coconut 600 m^2)	(600)	
Total	(1900)	1000
Grand Total	(3200)	2000

B.03 Technical Programme (Enterprise/enterprises detail and allocation of land)

(Rice based IFS with upland 0.2 ha (model-I)

Enterprise/enterprises	Gross area m^2/unit size	Actual area
A. First crop rice (medium duration)	(2000)	2000
B. Second crop rice (short/medium duration)	(2000)	
(Fringe crop of cowpea in the outer bunds)		
C. Third crop season (i) Bhindi (ii) Fodder cowpea (iii) Green Manure crop	 (667) (667) (667)	
Gross area utilized per annum	6001	
D. Animal component		
Cow (1+1) one unit	100	100
E. Mushroom Production	80	80
Total	(6181)	2180

B.04 Technical Programme (Enterprise/enterprises detail and allocation of land)

(Rice based IFS for wetland 0.2 ha (model-II)

Enterprise/enterprises	Gross area m^2/unit size	Actual area
1. Rice crop in the raised field (First crop season)	900	
2. Banana/tuber crops (cassava, yam/sweet potato) 300 m^2 per crop (After the harvest of rice)	900	
• Animal component		
• Duck shed	100	
• Fish and Duck (trenches)	1000	
• Gross area	2900	2000

Centre name: Old Goa (Goa) - Western Coast Plain and hills

A. Location of the centre and present scenario of agriculture in the region

Sl. No.	Particulars	Details
1	Name of the centre and its location	ICAR Research Complex for Goa, Old Goa
2	Name of the University/ ICAR institute	ICAR Research Complex for Goa, Old Goa
3	Ecosystem under which centre falls Agro climatic region NARP Zone	Coastal humid ecosystem West Coast Plains and Ghats Region Western Ghats and Coastal Plains
4	Predominant farming systems (not more than 2) and percentage of the farm families adopting these farming systems	Crops + Dairy
5	Important crops (including horticultural crops) and species, cropping systems of dominated farming system/systems	Cashew, Rice, Coconut, Pulses like Cowpea, Banana, Arecanut, Vegetables like Brinjal, Chillies, Okra, Dairy, Goat and Fish culture
6	Per cent contribution of individual enterprises to the economy of dominant farming systems	Crops - 60 to 70% Dairy / Piggery / Backyard Poultry- 30-40% Fish - <10%
7	Yield gaps (Farmer yield V/s Achievable yields) for important enterprises	Rice - 67% Cashew - 100% Coconut - 56% Dairy - 60% Fish - 90%
8	Available low cost technologies to overcome these gaps (for each crop/ animal/ other component)	Rice: • HYV/hybrids suitable to different rice growing situations • Balanced nutrition through INM • IPM for weed and pest management Coconut: • Planting selected HY seedlings from reputed nurseries • Optimum spacing and water management • Integrated pest and disease management Dairy: • Rearing of crossbred high yielding cows • Balanced nutrition through feeds and fodder • Better animal health care Fish Culture: • Rearing of fast growing varieties of carps • Use integrated farming system to reduce cost of inputs
9	Promising low-investment enterprise(s), which may be integrated profitably to diversify the existing dominated farming system of small and marginal farms (as given above)	(i) Mushroom production- Ideal low cost enterprise for rice (ii) Fish production - Utilization of available water bodies with culture of IMCs using the naturally available plankton (iii) Dairy-Rearing of crossbred high yielding cows. Balanced nutrition and better health care. (iv) Vermicompost - Due to the abundant rainfall and warm humid tropical climate, the growth of biomass is abundant in the region. Further, plenty of animal recyclable wastes may be utilized for preparation of high nutrient containing vermi-compost. (v) Backyard Poultry - For efficient utilization of homestead waste and to have a cleaner environment, the integrated backyard poultry using the wastes/ by-products from the crop resources have been found promising.

B. Technical Programme (Enterprise/enterprises detail and allocation of land)

Enterprise/enterprises	Gross area (ha)
Cereals (Rice)	0.4
Oilseeds (Groundnut)	0.1
Cowpea	0.1
Vegetables	0.1
Flowers Marigold	0.05
Gladiolus	0.05
Green fodder (Hybrid napier)	0.02
Cashew	0.28
Coconut	0.1215
Arecanut	0.2612
Pineapple	0.28
Banana	0.2612
Black pepper	0.1215
Dairy	0.01
Poultry	0.02
Mushroom Production	–
Goatery	0.01
Apiary	–
Duckery	0.01
Fishery	0.45
Total	1.6

Centre name: Durgapura (Rajasthan) - Western Dry Region

A. Location of the centre and present scenario of agriculture in the region

Sl. No.	Particulars	Details
1	Name of the centre and it's location	AICRP on IFS, Agricultural Research Station, Durgapura, Jaipur (Rajasthan)-302018
2	Name of the University/ICAR institute	S.K. Rajasthan Agricultural University
3	i) Ecosystem under which centre falls ii) Agro Climatic Region iii) NARP Zone	Semi arid region Western dry region (14) Semi Arid Eastern plain zone (III a)
4	Predominant Farming Systems (not more than 2) and percentage of the farm families adopting these farming systems.	Crops+Dairy (90 %)
5	Important crops (including horticultural crops) and cropping systems of dominated farming system/ systems.	Important crops: Kharif: Pearlmillet,Clusterbean,Greengram,Cowpea, Groundnut Rabi: Wheat, Barley, Mustard, Gram

		Important cropping systems: 1. Pearl millet-Wheat 2 .Cluster bean-Wheat
6	Per cent contribution of individual enterprises in the economy of dominant Farming Systems.	Crops (60-65 %) Dairy(35-40 %)
7	Yield gaps (Farmer yield V/S Achievable yields) for important enterprises.	Crops: (i) Wheat-51.6%, (ii) Barley- 45.8 % (iii) Gram-68 %, (iv) Mustard-58.9 % (v) Pearlmillet-66% Milk: Cow-130.5%, Buffalo-135.8%
8	Available low cost technologies to overcome these gaps (for each crop/ animal/ other component)	Wheat/Barley: • Recommended high yielding varieties for respective sowing time (Timely /delayed). • Balanced nutrition through INM. • Chemical control of weeds. Gram: • Balanced nutrition through INM. • Use of IPM Mustard: • Use of IPM • Use of sulphohydral compounds for mitigating water stress and frost Pearl millet: • Hybrid early maturing varieties • Use of INM Milk: • High yielding cross bred cows and improved breed of buffaloes. • Round the year supply of green fodder. • Fed with balanced ration, salt and mineral mixtures • Use of vaccination against diseases
9	Promising low-investment enterprise(s), which may be integrated profitably to diversify the existing dominated farming system of small and marginal farms	• Goatery, Multistoried horticulture orchards, Backyard poultry, • Vermi-compost unit

B. Technical Programme (Enterprise/enterprises detail and allocation of land)

Enterprise/enterprises	Gross area, m²/ Unit size
A. Crop production (Net sown area 10,000 m²) i) Cereals (Pearlmillet, Barley, Wheat) ii) Pulses (Green gram, Mothbean, Cowpea) iii) Oilseeds (Groundnut,Mustard) iv) Green fodders (Pearlmillet,Lucerne, Oats) vi) Dry fodders (Wheat, Pearlmillet, Barley etc.)	 6060 1848 1296 2796 -
Total A	12000
B. Dairy (Milk) unit Two milch animals	1 buffalo + 2 cow
C. Poultry	250
D. Horticulture Unit Fruits Vegetables (intercrop)	 2500 -
E. Goatry	4+1
F. Composting Vermicompost	 250
G. Land for common uses such as; Animal sheds, stores, dwelling unit, threshing floor, tube-well etc.	500

Centre name: Sardar Krushinagar (Gujarat) - Gujarat plain and hills

A. Location of the centre and present scenario of agriculture in the region

Sl.No	Particulars	Details
1	Name of the centre and its location,	AICRP on Integrated Farming Systems, SDAU, SKNagar-385 506 (Gujarat)
2	Name of the University/ICAR institute	Sardar Krishinagar Dantiwada Agricultural University
3	(1) Ecosystem under which centre falls	Arid
	(2) Agro climatic Region	Western plains of India
	(3) NARP Zone	North Gujarat Agro-climatic Zone
4	Predominant Farming Systems and percentage of the farm families adopting these farming systems.	Crops + Dairy (95 %)
5	Important crops and cropping systems of dominated farming system / systems.	a) Important crops: Kharif: Pearl millet, Green gram, Castor, Cotton, Fodder sorghum Rabi: Mustard, Wheat, Potato Summer: Pearl millet, Green gram Fodder sorghum (b) Important cropping systems: Pearl millet –Mustard Green gram –Mustard-Pearl millet Castor alone Cotton alone

6	Per cent contribution of individual enterprises in the economy of dominant farming systems.	Crops-67 % Dairy- 33 %
7	Yield gap (Farmer yield V/s Achievable yields) for important enterprises.	Crops: i) Pearl millet Kharif : 54 % Summer : 52 % ii) Green gram Kharif : 31 % Summer : 64 % iii) Castor : 57 % iv) Mustard : 40 % v) Wheat : 35 % Milk: i) Buffalo : 71 %
8	Available low cost technologies to overcome these gaps (for each crop / animal / other component)	Crops: • Summer pearl millet Sowing between 15th Feb to 5th March Supplement 25% N by Castor Cake Weed control by Atrazine Use certified varieties i.e. GHB-558,526 • Greengram Timely sowing, weed control, water management, plant protection with high yielding variety of GM-4, Seed inoculation with Rhizobium and PSB inoculation • Castor Adopt GCH-7 wilt resistant variety, Sowing between 15th July to 15th August Green gram relay cropping/intercropping with Castor or Adopt Green gram- Rabi castor crop sequence for higher profit and maintain soil fertility. Alternate furrow irrigation method for higher WUE • Mustard Sowing in between 15th Oct to 25th Oct Adopt GM-3 variety Crop rotation: Adopt plant protection measures for to control rust and pow dery mildew diseases No irrigation after 80 days of sowing • Bufalloes Ensure year round supply of green fodder of cereal and legumes Fed with balanced ration with salt and mineral mixtures Timely supply of drinking water Protect resident area from parasites Timely AI Temperature control in Summer season
9	Promising low-investment enterprise(s) which may be integrated profitably to diversify the existing dominated farming system of small and marginal farms	i) Multistoried fruit and vegetable orchards – Small and medium categories of farmers having compara tively more cultivated land can practice this for increased year round income and more employment generation/ unit area/ unit time. ii) Vermicompost – Cowdung, urine and farm waste can be utilized for preparation of high nutrient containing vermicompost rather

		than poorly decomposed FYM with low nutrient content. iii) Farm forestry / boundary plantations All field boundaries will be utilized for plantation of perennial fruit, fuel and timber plantations. Boundary will be planted with Ardusa (Alianthus excelsa) (80 plants), Date palm (40 plants), Tamarind (30 plants) and Eucalyptus (10 plants). Boundary bunds are to be stabilized by Dhaman grass. Growing bottle, bitter, ridge and little gourds on the support of fencing of boundary wire and chainlink

B. Technical Programme (Enterprise/enterprises detail and allocation of land)

Enterprise/enterprises	Gross area(m^2)/ Unit size
A. Crop production (Net area =7000 m^2)	
1. Cereals Pearl millet Wheat	2400 1600 800
2. Pulses Green gram	8000 8000
3. Oilseeds Edible - Groundnut Mustard Non-Edible – Castor	3200 800 2400 3200
4. Geen fodders Hybrid Napier Cowpea, Lucerne + Chicory Rajka Bajra Boundary bunds fodder	2600 600 600 600 800 –
5. Dry fodders Sorghum dry fodder Pearl millet Wheat Green gram Groundnut	1600 1600 1600 800 8000 800
Total of 0.70 ha	21000
B. Dairy (Milk) unit Two milch buffalo	Two buffalo
C. Horticulture Unit Fruits Vegetables(Inter crops)	2500
D. Composting (Vermicompost preparation)	
E. Boundary plantation Ardusa Datepalm Tamarind Eucalyptus Grasses and Vegetables on bunds	 80 nos 40 nos 30 nos 10 nos
F. Land for common uses (Animal shed, stores, dwelling unit, threshing floor, tube-well etc.)	500

Centre name: Port Blair (A&N Island)

A. Location of the centre and present scenario of agriculture in the region

Sl. No.	Particulars	Details
1	Name of the centre and it's location	Port Blair, Andaman and Nicobar Islands
2	Name of the University/ICAR institute	Central Agricultural Research Institute, Port Blair (An ICAR institute)
3	i) Ecosystem under which centre falls ii) Agro Climatic Region iii) NARP Zone	Island Eco system The Islands Region Andaman and Nicobar Islands : Southern Zone
4	Predominant Farming Systems (not more than 2) and percentage of farm families adopting these farming systems.	Plantation crops+ Pig (50 %) Crops+ cattle + fish (45%)
5	Important crops (including horticultural crops) and cropping systems of dominated farming system/ systems.	a) Important crops: Rice, maize vegetables, coconut, clove, nutmeg, pineapple b) Important cropping systems: i. Rice +vegetables + flowers in BBF system ii. Fodder-rice-fodder iii. Coconut + nutmeg & clove +pineapple
6	Per cent contribution of individual enterprises in the economy of dominant Farming Systems.	Low lying valley areas Crops : 55 to 60 %, Livestock: 40 to 45 % Hilly areas Crops : 80 to 85 %, Livestock: 15 to 20 %
7	Yield gap (Farmer yield V/s Achievable yields) for important enterprises.	Crops Rice : 58 % Vegetables : 60 % Coconut : 85 % Fodder : >100 % Nutmeg, Clove & Pine apple : >100 % Milk Cattle : 35 %
8	Available low cost technologies to overcome these gaps (for each crop/ animal/ other component)	Plantation crops • Intercropping in coconut with nutmeg, clove, pineapple • Cultivation of fodder in coconut garden • Balanced nutrition through INM using cover crops • Mulching of palm basins Rice • MAT nursery • Introduction of high yielding long duration varieties • SRI planting • IPM for control of leaf folder and stem borer • Split application of nutrients Fodder • Cultivation of short duration fodder before and after rice • Fodder in slopes of beds in BBF system Vegetables • Cultivation of vegetables in BBF system during mon soon season Milk • Deworming and mineral supplementation for cattle

		• Year round supply of fodder Goat • Deworming and mineral supplementation for goat • Artificial Insemination (AI) with Boer goat semen • Ultrasonography to detect early prgnency Poultry • Rearing of Improved breeds like Nicobari and Nishibari • Deworming and vitamin supplementation • Integration of fish + poultry +duck
9	Promising low-investment enterprise(s), which may be integrated profitably to diversify the existing dominated farming system of small and marginal farms (as given above).	i) Broad Bed and Furrow (BBF) system: Low lying areas where in only rice is cultivated can be converted as multi enterprise farming through BBF in which rice, vegetables, flowers and fish can be grown together meeting the require ments of farm family. ii) Multistoried cropping: Productivity of Coconut gardens can be improved through planting nutmeg, clove and pineapple iii) Rainwater based irrigation during summer: Plantation crops in Islands suffer severe moisture stress during dry season which can be irrigated by collecting rain water in lined ponds which can double the yield of crops. iv) Vermicompost: The waste materials generated from plantations and other crops can be converted in to an enriched Vermicom post by mixing it with dung and urine of animals which will ensure availability of macro and micronutrients to crops apart from cleaning the environment. v) Poultry ÷ Duck + fish: Integration of poultry, ducks in fish pond will enable to recycle the wastes effectively vi) Backyard Poultry : Backyard poultry with improved breeds are found to be profitable enterprises in the farming system vii) Fresh water fish production : Production of Indian Major Carps (IMC) in fresh water based system is feasible and profitable under coastal ecosystem of A&N Islands viii) Azolla : Combination of azolla +Tilapia rearing in lined ponds are an important enterprise which can meet the tein requirement. ix) Pigs: Coconut and pigs are the integral part of tribal farming in Andaman and Nicobar Islands. Pigs can convert all the waste materials in the form of meat. Pig manure can be recycled back to the system

B. Technical Programme (Enterprise/enterprises detail and allocation of land)

Enterprise/enterprises	Gross area(m^2)/ Unit size
A. Crop production: Net sown area = 9000 m^2	
Coconut (for pigs + house hold + sale)	9288
Nutmeg	3620 (45 plants)
Clove	3620 (101 plants)
Pine apple	3000
Tapioca(for pigs)	4240
Colacasia (for pigs)	3000
B. Pig unit	4 pigs
C. Fish + Poultry + duck	
Fish	378
Poultry	25
Duck	20
D Azolla + Tilapia	84
E. Composting (Vermicompost preparation)	100
F. Land for common uses such as; Animal sheds, stores and dwelling unit	150

CHAPTER - 9

OBSERVATION SCHEDULES FOR FARMING SYSTEMS EXPERIMENTS

All India Coordinated Research Project on Integrated Farming Systems Research
(I.C.A.R)
On Station Research

Name of the Centre ------

GENERAL INFORMATION

1. Year and Season of the Data reported		
2. Location	(a) State:	(b) District:
	(c) Taluka:	(d) Place:
	(e) Longitude :	(f) Latitude:
	(g) Elevation (m. msl) :	(h) Others :

3. (a) Agro climate zone: (b) Agro-Eco region :

   (c) NARP Zone :

4. Year of start of the experiment:
5. Farming Systems (Prevalent in the NARP Zone)
6. Farming System undertaken:
7. IFS Model experimental area (m^2) :
8. Treatment details
   - (i) Crops/ Cropping Systems followed
   - (ii) Livestock details (Animal species/size and/or number of the unit/ birds/ fisheries units, etc.)
   - iii) Nutritional multi- storied Horti. Unit/Agro – Horti. / Agro Forestry units (Please specify)

iv) Other enterprise/ enterprises (Please give details)

v) Post harvest value addition units (if any)

9. Total cost of each unit :

10. Unit wise returns :

11. Gross returns from the IFS model :

12. Other important information (if any), use extra sheets :

Note: The observation schedules for different components of farming systems are placed in Annexures (I to XI)

Annexure-I

ALL INDIA COORDINATED RESEARCH PROJECT ON INTEGRATED FARMING SYSTEMS RESEARCH (I.C.A.R)

ON STATION RESEARCH

Observation Schedule for Farming Systems Experiments

Centre:

A. Crops / Cropping Systems

1. Year and Season		
2. Cropping systems followed	Cropping Systems i. Rice-wheat-green gram ii. Maize + red gram -wheat iii. Sorghum (F) –potato-wheat iv. v.	Area (m^2)
3. Soil Description		
(a) Soil series group class		
(b) Mechanical analysis	Sand % : Silt% : Clay% : Soil texture:	
(c) Physical parameters	Bulk density : Field capacity : Infiltration rate : Permanent Wilting:	
(d) Chemical analysis	pH: EC:	
	ESP : OC (%): Available N=kg/ ha Available P=kg/ ha Available K=kg/ha Micronutrients (As per lab. facility)	

4. Sowing/planting details as per plot/crop sequence wise

Crops in a cropping sequence For example : Rice-wheat-green gram	Rice	Wheat	Green gram
(a) Variety:			
(b) Duration (seed to seed):			
(c) Date of seeding/ nursery sowing:			
(d) Method of sowing			
(e) Seed rate (kg/ha)			
(f) Spacing (cm) (i) Inter-row (ii) Intra-row			
(g) Date of sowing/ transplanting			
(h) No. of seedlings /hill			
(i) Germination %			
(j) Date of thinning			
(k) Date of gap filing			
(l) Date (s) of Harvest			

5. Fertilizer application :

Quantity (in grams and/or in kg.) of fertilizer to be mentioned as per plot/crop sequence

Nutrient/ material used	N	P_2O_5	K_2O	Micro-nutrients	Others (specify)
(a) Date of application					
(b) Method of application					
(c) Type of fertilizer					
(d) Composition of fertilizer %					
(e) Amount (kg/ ha)					
(f) Total cost (Rs.)					

6. Irrigation details as per plot/crop sequence wise

(a) Irrigation status	Irrigated/ rainfed / dry land
(b) If irrigated, source and method of irrigation Method: Flooding/ check basin / sprinkler/ drip	Source: Canal / Tubewell/Well/Others (Specify)
(c) No. of irrigations	
(d) Total cost involved (Rs.)	

7. Herbicide application (if any) as per plot/crop sequence wise

(a) Name of the herbicide / formulation (i. e. EC/SP/Granules etc)	
(b) Application rate (kg a. i. /ha)	
(c) Method (Pre-plant / Pre/ post-em) and date of application	
(d) Total cost of the herbicide/herbicides used	

8. No & dates of tillage operations as per plot/crop sequence wise

Operations	Ploughing	Harrowing	Tilling	Planking
Cost involved (Rs.)				
Operations	Puddling	Hoeing	Earthing up	Others (Specify)
Cost involved (Rs.)				
Total cost (Rs.)				

9. Plant protection as per plot/crop sequence wise

Name of crop/ pest/disease	Treatments given & intensity of attack	Name of chemical used	Quantity applied (indicate unit/ha)	Date of application	Total cost involved (Rs.)

10. Yield data as per plot/crop sequence wise

Type of observation	Crop and date of observation recording
(a) Grain yield (kg/gm per net plot)	
(b) Straw/green fodder yield (kg/ gm) per net plot	
(n) Any other (specify)	

11. Input output flow in an IFS

Sl. No.	Inputs obtained from the system*	Inputs purchased from outside the farm/market*	Products and by-products provided to other farm enterprise/ enterprises within the system*	Products and by-products sold in market*
1				
2				
3				
4				
5				
* Please mention input/output name, quantity and market value of different items				

12. Any other information relevant to the enterprise :

Annexure-II

ALL INDIA COORDINATED RESEARCH PROJECT ON INTEGRATED FARMING SYSTEMS RESEARCH (I.C.A.R)

ON STATION RESEARCH

Observation Schedule for Farming Systems Experiments

Centre:

B. Dairy components

I. Description of Animal

Dairy animals	Buffalo	Cow	Others (Goat/ Camel etc)
1. No of animals			
2. Breed of animal			
3. Lactation number			
4. Age of animal			
5. Purchase value of animals (Rs.)			

II. Input Flow Details for Dairy Farming

Source/Crops	Quantity utilized (quintal)		Price (Rs)	
	On-Farm Produce	Purchased from market	On-Farm Produce	Purchased from market
a. Sorghum				
b. Bajra				
c. Maize				
d. Rice				
e. Wheat				
f. Others (Please specify) i) ii)				

2. Green Fodder

Source/Crops	Quantity utilized (quintal)		Price (Rs)	
	On-Farm Produce	Purchased from market	On-Farm Produce	Purchased from market
a. Sorghum				
b. Bajra				
c. Maize : i. Sole crop ii. Mixed				
d. Berseem				
e. Oat				
f. Cowpea				
g. Others(eg.Perennial grass Hy. Napier etc.)				

3. Crop/ Tree Residues & Other Farm By- Products Used as Fodder

Particulars	Quantity (q)	Price (Rs.)
a. Sugarcane tops		
b. Hulls of different grain crops		
c. Tree leaves		
d. Grasses/weeds		
e. Others		

4. Grain

Source	Quantity utilized (quintal)		Price (Rs)	
	On-Farm Produce	Purchased from market	On-Farm Produce	Purchased from market
a. Crops				
i. Cereals				
ii Pulses				
iii. Oilseeds				
iv. Others				

5. Crops By-Products

By-products of cereals and pulses(Wheat & Rice bran, Broken grains, Tur chuni, Gram chuni, Mung chuni, Deoiled cake)	Quantity Utilized (quintal)	Price (Rs)
a. Cereals		
b. Pulses		
c. Oilseeds		
d. Others		

6. By Products From Horticultural Units

Source	Quantity (quintal)	Price (Rs)
a. Vegetable(leaves ,tuber and stem of vegetable crops)		
b. Fruit crops by products		
c. Others		

III. EXTERNAL INPUTS-UTILIZED

Particulars	Quantity /unit	Price/Rs./ unit	Total value (Rs.)
a. Concentrate feed			
b. Locally available Agro-industrial by-products			
c. Medicines			
d. Mineral mixture			
e. Vaccine			
f. Veterinary services			
g. Labour charges(man days/year)			
i. Farm labour			
ii. Hired labour			
h. Others			

Out Put Flow From Dairy Unit

1. Milk Production

Particulars	Quantity Produced (Liter)	Price (Rs./liter)	Total value (Rs.)
a. Average daily milk production.			
b. Annual milk production /lactation			
c. Milk required for home consumption			
d. Surplus milk disposed in the market			
e. Cost of production of milk per litter.			

2. DUNG PRODUCTION

Particulars	Quantity (Kg.)	Price (Rs./kg)	Total value (Rs.)
a. Daily production of dung.			
b. Annual dung production (on dry matter basis)			
c. Quantity of dung used for vermicompost			
d. Total vermicompost produced			
e. Nutrient content and value of vermicompost in term of nutrients (N,P and K)			
f. Quantity of dung used for other purpose i. Dung cakes ii. Farm yard manure iii. Used in fish pond iv. Other uses (Please specify)			
g. Nutrient (NPK) content and it's monetary value i. Dung cakes ii. Farm yard manure iii. Used in fish pond iv. Other uses (Please specify)			

3. CALF PRODUCTION

Particulars	Quantity	Market Price (Rs)	Age of calf/calves
a. Total no of calves			
b. Age of calves at the time of sale			
b. Market price of the calves			

4. INCOME

Particulars	Rs. / Animal
a. Gross return	
b.Net return	
c. Benefit : Cost ratio	

5. REPRODUCTIVE TRAITS

a. First sign of heat after parturition	
b. AI/Natural Service after parturition	
c. Service period	
d. Inter - calving period	
E Lactation length	
f. No of AI/NS required to conceive	

6. Input output flow in an IFS

Sl. No.	Inputs obtained from the system*	Inputs purchased from outside the farm/market*	Products and by-products provided to other farm enterprise/ enterprises within the system*	Products and by-products sold in market*
1				
2				
3				
4				
5				
* Please mention input/output name, quantity and market value of different items				

7. Any other information relevant to the enterprise:

Annexure-III

ALL INDIA COORDINATED RESEARCH PROJECT ON INTEGRATED FARMING SYSTEMS RESEARCH (I.C.A.R)

ON STATION RESEARCH

Observation Schedule for Farming Systems Experiments

Centre:

C. Information schedule for bird components – a) Backyard Poultry
(Productive and reproductive traits)

1. Bird Nos. Male Female	2. Species/ Breed:
3. Weight gain (a) Body wt at birth (g):	(b) Wt. at 8 Weeks (g):
(c) Wt. at 16 Weeks (g):	(d) Wt. at 32 Weeks (g):
(e) Wt. at 40 Weeks (g):	(f) Wt. at 64 Weeks (g):
6. Mature body wt (F/ M) (kg):	
7. Carcass wt (kg)	8. Carcass length (cm):
9. Dressing percentage (%)	10. Meat bone ratio:
11. Economics Total eggs production/year Total meat production/year Total income (Rs.) /year)	

12. Input output flow in an IFS

Sl. No.	Inputs obtained from the system*	Inputs purchased from outside the farm/market*	Products and by products provided to other farm enterprise/ enterprises within the system*	Products and by-products sold in market*
1				
2				
3				
4				
5				
* Please mention input/output name, quantity and market value of different items				

13. Any other information relevant to the enterprise:

Annexure-IV

ALL INDIA COORDINATED RESEARCH PROJECT ON INTEGRATED FARMING SYSTEMS RESEARCH (I.C.A.R)

ON STATION RESEARCH

Observation Schedule for Farming Systems Experiments

Centre:

C. Information schedule for bird components – b) Egg Laying birds
(Productive and reproductive traits)

1. Bird Nos.	2. Species/ Breed
3. Dam No.	4. Sire No.
5. (a) No of eggs produced in a year:	(b) Av. egg wt (g/ kg):
6. Livability (%) :	7. Age at maturity (days):
8. Age at slaughter	9. Feed intake (g/ bird/ day)
10. Egg wt (g/ egg)	
Dietary treatments:	11. Feed ingredients:
12. (a): Feed intake by hatching bird (g/ day):	(b) Feed intake by growing bird (g/ dam):
13. Cost of feed supplied to hatchery bird (Rs/ bird):	
14. Cost of feed supplied to growing bird (Rs/ bird):	
15. Gross return (Rs)	
16. Net return (Rs)	

17. Input output flow in an IFS

Sl. No.	Inputs obtained from the system*	Inputs purchased from outside the farm/market*	Products and by-products provided to other farm enterprise/ enterprises within the system*	Products and by-products sold in market*
1				
2				
3				
4				
5				
* Please mention input/output name, quantity and market value of different items				

18. Any other information relevant to the enterprise:

Annexure-V

ALL INDIA COORDINATED RESEARCH PROJECT ON INTEGRATED FARMING SYSTEMS RESEARCH (I.C.A.R)

ON STATION RESEARCH

Observation Schedule for Farming Systems Experiments

Centre:

FISHERY COMPONENT

1. Fish pond culture

A. POND DETAILS

Sl. No.	Observation	Units
1	Total area of the IFS unit	
2	Total area of the pond	
3	Water spread area of the pond	
4	Length of the pond	
5	Width of the pond	
6	Water depth of the pond	
7	Free board area(All inner , upper and outer sides of the pond) for cultivation of grasses / horticultural crops/livestock viz; duck,poultry.pigs etc.	

B. SPECIES & THEIR STOCKNG RATE AND RATIO

Sl.No.	Species	Species Ratio	Number Stocked
1			
2			
3			
4			
5			
6			

C. FISH STOCKING & HARVESTING DETAILS

Sl.No.	Observation	Units
1	Fish stocking size	
2	Fish stocking month	
3	Periodical harvesting (mention date & quantity)	
4	Final Fish harvesting(mention date & quantity)	

D . CONSTRUCTION & MAINTANANCE COST OF THE FISH POND

Sl.No.	Observation	Units (Rs.)
1	Construction of pond	
2	Maintenance cost of the pond	
3.	Input cost (Fish production + others)	
	Total (1+2+3)	

E. OUT PUT FLOW

Sl.No.	Observation	Units
1	Volume of pond water to be recycled (Liters)	
2	Quantity of soil (kg)	
3	Analysis of soil (a) Moisture (%) (b) OC (%) (c) Available Nitrogen (%) (d) Available P_2O_5 (%) (e) Available K_2O (%)	
4	Analysis of pond water (a) Nitrate (ppm) (b) Nitrite (ppm) (c) Phosphates (ppm) (d) Potassium (ppm)	
5	i. Value of pond silt and water in term of revenue ii. Monetary return from sale of fish iii. Monetary return from sale of different marketable products grown on free board area of the pond	
	Total	

F. NET RETURNS = GROSS PROFIT – COST OF PRODUCTION (E-D)

FISHERY COMPONENT

2: Integration of fish farming with subsidiary components

a) FISH-CUM-DUCK FARMNG

(Additional observations on duckery other than fish cultivation as above)

Si. No.	Observation	Units
1	Number of ducks raised	
2	Cost of ducklings	
3	Volume of pond water to be recycled (Liters)	
4	Quantity of soil (kg)	
5	Quantity of duck droppings (kg)	
6	Analysis of duck dropping (a) Moisture (%) (b) Nitrogen (g/100g) (c) Phosphates (g/100g) (d) Potassium (g/100g)	
7	Analysis of pond soil (a) Moisture (%) (b) Nitrogen (g/100g) (c) Phosphates (g/100g) (d) Potassium (g/100g)	
8	Analysis of pond water (a) Nitrate (ppm) (b) Nitrite (ppm) (c) Phosphates (ppm) (d) Potassium (ppm)	
9	Number of duck eggs	
10	Duck meat (kg)	
11	Quality & quantity of feed given to ducks(kg)	
12	Cost of feed for ducks (Rs)	
13	Cost of maintenance	
14	Revenue earned (a) Eggs (Rs) (b) Meat (Rs) (c) Soil(Fertilizer)(Rs) (d) Water (Fertilizer)(Rs)	
15	Profit (Rs)	

b) FISH-CUM-POULTRY FARMNG

(Additional observations on poultry other than fish cultivation as above)

Sl. No.	Observation	Units
1	Number of chickens raised	
2	Cost of chicks	
3	Volume of pond water to be recycled (Liters)	
4	Quantity of soil (kg)	
5	Quantity of chick droppings (kg)	
6	Analysis of chick dropping (a) Moisture (%) (b) Nitrogen (g/100g) (c) Phosphates (g/100g) (d) Potassium (g/100g)	
7	Analysis of pond soil (a) Moisture (%) (a) Nitrogen (g/100g) (c) Phosphates (g/100g) (d) Potassium (g/100g)	
8	Analysis of pond water (a) Nitrate (ppm) (b) Nitrite (ppm) (c) Phosphates (ppm) (d) Potassium (ppm)	
9	Number of chicken eggs	
10	Chicks meat (kg)	
11	Quality & quantity of feed given to chicks (kg)	
12	Cost of feed for chickens (Rs)	
13	Cost of maintenance	
14	Revenue earned (a) Eggs (Rs) (b) Meat (Rs) (c) Soil(Fertilizer)(Rs) (d) Water (Fertilizer)(Rs)	
15	Profit (Rs)	

c) FISH-CUM-PIG FARMNG

(Additional observations on piggery other than fish cultivation as above)

Sl. No.	Observation	Units
1	Number of pigs raised	
2	Cost of piglet	
3	Volume of pond water to be recycled (Liters)	
4	Quantity of soil (kg)	
5	Quantity of pig droppings (kg)	
6	Analysis of pig dropping (a) Moisture (%) (b) Nitrogen (g/100g) (c) Phosphates (g/100g) (d) Potassium (g/100g)	
7	Analysis of pond soil (a) Moisture (%) (b) Nitrogen (g/100g) (c) Phosphates (g/100g) (d) Potassium (g/100g)	
8	Analysis of pond water (a) Nitrate (ppm) (b) Nitrite (ppm) (c) Phosphates (ppm) (d) Potassium (ppm)	
9	Pig meat (kg)	
10	Quality & quantity of feed given to pigs (kg)	
11	Cost of feed for pigs (Rs)	
12	Cost of maintenance	
13	Revenue earned (a) Meat (Rs) (b) Soil (Fertilizer) (Rs) (c) Water (Fertilizer) (Rs)	
14	Profit (Rs)	

d) PADDY-CUM-FISH FARMNG

(Additional observations on fishery other than rice cultivation as in crop component)

Sl .No.	Component	Unit	
1	Area of paddy field		
2	Area of fish channels/ pits/pond		
3	Depth of channels/ pits/pond		
4	Species	Ratio	Number
5	Construction cost of Trences/channels/ pits/pond		
6	Cost of fish seed (Rs)		
7	Cost of fish feed (Rs)		
8	Cost of maintenance (Rs)		
9	Fish harvested (kg)		
10	Profit (Rs)		

e) MAKHANA-CUM-FISH FARMNG

Sl. No.	Component	Unit	
1	Area of pond		
2	Depth of pond		
3	Fish species	Ratio	Number
4	Cost of Pond construction (Rs.)		
5	Maintenance cost of the pond (Rs.)		
6	Cost of fish seed (Rs)		
7	Cost of fish feed (Rs)		
8	Cost of makhana seed		
9	Cost of maintenance (Rs)		
10	Fish harvested (kg)		
11	Makhana harvested (kg)		
12	Revenue earned from fish sale(Rs)		
13	Revenue earned from Makhana		
14	Profit (Rs)		

f) TRAPA-CUM-FISH FARMNG

Sl.No.	Component	Unit	
1	Area of pond		
2	Depth of pond		
3	Species	Ratio	Number
4	Cost of pond construction (Rs.)		
5	Maintenance cost of the pond (Rs.)		
6	Cost of fish seed (Rs)		
7	Cost of fish feed (Rs)		
8	Cost of trapa seed		
9	Cost of maintenance (Rs)		
10	Fish harvested (kg)		
11	Trapa harvested (kg)		
12	Revenue earned from fish sale(Rs)		
13	Revenue earned from trapa		
14	Profit (Rs)		

FISHERY COMPONENT

(Summary Of The Observations Included)

a) Soil Parameters to be Recorded at the Start & End of the Project

Sl.No.	Parameters	Observatons
1	Soil texture Sand Silt Clay	
2	Soil colour	
3	PH	
4	Water retention capacity	
5	Total Nitrogen	
6	Phosphates	
7	Potassium	
8	Organic Carbon	
10	Electrical Conductivity	

b) WATER QUALITY TRAITS TO BE RECORDED TWICE A YEAR

(Physico - chemical & biological)

Sl.No.	Parameters	Observation
1	Air Temperature (°C)	
2	Water Temperature (°C)	
3	Water Transparency (mm)	
4	PH	
5	Total Alkalinity (ppm)	
6	Total Organic Matter (ppm)	
7	Total Nitrogen (ppm)	
8	Phosphates (ppm)	
9	Dissolved Oxygen (ppm)	
10	Free Carbon dioxide (ppm)	
11	Phytoplankton (nos./lt.)	
12	Zooplankton (nos./lt.)	
13	Total plankton (nos./lt.)	

c) SAMPLING OF FISH GROWTH (AT HARVEST)

Date_____

	SPECIES											
Sl.No.	**Catla**		**Rohu**		**Mrigal**		**S.Carp**		**G.Carp**		**C.Carp**	
	Length (mm)	Wt. (g)	Length (mm)	Wt. (g)	Length (mm)	Wt. (g)	Length (mm)	Wt. (g)	Length (mm)	Wt. (g)	Length (mm)	Wt. (g)
1												
2												
3												
4												
5												
6												
7												
8												
9												
10												
11												
12												
13												
14												
15												
Range												
Av.												
S.D.												

SUMMARY OF FISH GROWTH

	Pond Area(ha)						
		Species					
Sl.No.	Parameters	Catla	Rohu	Mrigal	S.Carp	G.Carp	C.Carp
1	No. of Fish Stocked						
2	Stocking Ratio						
3	Initial Length (mm)						
4	Initial Weight (g)						
5	Final Length(mm)						
6	Final Weight (g)						
7	Increment in Length(mm)						
8	Increment in Weight(g)						
9	Survival (No.)						
10	Survival (%)						
11	Total feed given						
12	Gross Fish Harvested						
13	Food Conversion Ratio						

Input output flow in an IFS (Fish culture)

Sl. No.	Inputs obtained from the system*	Inputs purchased from outside the farm/market*	Products and by-products provided to other farm enterprise/ enterprises within the system*	Products and by-products sold in market*
1				
2				
3				
4				
5				
* Please mention input/output name, quantity and market value of different items				

Any other relevant information:

Annexure-VI

ALL INDIA COORDINATED RESEARCH PROJECT ON INTEGRATED FARMING SYSTEMS RESEARCH (I.C.A.R)

ON STATION RESEARCH

Observation Schedule for Farming Systems Experiments

Centre:

INFORMATION SCHEDULE FOR PIGS/ GOATS/ SHEEP FARMING:

Productive and reproductive traits

1. Species/ Breed Male Female	2. Number of animals
3. a) Dam's Gestation length (days):	b) Kidding interval (days):
(c) Season of kidding:	(d) Dam's wt at kidding (kg):
4. a) Dam's live weight at kidding (kg):	b) Age at farrowing (days)
(c) Multiple births (No's)	
5 a) Litter size at birth:	b) Liter wt at birth (kg):
6. a) Animal's weight at birth (kg):	b) Weaning wt (kg):
c) Weight: 20 weeks:	d) Weight : 28 weeks
e) Weight: 36 weeks	f) Weight: 56 weeks
7. Market Price of animal	
8. Age at selling time (days)	
10. Total excreta produced (kg/year)	

11. Distribution of excreta to other farm components (kg/component)	
12. Nutritional value of the excreta	
13. Gross returns from the sale of the animals and their products & by products	

Dietary Intake

i. Feed ingredients		
ii. Feed intake by Dam	a) Roughage (%):	b) Concentrate (%)
c) Feed intake: (on dry matter basis) ;	d) DMI (g/kg);	
iii. Feed intake by litter group	b) Roughage (%):	b) Concentrate (%)
c) Feed intake: (on dry matter basis)	d) DMI (g/kg);	
iv. Ration (K cal DM/ kg feed) to Dam:		
v. Ration (K cal DM/ kg feed) litter group:		
vi. Composition of ration:		
vii. Cost of ration supplied to Dam (Rs/ dam/year) :		
viii. Cost of ration supplied to litter (Rs/ litter/ year)		
ix) Total cost of production		
x. Net return per lactating animal:		

Input output flow in an IFS

Sl. No.	Inputs obtained from the system*	Inputs purchased from outside the farm/market*	Products and by-products provided to other farm enterprise/ enterprises within the system*	Products and by-products sold in market*
1				
2				
3				
4				
5				
* Please mention input/output name, quantity and market value of different items				

Any other information relevant to the enterprise:

Annexure-VII

ALL INDIA COORDINATED RESEARCH PROJECT ON INTEGRATED FARMING SYSTEMS RESEARCH (I.C.A.R)

ON STATION RESEARCH

Observation Schedule for Farming Systems Experiments

Centre:

INFORMATION SCHEDULE FOR MUSHROOM COMPONENT:

1(a) . Mushroom family	(b) Strain (Local/ Hyb.)
2. Growing area (sq m)	
3. Preparation of natural Compost (Quantify)	
4. Type of bed (Hallow/ Compact- square/ Compact bed-round) (m diam):	
5. Formulation used for preparing compost:	(a) Wheat straw (kg):
(b) . Chicken straw (kg):	(c) Wheat bran (kg)
(d). Urea (kg)	(e) Cotton seed cake (kg):
(f) Cotton seed meal (kg):	(g) Cotton lint (kg):
(h) Gypsum (kg):	(i) Mollases (kg)
6. Substrate treatment	(a) Hot water treatment:
(b) Spraying mushroom beds at pinning:	
7. Disease/ Pest encountered, causing economic losses:	
8. Time taken to fruit (days):	
9. (a) . Av fruit body wt (g):	(b) Av. fruit bodies No.
10. Data to be recorded during cropping days (periodic):	(a) Ist harvest (after casing/ No. of days taken)

(b) . Last harvest (Data after total cropping days of 6 weeks to be recorded)	(c) No of pickings taken:
(d) Yield per picking- kg (area wise):	
11. Time taken for I, II and III flush:	
12. Quality parameters of button mushrooms:	(a) Total yield (g):
(b) Whole length (mm):	(c) Pileus-diam (m):
(d) Pileus wt (g):	(e) Stipe length (mm):
(f) Stiple diam (mm)	(g) .Stipe wt (g):
(h) Whiteness (%):	(i) : Dry wt (g):
13. Mushroom Processing cost (Rs.)	(a) Total cost for preparation of compost (Rs.)
(b) Total cost for creating infrastructure (Rs.)	(c) Transportation cost (Rs)
14. Cleaning, Plucking, grading and Packing cost (Rs.) :	
15. Cost of cultivation (Rs).	
16. Total sale value (Rs):	
17. Cost of Spawn production	
18. Cost of Mushroom Production (Rs):	
19. (a) Material cost (Rs):	(b) Labour cost (Rs):
20. Total Cost (Rs):	
21. Total Net return (Rs.)	

Input output flow in an IFS

Sl. No.	Inputs obtained from the system*	Inputs purchased from outside the farm/market*	Products and by-products provided to other farm enterprise/ enterprises within the system*	Products and by-products sold in market*
1				
2				
3				
4				
5				
* Please mention input/output name, quantity and market value of different items				

Any other information relevant to the enterprise:

Annexure-VIII

ALL INDIA COORDINATED RESEARCH PROJECT ON INTEGRATED FARMING SYSTEMS RESEARCH (I.C.A.R)

ON STATION RESEARCH

Observation Schedule for Farming Systems Experiments

Centre:

INFORMATION SCHEDULE FOR APICULTURE COMPONENT:

1 . Species:	2. No. of boxes
3. No. of frames in each box:	4. No. of super:
5. Seasons to extract honey:	Autumn/ Spring/ Rainy/ Other:
6. (a) Honey per box (kg):	(b) No of extraction:
7. (a) : No of Comb sheets used:	(b) Price for Comb sheet:
8. Cost on protection measures (Rs):	
9. (a) Cost on artificial sugar (Rs.):	(b): Cost on momaging water/change in place/ creating flora for honey (Rs):
(c). Cost of basic appliances and honey extraction machine (Rs.)	
10. (a): Cost of depreciation (Rs):	(b): Cost of appreciation (Rs):
11. Price of honey (Rs.):	
12. Use of by-products:	
13. Price of by-products (Rs):	
14. Gross return (Rs.)	15. Net return (Rs):
16.No of man-days involved per box:	
17 Extra employment on the basis of unit:	

Input output flow in an IFS

Sl. No.	Inputs obtained from the system*	Inputs purchased from outside the farm/market*	Products and by-products provided to other farm enterprise/ enterprises within the system*	Products and by-products sold in market*
1				
2				
3				
4				
5				
* Please mention input/output name, quantity and market value of different items				

Any other information relevant to the enterprise:

Annexure-IX

ALL INDIA COORDINATED RESEARCH PROJECT ON INTEGRATED FARMING SYSTEMS RESEARCH (I.C.A.R)

ON STATION RESEARCH

Observation Schedule for Farming Systems Experiments

Centre:

INFORMATION SCHEDULE FOR APICULTURE COMPONENT:

1. Fruit species grown:	2. No of plants:
3. Area (sq m):	4. Nursery raise/ Planting
5. Plantation in block or boundary row:	
6. Age at the time of planting:	7. Spacing (m)
8. Method of Plantation:	
9. (a) Ingredients applied per plant at planting:	(b) Fertilizer or manure schedule:
10. a) Method of irrigation	(b) No of irrigations applied:
11. No of Planting/ cutting/ shaping:	
12. Appearance of fruits (Year after plantation)	
13. No of fruits taken during Ist year and subsequent years:	
14. (a) Av. fruit size (cm):	(b) Av, fruit wt (g):
15. Method of detaching the fruits:	
16. Cleaning, grading & waxing, packaging:	

17. Cost involved (Rs):	(a) Plants:
(b) . Plantation	(c) Management including labour:
(d) Inputs:	(e) Plant Protection measures
(f): Harvesting & Processing:	
18. By-Product returns (Rs):	
19. Total cost area wise/ Plant wise (Rs):	
20. Total return area wise/ Plant wise (Rs):	
21. Net return area wise/ Plant wise (Rs):	

Input output flow in an IFS

Sl. No.	Inputs obtained from the system*	Inputs purchased from outside the farm/market*	Products and by-products provided to other farm enterprise/ enterprises within the system*	Products and by-products sold in market*
1				
2				
3				
4				
5				
* Please mention input/output name, quantity and market value of different items				

Any other information relevant to the enterprise:

Annexure-X

ALL INDIA COORDINATED RESEARCH PROJECT ON INTEGRATED FARMING SYSTEMS RESEARCH (I.C.A.R)

ON STATION RESEARCH

Observation Schedule for Farming Systems Experiments

Centre:

Information schedule for Sericulture

1.	(a) Species:	(b) Variety:
2.	Land preparation:	(a) Field area (sq m):
	(b) Spacing (sq cm):	(c) Stake Length (cm):
	(d) No of buds:	
3.	Fertilization (Quantify)	(a) Ist stage:
	(b) IInd stage:	(c) Subsequent stages:
4.	Green manuring & Mulching (Quantify):	
5.	Irrigation- stages:	
6.	(a) Insecticides used (Quantify)	(b) Pesticides/ Fungicides (Quantify):
7.	Pruning stage (days):	
8.	Leaf harvest (ht. from the ground):	
9.	Egg stage (days):	
10.	Larval stage:	
11.	Pupa stage:	
12.	Total quantify of leaf required to raise	
13.	Silkworm rearing:	

14. Reeling process:	(a) Cooking
(b). Bivoltine cocoon harvest:	
15. Silkworm rearing:	
16. Land preparation (Rs.):	
17. Fertilizer & manuring cost (Rs.) :	
18. Insecticide/ Pesticide/ Fungicide cost	
19. Irrigation cost (Rs):	
20. Labour cost (Rs.)	
21. Cocoon production cost (Rs):	
22. Cost of sticks byproduct cost (Rs)_:	
23. Cost of excreta/ sludge (Rs):	
24. Total cost of production (Rs):	
25. Total net return (Rs):	

Input output flow in an IFS

Sl. No.	Inputs obtained from the system*	Inputs purchased from outside the farm/market*	Products and by products provided to other farm enterprise/ enterprises within the system*	Products and by-products sold in market*
1				
2				
3				
4				
5				
* Please mention input/output name, quantity and market value of different items				

Any other information relevant to the enterpris.

Annexure-XI

ALL INDIA COORDINATED RESEARCH PROJECT ON INTEGRATED FARMING SYSTEMS RESEARCH (I.C.A.R)

ON STATION RESEARCH

Observation Schedule for Farming Systems Experiments

Centre:

Information schedule for Agro forestry system

1. Tree species
   System: Compact block, Boundary plantation, Agro forestry system , others.
2. Source/ sources of planting material:
3. Date of planting:
4. Locality (Site) information:
   Agro-climatic zone:
   Mean average annual temperature (^{0}C) :
   Mean average annual rainfall (mm):
   Edaphic characteristics:
   Longitude: Latitude : Altitude (m, msl):
5. Spacing (m x m) and density (plants/ha):
6. Total area:
7. Irrigation: Irrigated/ rainfed
8. Total number of plants accounted for taking data:
9. Rotation (years):
10. Crop rotation : Kharif
    Rabi
    Summer

11. Tree and crop growth data:

Tree spacing (m)	Ht. (m)	DBH (cm)	Vol. (m^3/tree)	Fruit/ other tree produce yield	Crop yield (kg/ha)					
					Kharif		Rabi		Summer	
					Under AF	Control	Under AF	Control	Under AF	Control

12. Data under tree canopy and in open conditions (pure crop) at different depths

Parameters	Soil carbon	Soil moisture	Soil pH	Available N P, K	availability of light	PAR	Any other relevant information
Under tree canopy							
Without tree (Control)							

13. Harvesting Data:

Tree Species	Age (Months)	Height (m)	DBH (cm)	Vol. (m3/ Tree)	Biomass (kg/tree)				
					Leaf	Bole	Branch	Root	Total

14. Economics of both the systems:
Cost of cultivation per rotation (Rs/ha)

System	Rotation (years)	Density	Amount (Rs.)
Compact block			
Bund/boundary plantation			
Agroforestry/ /silviculture - trees - crops - grasses			
Total			

Gross and net returns (Rs./ha)

Component	Yield	Cost of production	Returns	Net Profit	B: C ratio
1 Crops and cropping systems					
2 Tree component					
3 Tree +Crop					

15. Input output flow in an IFS

Sl. No.	Inputs obtained from the system*	Inputs purchased from outside the farm/market*	Products and by-products provided to other farm enterprise/ enterprises within the system*	Products and By-products sold in market*
1				
2				
3				
4				
5				
* Please mention input/output name, quantity and market value of different items				

16. Any other information relevant to the enterpris.

Common format for calculating economics of different crops
Economics of various crops (Annual Cost in Rs.)

Economics of various crops (Annual Cost in Rs.)								
Cost components	Rice	Wheat	Jowar	Bajra	Maize	Pulses	Oilseeds	Veg.
Land prepartion								
Seed/ nursery								
Sowing/transplanting								
FYM								
Fertilizers								
Other Chemicals								
Irrigation								
Labour charge								
Harvesting/ threshing								
Transportation cost								
Total operational cost								
Interest on oper.cost								
Depreciation								
Interest on fixed capital								
Total cost								
Yield (Q/ha.)								
Price / Q								
Value								
Value of by product								
Gross return								
Net return								

Common format for calculating economics of dairy enterprise

Economics of dairy farming (Annual Cost in Rs.)

Particulars	Miliching Animals					
	Desi Cow	Improved breeds of cow	Desi Buffalo	Improved breeds of buffalo	Goat	Camel
Area under dairy farming (ha.)						
Number of milich animals (no.)						
Operational Cost (in Rs.)						
Cost of green fodder						
Cost of dry fodder						
Concentrate						
Labour charges : Hired						
Family						
Veterinary charges						
Electricity charges						
Miscellaneous cost						
Total						
Interest on operational costs @ 10% for 6 months						
Interest on fixed cost						
Depreciation						
Total Cost						
Return						
Net gain of animal sold/purchased during the year (Rs.)						
Production of milk (l)						
Price (Rs.)/l.						
Value of milk produced						
Value of excreta produced						
Gross Return						
Net Return						

Common format for calculating economics of Fishery enterprise

Particulars	Annual Cost (Rs.)
Area (ha.)	
*Construction cost of ponds (fixed cost)	
Cost of Finger lets	
Feed (Q)	
Value (Rs.)	
Electricity / Irrigation charges	
Urea	
Cost of SSP	
Cost of FYM	
Labour wages (Rs.)	
Maintenance cost / Rent (variable cost)	
Total Operational Cost (Rs.)	
Interest on operational cost	
Interest on fixed cost	
Total cost	
Output (qtl.) per annum	
Price (Rs.)	
Gross return (Rs.)	
Net return (Rs.)	
Employment generation	

* The total construction cost of the pond is to be divided into 10 years assuming the life of pond of 10 years

Common format for calculating economics of poultry enterprise

Economics of poultry farming

Particulars	Annual Cost (Rs.)
Area ha.	
Cost of construction of shed (Fixed Cost)	
Number of chicken	
Mortality rate	
Operational cost	
Variable cost	
Value of chicken	
Cost of feed	
Labour wages	
Cost of medicine	
Total	
Interest on operational costs	
Interest on fixed cost	
Total cost	
Output	
Number of unit sold	
Price per unit	
Gross return	
Net profit	
Returns over variable cost	
Returns per day	
Additional employment generated (mandays)	

Common format for calculating economics of piggery enterprise

Economics of piggery farming

Particulars	Annual Cost (Rs.)
Number of Pig	
Male	
Female	
Total	
Fixed Cost (construction of shed)	
Interest on Fixed cost	
Variable cost	
Cost of feed	
Labour wages	
Total	
Total cost	
Output (Q)	
Weight of pig	
Price per kg of weight	
Gross return	
Net return	
Returns over variable cost	
Employment generated	
Net returns per day	

PARTICIPANTS OF BRAIN STORMING SESSION-CUM-LAUNCHING WORKSHOP OF AICRP ON IFS

1. Shri. Mullakkara Ratnakara, Minister for Agriculture, Government of Kerala
2. Dr. A.K. Singh, DDG (NRM), ICAR, Krishi Anusandhan Bhavan-II, Pusa New Delhi-110 012
3. Shri K.R. Vishwambharan, Vice Chancellor, Kerala Agricultural University, P.O. KAU, Vellanikkara, Thrissur-680 656 (Kerala)
4. Dr. I.C. Mahapatra, Chairman, Research Advisory Committee, PDFSR, Modipuram
5. Dr. G.B. Singh, Ex-DDG (NRM), 3/35 Virat Khand, Gomtinagar, Lucknow
6. Dr. M.M. Panda, Dean of Research, OUAT, Bhubaneswar-751 003
7. Dr. B. Gangwar, Project Director, PDFSR, Modipuram
8. Dr. Kamta Prasad, Principal Scientist (Agronomy) & PF (CU), PDFSR, Modipuram
9. Dr. S.S. Pal, Principal Scientist (Soil Science) & PF (SRM), PDFSR, Modipuram
10. Dr. J.P. Singh, Principal Scientist (Agronomy) & PF (IFS), PDFSR, Modipuram
11. Dr. A.K. Nayak, Principal Scientist (Soil Science), PDFSR, Modipuram
12. Dr. S.P. Singh, Sr. Scientist (Agril. Econ.) & PF (SDDE), PDFSR, Modipuram
13. Dr. R.K. Langer, Sr. Scientist, (Fsiheries Sci.), PDFSR, Modipuram
14. Dr. Akath Singh, Scientist, (Horticulture), PDFSR, Modipuram
15. Dr. T.K. Adhya, Director, Central Rice Research Institute, Cuttack-753 006 (Orissa)
16. Dr. S. Jayaraman, Director, CSCMS, TNAU, Coimbatore-641 003
17. Dr. S.K. Naskar, Director, Central Tuber Crops Institute, Trivendrum (Kerala)
18. Dr. K. Haritshirm Nair, Dean, College of Agriculture, KAU, Trissur (Kerala)
19. Dr. S.K. Nanda, Project Coordinator, AICRP on PHT, CIPHET, Ludhiana (Punjab)
20. Dr. S. Subramaniam, Pr. Investigator, AICRP on Integrated Farming Systems, ICAR Research Complex for Goa, Ela, Old Goa-403 402 (Goa)
21. Dr. S.K. Ambast, Head (NRM) & Director (I/c), Central Agricultural Research Institute, P.B. No. 181, Port Blair-744 101 (A&N Islands)
22. Shri. Gopakumaran Nair G, Asst. General Manager, NABARD, Trivandrum (Kerala)
23. Shri. G. Ramesh Kumar, Manager, NABARD, APRO RTC 'X' roads, Musherabad, Hyderabad-500 020

24. Dr. B.T. Pujari, Director of Research, University of Agricultural Sciences, Raichur-584 101 (Karnataka)
25. Dr. B.K. Desai, Professor of Agronomy & Project Leader, IFS, University of Agricultural Science, Raichur-584 101 (Karnataka)
26. Dr. T.I. Mathewkutty, Deputy Director, Coconut Board, Kochi
27. Dr. V.S. Vijayan, Chairman, Kerala State Biodiversity Board, Kerala
28. Dr. R.V. Varma, Kerala State Biodiversity Board, Kerala
29. Dr. N.P. Singh, Director, ICAR Research Complex for Goa, Ela, Old Goa-403 402 (Goa)
30. Dr. A. Updendra Rao, Senior Scientist (Agronomy), APRRI, Maruteru (A.P.)
31. Dr. G.E. Ch. Vidya Sagar, Senior Scientist (Agronomy), CSRC, RS&RRS, Rudrur (A.P.)
32. Dr. V.B. Bhanu Murthy, Chief Agronomist, AICRP on Integrated Farming Systems, Department of Agronomy, Acharya NG Ranga Agricultural University, Rajendranagar, Hyderabad-500 030 (A.P.)
33. Dr. N. Ravisankar, Pr. Investigator, AICRP on Integrated Farming Systems, Central Agricultural Research Institute, PB No. 181, Port Blair-744 101 (A & N Islands)
34. Dr. Ajit Baishya, Chief Agronomist, AICRP on Integrated Farming Systems, Department of Agronomy, Assam Agricultural University, Jorhat-785 013 (Assam)
35. Dr. R.P. Sharma, Chief Agronomist, AICRP on Integrated Farming Systems, Bihar Agril. College (RAU), Sabour, Dist. Bhagalpur-813 210 (Bihar)
36. Dr. S.K. Sarawgi, Chief Agronomist, AICRP on Integrated Farming Systems, Indira Gandhi Krishi Vishwavidyalaya, Krishak Nagar, Raipur-492 001 (Chhattishgarh)
37. Dr. B.S. Patel, Research Scientist, AICRP on Integrated Farming Systems, Sardarkrushinagar-Dantiwada Agricultural University, Sardarkrushinagar, Dist. Banaskantha-385 506 (Gujarat)
38. Dr. B.M. Dabhi, Agronomist, Department of Agronomy, JAU Junagadh-362 001 (Gujarat)
39. Dr. R.A. Dungrani, Agronomist, Department of Agronomy, College of Agricultural, Bruchar Rasta, Navsari-50 (Gujarat)
40. Dr. Pawan Kumar, Agronomist, AICRP on Integrated Farming Systems, Department of Agronomy, CCS Haryana Agricultural University, Hisar-125 004 (Haryana)
41. Dr. S.C. Negi, Chief Agronomist, AICRP on Integrated Farming Systems, Department of Agronomy, CSK Himachal Pradesh Krishi Vishwavidyalaya, Palampur, Dist. Kangra-176 062 (H.P.)
42. Dr. S.S. Rana, Scientist, AICRP on Integrated Farming Systems, Department of Agronomy, CSK Himachal Pradesh Krishi Vishwavidyalaya, Palampur, Dist. Kangra-176 062 (H.P.)
43. Dr. Dileep Kachroo, Chief Agronomist, AICRP on Integrated Farming Systems, Sher-E-Kashmir University of Agricultural Sciences & Technology (Main Campus), Chatha, Jammu-180 012 (J&K)
44. Dr. Ashok Kumar Gupta, Senior Scientist (Agronomy), AICRP on Integrated Farming Systems, Sher-E-Kashmir University of Agricultural Sciences & Technology (Main Campus),

Chatha, Jammu-180 012 (J&K)

45. Dr. M.K. Singh, Chief Agronomist, AICRP on Integrated Farming Systems, Department of Agronomy, Birsa Agricultural University, Kanke, Ranchi-834 006 (Jharkhand)
46. Dr.. J. Prasad, Jr. Scientist, Birsa Agricultural University, Kanke, Ranchi-834 006 (Jharkhand)
47. Dr. R.P. Mannjhu, Jr. Agronomist, Birsa Agricultural University, Kanke, Ranchi-834 006 (Jharkhand)
48. Dr. H. Chandrappa, Chief Agronomist, AICRP on Integrated Farming Systems, UAS-B Agricultural Research Station, Kathalagere, Dist. Davanagere-577 219 (Karnataka)
49. Sri. M.A. Basavanneppa, Chief Agronomist, AICRP on Integrated Farming Systems, UAS-R Agricultural Research Station, Siruguppa, Dist. Bellary-583 121 (Karnataka)
50. Dr. Kuruvilla Varughese, Chief Agronomist, AICRP on Integrated Farming Systems, KAU Agricultural Research Station, Karamana, Trivandrum-695 002 (Kerala)
51. Dr. Jacob John, Agronomist, KAU, Karmana, Trivandrum
52. Dr. B. Rani, Soil Scientist, KAU, Karmana, Trivandrum
53. Dr. C.S. Ravindran, HoD Crop Production, CTCRI, Trivandrum
54. Dr. James George, Principal Scientist, CTCRI, Trivandrum
55. Dr. Thomas Methew, Associate Professor, ECF Centre, KAU Kerala
56. Dr. V.B. Upadhyay, Chief Agronomist, AICRP on Integrated Farming Systems, Department of Agronomy, JNKVV, Adhartal, Jabalpur-482 004 (M.P.)
57. Shri. A.K. Kumhar, SRF, Department of Agronomy, JNKVV, Adhartal, Jabalpur-482 004 (M.P.)
58. Dr. B.V. Saoji, Chief Agronomist, AICRP on Integrated Farming Systems, Department of Agronomy, Dr Panjabrao Deshmukh Krishi Vidyapeeth, Krishinagar, Akola-444 104 (Maharashtra)
59. Shri. P.F. Khan, Research Assistant, Dr Panjabrao Deshmukh Krishi Vidyapeeth, Krishinagar, Akola-444 104 (Maharashtra)
60. Shri. P.V. Mohd, Jr. Research Assistant, Dr Panjabrao Deshmukh Krishi Vidyapeeth, Krishinagar, Akola-444 104 (Maharashtra)
61. Shri. R.J. Nikesu, Jr. Soil Scientist, Dr Panjabrao Deshmukh Krishi Vidyapeeth, Krishinagar, Akola-444 104 (Maharashtra)
62. Dr. L.G. Pawar, Chief Agronomist, AICRP on Integrated Farming Systems, DBSKKV Agricultural Research Station, Karjat, Dist. Raigad -410 201 (Maharashtra)
63. Dr. M.S.I. Shaikh, Agronomist ECF, Roha, DBSKKV, Dapoli, Dist. Ratnagiri (Maharashtra)
64. Dr D.G. Jondhale, Jr. Soil Scientist, DBSKKV Agricultural Research Station, Karjat, Dist. Raigad -410 201 (Maharashtra)
65. Dr. W.N. Narkhede Chief Agronomist, AICRP on Integrated Farming Systems, Marathwada Agricultural University, Parbhani-431 402 (Maharashtra)

66. Dr. A.G. Wani, Chief Agronomist, AICRP on Integrated Farming Systems, Mahatma Phule Krishi Vishwavidyalaya, Rahuri, Dist. Ahmednagar-413 705 (Maharashtra)
67. Dr. A.S. Panwar, Pr. Investigator, AICRP on Integrated Farming Systems, ICAR Res. Complex for NEH Region Umroi Road, Umiam-793 103 (Meghalaya)
68. Dr. Lalita Mohan Garnayak, Chief Agronomist, AICRP on Integrated Farming Systems, Orissa University of Agriculture and Technology, Bhubaneswar-751 003 (Orissa)
69. Dr. S.S. Walia, Chief Agronomist, AICRP on Integrated Farming Systems, Department of Agronomy & Agro-meteorology, Punjab Agricultural University, Ludhiana-141 004 (Punjab)
70. Dr. Satpal Singh, Agronomist, ECF Amritsar, Punjab Agricultural University, Ludhiana-141 004 (Punjab)
71. Dr. O.P. Gill, Chief Agronomist, AICRP on Integrated Farming Systems, Agricultural Research Station (RAU), Durgapura, Jaipur-302 015 (Rajasthan)
72. Dr. K. Siddeswaran, Chief Agronomist, AICRP on Integrated Farming Systems, Department of Agronomy, TNAU, Coimbatore-641 003 (T.N.)
73. Dr. A.K. Bhardwaj, Chief Agronomist, AICRP on Integrated Farming Systems, Department of Agronomy, GB Pant University of Agriculture and Technology, Pantnagar, Dist.Udham Singh Nagar-263 145, (Uttarakhand)
74. Dr. Dinesh Kr. Singh, Jr. Scientist, AICRP on Integrated Farming Systems, Department of Agronomy, GB Pant University of Agriculture and Technology, Pantnagar, Dist. Udham Singh Nagar-263 145, (Uttarakhand)
75. Dr. Purushottam Kumar, Agronomist, AICRP on Integrated Farming Systems, Department of Agronomy, GB Pant University of Agriculture and Technology, Pantnagar, Dist. Udham Singh Nagar-263 145, (Uttarakhand)
76. Dr S.P. Singh, Agronomist, AICRP on Integrated Farming Systems, Department of Agronomy, ND University of Agriculture & Technology, Kumarganj, Faizabad-224 229 (U.P.)
77. Dr. M.P. Yadav, Chief Agronomist, AICRP on Integrated Farming Systems, Department of Agronomy, CSA University of Agriculture & Technology, Kanpur-208 002 (U.P.)
78. Dr. J. Rai, Scientist (Economics), AICRP on Integrated Farming Systems, Department of Agronomy, CSA University of Agriculture & Technology, Kanpur-208 002 (U.P.)
79. Dr. J.S. Bohra, Agronomist, AICRP on Integrated Farming Systems, Dept. of Agronomy, Agricultural Research Institute, B.H.U. Varanasi-221 005 (U.P.)
80. Dr. Manabendra Roy, BCKVV, Kalyani, Nadia-741 235 (W.B.)
81. Dr. G.S. Bhatnagar, Agronomist, Agricultural Research Station, Kota (Rajasthan)
82. Shri. Dhananjay Tripathi, Technical Officer, PDFSR, Modipuram
83. Shri. Rajesh Kumar, PA to Project Director, PDFSR, Modipuram

NOTES