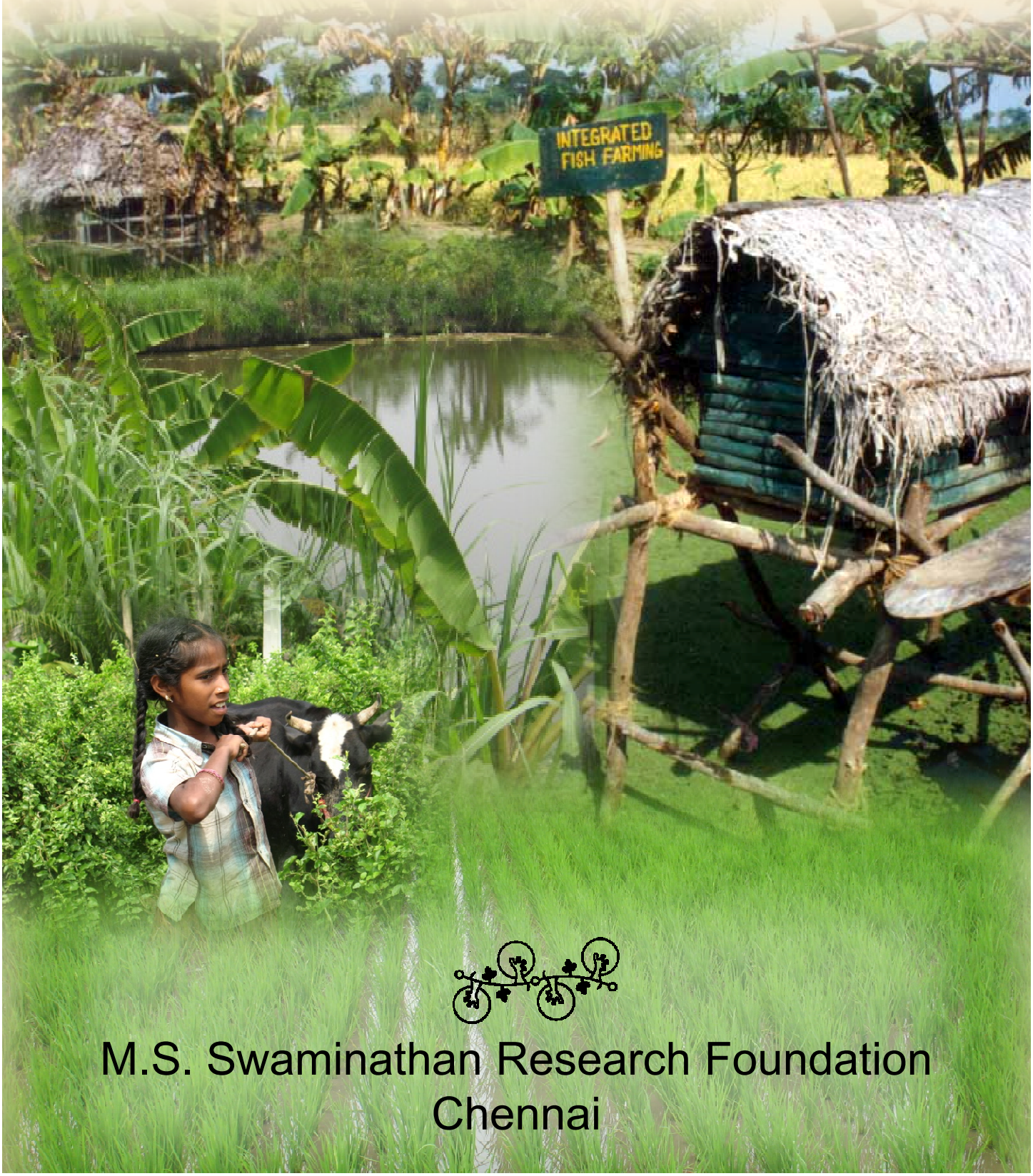
Demonstration and Replication of Integrated Farming Systems at Chidambaram



M.S. Swaminathan Research Foundation
Chennai

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Preface

M S Swaminathan Research Foundation has been working on Sustainable Integrated Farming Systems (SIFS) during the last fifteen years in several parts of Tamil Nadu. SIFS helps to optimise the benefits of the resources available to a farming family. It involves crop-livestock-fish integrated farming wherever this is feasible. Thus, SIFS is based upon efficient natural resources management, which can lead to the enhancement of productivity in perpetuity without associated ecological harm.

Over 80% of our farms are operated by small and marginal farmers. Such farming requires additional income in order to safeguard their livelihoods. This is where SIFS plays a key role. Such integrated farming systems can be designed taking into account the opportunities available in the area for assured and remunerative marketing.

I hope this report will provide guidelines for enhancing the productivity, profitability and sustainability of small farms. I thank Dr M Nageswaran and his colleagues for this useful and timely publication.

M S Swaminathan

Acknowledgements

We would like to thank Prof M S Swaminathan, Chairman, MSSRF, for his inspiration in developing the Costal IFS model. We have benefited from the earlier surveys and documentation carried out by Mr G Venkataramani, former Agricultural Correspondent, The Hindu and Dr K Balasubramanian, former Director, JRD Tata Ecotechnology Centre, who were instrumental in developing the model IFS farm at Keelamanakudi during the initial stages.

We wish to express our gratitude to Dr Venkatesh B Athreya, former Professor and Head, Department of Economics, Bharathidasan University, Tiruchirapalli for his expert guidance in developing the research methodologies for this study and Mr R Gopinath who compiled the list of Tamil Nadu Government Schemes suitable for IFS farmers.

We would also like to thank the farmers, members of the Sethiyathope Anaicut Farmers' Welfare Association, Manikollai Small Farmers Lift Irrigation Federation, Thenkoodu SHG Federation and Vallan Kundra Vellan Association who cooperated throughout the project duration and are carrying forward the work now.

We would like to acknowledge the contributions and support we have received over the years from our colleagues in the development and replication of the IFS farms not only in Chidambaram but in other sites as well.

Contents

Introduction

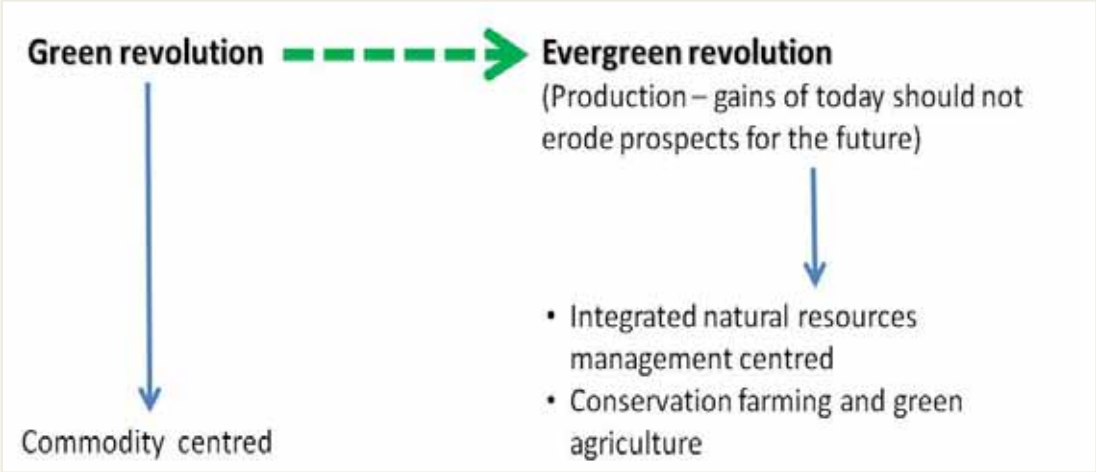
Increasing human population brings about an increase in demand on natural resources especially food products. The pathway of improving crop production through high yielding varieties, artificial fertilizers, pesticides and herbicides among other support systems such as subsidiaries and buy back arrangements, brought about tremendous improvement in crop production starting in the late 1960's, a phenomenon called the "Green Revolution".

Increasing human population brings about an increase in demand on natural resources especially food products. The pathway of improving crop production through high yielding varieties, artificial fertilizers, pesticides and herbicides among others support systems such as subsidiaries and buy back arrangements, brought about tremendous improvement in crop production starting in the late 1960's, this phenomenon was called as "Green Revolution".

The spread of the Green Revolution was limited to certain pockets of the country, which were able to ensure irrigation, *i.e.*, in the traditional wet lands and areas that were covered through various irrigation schemes and projects of the government. However, in the 1990's, it was observed that there was a steady decline in food grain production when compared with the rate of population growth. The contributing factors were the changes in government policies towards agriculture support, crops reaching their limits in yield potential and in general agriculture becoming economically unattractive for majority of the farmers.

Many individuals and groups have started advocating alternative and environment friendly systems of cultivation, while some go beyond that and ensure the well being of the farming community itself. Depending upon one's ideology, issues such as livelihood, equity, health and education are often interlinked with the food quality, value chain, sustainability of the natural resource base and/or of the production system itself. The common factors among these alternative systems of farming, have elements of crop rotation, absence of agro-chemicals usage, mixed farming systems and resource recycling.

A paradigm shift advocated for food production is the concept of **Evergreen Revolution** which is embedded in the principles of enhancement of productivity in perpetuity, without associated ecological or social harm. The green revolution becomes an evergreen revolution when it is rooted in the principles of ecology, economics and social equity. The transformation from green revolution to evergreen revolution is illustrated below:



The components of the evergreen revolution are:

- Biovillages: Emphasis on the sustainable management of natural resources and on-farm, off-farm and non-farm livelihoods
- Eco-agriculture: Encompasses the concept of productivity in perpetuity
- Ethics and equities: In economic, social and gender fields
- Community Learning Centres: Providing relevant locale specific information

Among the popular alternative systems of farming encompassing the eco-agriculture approach is the Integrated Farming System (IFS) approach. The term "Integrated Farming" is used for denoting farming practices that adopt and integrate components of crops, livestock, aquaculture and agro-forestry in a manner that mimic natural feedback loops whereby enhancing the overall synergy of the system. The key consideration in such farming system is to minimise the use of

Integration of crops, livestock, aquaculture and agro-forestry within a production system while addressing the social, economic and environmental concerns helps in sustaining such a production system.

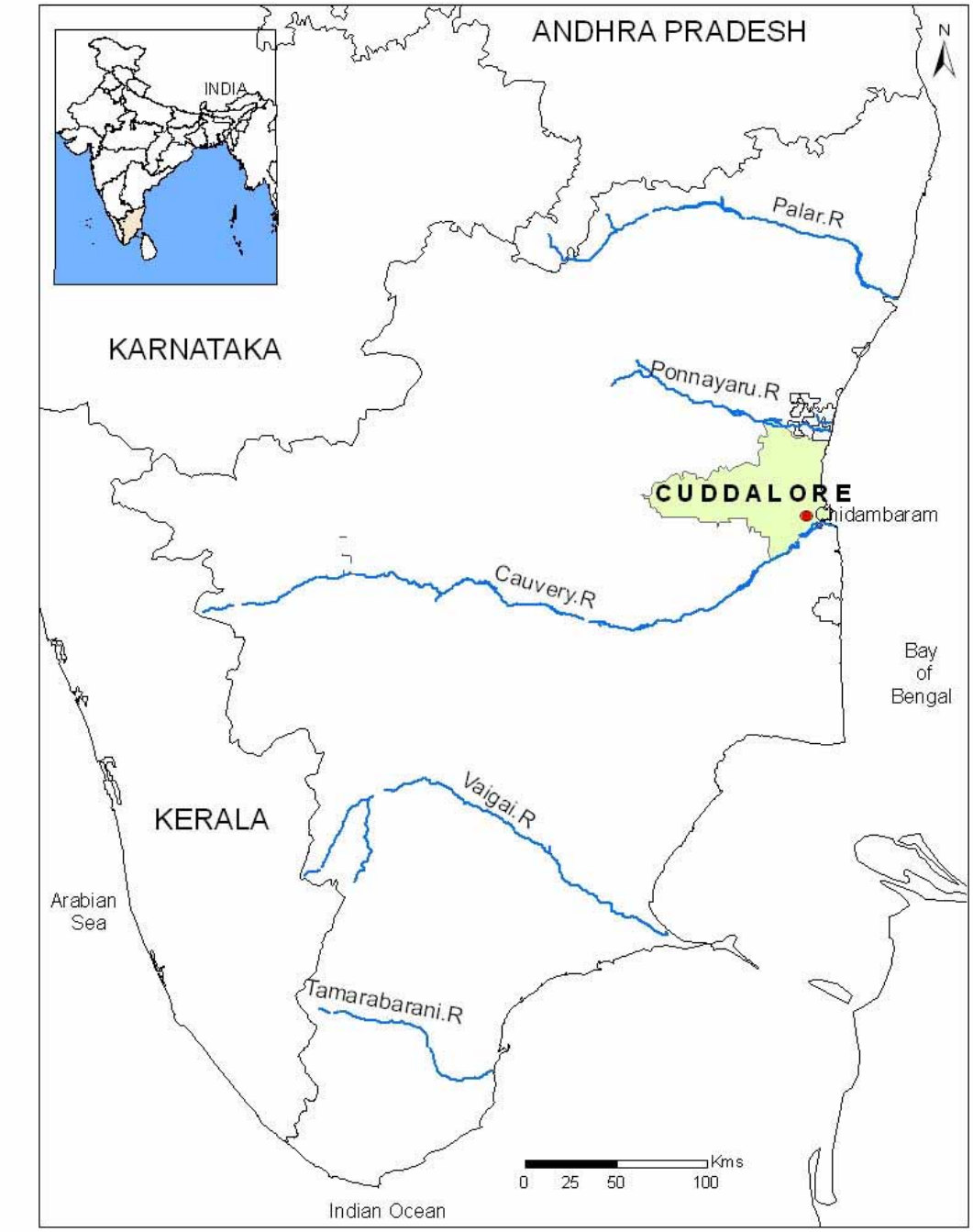
external inputs by enhancing the recycling of materials within the system through a process of value addition, which is achieved by including intermediate components that make use of the by-products (wastes) from one component as inputs (fertilizers, food) for another. Though, the nature of the components that are integrated in any individual farm will depend upon the local resources, ingenuity of the practising farmer and market opportunity, it will always have a few key components around which all other activities are interlinked and built upon. The IFS is based on a systemic and interdisciplinary approach, looking at the production process in a holistic manner taking in the best of available knowledge and technologies for maximising production. IFS is also viewed as a symbiotic partnership between farming families and their natural resource endowments.

This report captures the experience and learning of the Foundation during the last decade of its IFS intervention in the region. It covers three distinct phases, the first phase of setting up of the IFS Demonstration and Training Centre at Keelamanakkudi in 1996, the second phase when the farmers began adopting IFS approach during 1998 and the third phase in 2002, which marked the end of the demonstration phase and the start of implementation of the government's farm pond scheme.

Integrated Systems Approach and its variations are among the many alternative of natural friendly farming systems advocated as a basic food production system among the small-scale producers. This is a holistic approach which as per the FAO Strategic Framework 2000-2015, gives importance to the "effective intensification of production systems". The nature of integration includes a "horizontal" element (knowledge based and improved management practices) and the "vertical" element (an end to end approach which includes value addition and marketing), along with the recognition of the economic and social dimensions of technology transfer and adoption.

Profile of the Study Area

Cuddalore District is one of the 32 districts of Tamil Nadu in South India. The District lies between 15° 5' and 11° 11'and 12.35" of the Northern Latitude and 78° 38' and 80° 00' Eastern Longitude with an area of 3,678 km², with headquarters at Cuddalore.



It shares its boundary in the North with Villuppuram District, in the North-East with the Union Territory of Puducherry, in the South with Nagapattinam District, in the West with Perambalur District and in the East with the Bay of Bengal. For administrative purpose the District is divided into Revenue Divisions consisting of Taluks which in turn are divided into Blocks.

The topography of the area is generally a flat plain, sloping gently from North to South and from West to East towards the sea and the predominant soil types of this District are red soil, red loam, clay loam and sandy soil. The only hills of the District are the Mount Copper Hills near Cuddalore and the Red Hills to the West of Puducherry.

The normal rainfall of the District is 1,235.8 mm per annum of which 57.98% is contributed by the South-West monsoon (June – September) and 30.23% from the North-East monsoon (October to December).

The forest resources of the District are meagre. Neem, banyan, palmyra, coconut, tamarind, mango, cashew and jack are the common trees found in the District. Casuarina cultivation is common in the coastal stretches of the District. In the backwaters of Pitchavaram near Chidambaram is a mangrove forest declared as a reserve forest. The cattle population here is of inferior breed and generally fit only for ploughing the soil, while improved breeds are reared for dairy purposes. Sheep and goats are reared for flesh and fleece. Since there is no dense forest in the District, wild animals are rare.

The District has a population of 22,85,395 in which males account for 11,50,908 and females 11,34,487. The population density is 621/km area and the sex ratio is 985 females per 1000 males. Out of the total population, 78.5% are literates. This District has 66.99% rural population and 33.01% as urban population and the literacy level is at 62.16%.

Out of the total working population in the District, 25.62% are cultivators and 41.44% are agricultural labourers. Those engaged in household industry, manufacturing, processing and repairing services account for 1.66% of the workforce. The rural population of Cuddalore District is 21,22,759. Out of the total population, 10.68% are cultivators. Of the total population in Cuddalore District 13.28% of them are agricultural labourers. Of the total population, 2.98% are engaged in household industry and manufacturing sector.

The total number of households in Chidambaram Taluk is 91,026 with a population of 4,09,047 (2,04,264 male and 2,04,783 female). Of the total population 69% are in rural area in 64,660 households. In the rural areas literates account for 56.98% (67.62%% male and 46.16% female). Of the total rural

population 10.2% are classified as Main Cultivators, 15.7% as Main Agricultural Labourers, 1.4% Marginal Cultivators and 11.2% as Marginal Agricultural Labourers (Census 2001).

The predominant crops cultivated in the District to the gross area sown, as per the Season and Crop Report - Tamil Nadu (2005-06) are as follows: paddy (42%), sugarcane (13.7%), fruits (13.2%), pulses (9.5%), groundnut (7.9%) and vegetables (2.7%).

The irrigation system of Chidambaram Taluk is characterised with Vellar River being the main source of water supply. During North East Monsoon, it receives heavy flood discharge and moderate normal flow during the South West Monsoon. Sethiathope Anaicut diverts flood flows in Vellar River to a supply canal named Vellar Rajan. Direct irrigation from Sethiyathope Anaicut covers 22,205 acres in Chidambaram Taluk. Indirect irrigation is provided through the network connected to Walajha Tank. Sethiyathope Anaicut region covers 40,000 acres of ayacut in Chidambaram and Cuddalore Taluks in Cuddalore District. Sethiyathope Anaicut is the last anaicut across Vellar River. It also receives supply of Veeranam Tank situated just above the Sethiathope Anaicut on the right side of the Vellar River. Sometimes this system also receives supply of the pumped discharge of water from Nevelli Lignite Corporation (NLC) lignite mine.

Though the network of irrigation canals is well developed, the availability of water for irrigation is limited by the supply through irrigation canals and rainfall. As both these are erratic, the agricultural operations and planning get affected. The ground water is unsuitable for irrigation as it has a high pH and EC value. There have been suggestions for developing alternative cropping patterns for the region for mitigating the issues related to uncertainty in availability of irrigation water for agricultural operations.

Participatory Demonstration on Integrated Farming System

Between 1996 and 2002, MSSRF had been carrying out adaptive participatory research and demonstration on IFS at Keelamanakkudi village, Parangipettai Block, Chidambaram Taluk with a major focus on demonstrating water use efficiency by incorporating intermediate components into the conventional paddy cultivation practice. This initiative was based on the premise that farmers would be able to mitigate issues relating to water constraints faced during the critical periods of crop growth by having water storage structures in their farms. It was also envisaged that incorporating multiple activities along with the farm ponds, based on IFS concepts would provide opportunities of enhanced livelihood options in the region. Based on the above premises, the objectives at that period were defined as:

- Develop and demonstrate IFS suitable to the region
- Carryout participatory research and conduct training programmes as part of the capacity building among the farming community
- Develop grass root institutions
- Identify and promote livelihood options among the members of the grass root institutions
- Facilitate replication of the IFS farms in the region
- Monitor the impact of the demonstration plot in the region by comparing with the trends and practices in randomly selected farmers' fields

The JRD Tata Ecotechnology Centre within MSSRF serves the purpose of generating and extending new knowledge and practices of technologies, which help in operationalising the concept of sustainable rural development at community/ farm and household levels with a focus on ecological sustainability, economic viability, employment generation, energy efficiency, and social and gender equity.

The strategies and approaches adopted by the Centre for strengthening the process of sustainable development reflect, the adaptive participatory research and development process based on local requirements and involves community mobilisation, training and capacity building, promoting and strengthening community based institutions, encouraging partnership and networking, and gender mainstreaming. System management and role change have been the processes through which the Centre facilitates improvement in livelihood options of the community. The Biovillage paradigm is the broader framework, within which ecotechnology is practiced at grass-root level by Centre for developing region specific models.

The demonstration plot also served as the training ground for the farmers in the region. Farmers from neighbouring villages and on training with the Government Departments such as Fisheries, Agriculture and Horticulture visited the IFS demonstration plot. As the Foundation was also promoting livelihood options for Self Help Groups (SHG), many women entrepreneurs visited the demonstration plot under the *Malalir Thittam*, a socio-economic empowerment programme for women implemented by the Tamil Nadu Corporation for Development of Women

Limited (a Government of Tamil Nadu Undertaking). The trainees were encouraged to analyse the cost effectiveness of the farm operations and determine the suitability of the various integrations carried out at the demonstration plot. The feedbacks received were positive for economic viability, environmental sustainability and its social acceptability. During the demonstration phase more than 150 farmers were trained as core resource persons for the spread of IFS concept in the region. Many of them have adopted components of IFS integration in their fields. Post 2002, the focus of activities at Chidambaram shifted towards strengthening the SHGs and facilitating lift-irrigation.

Though the demonstration phase ended in 2002, monitoring of the IFS farms adopted by the early adopters and the subsequent spread of such farming system in the region during the last 6 years was periodically followed. The IFS programme got a boost during 2002-2003 when the Government of Tamil Nadu started its Farm Pond scheme through the Agricultural Engineering Department, with 90% subsidy to farmers to develop a pond area of 0.33 acres. Current status and trends indicate that this concept has become popular in the region and there will be a further boost as the Public Works Department (PWD) of Tamil Nadu has initiated the implementation of Irrigated Agriculture Modernization and Water-bodies Restoration and Management (IAMWARM) project with the support of World Bank.

The willingness of the farmers from Keelamanakkudi to participate in this programme helped in establishing the IFS demonstration plot at Keelamanakkudi village in 1997. Based on interactions and discussions, a group of 20 individuals, which had cross sectional representation based on farm size, sex and representation from the landless agriculture labourers, was formed and informally identified as *Vallankundra Vellan Association* (Association for Sustainable Agriculture). The group maintained its association with the activities of the IFS demonstration plot till the end of the demonstration phase in 2002.

Demonstration IFS Farm at Keelamanakkudi

The framework for participatory research and demonstration for IFS was developed jointly through Participatory Rural Appraisal (PRA) and Focused Group Discussion (FGD). Baseline surveys were also conducted to record the existing status of agriculture, land tenure system, labour and employment availability, land transformation among others.

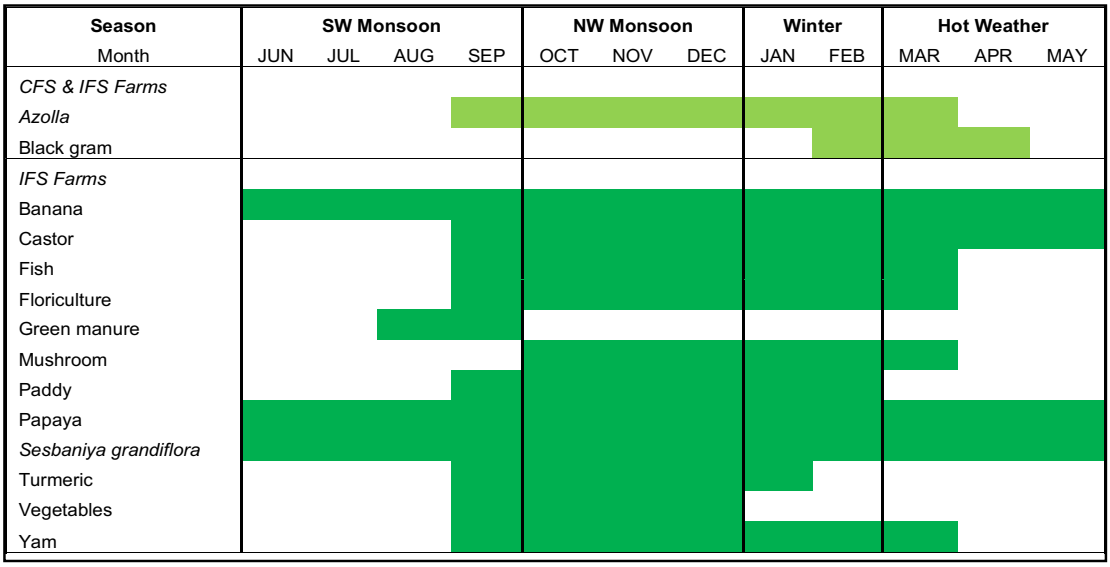
The selection of the site, its extent and the IFS components were determined jointly with the community. Twenty three components were initially identified for integration. The IFS plot was taken on lease from a farmer for a duration of 3 years and later extended for 2 years. The transformation of a paddy field into a full-fledged IFS plot took about 6 months. The IFS demo plot included a paddy cum fish culture spread over an area of 70 cents, where crop rotation was practised with the cultivation of green manure crops and pulses (blackgram), fish - *Azolla* pond with a mushroom unit extending to 8 cents. The thick bunds of the field were planted with banana and *Sesbania grandiflora*. The space between the *Sesbania grandiflora* and the bund was covered with vegetable crops such as snake-gourd, ribbed-gourd, floriculture, castor and cowpea. Buffalo grass was cultivated in the inner periphery of the bund. A bio-fence demarcated the demonstration site from the neighbouring fields. The farm at various points of time had mushroom cultivation, cows, goats, turkeys, poultry, pigeons, ducks, hens, rabbits and beehives among other enterprises. Organic method of cultivation was followed. By the end of the year of establishment of the demonstration plot, the following 15 components were identified as suitable for the region.

- The extent of the fish pond in the IFS demonstration plot was 0.05 acre. Canal water was stored in the pond and stocked with 6 species of fishes, which were selected based on the feeding habits of the fishes and local preference. The fish species were catla, grass crap, rohu, mirugal, common carp and botla
- A poultry shed was constructed on the banks of the pond. Around 12 ducks were reared. The droppings of these served as a potential source of feed for the fish as well as manure. Additional advantages were elimination of unwanted insects in the pond by the ducks
- A pigeon cage was also constructed above the fishpond with an initial stock of 2 pairs. This multiplied into 9 pairs within 14 months. The droppings of pigeon also served as good fertilizer for fishpond
- *Sesbania aculata* was cultivated as green manure in the paddy field. The soil sustainability was maintained by the use of the green manure crop. Forty five days after sowing, *Sesbania aculata* gave 4.75 tonnes yield (fresh weight). The green manure crop was used for rapid biomass generation. It easily decomposed and had considerable quantity of nitrogen. Besides this

nitrogen contribution, the green manure crops improved the physical and chemical properties of the soil

- Calf rearing as an enterprise – the animals were purchased each year and sold later with profit
- Two stall fed goats were reared. These goats were fed with buffalo grass. The droppings of the goats were collected and they were used to fertilize the pond as well as for farmyard manure
- Mushroom cultivation was one of the activities of IFS. In this farm, oyster mushroom species was cultured. Once the mushroom was harvested, the leftovers were used as feed for fish
- *Azolla* was cultured in fishpond covering the size of 40 m^2 for use as nitrogen-fixing agent in the paddy field and as feed for ducks
- Bio-fencing - plants such as *neem, kiluvai, othiyan, vathanarayanan, poovarasu, annual thuvarai and agathi* were used for bio-fencing the periphery of IFS demo unit. The by products of bio-fencing and herb were used as fodder and manure

Additional component gets introduced in the cropping pattern when IFS approach is followed. This is schematically represented in the following chart.



The IFS plot also served as a subject of research to determine the contribution in terms of operational efficiency, crop intensity, labour intensity and enterprise integration of IFS as against the conventional farming. The specific objectives of the study were as follows.

1. To analyse and compare cost of cultivation, income, employment and cost benefit ratio for experimental IFS and conventional farming

2. To examine the influence of experiments in IFS in the selected village on the use of organic fertilizer, chemical fertilizer, chemical pesticides and on soil status
3. To examine the forward and backward linkages between the different components of IFS in the project area
4. To make comparative analysis on the enterprises demonstrated in the IFS demonstration plot with those replicated by the IFS farmers (replicated IFS)

Farm records and log books were maintained for each activity and farm operations at the IFS demonstration plot. The data collection ranged from, labour register, input expenditure, soil health register, feed register for livestock and fish, details of resource recycling, biometric observations, sales register, training register and visitors register among others. These were monitored periodically and formed the basis for further development of the IFS plot.

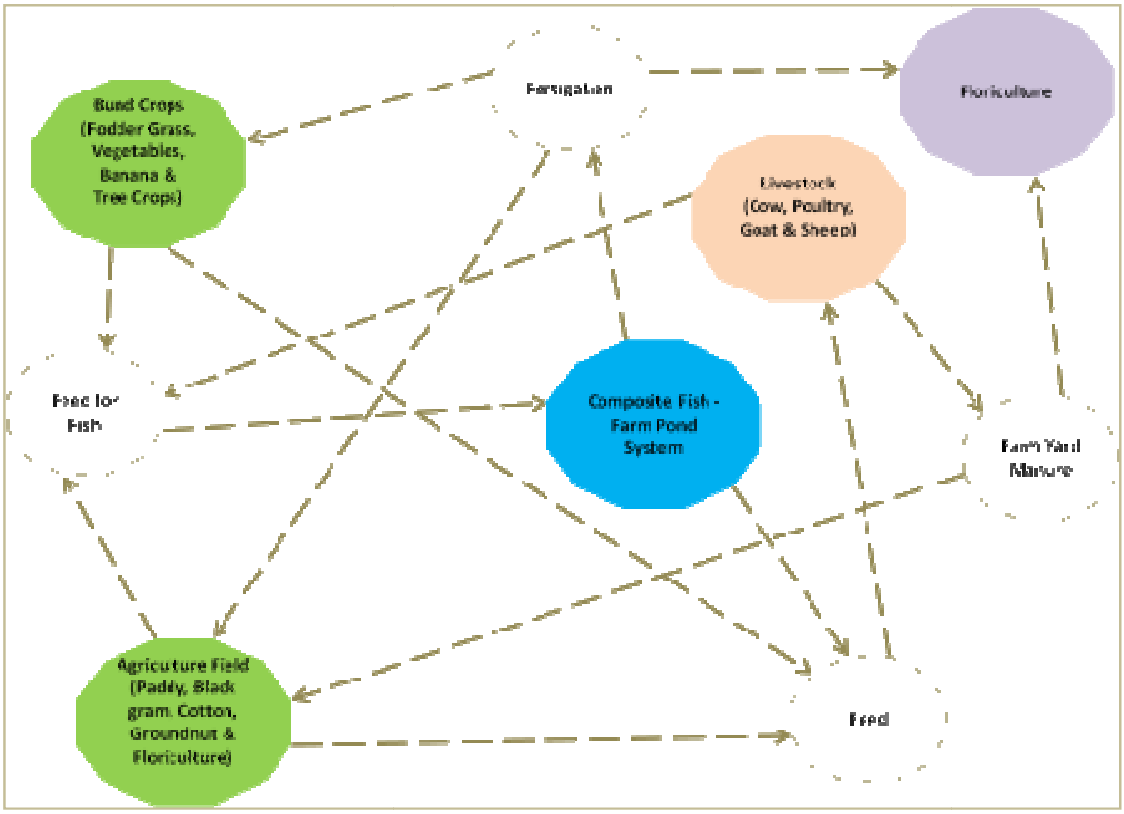
The following hypotheses were formulated, keeping the content and focus of the framed objectives in mind.

1. The cost of cultivation per acre of paddy and black gram taken together as well as of paddy by itself is higher in Conventional Farming System (CFS) than in IFS
2. The net annual revenue per acre is higher for IFS as compared to CFS
3. The IFS provides a significantly larger quantum of annual employment of labour per acre than the CFS
4. Improvement in soil quality has been greater in the case of IFS than in the case of CFS

Based on the above objectives and hypotheses, data were collected following standard research methodologies on physical inputs, costs and return, income and employment generation. Soil samples were collected and analysed for monitoring the soil health in IFS and CFS, at the time of pre-sowing and post harvest. The research studies were carried out between 1997 and 2002 for comparison between IFS and CFS and a one year study (2001-2002) for comparison between experimental IFS and replicated IFS. While data on IFS components were collected from the demonstration plot, the comparative data for analysing conventional farming practices were collected from 32 randomly selected households, which formed 20% of the total farming households at Keelamanakkudi village. In the case of replicated IFS, 10 households were selected from the 25 households that had adopted IFS. These 10 replicated IFS farms were the ones that had completed one year or more of IFS practice and were located in and around the project village. The highlights of the research findings are discussed below.

Integration of Various Enterprises in IFS

Schematic diagram showing broad integration within IFS farms



IFS approach places emphasis on inter-linkages within the components and resource recycling within the farm. Given below are some of the linkages between the components in the IFS demonstration plot.

- *Azolla* (for nitrogen fixation) > Paddy (paddy straw as cattle feed) > Cow (cow dung as fertilizer) > *Azolla*
- Banana (dried leaves as mushroom substrate) > Mushroom (mushroom waste as fish feed) > Fish > Fish pond (enriched water as fertigation and pond silt) > Banana
- Banana (leaves as fish feed) > Fish > Fish pond > (enriched water as fertigation and pond silt) > Banana
- Fish > Fish pond (enriched water as fertigation) > Buffalo grass (as cattle feed) > Cow (cow dung as fertilizer) > Fish pond > Phytoplankton (as fish feed) > Fish pond > Fish
- Paddy (broken rice grains as poultry feed) > Poultry (poultry manure) > Paddy

- Paddy (paddy straw as cattle feed) > Cow (cow dung as raw materials) > Compost pit (compost as farm yard manure) > Paddy
- Paddy (paddy straw as mushroom substrate) > Mushroom (mushroom waste as fish feed) > Fish > Fish Pond > (enriched water as fertigation) > Paddy

All the above integration and resource cycle occur within the IFS demonstration plot.

Comparison between Demonstrated Integrated Farming System and Farmers' Conventional Farming System

Various parameters were taken for comparing IFS and Conventional Farming System (CFS), such as input use pattern, cost, gross and net income, employment generation and benefit cost ratio among others. Some of the results are discussed here.

Maintaining soil health fertility is an important factor for getting good agriculture yields. The IFS approach at Keelamanakkudi had emphasised the organic method of farming, wherein no agro-chemicals were used. To understand the changes in soil characteristics within the IFS demonstration plot, soil samples were collected, as per standard procedures, before sowing and again after harvest. Similarly, soil samples were collected from the two farms practising CFS and were situated 500 m away from IFS demonstration plot. The soil samples were analysed for their pH, organic carbon, microbial population and porosity, among other parameters.

The following table records the pH values in IFS and the 2 CFS.

Soil pH in the two farming systems

Year	IFS	CFS I	CFS II
Nov-98	7.80	7.60	7.92
Apr-99	7.50	7.84	8.26
Nov-99	7.69	7.89	7.95
Feb-00	7.82	7.95	7.21
Nov-00	7.68	8.13	8.19
Apr-01	7.68	8.28	8.31
Nov-01	7.80	7.80	7.80
Apr-02	7.00	7.40	7.50

As seen in the table there has been a decrease in soil pH across all the 3 samples; yet the degree of pH reduction in IFS demonstration has been the maximum. It is true that in conventional farms too, a declining trend in pH value was observed. In both the conventional farms pH value did not reach the neutral level. On the other hand, neutrality of pH value was attained in April 2002 in the IFS plot possibly due to intensive application of organic input. In the conventional farms, there was building up of salt leading to alkalinity. The mean pH on the IFS plot was distinctly lower than that on conventional farms.

The hypothesis that use of organic fertilizers may have helped lower the pH of the soil close to 7.0 in the case of IFS gets support from the declining trend in pH value observed due to gradual application of organic manure in recent years in the conventional farms.

Organic matter is one of the constituents of the soil, which enhances the availability of nutrients for crop growth and development. Building up of organic matter in a soil is a slow and tedious process, but regular application of more organic manures over the years may sustain and enhance the organic carbon content in the soil. The following table provides the data on levels of organic carbon at eight observation points between 1998 and 2002 in the IFS and the two conventional farms.

Organic Carbon (%)

Year	IFS	CFS I	CFS II
Nov-98	0.54	0.65	0.60
Apr-99	0.52	0.41	0.42
Nov-99	0.93	0.71	0.58
Feb-00	0.65	0.50	0.50
Nov-00	0.93	0.75	0.89
Apr-01	0.65	0.50	0.50
Nov-01	1.04	0.62	0.85
Apr-02	1.18	0.64	0.59

It is clear that the concentration of soil organic carbon in integrated farming system has shown an increasing trend in the period of analysis, though with some fluctuations over the five year period. In the case of conventional farms, the soil organic carbon level has not shown any clear trend, but has fluctuated around 0.60 percent. With the demonstration effect of organic farming practices at IFS spreading to more farmers, one may expect a general increase in levels of organic carbon in the soils of the conventional farms in course of time. The increase in soil organic carbon level would increase the yield of crops in the long run.

The data on the microbial population in the soils of these farming systems are furnished in the following table. In the conventional farming system practised, the population of selective microorganisms namely bacteria, actinomytes and fungi was comparatively low in the IFS model. When more microorganisms are present, the soil health will be better, leading to higher production.

Microbial Population (million)

	IFS	CFS I	CFS II
Bacteria THC (x 10^5)	94	46	56
Actinomycetes CFU (x 10^4)	42	6	16
Fungi CFFU (x 10^3)	86	44	55

A comparison of microbial activities in terms of density of microbial population also shows that the IFS farm has a more healthy soil than that of CFS farms.

Economics of Returns

For the purpose of comparing overall economic performance between IFS and CFS, the approach adopted is holistic taking IFS and its components in total, though CFS had only 2 crops (paddy and black gram) per year. This is because the specific strength of IFS is its integrated and zero-waste approach whereby (a) dependence on external inputs is minimized, and (b) all internal resources, including by-products of all the components, are recycled and fully utilized within the farm. Hence a holistic assessment of the performance of IFS when comparing with CFS would be most appropriate.

The data for carrying out the comparative economics of the farm operations were collected from IFS demonstration plot and of CFS from 32 households. The highlights of results of the 5 year study are presented here.

It was observed that the IFS approach realised higher return in terms of net revenue. The average annual net revenue per acre of IFS was more than 2.5 times that of CFS. It was seen that the net annual revenue of IFS increased steadily between 1997-98 and 2001-02 whereas in the case of CFS the values fluctuated considerably. It was be noted that the year 2000-01, which saw exceptionally large net returns from black gram in CFS, if excluded from the net earnings of CFS of the other years, was at a much lower level than that of IFS.

The average earning was higher for IFS because it had integrated paddy and black gram with several other enterprises such as mushroom, fish, poultry, vegetable cultivation etc.

Another fact to be noted was that in the event of failure of any crop due to delay or heavy rainfall, other enterprises in IFS would tend to compensate, a cushion absent in conventional farming.

Year wise Overall Returns of IFS and CFS (1997 to 2002)*

	IFS				CFS			
Year	Total cost (Rs.)	Total revenue (Rs.)	Revenue Net (Rs.)	Benefit/ Cost ratio	Total cost ** (Rs.)	Total revenue (Rs.)	Revenue Net (Rs.)	Benefit/ Cost ratio
1	2	3	4	5	6	7	8	9
1997-1998	11,350.44	10,717.03	-633.41	0.94	5,581.06	8661.13	3,080.00	1.55
1998-1999	18,815.93	28,318.00	9,502.07	1.51	6,198.42	8,405.65	2,207.23	1.36
1999-2000	21,391.58	33,661.44	13,184.15	1.57	6,602.33	9,942.00	3,846.30	1.51
2000-2001	23,298.86	40,069.29	16,770.43	1.72	7,069.80	17,396.28	10,326.68	2.46
2001-2002	38,953.05	58,111.36	19,489.61	1.49	7,163.45	9,706.85	3,306.33	1.36
Mean	22,761.97	34,175.42	11,662.57	1.50	6,523.01	10,822.38	4,553.31	1.66
Standard deviation	9,056.62	15,443.68	7,007.52		653.46	3,733.20	3,281.06	
Coefficient of variation	39.79	45.19	60.09		10.02	34.50	72.06	
Percentage change between 1997-98 and 2001-02	243.19	442.23	2,976.93		28.35	12.07	7.35	

* All figures calculated for a landholding of an acre
** Includes imputed value of family labour
Note: Cost ratio is net revenue divided by cost

Comparative analyses were also carried out for determining the days of labour requirement in IFS and CFS. The following table provides data on the average annual number of person-days of employment provided by the two types of farming practice. It can be seen that the mean annual employment provided by IFS was more than twice that provided on CFS farms. The increase in the value for labour absorption in IFS farm was due to additional components brought into integration within the IFS farm. In CFS, the rate of labour absorption remained more or less constant through the years. The year 2000-01 saw an exceptionally good harvest in CFS farms which called for additional labour.

Comparison of Labour absorption in IFS and CFS (in labour days/ acre)

Year	IFS	CFS*
1997-1998	171.99	87.59
1998-1999	204.15	79.54
1999-2000	163.14	74.41
2000-2001	165.55	112.12
2001-2002	224.07	94.49
Mean	185.78	89.63
Standard deviation	27.00	14.72
Coefficient of variation	14.53	16.43
Percentage change between 1997-98 and 2001-02	30.28	7.88

* Based on the average of 32 CFS farms and compared with IFS demo plot

In the foregoing analysis, the differential performances of Integrated IFS and CFS for various crops including paddy, black gram etc in respect of input use pattern, the economics of cultivation, soil health etc were analysed. The contribution of other integrated enterprises such as fish, vegetable cultivation, mushroom, poultry etc, which led to relatively higher returns in IFS was also brought out. An examination of the rate of labour absorption in two farming systems showed that IFS applied more labour intensive techniques, absorbing relatively more the female members of the household owning the IFS farm and also, offering employment opportunities throughout the year. It emerged from the analysis that if conventional farmers were to adopt the method of IFS, they would be able to obtain higher net returns, provide greater employment and enhance soil quality and sustainability of farming in the long run.

The data sets compared were from the randomly selected CFS. Some of the comparative highlights between IFS and CFS are given below.

The cost of cultivation per acre of paddy and black gram taken together as well as of paddy by itself was higher in CFS than in IFS. IFS is a low external input farming system with no chemical fertilizers or pesticides thus reducing the cost of cultivation as compared to CFS.

The net annual revenue per acre is higher for IFS as compared to CFS: The average net annual revenues per acre for IFS and CFS and IFS are Rs. 11,662.57 and Rs. 4,553.31 respectively.

IFS provides a significantly larger quantum of annual employment of labour per acre than CFS. In our experiment, the average annual employment in IFS turned out to be 185.78 person days and that in CFS was 89.63 person days.

Improvement in soil quality was greater in the case of IFS than in the case of CFS: Soil quality has been measured in terms of three characteristics: Soil pH, percentage of organic carbon in the soil and soil porosity. Our data show that soil porosity levels are not very different as between IFS and CFS, and also that not much improvement is seen over the years either in IFS or in CFS. However with respect to both organic carbon and pH, the degree of improvement in soil health is noticeably greater in IFS than in CFS. The percentage of organic carbon doubled on the IFS farm from 0.54 in November 1998 to 1.18 in April 2002. Though there were some fluctuations across time, the trend was clearly one of increase in the percentage of organic carbon. On CFS farms, however, the percentage of organic carbon did not show any change during the period, the values in April 2002 being more or less the same as in November 1998. With regard to pH level, there was a trend of increase in the case of the CFS farms, though with some fluctuation. This indicated a decline in soil quality, alkalisation. However, in the case of IFS, the level of pH did show a declining trend in the direction of neutrality, and in April 2002, the pH was exactly 7.0. This is evidence of improved soil health in IFS as against a decline in soil health under CFS. The main reason for the increasing alkalinity of the soil on CFS farms reflected in the rise in pH levels could be the use of large amounts of chemical fertilizers. Since IFS followed organic farming practices, alkalinity reduced between 1998 and 2002 on the IFS farm appreciably.

The findings from the comparative studies are highlighted below.

- The economics of paddy and other enterprise in IFS and conventional farming revealed that IFS had relatively more number of enterprises compared to conventional farming. The mean net income in IFS at Rs. 11,663 per year was about 2.5 times that of conventional farming at Rs. 4,553 (calculated for a farm size of one acre).
- The mean paddy yield at 1,140 kg per acre was found to be lower in IFS than that of the CFS at 1,687 kg. The IFS involved exclusive application of organic manuring and avoidance of inorganic fertilizers. This led to lower yields initially, but as the organic manure got digested and absorbed by the soil, and soil fertility improved in a sustainable manner, and the capacity of the soil to absorb and retain nutrients improved with organic cultivation practices followed in IFS, the yield could be expected to improve. Besides, the quality of seeds obtained from the paddy output of IFS was considerably enhanced on account of organic farming practices. Farmers offered a good price for seeds from IFS farms. This contributed to increased net income. In short, overall productivity per acre of an IFS worked out higher than that of CFS.
- It is significant to note that bio-fencing protects IFS. The bio- fencing was done by planting trees of economic value (such as trees for fuel, fodder,

green manure among others). In the long run, there will be significant income flows from these trees and this could be sustained.

- The cost perspective showed that CFS had incurred just one third of the cost of IFS, mainly due to the fact that it had only two activities (paddy and black gram cultivation) whereas IFS integrated many different activities. The other side of this was that IFS provided more employment, and its overall income was higher.
- Enterprise-wise, only paddy and black gram can be compared as between IFS and CFS. Paddy and black gram yields were slightly lower in IFS mainly due to the application of only organic manure and other organic methods followed. Conventional farming applies both organic and chemical fertilizers. Relatively higher yield of black gram in conventional farming is attributable to the fact that chemical fertilizers retained in the soil from the first (paddy) crop are available to the next crop.
- The benefit-cost ratios of paddy and black gram showed that paddy in IFS realised higher mean benefit per rupee invested (Rs.1.61) compared to CFS (Rs.1.47). On the other hand, the benefit-cost ratio for black gram in conventional farming (2.47) was slightly higher than the return realised in IFS (2.33), for the reasons already mentioned. Moreover the conventional farming system intensively adopted black gram as a second crop. This had been practised traditionally and realised better returns. However, the application of large amounts of chemical fertilizers in conventional farm would jeopardize soil quality in the long run. The mean benefit-cost ratio in IFS, taking into account all activities, was 1.50 as against 1.66 for CFS confined to paddy and black gram. Even this marginally higher benefit-cost ratio of CFS than that of IFS was likely to be a short term phenomenon, as the IFS farm benefits from soil improvement through its organic farming methods. In the long run, improvements in soil quality and fertility in the IFS farm will enable it to reach better benefit-cost ratios.
- The level of inorganic fertilizer use has been remarkably reduced in conventional farms in the study area declining from 202.43 kg per acre to 142 kg per acre during 1997-98 to 2001-02. This implies that the farmers are slowly adopting to the organic farming concept, influenced, at least in part, by the initiatives taken by MSSRF in demonstrating IFS approach of farming.
- Another dimension of comparison is the average size of employment in IFS and conventional farming. The mean annual employment on the IFS farm is 186 days as compared to only 90 days on the CFS. In other words, per acre employment in IFS is a little over twice that on CFS.
- On the basis of assessment of 5 year-field data, soil tests were made and quality of soils between experimented integrated farming system and conventional farming system compared. It was observed that the experimented integrated farming system had neutral pH value in

consequence of massive application of farmyard manure and bio-fertilizers in the study period. In conventional farms, neutrality in pH value was not experienced during the 5 year period. However, a declining trend was observed in pH value, due to gradual application of organic inputs in recent years, plausibly a result of the demonstration effect of the IFS farm.

- It was noticed that in the IFS farm, organic carbon level in the soil increased significantly in contrast to conventional farms. Organic content of soil is the chief medium which enhances the availability of nutrients to the growth of plants. Further, it was observed from the soil testing of two farms that the soil of the experimented integrated farming system had more microbial population than the soils of conventional farming system. The chemical inputs destroyed the soil microbial population, thereby reducing soil fertility.

Comparison between Demonstrated Integrated Farming System and Replicated Integrated Farming System

Around the project site, beginning sometime during 1997 - 1998, it was observed that some of the farms started adopting IFS approach. In all about 25 IFS farms were functioning during 2001. Of these 10 farms which had completed at least one year of IFS practice were selected for an in-depth study. Since the project was ending its demonstration phase at the project area a preliminary study was conducted to determine the extent of adoption of IFS practices and the manner in which they were adopted, such as the number of enterprises integrated in their IFS farm, the average input use, and the economics of paddy and black gram cultivation.

It was observed that the farmers were in the early phase of shifting from CFS to IFS, wherein one could observe a mixture of both the practices. On one hand they had introduced the IFS components into their farm operations, such as livestock, fish, vegetables and tree crops. While they continued using agro-chemicals, they also included some of the practices advocated for organic method of cultivation, such as Farm Yard Manure, green manure, neem cake and the use of need based pesticides.

In the sample village, farmers were generally adopting conventional 'modern methods' of farming, using a lot of chemical fertilizers and pesticides. There was little use of organic fertilizers or bio-pesticides. Even the use of farmyard manure was limited. The IFS demo plot served the purpose of bringing about awareness among farmers in the area on the benefits of bio-fertilizer, integrated farming systems etc. This changed the farming practices in the sample village and facilitated 10 farmers to undertake integrated farming system methods. However, they did not completely give up chemical fertilizers nor had they fully implemented the enterprises of integrated farming systems.

The findings are highlighted below.

An analysis of this mixture of application of both organic and in-organic methods in respect of the performance of paddy and black gram was undertaken. The following table captures the economics and labour absorption of a typical one acre IFS farm.

Year	Total cost * (Rs.)	Total revenue (Rs.)	Net revenue (Rs.)	Benefit/ Cost ratio	Labour Absorption			
					Family Labour		Hired Labour	
					M	F	M	F
1	2	3	4	5	6	7	8	9
Paddy	8,603.66	11,645.00	3,041.10	1.40	9.1	4.76	16.15	29.60
Black gram	1,129.20	2,522.80	1,393.60	2.25	1.49	0.59	1.39	5.28
Fish	1,407.85	1,544.50	496.65	1.48	45.04	33.12	5.21	-
Livestock	12,359.88	20,328.75	7,968.88	1.60	46.50	111.00	-	-
Vegetables	290.00	792.14	502.14	2.99	2.43	3.29	-	-
Total					**104.56**	**152.76**	**22.75**	**34.88**

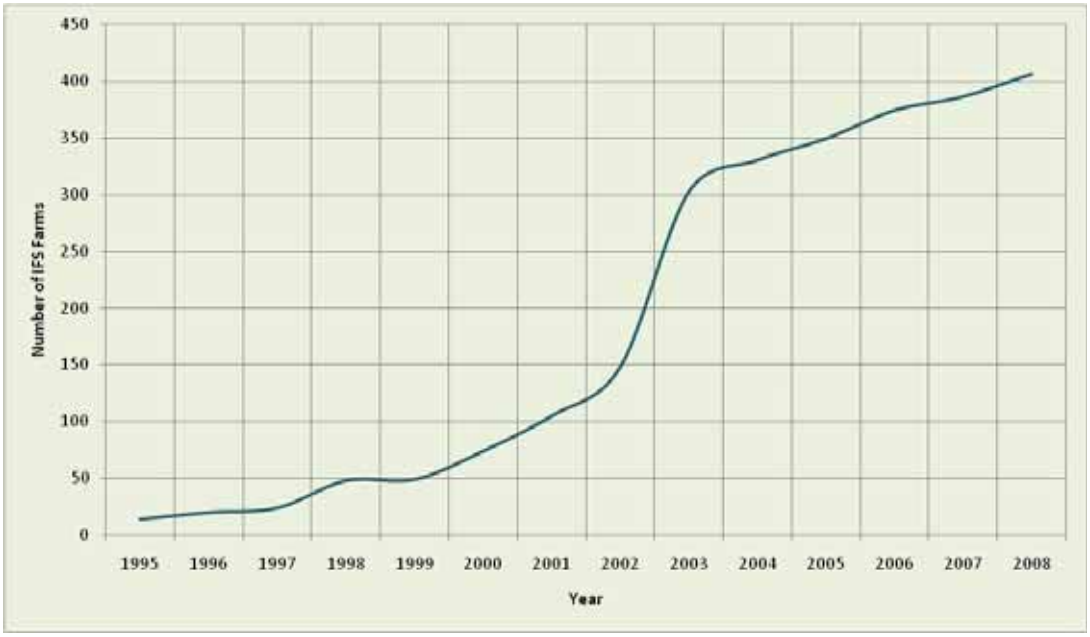
* Includes imputed value of family labour and the resources recycled

- Replicated IFS farms (RIF) have adopted several but not all of the activities in IFS.
- Overall, the mean benefit-cost ratio in 2001-02 for RIF was 1.53 as against 1.49 for IFS. In terms of benefit-cost ratio. Therefore, there was little difference between IFS and RIF. With imputed costs of family labour in RIF farms, one can conclude that RIF can be economically quite viable. They may also be expected to show improvements in future, as they learn from IFS and their own experience, and improve soil fertility through greater use of organic methods.
- From the employment perspective, the replicated IFS has been proved to be more labour intensive, offering a mean employment of 316 person days per annum. Conventional farming provides lower employment opportunities, since it encompasses fewer activities. From the viewpoint of expanding employment opportunities and minimizing waste, RIF practices based largely on IFS methods, need to be encouraged. It is true that in certain aspects, RIF are doing even better than IFS. Hence, the farmers practising conventional farming may slowly move to replicate the IFS practices to ensure sustainability.
- Mushroom, banana cultivation and poultry were found only with experimented IFS. These were integrated enterprises of IFS. The poultry included rearing of rabbit, pigeon, ducks and turkey, which yielded quite a considerable income and inputs through their by-products.
- The overall mean cost benefit ratio in all the three farming systems indicated that RIF had been quite viable. Replicating the methods of IFS, but with appropriate local variations, could contribute to a viable and sustainable agricultural system that enhanced farmers' incomes, expanded employment and used resources effectively.

Integrated Farms of Chidambaram Taluk – Adoption of Integrated Farming System by Farmers

Though the demonstration phase ended in 2002, the IFS farms have been periodically monitored. The IFS programme got a boost during 2002-2003 when the Government of Tamil Nadu started its Farm Pond scheme through the Agricultural Engineering Department, with 90% subsidy to farmers to develop a pond area of 0.30 acres. About 57% of the IFS farms documented in this report have their origin from this scheme. Current status and trends indicate that this concept has become popular in the region and there will be further boost as the Public Works Department of Tamil Nadu is now taking up schemes for implementing Irrigated Agriculture Modernisation and Water-Bodies Restoration and Management (IAMWARM) in the region. The figure below captures the trend over the years, starting from 1995, the year when the farm pond was established by the farmer.

Cumulative Figure of IFS Farms Replication



Some of the factors that contributed to the spread of IFS in this region were:

- Inter-state Cauvery dispute that surfaced during 1976 resulted in low water supply for irrigation that compounded other problems leading to reduced cropping intensity and a decline in income
- Promotion and facilitation of fresh water fish cultivation in the region by the Fishery Department as part of its Fish Farmers Development Agency (FFDA) programme starting sometime during 1980's

- The implementation of farm ponds schemes by the Agriculture Engineering Department starting 2002 with 90% subsidy

This section of the report documents the exercise undertaken by the Foundation between July and November 2008 with the following objectives:

- To determine by physical verification the number of farms that have adopted IFS approach in Chidambaram Taluk
- To determine the scale of integration within farmers' fields
- To carry out a preliminary study for understanding performance of IFS pertaining to economics, integration, resource recycling and labour absorption
- Develop a directory of farmers practising IFS

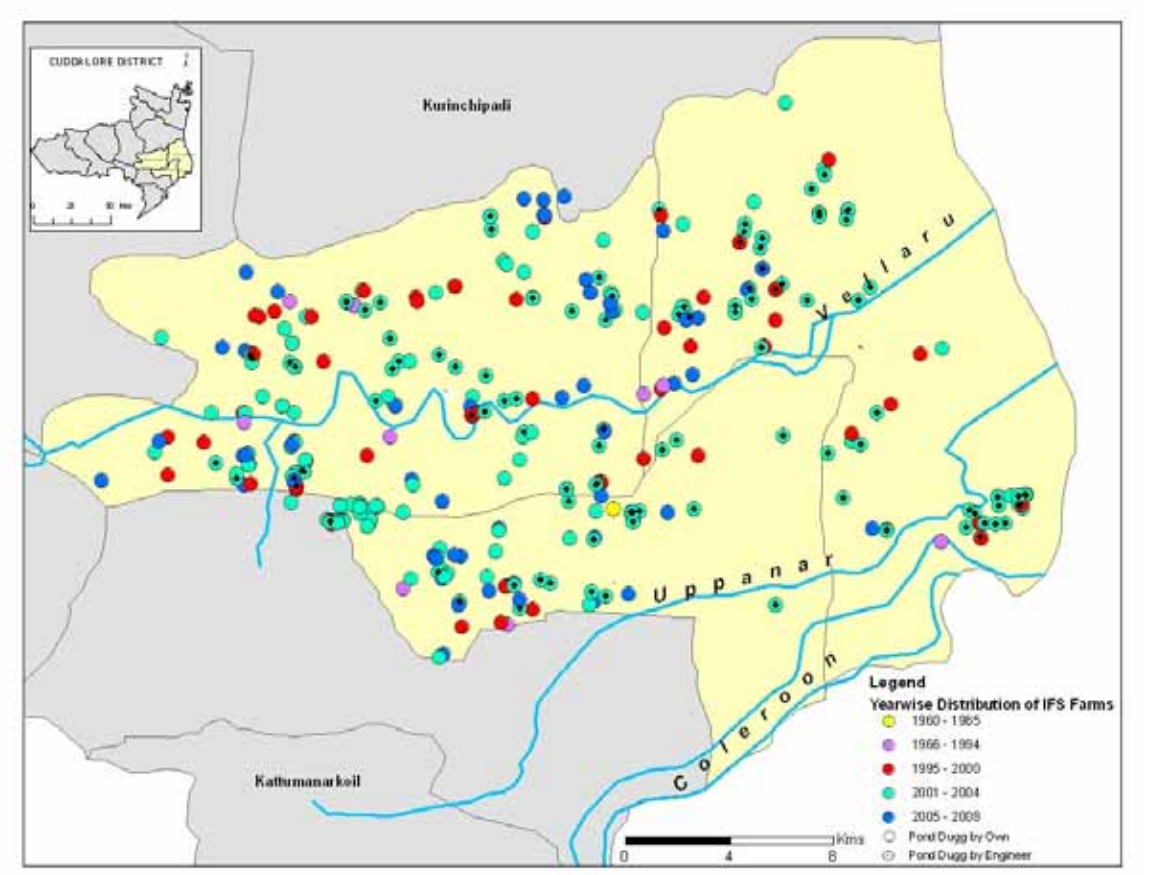
It was envisaged that such a study would help in developing appropriate strategy for scaling up of IFS integration and encourage its replication through policy advocacy at all levels. It is also proposed to federate the IFS practising farmers and create a platform for them to exchange information, access markets and for interaction with other institutions and government agencies and provide a power of scale to access to technology and credit inputs,

The methodology followed for this study is based on a questionnaire schedule in which data were collected from every farmer practising IFS. The details collected included name, address, nature of integration, land and pond size, sources of water, whether the farm pond was dug with subsidies, cropping pattern, land use pattern and year-wise replicated details etc. In addition to a general survey, 10% of the farmers surveyed were randomly selected for a detailed survey regarding production, consumption, market structures, percentage of integration, on-farm recycling and so on. The survey was undertaken between April and May 2008 for Parangipettai Block, August – October 2008 for Keerapalayam Block and November 2008 – January 2009 for Bhuvanagiri Block. Through this survey 406 IFS ponds were identified in Chidambaram Taluk. The Block wise distribution of IFS farms is given in the table below.

Distribution of Farmers Practising IFS Approach

Block	Number of IFS farmers Surveyed
Parangipettai	93
Keerapalayam	193
Bhuvanagiri	120
Total	**406**

Map showing the locations of IFS farms data



The following table shows the distribution of IFS farmers based on landholdings.

Land Size (acres)	Parangipettai	Keerapalayam	Bhuvanagiri	Total	Percentage
Marginal Farmers (below 2.5 acres)	57	89	46	192	47.3%
Small Farmers (2.51 to 5.00 acres)	14	51	36	101	24.9%
Large Farmers (above 5.01 acres)	22	53	38	113	27.8%
Total	**93**	**193**	**120**	**406**	**100.0%**

Based on the size of the land holding three representative cases are presented, one for each class, to highlight the similarities and differences in the approach adopted.

Table highlighting the comparative differences and similarities in the IFS approaches adopted by the farmers based on land holdings. The figures are given per acre for one year (2007-2008)

Particulars	Marginal Farmers	Small Farmers	Large Farmers
Gross income (Rs.)	46,370.66	31,853.00	23,918.71
Household consumption (Rs.)	5,846.15	3,648.97	3,947.74
Labour absorption (in person days, total)	245.04	103.40	121.94
Family labour absorption (in person days, total)	194.21	30.61	39.68
Resource recycling within farm and own labour inputs	46.64%	19.26%	43.30
CBR – Including resource recycling within farm and own labour inputs	2.42	1.57	2.41
CBR – Excluding resource recycling within farm and own labour inputs	4.52	1.94	3.76

The marginal farmers have a higher gross income compared to the small and large farmers. This is due to the fact that marginal farmers have higher family labour contribution in the managing of the farm. It may also be noted that the marginal farmers have a tendency to have more components of integration than the small or large farmers. The marginal farmers also depend on the farm produce for meeting their own food requirements. The Cost Benefit Ratio (CBR) shows that when total expenditure and income are taken into account the marginal and large farmers show better performance and are similar. However when resource recycling within farm and own labour inputs are excluded while calculating CBR, the marginal farmers show better performance.

Case Studies

The following case studies bring out the integration approach adopted by the farmers based on their landholding size and resources. Each of these case studies is representative of the general pattern.

The details provided below were from the survey collected during December 2008 and covered the activities of integrated farming systems, water management, integrated nutrition management, integrated pest management, resources recycling, economic efficiency and were validated with similar class of landholding farmers for accuracy in bringing out the representative nature of the case studies. The details provided in the case studies pertained to the agricultural season 2007 – 2008.

Case Study – 1 (Marginal Farmer)

Mr. S. Saravanan, aged 50 years, is a progressive farmer from P. Arunmozhidevan, Parangipettai Block, Cuddalore District. He has completed the Secondary School Leaving Certificate (SSLC). He has been cultivating his 2.32 acres of land since 1990. He lives with his wife, two sons and a daughter.

He has attended various training programmes related to integrated farming, turkey rearing, cashew cultivation and INM and IPM for paddy cultivation conducted by MSSRF, FFDA and Government departments.

Land holding details of the farmer

Land details	Total extent (acres)
Wet land	0.90
Dry land	1.02
House and Cattle shed	0.05
Fish Farm (Wet land)	0.35
Total	**2.32**

Cropping pattern followed

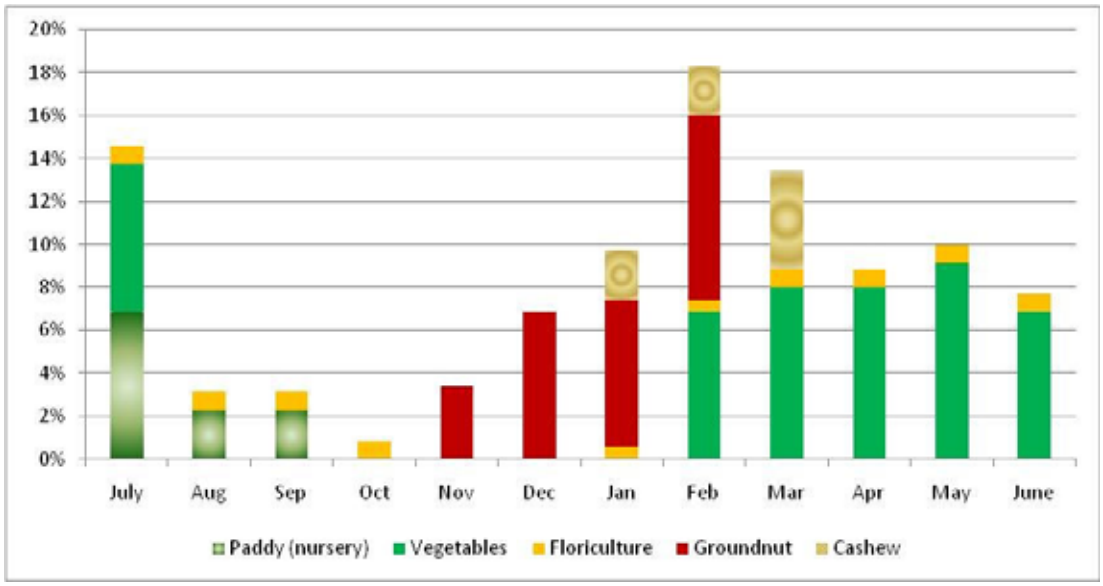
Name of the crops	Wet land (acres)	Season	Dry land (acres)	Season
Paddy	0.90	September	-	-
Black gram	0.90	January	-	-
Groundnut/Cowpea/Black gram	-	-	0.50	November
Jasmine/Crossandra	-	-	0.10	Perennial
Vegetables/Amaranthus	-	-	0.10	February – May
Coconut			Bund crop	Perennial
Pisiculture	0.35	-	-	-
Cashew	-	-	0.32	Perennial
Grass cropped area	2.15		1.02	

Water Source and Management

The water source for irrigation is from the Manampathan channel of the Sethiyathope Anaicut and the farm pond which harvests the rain water as well as stores water from the channel. While major irrigation is from the channel supply and is used mostly for paddy cultivation, the farm pond acts as a buffer and ensures the farmer an assured quantity of water to plan his farm operations. The following table gives an overview of the use of water from the farm pond.

Crop	Number of times irrigated	Total hours irrigated
Paddy nursery	8	7
Groundnut (120 days crop)	15	22.5
Vegetable crops (180 days crop)	40	40
Cashew (perennial crop)	4	8
Jasmine (perennial crop)	45	31.5

The farm ponds form an integral part of the IFS approach wherein all other components are built around it, as water forms the crucial resources. The water is rich in nutrition, due to the presence of planktons and fish which help in resource recycling. Hence, water from such ponds is used for fertigation of the crop fields. The figure below captures the relative quantity of water supplied to various crops during each month.



Generally this region is flooded by water during the rainy season. Hence, he cultivates long duration paddy variety viz., Ponmani. He starts his paddy nursery during the month end of July with enriched fish farm water with an area of 0.15 acre. Rice follows black gram is the regular practice. But unfortunately during 2007 – 2008, black gram crop failed because of unseasonal rainfall. For dry land cultivation, he depends on the water from the fish pond. Crops cultivated in the dry land are black gram with groundnut (VR2 variety) as an intercrop in dry land during November month in 0.50 acres of dry land. Vegetables, such as brinjal, tomato, amaranths and bhindi cultivation is taken up during February – July 0.10 acres, and jasmine (110 plants) in an area of 0.10 acres with the intercrop of

crossandra (200 plants). Black gram is also cultivated as an intercrop in the cashew plantation (70 trees) covering an area of 0.32 acres.

The fish pond (0.35 acres) was excavated under the farm pond scheme by the Department of Agricultural Engineering with his 10% contribution. 900 fingerlings (Indian carp, Chinese carps, mural, thelepia) are stocked during the month of September and harvested between May and June.

Different tree crops are cultivated in various places like bunds, bunds of farm pond, intercrops and so on. The age wise species are given below:

Details of trees as on July 2007

Name of the trees	No. of trees	Years
Coconut	11 (6+5)	7 + 4
Banana	20	3
Moringa	4	5
Neem	10	8
Sesbania	1	7
Teak	10	8
Thespesia	22	10
Papaya	3	2
Sapota	2	3
Mango	2	3
Citrus sp.	3 + 1	2 + 1
Nuna	3	2
Eucalyptus	14	6

Animal Husbandry

Mr. Saravanan is rearing milch animals, bullocks, turkey and poultry in a small scale, they multiplied and he sold them out.

Details of Animal Husbandry as on July 2007

Particulars	Numbers
Cows	5
Bullocks	2
Calf	1
Goat	1
Poultry	40
Turkey	56

Livestock

He purchased one cross breed Cow 10 years ago for Rs. 3,000. After that she gave birth to 5 cows and 2 bullocks; he sold 3 cows the valued of Rs. 28,000 and 2 male calves for Rs. 3,000. He has 2 cows and one female calf now. A goat for Rs. 500 was bought.

Poultry Farming

a) Turkey Rearing

He first purchased 3 sets of turkey out of which 4 were female and 2 were male for Rs. 900 in 2007 and he now has 30 turkeys.

b) Poultry Farming

Mr. Saravanan first purchased 4 country breed poultry birds in 2007 for Rs. 200 each and now he has 40 birds.

Buffalo Grass

He is cultivating Buffalo grass in the periphery of Fish farm pond.

Nutrition and Pest Management

The farmer practises conventional nutrient management practices wherein chemical fertilisers along with farm yard manure (FYM) and green leaf manure are recommended. During the year he had used super phosphate (90 kg), urea (100 kg), and potash (50 kg) as basal dosage, *Factomphos* (120 kg) was also applied during various stages of crop cultivation of paddy, groundnut, cashew and jasmine. Green leaf manure (420 kg) was also used while preparing the field for paddy. For soil enrichment he had used 4,245 kg of FYM during the year. The farmer also reported the use of neem cake (50 kg).

The farmer prepares *Panchagavya* himself, for use as growth promoter for groundnut and jasmine. For groundnut cultivation, he has applied 3% of *Panchagavya* diluted with water and sprayed five times for various stages of groundnut crop growth and for jasmine cultivation, sprayed four times every month from February to September.

The farmer prepares his own botanical pesticides by mixing 4 kg each of Nochi, Aadathoda, and Calotropis leaves along with 6 kg of neem seeds to make 3 litres of botanical pesticides. This is diluted with 52 litres of water and sprayed for paddy crop of various stages. He also prepares *Amiritha Karaisal* himself by mixing 3 litres

of cow's urine with 5 kg cow dung. He has sprayed this mixture on both groundnut and jasmine with 5% concentration three times for the two crops.

The following table explains resource-recycling feed for fish culture for eight months.

Details of feed for Integrated Fish Farming (2007-2008)

Particulars	Period	Quantity (kg)	Total (kg/batch)
Turkey droppings	Daily	1.25	300
Cow dung	Daily	3.00	720
Rice husk	Two months	100.00	100
Groundnut plants	One time	125.00	125
Buffalo grass	Weekly	40.00	320
Vegetable waste	Two times	10.00	10

Household's consumption and marketable surplus

The special feature of integrated farming systems is the provision of balanced diet to all the members of the family instead of giving one cereal. Mono-cultivation provides yield after some months, whereas integrated farming systems provide diet in various farms round the year. In addition integrated farming provides steady income through sale of various farm products. These are explained in the following table.

Particulars	Home Consumption		Marketing	
	Quantity	Amount (Rs.)	Quantity	Amount (Rs.)
Paddy (in kg)	610	5,000	1,830	18,000
Black gram (in kg)	20	700	240	8,400
Fish (in kg)	40	1,600	263	9,920
Vegetables (in kg)	60	600	412	3,172
Floriculture (in kg)	5	200	720	28,800
Coconut Leaf (in Nos.)	100	350	-	-
Coconut (in Nos.)	125	500	120	480
Coconut oil (in l)	5 l	400	-	-
Broom (in Nos.)	9	50	9	50
Cashew (in kg)	2	80	80	3,200
Groundnut (in kg)	30	825	400	11,000
Egg (in Nos.)	480	960	-	-
Chicken (in Nos.)	5	1,000	-	-
Milk (in l)	240	2,400	1,265	12,650
Crossandra (in kg)	1	100	15	1,500
Total		**14,765**		**97,172**

Labour absorption of the farm

A special feature of integrated farming systems is value addition due to employment of family members and non - farming families. One marginal farmer in average absorbed 593 person days, out of which family labour absorption was 470 person days. Moreover 342 women days were utilised during 2007-2008. Thus integrated farming systems provide sustainable livelihoods for coastal ecosystem. The table below explains crop and enterprise wise labour absorption - both family and hired labours.

Particulars	Family Labour		Hired Labour	
	Male	Female	Male	Female
Paddy	17	11	11	42
Black gram	4	10	2	2
Fish	17	4	5	0
Vegetables	15	34	0	0
Floriculture	60	60	25	0
Neem Trees	1	2	0	0
Coconut Trees	4	9	0	0
Livestock	60	90	0	0
Poultry	15	30	0	0
Groundnut	15	12	0	36
Total	**208**	**262**	**43**	**80**

Crop Calendar

Particulars	July	Aug	Sep	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	June
Paddy nursery												
FYM applied												
Main field preparation												
Land levelling												
Transplantation												
Fertilizer apply												
First weeding												
Second weeding												
Second fertilizer												
Harvest												
Fish												
Ground nut												
Jasmine												
Cashew												
Kanagambaram												
Vegetables												
Amaranthas												
Nature pest												
Panchakauya												

Resource Recycling

Resource recycling is the central theme of integrated farming systems, as it has reduced the economic burden, increased the net income, reduced purchase of inputs and enhanced the soil health and environmental quality of coastal eco system. The table below explains crop wise by product recycling with quantity and values

On Farm Resource Recycling - 2007-2008

Particulars	Paddy by product @		Vegetables #		Animal waste *		Fodder (Buffalo grass)		Groundnut $	
	Kg	Rs.	Kg	Rs.	Kg	Rs.	Kg	Rs.	Kg	Rs.
Paddy	180	100			1725	173				
Blackgram										
Fish	280	275	12	5	720	72	320	160	125	10
Vegetables					450	45				
Groundnut					1500	150				
Animal husbandry	500	500					720	360		
Jasmine					200	20				
Trees Crops					120	12				
Total	**960**	**875**	**12**	**5**	**4715**	**472**	**1040**	**520**	**125**	**10**

@ Paddy by products viz paddy straws, rice husk, chaff
# Vegetable by product is vegetable waste
* Animal waste – cow dung, urine, turkey and poultry droppings
$ Groundnut waste (plants)

Economics of Integrated Farming

Economics is also a major factor of replication of any new farming system among the farming community irrespective of farm size. Benefit cost ratio during 2007-2008 is rupees 2.41 for every one rupee invested including own inputs like labour and on - farm recycling whereas excluding own inputs a farmer gets Rs. 4.52 per rupee invested. This is explained below:

Economics of IFS

Particulars	Total cost	Total Income	Net Income	CBR	Total Cost (Excluding own inputs)	CBR
1	2	3	4	5	6	7
Paddy	7,440	23,000	15,560	3.09	2,125	4.32
Black gram	1,575	9,100	7,525	5.77	975	15.16
Groundnut	3,727	10,320	6,593	2.76	2,147	6.53
Cashew	955	3,772	2,817	3.94	400	6.79
Fish	12,550	29,000	16,450	2.31	6,000	4.42
Vegetables	712	1,330	618	1.86	312	3.32
Floriculture	7,920	15,050	7,130	1.9	6,000	7.83
Coconut trees	3,395	5,960	2,565	2.62	1,125	2.62
Livestock	7,450	11,825	4,375	1.58	2,300	2.29
Poultry	975	3,280	2,305	3.36	400	5.70
Total	**46,699**	**1,12,637**	**65,938**	**2.42**	**21,784**	**4.52**

Out of total inputs internal (ie internal to the system) amounted to 46.64 %.

Have integrated farming systems increased women drudgery or added value to women labour?

Involvement of women is more in integrated farming systems. Integrated farming systems having many more crops and enterprises, requires more labour, but each enterprise needs a small amount of labour every day. Hence family labour is necessary, it also adds value to the women labourers. The result is higher benefit cost ratio with more women labourers, e.g., livestock rearing 90 days, floriculture 60 days, vegetable cultivation 34 days.

Case Study – 2 (Small Farmer)

Mr. Devendran, 62 years old progressive farmer residing at Keel Valayamadevi, Melbhuvanagiri Block, Cuddalore District. He has passed SSLC and is cultivating 4 acres of land since 1978. He lives with his wife and four sons.

Land holding details of the farmer

Land details	Total extent (acres)
Wet land	4.00
Dry land	0.20
House, Cattle shed and Mushroom shed	0.15
Fish Farm (Wet land)	0.25
Total	**4.60**

Cropping pattern followed by the farmer

Name of the crops	Wet land (acres)	Season	Dry land (acres)	Season
Paddy	2.00	September		
Sugarcane	2.00	January		
Minor millets			0.20	Sep – Nov
Vegetables			Bund crop	July – Feb
Marigold			Bund crop	Sep – March
Coconut			Bund crop	Perennial
Banana			Bund crop	Perennial
Annual Moringa			Bund crop	One year
Mango			Bund crop	Perennial
Neem			Bund crop	Perennial
Teak			Bund crop	Perennial
Sesbania grandiflora			Bund crop	Perennial
Jack			Bund crop	Perennial
Gross cropped area	**4.00**		**0.20**	

Water Source and Management

The major water source for cultivating crops in Keel Valayamadevi village is rain water, drainage water and bore wells. The farmer fills the farm pond with water from the bore well in August, February and March. The farm pond also harvests the rain water during September and October. Irrigation for paddy and sugarcane cultivation is met by pumping water from the bore well. The farm pond water is used for vegetable and flower crop cultivation, and for tree crops.

Paddy Cultivation

Mr. Devendran has cultivated paddy (BPT) with an area of 2 acres irrigated by bore well water.

Sugarcane cultivation

He has cultivated Sugarcane with an area of 2 acres irrigated by bore well water.

Minor millets cultivation

He has cultivated minor millets with an area of 0.20 acres irrigated by Bore well water.

Integrated pond

a) Fish Rearing

Mr. Devendran excavated an integrated pond in 0.25 acres. During the month of August, he stocked fingerlings, about 900, comprising of Indian Carps and Chinese Carps with various feeding habits viz., bottom, middle and surface feeders.

b) Tree cultivation

Mr. Devendranl has cultivated different tree species in various places like bunds, bunds of integrated pond. The age wise species are given below:

Details of trees as on July 2007

Name of the trees	No. of trees	Years
Coconut	6	7
Banana	45	4
Annual Moringa	15	3
Neem	30	7
Mango	3	6
Sesbania grandiflora	1	6
Soundal	2	6
Teak	26	6
Jack	5	1

c) Marigold cultivation

He has cultivated 150 Marigold plants as bund crop since 2007.

d) Vegetable cultivation

He has cultivated vegetables on the integrated pond bunds viz., Bhindi, Brinjal, Cucurbits, green leafy vegetables, Chillies and Curry leaves, irrigated from enriched integrated pond water.

Buffalo Grass

He is cultivating Buffalo grass in the periphery of Fish farm pond.

Animal Husbandry

Mr. Devendran is rearing milch animals and poultry birds in small scale and they have multiplied and been sold out.

Details of Animal Husbandry as on July 2007

Particulars	Total
Cows	2
Poultry	8

Livestock

He purchased one cross breed Cow during the year 2000 for Rs. 7,000. After that she gave birth to 4 cows and 1 bullock. He sold 3 cows for Rs. 21,000 and 1 male calf with for Rs. 1,000. Now he is having 2 cows.

Poultry Farming

Mr. Devendran first purchased 2 Giri Raja Chicks in the beginning of 2007 for Rs. 10 and now he is having 8 birds.

Integrated pond

Because of failure of rainfall, labour problem and space for storing rain water he excavated fish farm pond by himself. By using this enriched integrated pond water he is cultivating vegetables, marigold, and tree species, fodder crops, does fish farming, animal husbandry and poultry farming.

Mushroom cultivation

He has started mushroom production in the beginning of 2008. He has produced so far 8 kg of milky mushroom and sold them for Rs. 400.

Nutrition and Pest Management

The farmer had used 10,800 kg of FYM during the year for enriching the soil. He had also applied 45 kg of neem cake for paddy cultivation. During the year, the chemical fertilizers and the total quantity were complex (700 kg), urea (550 kg), potash (350 kg). These were applied during the various stages of paddy and sugarcane cultivation. He had also applied *Monocrotophos* (1.5 litres) for controlling Brown Plant Hopper and leaf folder in paddy crop.

Household consumption and market surplus

Under the integrated farming system, the respective farmers had cultivated various crops. This system provides balanced diet to the farmer's families. In addition it provides marketable surplus for sustainable livelihood. The table here explains household consumption crop wise and enterprise wise.

Particulars	Home Consumption		Marketing	
	Quantity	Amount (Rs.)	Quantity	Amount (Rs.)
Paddy (in kg)	1,200	10,000	2,640	22,000
Sugarcane (in kg)	-	-	86,000	88,580
Fish (in kg)	30	1200	210	8,400
Vegetables (in kg)	58	500	300	980
Minor millets (in kg)	20	300	290	4,350
Coconut Leaf (in Nos.)	50	150	50	150
Coconut (in Nos.)	60	240	-	-
Coconut Oil (in l)	25	2,500	-	-
Banana (in Nos.)	12	720	53	3,200
Marigold (in kg)	-	-	40	400
Egg (in Nos.)	20	40	-	-
Milk (in l)	150	1,500	450	4,500
Total		**17,150**		**1,32,560**

Labour absorption details of the farm

The integrated farming system created 486 person days , out of which 342 person days wer hired and the rest was of family labour. The labour absorption details are tabulated below.

Particulars	Family Labour		Hire Labour	
	Male	Female	Male	Female
Paddy	34	2	36	101
Sugarcane	10	18	60	74
Fish	-	11	22	-
Vegetables	-	4	2	-
Livestock	8	22	-	-
Mushroom	2	5	-	-
Minor millets	1	3	2	6
Marigold	-	5	-	-
Total	**55**	**70**	**122**	**181**

Crop calendar for IFS

Particulars	July	Aug	Sep	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	June
Paddy nursery												
FYM applied												
Main field preparation												
Land levelling												
Transplanting												
Fertilizer apply												
First weeding												
Second weeding												
Second fertilizer												
Harvest												
Sugarcane												
Tractor ploughing												
Planting												
Basal application of fertilizers												
First weeding												
Leaf removing												
Top dressing												
Second weeding												
Irrigation												
Harvest												
Fish												
Vegetables												

Resource Recycling

Paddy, fish and vegetables and livestock are the major crop and enterprises of this farm. The details of the integration with quantity and value of recycling are given in the following table.

Particulars	Paddy by-products		Vegetables		Animal waste		Fish		Sugarcane		Fodder (Buffalo grass)	
	Kg	Rs.	Kg	Rs.	Kg	Rs.	Kg	Rs.	Kg	Rs	Kg	Rs
Paddy					19,600	1,960						
Vegetables					500	50						
Animal husbandry	7,040	7,450										
Fish	100	260	40	20	1,500	150	50	250	128	40	480	240
Coconut	300	150										
Banana												
Sugarcane												
Total	**7,440**	**7,860**	**40**	**20**	**21,600**	**2,160**	**50**	**250**	**128**	**40**	**480**	**240**

Economics of IFS

For 4.6 acre of land cultivated with the adoption of IFS concept, he gets on an average Rs. 2.63 benifit cost ration per Rupee invested including own inputs, like home labour and on farm recycling.

Particulars	Total cost	Total Income	Net Income	CBR
Paddy	15,043	32,000	16,957	2.12
Fish	5,525	9,600	4,075	1.73
Vegetables	585	1,480	895	2.52
Animal Husbandry	2,910	6,000	3,090	2.06
Sugarcane	68,370	88,580	20,210	1.29
Minor millets	1,980	4,650	2,670	2.34
Banana	850	3,920	3,070	4.61
Marigold	120	400	280	4.31
Total	**95,383**	**1,49,670**	**51,247**	**2.63**

Case Study – 3 (Large Farmer)

Mr. Palanivel (60 years) residing at K. Adoor, Keerapalayam Block, Cuddalore District is a large farmer. He has completed SSLC and is cultivating 6.20 acres since 1997. He lives with his wife, son, daughter and a grand daughter.

Land holding details of the farmer

Land details	Extent (acres)
Wet land	6.20
Dry land	0.30
House and Cattle shed	0.10
Fish Farm (Wet land)	0.25
Total	**6.85**

Cropping pattern followed by the farmer during 2007-2008

The cropping pattern of this farmer is rice fallow black gram and cultivation of various crops on the integrated fish pond. The details of the cropping pattern are tabulated as below.

Name of the crops	Wet land (acres)	Season	Dry land (acres)	Season
Paddy	6.20	September		
Blackgram	6.20	January		
Vegetables			0.20	Feb – May
Coconut			Bund crop	Perennial
Lemon			Bund crop	Perennial
Guava			Bund crop	Perennial
Arecanut			Bund crop	Perennial
Neem			Bund crop	Perennial
Banana			Bund crop	Perennial
Gross cropped area	**12.40**		**0.20**	

Water Source and Management

The major water source for cultivating crops and storing water in the farm pond is from the irrigation channel originating from Veeranam tank. During the month of September and October the fish pond is filled by canal water and rain water. The water from the farm pond supplements irrigation requirements for paddy and black gram cultivation. The bund crops, vegetables and fruit trees are irrigated manually with the water from the farm pond.

Paddy Cultivation

Mr. Palanivel has cultivated Paddy (BPT) with an area of 6.20 acres irrigated by both fish pond water and channel water.

Black gram Cultivation

He has cultivated black gram (ADT – 3) with an area of 6.20 acres after paddy cultivation with the enriched fish pond water.

Integrated pond system

Mr Palanivel has adopted integrated pond system and utilized every cubic meter of water and every centimetre of land for fish rearing inside the pond, vegetable cultivation, tree cultivation, floriculture.

a) Fish Farming

Mr. Palanivel had excavated fish pond of 0.25 acres himself during 2001. During the month of September he stocked fingerlings, about 1000 numbers, comprising Indian Carps and Chinese Carps with species of various feeding habits viz., bottom, middle and surface feeders.

b) Vegetable cultivation

He has cultivated vegetables viz., Bhindi, Brinjal, Tomato, Chillies and Cucurbits in an area of 0.20 acres (app. Bunds area) with enriched fish pond water.

c) Tree cultivation

Mr. Palainvel has cultivated different tree species in various places like bunds, bunds of farm ponds. The age wise species are given below:

Details of trees as on July 2007

Name of the trees	No. of trees	Years
Coconut	40	6
Banana	50	7
Moringa	1	2
Neem	20	7
Arecanut	10	7
Citrus Sp.	2 + 1	3
Guava	3	3
Teak	12	7
Jack	1	3

d) Flower cultivation

Mr. Palanivel has cultivated different flower crops in various places viz., bunds, backyard etc. He has used the flowers himself and also given them away to temples and relatives.

Name of the Flower crops	No. of plants	Years
Crossandra	10	2
Rose	1	2
Jasminum sp	5	3
December	3	2
Hibiscus	1	4
Nanthiyavatti	2	3

e) Buffalo Grass

He is cultivating Buffalo grass in the periphery of Fish farm pond.

Animal Husbandry

Mr. Palanivel is rearing milch animals in small scale they multiplied and were sold out.

Details of Animal Husbandry as on July 2007

Particulars	Total
Cows	3
Poultry	19
Turkey	5

Livestock

He purchased two cross breed cows before 7 years ago for Rs. 11,500. After that they gave birth to 5 cows and 2 bullocks. He sold out 2 cows for Rs. 16,000 and 2 male calves for Rs. 3,000. He has now 3 cows.

Poultry Farming

a) Turkey Rearing

In 2007 he purchased 5 turkey birds from Kerala, (2 female and 3 male) for Rs. 500.

b) Poultry Farming

Mr. Palanivel first purchased 3 Giri Raja Chicks during the beginning of 2006 for Rs. 15 and now he is having 16 birds.

Integrated farm pond

For storing canal water and rainwater for crop cultivation he excavated farm pond himself. By taking water from this farm pond he cultivated different crops. By cultivating paddy, vegetables, forest and NHM tree species, fodder crops, fish farming, animal husbandry and poultry farming, in an integrated manner he could increase employment opportunities and generate more income.

Nutrition and Pest Management

The farmer applied enriched FYM of about 20,100 kg a year for soil enrichment In addition he applied 650 kg of green leaf manure during the time of main field preparation for paddy cultivation. 40 kg of neem cake was also used for paddy cultivation. 6 kg of poultry manure was used for coconut cultivation. In addition, he applied chemical fertilizers viz., DAP (600 kg), urea (450 kg), potash (250 kg) in various dosages for various stages of paddy cultivation. During the year, he did not use any chemical pesticide for control of pests in paddy. He prepared a botanical pesticide using 8 kg of leaves from each of the following plants, Nochi, Aadathoda, Nuna and Calotropis and 10 kg of neem. The 12 litres of botanical pesticides was diluted with 468 litres of water and sprayed on paddy crop at various stages.

Household consumption and market surplus

The detail of household consumption and market surplus are explained below.

Particulars	Home Consumption		Marketing	
	Quantity	Amount (Rs.)	Quantity	Amount (Rs.)
Paddy (in kg)	900	7,500	11,300	92,500
Black gram (in kg)	40	800	350	7,000
Fish (in kg)	140	5,600	50	2,000
Vegetables (in kg)	65	636	-	-
Coconut Leaf (in Nos.)	200	600	300	900
Coconut (in Nos.)	100	300	240	720
Coconut Oil (in l)	23	2,300	-	-
Banana (in Nos.)	10	500	29	6,450
Egg (in Nos.)	720	1,440	-	-
Milk (in l)	480	4,800	1,425	14,250
Total		**24,476**		**1,23,820**

Labour absorption

Totally 756 person days were used for 6.85 acre of land cultivation during 2007-2008, out of this 246 person days were of labour. In total 563 woman days were used during 2007-2008. Crop wise labour absorption is explained in the following table.

Labour absorption of IFS

Particulars	Family Labour		Hire Labour	
	Male	Female	Male	Female
Paddy	23	2	154	290
Black gram	4	2	10	43
Fish	22	1	-	-
Vegetables	1	3	-	-
Coconut	8	-	13	-
Banana	12	3	-	-
Livestock	40	35	-	-
Poultry	-	90	-	-
Total	**110**	**136**	**177**	**333**

Crop calendar for IFS

Particulars	July	Aug	Sep	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	June
Paddy Nursery												
FYM applied												
Main field preparation												
Land Leveling												
Transplanting												
Fertilizer apply												
First Weeding												
Second Weeding												
Second Fertilizer												
Harvest												
Fish												
Blackgram												
Vegetables												
Botanical pesticides												

Resource Recycling

Paddy, fish, vegetables and livestock are the major crop and enterprises of this farm, The details of integration with quantity and value of recycling are given below:

Resources recycling -2007-2008

Particulars	Paddy by-products		Vegetables		Animal waste		Fodder (Buffalo grass)	
	Kg	**Rs.**	Kg	**Rs.**	Kg	**Rs.**	Kg	**Rs.**
Paddy	200	50						
Fish	150	260	30	30	1500	150	300	150
Vegetables	-	-	-	-	500	50		
Animal husbandry	7040	7450	--	-	-	-	800	400
Total	**7390**	**7760**	**30**	**30**	**2000**	**200**	**1100**	**550**

Economics of IFS

For 6.85 acre of land cultivated with the adoption of integrated farming systems concept, he gets on an average Rs. 2.1 benefit cost ratio per rupee invested including own inputs like home labour and on - farm recycling. Excluding own inputs, he gets Rs. 3.76 benefit cost ratio per rupee invested. The details of the economics of IFS is given in the table below.

Cost and economics of integrated farming system 2007-2008

Particulars	Total cost	Total Income	Net Income	CBR	Total Cost (Excluding own inputs)	CBR
Paddy	44,950	1,00,000	55,050	2.22	27,590	3.62
Black gram	6,650	7,800	1,150	1.17	3,150	2.47
Fish	3,400	7,600	4,200	2.23	740	10.47
Vegetables	300	636	336	2.12	50	12.72
Coconut	2,100	4,820	2,720	2.29	1,300	3.70
Banana	2,460	6,950	4,490	2.82	1,110	6.26
Total	**59,860**	**1,27,806**	**67,946**	**2.13**	**33,940**	**3.76**

Key Learning

The demonstration of the Integrated Farming System at Keelamanakudi and its subsequent adoption by the farmers in this region have been positive. Farmers, by adopting an integrated approach of farming along with livestock and fish culture, have been able to ensure the following benefits:

- Offer scope of getting income throughout the year
- Reduce dependency on external inputs
- Provide employment opportunity throughout the year
- Environmental friendly
- Reduce risks due to vagaries of Nature
- Bring about a general level of self-reliance in the community

Findings from the survey of the IFS practising farmers show that the overall trend indicated that the benefits of IFS accrued to the Small Farmers (with land holdings between 2.51 and 5.00 acres). They form 24.9% of the sample while 47.3% of the IFS practising farmers were Marginal Farmers (with land holding below 2.5 acres). Farmers with large landholdings (more than 5.01 acres) just formed 27.8% of the sample.

One can say that there is a marked shift towards IFS approach as the approach brought in the concept of water harvest and storage in farm planning, reduction on external fertilizer inputs, shift from mono- to multi-cropping, livestock and fish becoming integral components.

As indicated earlier, the success of the IFS depends upon a holistic farm approach with suitable forward and backward linkages which enable the farm to be efficient in resource utilisation. Other factors are linkages to technical support, input supply and market linkage. Unfortunately access to such extension support for marginal and small farmers in IFS approach is currently not available. The IFS practising farmers have to depend upon the existing system of extension support that is sectorial in approach, wherein inputs from various departments (such as agriculture, horticulture, veterinary and fishery) have to be sought. This limitation has resulted in the farmers practising IFS approach more in an ad-hoc approach and their own experience helping them in improving or fine-tuning the integrations in their farm.

Based on the feedback from the IFS farmers the following shortcomings were identified:

- Support for procuring improved breeds of livestock would help in enhancing dairy related activities and add to the income of the farm

- Timely availability of fish seed and fish feed
- Low cost and energy efficient device for pumping out water for irrigation
- Information on Government schemes
- Credit support from financial institutions

As the IFS practising farmers are scattered over the region it may be desirable that cluster wise IFS Farmers Associations are formed which will play a vital role in addressing the problems faced by the farmers and developing the scale of operation that will help in the farmers in negotiating or accessing various external institutions. This will also help in organising training programmes for the farmers in optimising the IFS practices in their farm.

Way Forward

The experiences gained from the Kelamanakudi experience were helpful in demonstrating a similar IFS model farm at Manitri village in Kendrapara District, Orissa in 2004. The uniqueness of this model farm is that it is managed by a group of 36 women from 3 SHGs. Similar community managed water harvesting structures around dry land IFS model farms have been developed in Pudukottai District. Over the years, there has been an acceptance of the system of farming and self replication of IFS farms can be seen in Chidambaram Taluk as well as Kendrapara District. During this year, demonstration of coastal IFS models have been established in Kaveripoompattinam, Nagapattinam District.

While the coastal IFS farms in Chidambaram Taluk still retain paddy as the central component over which other integrations are incorporated, the Kendrapara coastal IFS farms are centred on aquaculture. However, the trend anticipated in the coastal IFS system is that the aquaculture will play a dominant role. In Pudukottai, the IFS ponds are viewed as essential systems in water harvesting and recharge of aquifers.

These farms are scattered and there is no extension or institutional support for the IFS farmers. There is a tremendous potential for developing such farms to their optimal levels and through a system of networking of such farms it is possible to develop a sustainable production systems for the region. The networking can be done through information technologies (IT) services too and information and data exchanged.

Towards this end the JRD Tata Ecotechnology Centre has been working with the farmers for creating the necessary scale of operation, in disseminating information, technical support and linking with other research and financial institutions.

Some of the activities already initiated are indicated below

- Bring all the IFS farmers together as an association block wise
- Link all such associations with the line departments and financial institutions
- Developing resource persons among them for horizontal spread
- Scale up and market linkages
- Provide inputs and information and government reliefs
- Mapping of the IFS farms using geo-spatial tools
- Provide IT support

Annexure I

Questionnaire

Village	Block	District

GPS Reading (Latitude & Longitude)

Demographic Features

Name	Age (in years)	Sex	Education	Marital status	Occupation		Working on Own Farm	Income (Rs./ annum)	

Note on own farm work

Address

Land holding details (in acre)

Type of Land	Owned	Leased in	Leased out	Tenancy	Operation Holding
Wet land					
Dry land					
Poramboke					

Land allocation for different enterprises

Crop / Live stock fish pond	Area (acre)	Nos	Year of starting	Water source	Source of fund	Remarks
Paddy						
Black gram/ Green gram						
Vegetables						
Livestock						
Fish						
Others (specify…)						

Space allocation for different crops in bunds

Crop	Area (acre)	Nos	Year of starting	Water source
Coconut				
Banana				
Annual Moringa				
Neem tree				
Fodder grass				
Teak				
Other Trees				
Flowery culture				
Others (specify…)				

Area under different sources of irrigation (acre)

Crop	Tank	Canal	Spring	Groundwater
Paddy				
Black gram/ Green gram				
Vegetables				
Fish				
Bun crops/Trees				
Others (specify…)				

Input usage pattern in fish culture

Particulars	Quantity (kg/season/actual area))	Actual Expenditure (Rs.)
Purchased inputs a). Ground nut cake b). Rice husk c). Cow dung d). Lime e). Urea f). Super g). Complex i). Others (specify…)		
Non Purchased input a). Rice husk b). Cow dung c). Chaffy d). Paddy straw e). Others (specify…)		

Note: Include area of the fish pond

Is irrigation necessary for filling water in the pond? Yes / No (If yes, then proceed to the questions below)

Total number of days during which irrigation is necessary
Horsepower of the pump set (hp)
Total days of operation in one year (days)
Total hours of operation per day (hours)
Source of power for operating the pump sets:- diesel generator / electricity / both
No. of days on which the pump set operates on electricity (days/year)
No. of days in which the pump set operates on diesel (days/year)
If diesel, quantity used per day (litres)
Is electricity sufficient for irrigation? Yes/ No
Remarks regarding electricity sufficiency by the farmer:

Labour use pattern in fish culture (per season, actual figure)

Name of the Operation	Hired labour (Nos)		Family labour (Nos)		Hired labour (Rs.)		Family labour (Rs.)	
	Male	Female	Male	Female	Male	Female	Male	Female
Feeding labour								
Fish Sampling labour								
Harvesting labour								
Others (specify…)								
Total								

Note: Include labour hours per day for each operation

Labour use pattern in vegetable cultivation (per season, actual figure)

Name of the Operation	Hired labour (Nos)		Family labour (Nos)		Hired labour (Rs.)		Family labour (Rs.)	
	Male	Female	Male	Female	Male	Female	Male	Female
Total								

Note: (1) Include labour hours per day for each operation
(2) Include water consumption for vegetable cultivation

Is power consumed for irrigation? Yes / No. (if yes, get the following details).

Horsepower of the pump set (hp)
Total days of operation during normal days (days / season)
Total hours of operation per day during normal days (per day)
Total number of peak days of operation (days/season)
Total hours of operation per day during the peak days (per day)
Source of power for operating the pump sets:- diesel generator / electricity / both
No. of days on which the pump set operates on electricity (days/year)
No. of days in which the pump set operates on diesel (days/year)
If diesel, quantity used per day (litres)
Is electricity sufficient for irrigation? Yes/ No

Labour use pattern in paddy cultivation (per season, actual figure)

Paddy variety	
Extent (in acre)	

Nature of Activity	Wage Labour (in days)		Wage (in Rs.)		Family Labour (in days)		Exchange Labour (in days)		
	Male	Female	Male	Female	Male	Female	Male	Female	Children
Nursery Preparation									
Main field Preparation									
Transplantation									
Weeding I									
Weeding II									
Fertililizer application									
Post Spraying									
Harvesting and Threshing									

Note: Include labour hours per day for each operation

Cost of paddy cultivation (per acre)

Name of the Input	Quantity (kg)	Price (Rs.)
Seed (kg) -Own/Purchased		
Complex (kg)		
Urea (kg)		
Potash (kg)		
DAP (kg)		
Factompos (kg)		
Mixed Fertilizer (kg)		
Neem Cake (kg)		
Neem Oil (litre)		
Bio-Fertilizer (kg)		
Farmyard Manure (kg) Own/Purchased		
Pesticides (ml)		
Others (specify…..)		
Animal Ploughing		
Tractor Ploughing		
Tractor Threshing		
Rat Catching		
Total		

Yield (kg)	
Value (Rs.	

Note: (1) Include diesel consumption for machine use in the fields
(2) Include diesel consumption for transport of inputs and outputs
(3) Include irrigation power consumption

Is power consumed for irrigation? Yes / No (if yes).

Horsepower of the pump set(hp)
Total days of operation during normal days (days / season)
Total hours of operation per day during normal days (per day)
Total number of peak days of operation (days/season)
Total hours of operation per day during the peak days (per day)
Source of power for operating the pump sets: diesel generator / electricity / both
No. of days on which the pump set operates on electricity (days/year)
No. of days in which the pump set operates on diesel (days/year)
If diesel, quantity used per day (litres)
Is electricity sufficient for irrigation? Yes/ No
Remarks regarding electricity sufficiency by the farmer

Details of pulse cultivation (per season, actual figure)

Extent (in acre)	
Variety	

Crop	Own seed		Purchased seed	
	Quantity (Kg)	Price (Rs.)	Quantity (Kg)	Price(Rs.)
Black gram				
Green gram				

Note: (1) Give inputs used per acre
(2) Include irrigation power consumption:

Is power consumed for irrigation? Yes / No. (If yes)

Horsepower of the pump set (hp)
Total days of operation during normal days (days / season)
Total hours of operation per day during normal days (per day)
Total number of peak days of operation (days/season)
Total hours of operation per day during the peak days (per day)
Source of power for operating the pump sets:- diesel generator / electricity / both
No. of days on which the pump set operates on electricity (days/year)
No. of days in which the pump set operates on diesel (days/year)
If diesel, quantity used per day (litres)

Labour use pattern and cost of cultivation in pulses cultivation (per season, actual figure)

Name of the Operation	Hired labour (Nos)		Family labour (Nos)		Hired labour (Rs.)		Family labour (Rs.)	
	Male	Female	Male	Female	Male	Female	Male	Female
Seed sowing								
Plucking								
Threshing (Tractor)								
Cleaning								
Others								
Total								

Black gram yield (Kg)
Value (Rs.)
Green gram yield (Kg)
Value (Rs.):

Note: Include labour hours per day for each operation

Labour use pattern in livestock rearing (per year, actual figure)

Name of the Operation	Hired labour (Nos)		Family labour (Nos)		Hired labour (Rs.)		Family labour (Rs.)	
	Male	Female	Male	Female	Male	Female	Male	Female
Grazing and feeding								
Milching								
Others (specify…)								
Total								

Note: Include labour hours per day for each operation

Cost and Input use pattern in livestock rearing (per year, actual figure)

Particulars	Quantity (kg)	Price (Rs.)
Purchased inputs		
a). Ground nut cake		
b). Rice husk		
c). Commercial feed		
d). Paddy straw		
e). Others (specify…)		
Non Purchased input		
a). Rice husk		
b). Paddy straw		
c). Vegetable waste		
d). Others (specify…)		

Income from livestock (per year, actual figure)

Particulars	Quantity	Price (Rs.)
Milk (litres)		
Cow dung (kg)		
Sale of animal		
Total		

Utilization of on farm resource (per year, actual figure)

Particulars	Cow dung		Paddy straw		Rice husk		Chaffy		Others	
	Quantity (kg)	Price (Rs.)	Quantity (kg)	Price (Rs.)	Quantity (kg)	Price (Rs.)	Quantity (kg)	Price (Rs.)	Quantity (kg)	Price (Rs.)
Fish culture										
Paddy cultivation										
Vegetable cultivation										
Livestock rearing										
Others										

Water Recycling Crop wise (per season, actual figure)

Crops	No.of times discharge water per month	Hours of discharge	Power/ gravitation	Partially /Fully	Filling water (partial / fully)	No.of times
Paddy						
Pulses						
Vegetables						
Bund crops						
Others						

Extra

Details and nature of household fuel (is it met from IFS farm – biogas, cow dung, fire wood)

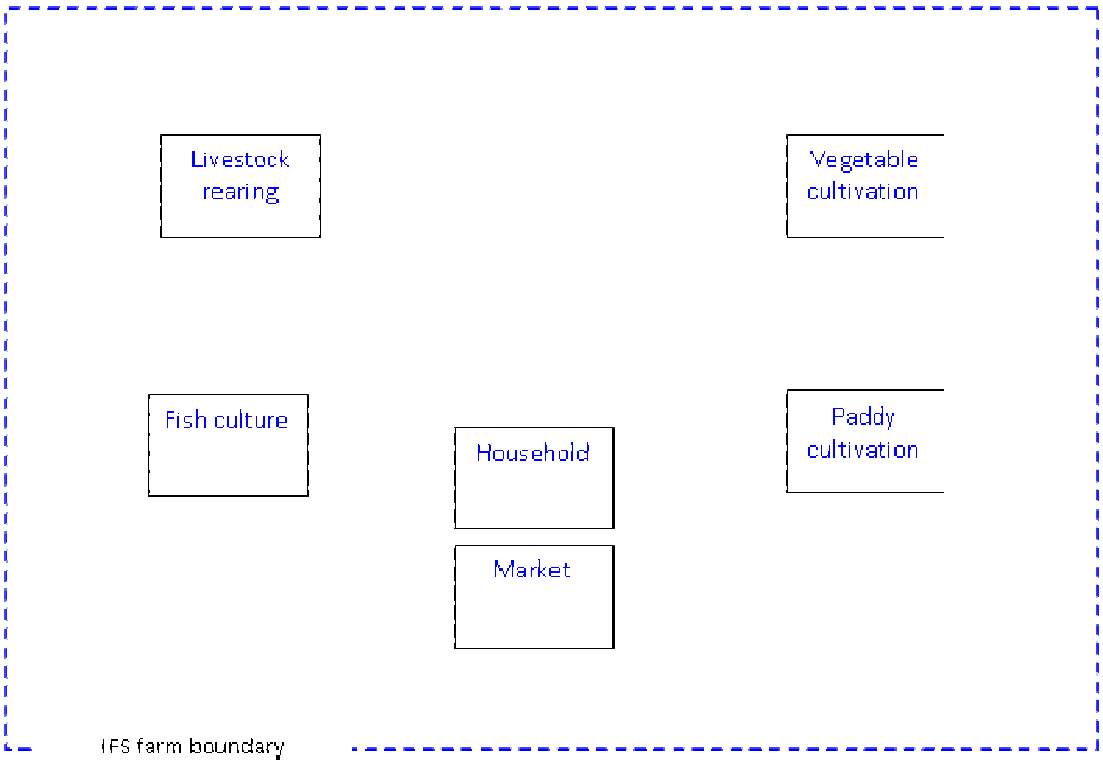
Value of on farm resource recycling (per season/year, actual figure)

Crop/ livestock	Inputs (value in Rs.)		Gross Income (Rs.)	Net Income (Rs.)		BC Ratio	
	Own	Purchased		Including own inputs	Excluding own inputs	Including own inputs	Excluding own inputs
Fish							
Paddy							
Pulse							
Livestock							
Bund crops							
Others							

Own consumption in quantity (per season/ year, actual figure)

Crop/ livestock	Own consumption (kg)	Free distribution (kg)	Sold out (kg)	Total Production (kg)
Fish				
Paddy				
Pulse				
Milk				
Vegetables				
Others				

Energy flow pattern in the IFS farm – diagrammatic sketch
(draw the transfer of inputs and outputs [give quantity] within the farm and outside the farm)



Annexure II

List of Integrated Farming System Farmers

Sr. No.	Block	Village	Name of the Farmer
1.	Bhuvanagiri	Adthivaraganatham	Arasapan, P
2.			Pandurangan, V
3.		Agraalampadi	Shanker, R
4.		Allambadi	Shankar, R
5.		Ampalpuram	Pazhanivel, K
6.			Puruchothoman, R
7.			Rasamoorthy, M
8.		Annaivari	Chinnadurai, N
9.			Ganasekaran, V
10.			Kasinathan, N
11.			Ramachandran, V
12.			Sundaram V, K
13.		Azhichikudi	Anbarasan, K
14.			Durai, S
15.			Ezhilarasan, K
16.			Pazhanivel, K
17.			Selvaraj, K
18.			Subramanian, M
19.			Veeramuthu, S
20.		B.Adhanur	Jayaselan, V
21.			Jayashankar, V
22.		B.Odaiyur	Shankar, V
23.		Bhuvanagiri	Anbu, D
24.			Maruthambal, S
25.			Uthirapathy, G
26.		Boodhavarayanpettai	Babu, K
27.		Chinnakuppam	Lakshmanan, G
28.		Erattikulam	Pandiyan, K
29.		Errumbur	Durairaj, R
30.			Iyyapan, N
31.			Nagaraj, T
32.			Nedunchezhiyan, K
33.			Pandiyan, K
34.			Pandiyan, K
35.			Pazhani, G
36.			Selvaraj, R
37.			Sundaramoorthy, E

Sr. No.	Block	Village	Name of the Farmer
38.		Jayankondan	Arivazhagan, R
39.			Kandan, K
40.			Kumaravel, S
41.		Krishnapuram	Ganesan, S
42.			Narayanan
43.			Rajendiran, K
44.			Ramasamy
45.			Sekar, G
46.			Vengadesan, R
47.		Kumudimoolai	Kaliyaperumal, M
48.			Pannerselvam, R
49.			Ramalingam, D
50.			Vaithiyanathan, D
51.			Vellaiyan, K
52.		Manjakollai	Aravanan, D
53.			Kalaichelvan, A
54.			Mahalingam, R
55.			Ravichandran, D
56.		Mathuvanai medu	Ramados, R
57.			Ramalingam, G
58.			Ramalingam, K
59.			Thiyagarajan, K
60.		Melamanakudi	Karunanithi, K
61.			Krishnasamy, R
62.			Rajendiran, K
63.			Kalyanasundaram, R
64.		Moganthrikuppam	Mariyammal, G
65.			Pichamuthu, R
66.			Selladurai, R
67.		Moongiladi	Arivazhakan, R
68.		Nallathannikulam	Manimaran, K
69.			Raja, D
70.		Nathamedu	Azhakri, D
71.			Dharmendra, S
72.			Panner, D
73.			Thanavasakan, K
74.			Thanikasalam, G
75.		Nellikollai	Selvam, K
76.		Periyakuppam	Chandrakasan, A
77.			Kunasekar, D
78.		Periyamedu	Kalimuthu, R

Sr. No.	Block	Village	Name of the Farmer
79.			Muthu, J
80.			Sarangapani, K
81.		Periyanarkunam	Amirthavalli, D
82.			Balamurali, v
83.			Ganeshamoorthy, K
84.			Kumar, M
85.			Rajavel, G
86.			Tharmalingam, C
87.		Pinnalur	Arulmurugan, N
88.			Mahesh, A
89.			Rasa, M
90.		Prasannaramapuram	Rajarathinam, C
91.		Sathapadi	Rathakrishnan, N
92.		Seeyapadi	Kolanchi, G
93.		Sethiyathope	Balu, G
94.		Sidheri	Adhimulam, A
95.			Pazhanisamy, K
96.			Rayar, V
97.		Thalaikulam	Kathirvel, P
98.			Senthil, M
99.		Tharumanallur	Elayaperumal, A
100.		Thatanodai	Ravi, P
101.		Theethanpalayam	RaguramanK, P,
102.		Therkuthittai	Mathivanan, R
103.		Uluthur	Veerappan, S
104.		V.Natham	Balakrishnan, T
105.			Chitybabu, G
106.			Ganesan, B
107.			Gunasekaran, K
108.			Jayaraman, N
109.			Lakshmi, J
110.			Radhakrishnan, G
111.			Senthil, P
112.		Vadakuthittai	Balasubramanian, K
113.			Paramaguru, R
114.			Pattusamy, R
115.			Perumal, K
116.		Vandurayanpattu	Chokalingam, K
117.			Krishnamoorthy, R
118.			Kumar, A
119.			Neethivendan, K

Sr. No.	Block	Village	Name of the Farmer
120.			Ramesh, K
121.	Keerapalayam	Akkaramangalam	Baskar, S
122.			Kandakumar, B
123.			Manavalan, P
124.			Senbagavalli, V
125.			Thangapazham, T
126.		Allure	Anbazhakan, OT
127.			Gopalakrishnan, C
128.			Krishnamoorthy
129.			Krishnamoorthy, K
130.			Manimaran, K
131.			Pichamuthu, G
132.			Sadaiyappan, V
133.			Selvakumar
134.		Baribooranantham	Kaliyaperumal, N
135.			Panjamirdham, K
136.			Rajendiran, T
137.			Ramakrishnan
138.			Sivanantham, T
139.			Subramaniyan, K
140.			Varadharajan, M
141.		Boongudi	Kunasekaran, C
142.		Boothankudi	Karunanithi, K
143.			Nadanasabapathy, R
144.			Ramakrishnan, G
145.			Ramamoorthy, P
146.			Velmurugan, R
147.		Chinnamanalmedu	Chinnaiya, R
148.		Dharasur	Dhanalakshmi, K
149.			Samiyappan, G
150.		Easanai	Dharmalingam, G
151.		Edaiyanpallchori	Jaganathan, K
152.			Padmanathan, K
153.		Ennainagaram	Rajan, V
154.			Rayar, V
155.		K.Adoor	Anantharaj, R
156.			Iyyapan, M
157.			Nadanasabesan, R
158.			Sundaramoorthy, A
159.		Kaliyamalai	Dhavaselvan, S
160.			Rasa, M

Sr. No.	Block	Village	Name of the Farmer
161.		Kannankudi	Jayabal, S
162.			Krishnamoorthy, R
163.			Manivannan, V
164.			Sabanatesan, T
165.			Selvaraj
166.			Sowri, R
167.			Varatharaj, V
168.			Vasu, R
169.		Kavalakudi	A.P Siva Kumar
170.			Elamaimani, S
171.			Ramalingam, M
172.		Keelnatham	Shanmugam, S
173.		Keerapalayam	Kesavan, A
174.			Ramadoss, R
175.			Sathyamoorthy, V
176.		Kodiyalam	Ramachandran, C
177.			Sanmugam, N
178.			Settu, V
179.			Thambiyapillai, J
180.			Vengadesanm, C
181.		Kondasamuthiram	Kavitha, K
182.		Kongarampalayam	Janagaraj, D
183.			Pandiyan, K
184.			Ponnambalam, D
185.			Ramalingam, S
186.			Selvaraj, T
187.		Koolapadi	Kunjitham, P
188.			Ramalingam, G
189.			Ramanadhan, A
190.			Ramanadhan, S
191.			Sandhalingam, K
192.			Subramaniyan, P
193.			Venkat, S
194.		Kudalaiyathur	Ramachandran, R
195.			Venkadesan, N
196.		Kumarakudi	Govindhasamy, M
197.			Meenachisundaram, D
198.			Palanivel, M
199.			Palaniyammal, G
200.			Poogazhenthi, K
201.			Velmurugan, P

Sr. No.	Block	Village	Name of the Farmer
202.		Madurandhaganallur	Thiruguanamoorthy, N
203.		Mazhavarayanallur	Dhanapal, R
204.			Mani, S
205.			Navaseelan, R
206.			Rajendran, M
207.			Selvaganapathi, R
208.		Melavanniyur	Padmavathy, M
209.			Subramaniyan, S
210.		Mudikandanallure	Jyothi, C
211.		Mugaiyur	Kabilar
212.			Matcharekan, R
213.			Narayanan, G
214.		Nandeeswaramangalam	Ramalingam, V
215.		Nankudi	Krishnan, A
216.			Selvarasu, K
217.		Nanteeswaramangalam	Selvaganapathi, T
218.			ViswanathanV
219.		Pannapattu	Arumugam, K
220.			Dharmalingam, P
221.			Jayaraman
222.			Kaliyaperumal, N
223.			Kumar, M
224.			Pallraj, P
225.			RamachandranA
226.			Ramalingam, G
227.			Selvaraj, B
228.			Thangamani, G
229.		Parathur	Jayavel, K
230.			Vivekanadan, S
231.		Perunganallure	Manimegalai, S
232.		Perur	Krishnapillai, S
233.			Subashchandrabose, S
234.		Ponavasal	Chitraarsu, S
235.			Sundramoorthy, D
236.		Ponnankovil	Nadarajan, K
237.		Poonthottam	Ealanchezhiyan, N
238.			Elavarasan, M
239.		Pudupettai	Balasundaram, G
240.			Elangovan, K
241.			Murugesan, K
242.			Ramajayam, R

Sr. No.	Block	Village	Name of the Farmer
243.			Ramalingam, R
244.			Sambamoorthy, C
245.			Senathipathy, R
246.		Ramapuram	Balusamy, R
247.		Sakankudi	Annadurai, T
248.			Kuppusamy, N
249.			Rajan, M
250.			Rathinavel, M
251.			Thiruzhanasambandam, S
252.		Sathamangalam	Elangovan, K
253.			Gopalakrishnan, E
254.		Sirukallur	Duraikannu, D
255.			Emperuman, B
256.			Adhimoolam, V
257.			Arivazhagan
258.			Ramu, A
259.		Sozhatharam	Ramalingam, S
260.			Shesalam, AP
261.			Thangasamy, P
262.		Thandakarankuppam	Balamurugan, M
263.		Thathempettai	Anna Ramalingam
264.			Ranganathan, G
265.		Thenpathi	Arivazhagan, N
266.			Baskar, G
267.			Ramalingam, A
268.			Ravichandran, R
269.		Therkuviruthanganallur	Nadarajan, R
270.		Thirupaninatham	Sundramoorthy, C
271.		Thorapadi	Kabilar, D
272.			Sivaraman, P
273.		Thusiramedu	Dhavamani, V
274.			Thirupathy, K
275.		Vadaharirajapuram	Sabanayakam, P
276.		Vadakkupalaiyam	Udhirapathy, D
277.		Vadapakkam	Asokan, G
278.			Chandrasekaran, T
279.			Gajendiran, M
280.			Kannadasan, L
281.			Karunanithi, M
282.			Kumar, K
283.			Kumarasamy, T

Sr. No.	Block	Village	Name of the Farmer
284.			Madhivanan, K
285.			Manimaran
286.			MurugananthamM
287.			Narayanamoorthy, N
288.			Paramasivam, A
289.			Raja, K
290.			Rajendiran, G
291.			Rajendiran, P
292.			Ramesh, H
293.			Ravichandran, T
294.			Sekar, R
295.			Sekar, R
296.			Sellamuthu, A
297.			Selvarasu, R
298.			Senthilvel, S
299.			Thamilselvan, S
300.			Thirumaran, T
301.		Valachakkadu	Nagendiran, K
302.		Vallkaramedu	Sezhian, V
303.		Vattathur	Anandhan, S
304.			Baskaran, R
305.			Elaiyaraja, P
306.			Ramesh, K
307.		Vazhaikkollai	Balasubramaniyan, R
308.			Muthu(viz)Kabilan, K
309.			Ramachandran, S
310.			Sekar, M,
311.			Vetri, J
312.		Villagam	Kaliyaperumal, N
313.			Madhiyazhagan, K
314.	Parangipettai	Ariyakosti	Paramasivam, Kumaravel
315.			Paramasivam, Kumaravel
316.		B.Mutlur P.O.	Abdulrasak, Samsudeen
317.			Paramasivam, Ayyaru
318.			Paramasivam, Ayyaru
319.			Radhakrishnan, Kaliyaperumal
320.			Vijayakumar, Kothandaraman
321.		Bhuvanagiri P.O	Balachandran, Krishnamoorthy
322.		Chinakomatti	Chandramohan, R
323.		Chithlapadi P.O.	Sunder, Seduraman
324.		Keelaperambai	Gothandapani, R

Sr. No.	Block	Village	Name of the Farmer
325.		Kodikalnagar	Mugamathukani, N
326.		Kodipallam P.O.	Ansari, Alli
327.			Ismail, Pavagani
328.			Ismail, Pavagani
329.			Pugari & Sivakumar, Nadarajan
330.		Kothattai P.O.	Appavau, Sundaram
331.			Kanagaraj, V
332.			Mari, Ranganathan
333.			Masilamani, Rathina Padaiyachi
334.			Puruzhoyhuman/Puruchothuman, Subramaniyan
335.			Rayar, Rathinasamy
336.			Saravanan, A Parimalanathan
337.			Vengadasen, Sangu
338.		Kottapulichavadi	Marimuthu, Ramaya
339.			Sundaramoorthy, Ramalingam
340.		Kovilampoondi P.O.	Elangovan, Nadesan
341.			Nambirajan, Mani
342.		Kuriyamangalam	Subramaniyan, P
343.		Kuriyamangalam P.O.	Kamaraj, Dr. AK Nadarajan
344.			Mohan, Kuppusamy
345.			Ramanujam, Ganapathy
346.			Selvaraj, Murgu
347.			Sunder, Ramakrishnan
348.			Vinoth, Kandasamy
349.		Manikollai P.O.	Kaliyamoorthy, Velautham
350.			Ramachandran, Ranganathan
351.			Rasa
352.			Umapathy, Muthaiyan
353.		Nanchaimagathu Vazhikai P.O.	Deivegan, Veerappan (Babu)
354.			Pichamoorthy, RI
355.		Narkandankudi P.O.	Karunanithi, Chandran
356.			Ramasamy, Chandran
357.			Seker, Athimola Padaiyachi
358.			Kulasekaran, Saminathan
359.			Nagapillai, K
360.			Rajalingam, Raguraman
361.		Periyakomatti	Arulmurugan, G
362.		Pichavaram	Jayasanker, V
363.			Sivasankaran, R 1
364.			Sivasankaran, R 2
365.		Pichavaram P.O.	Devendhiran, Kunjithapatham

Sr. No.	Block	Village	Name of the Farmer
366.			Devendhiran, Kunjithapatham
367.			Krishnamoorthy, Venugopal
368.			Kumaravadivel
369.			Lakshumanan, Muguthan
370.			Ramayan, Apparaj
371.			Shanmuga Madaliyar, Ramalingam
372.			Sundaram, Chinnapa Mudaliyar
373.			Suresh, Jaganathan
374.			Vedharathinam, R
375.		Pinnathur P.O.	Asupathy, R
376.			Marimuthu, Dharmalingam
377.			Murugasen, Apparu
378.		Ponnanthittu	Balu, Chandrakesen
379.			Manikandan, Chidambaranathan
380.		Puduchathram P.O.	Chandran, MR
381.			Ramalingam, VC
382.		Sathapadi P.O.	Padamavathy, Ranganathan
383.		Singarakuppem	Mani Bai, K
384.			Kaliyamoorthy, Veerapan
385.			Kumar, Ramalingam Mudaliyar
386.			Kumar, Ramalingam Mudaliyar
387.			Nadarajan, Ramalinga Mudaliyar
388.			Rajaram, Chinnasamy
389.			Rathinavel Subramani, Ramalinga Mudaliyar
390.			Sridhar, Vadamalai
391.		Thachakadu P.O.	Babu, Vathiyanathan
392.			Dhanagopal, Arumugam
393.			Govindarajalu, Santhanam A
394.			Kannan, Periyasamy
395.			Kumar, Sakaravarthy
396.			Mohan, Pattusamy
397.			Mudivannan, Muthukrishnan
398.			Murugan, Thirunaukarasu
399.			Saravanan, Singaravel
400.		Thambiku Nallan Pattinam	Veerasamy, PP
401.		Thillaividagan P.O.	Nadarajan, Ganapathy
402.			Radhakrishnan, Kupusamy Pillai
403.			Rajavelu, PM
404.		Uthamasozhamangalam	Ganesan, Marimuthu
405.			Kalliyapan, Govindasamy
406.		Vailamur	Senbulingam, S

Annexure III

List of Tamil Nadu Government State Schemes Suitable for Farmers Practising Integrated Farming System

The following are the some of the schemes taken from the Policy Notes respective departments for the year 2008 - 09, Government of Tamil Nadu and are relevant for promoting Integrated Farming System among the farmers.

DEPARTMENT OF AGRICULTURE

Supply of quality seeds

Seeds with genetic and physical purity standards certainly help to increase the productivity. The Government is very keen in making available good quality seeds of preferred varieties in time to the farmers through Public and Private outlets.

As per Government of India norms, the desirable Seed Replacement Rate (SRR) is 25% for self-pollinated crops, 35% for cross-pollinated crops and 100% for hybrids.

Regarding Maize, Sunflower and Cotton, hybrid seeds are supplied to cover 100%

SRR. In respect of Oilseeds and Pulses, special efforts will be taken to increase the SRR to more than 25% through public private partnership. The Department of Agriculture is directly involved in producing seeds by getting breeder seeds from TNAU. The foundation seeds are produced in 43 Government farms which are further multiplied as Certified seeds in farmer's holdings. The Private Seed producing companies are also organizing seed farms in the farmer's holdings. The seed farms organized both by the Department as well as Private seed producers are registered with the Seed Certification Department to ensure quality of seeds. The certifiedseeds produced by the Department are distributedthrough 379 main Agricultural Extension Centresand 501 sub Centres and the seeds produced by Private companies are sold through 5,313 No. of seed retail outlets.

Restoration of Soil Health and Management

The organic matter content in most of the soils of Tamil Nadu is low and widespread deficiency of micronutrients is also noticed all over the State. Hence the Government endeavors to distribute Soil Health Card to all the farm holdings to adopt the practice of application of Macro and Micro Nutrients based on the Soil Test report. With this view, new Soil Testing Labs have been established during 2007-08 in the districts of Thiruvallur, Villupuram, Thiruvannamalai, Namakkal, Krishnagiri, Perambalur, Karur, Nagapattinam, Thiruvarur, Virudhunagar and Ariyalur districts. All the districts have been provided with Soil Testing Laboratories to accelerate the work of distribution of Soil Health Card. More sophisticated equipment namely Atomic Absorption Spectro Photo Meter is also made available in all the Labs for analysis of micronutrients. Under National Agricultural Development Programme, it is proposed to establish 224 Nos. of Agri clinics with mini Soil Testing facilities at block level so that the farmers could easily access and get the soil tested.

Production and distribution of Green Manure Seeds

To rejuvenate the practice of cultivating Green Manure crops to increase the organic content of the soil and 250 MTs of Green Manure seeds are produced and distributed at 25% subsidy at a cost of Rs.50 lakhs.

Composting of Farm waste through Pleurotus

This scheme is promoted by distributing kits at free of cost, each containing one kg of pleurotus, five kgs of urea and a leaflet containing technical information at a cost of Rs.120 per kit. 5,000 kits at a cost of Rs.6.00 lakhs have been distributed.

Vermi Compost production

The scheme is implemented to conduct demonstration and training to farmers. 122 demonstrations have been conducted and 6,100 farmers have been trained at an outlay of Rs.4.71 lakhs.

Integrated Nutrient Management practices

The scheme promotes the use of biofertilizers like Rhizobium, Azospyrillum and Phosphobacterium. The biofertilizers packets are produced in six Biofertlizer Production Centres located at Cuddalore, Ramanathapuram, Salem, Kudumiyanmalai, Sakkottai and Trichy and distributed through Agricultural Extension Centres. During 2007-08, 79.25 lakhs packets have been produced and 74 lakh packets have been distributed till February 2008 as against the programme of 80 lakh packets.

Most of the soils are deficit in *Micro Nutrient* content and the farmers are advocated to apply Micro Nutrient based on the soil test recommendation and also based on the tract specific recommendation of the Tamil Nadu Agricultural University. The Micro Nutrient Production Centre at Kudumiyanmalai is producing 1,400 metric Tonnes of Micro Nutrient Mixtures of 14 types for different crops annually. The Micro Nutrient Mixtures are distributed through the Agricultural Extension Centres.

The Government is taking efforts to distribute *Soil Health Cards* to all the 80 lakhs farm holdings in a phased manner. In order to distribute Soil Health Cards in a comparatively shorter period of time, 11 new labs established during 2007-08 at a cost of Rs.0.77 crores. Establishment of 224 Agri Clinics with Mini Soil Testing Lab at a cost of Rs.7.16 Crores and replacing of 13 Mobile Soil Testing Labs by new vans and strengthening of existing Soil Testing Laboratory at a cost of Rs.3.40 crores is contemplated under National Agricultural Development Programme.

4,000 acres of *problem soils are reclaimed* every year in the districts of Nagapattinam, Tiruvarur, Vellore, Kancheepuram, Tiruvallur, Tiruvannamalai, Salem and Namakkal districts@ of 500 acres per district. Gypsum and Zinc Sulphate are supplied at 50% subsidy and Rs.1,000/- per acre is extended as assistance to provide drainage facilities.

Plant Protection

Protecting the crops from pests and diseases is vital to get potential productivity of crops. Constant monitoring of pests and diseases through pest surveillance and adoption of Integrated Pest Management (IPM) technologies have brought down the pesticide consumption to a considerable extent. The IPM concept is being promoted through Farmers' Field School wherein season long training has been extended to the farmers to understand and adopt the technology.

Pesticide Testing Laboratory

To ensure supply of quality pesticide to the farmers, 9 Pesticide Testing Laboratories are functioning at Kancheepuram, Cuddalore, Salem,
Coimbatore, Erode, Thanjavur, Trichy, Madurai and Thoothukudi with an annual analyzing capacity of14,700 samples. During 2007-08 six new Pesticide Testing Laboratories are established at Vellore, Dharmapuri, Nagapattinam, Theni, Sivaganga and Tirunelveli at a cost of Rs.300 lakhs.

National agricultural insurance scheme (provision of 50 per cent premium subsidy to non-loanee and loanee farmers

Crop Yield Competition

Crop Yield Competitions are conducted at the State level as well as at the district level to motivate the farmers to optimize crop yield through adoption of advanced scientific techniques in crops like paddy, groundnut, cholam, cumbu, greengram and blackgram.

Tamil Nadu Women in Agri Business and Extension (TANWABE)

This scheme is programmed for the empowerment of Farm Women socially, economically and technically by way of capacity building in farm and non-farm activities.

The following schemes are supported by the Central Government

Macro Management Mode

The Macro Management Mode scheme is under implementation since the year 2000 and the expenses is shared by Government of India and State Government on 90:10 ratio. The various programmes implemented under Macro Management Mode Scheme are as follows.

Cereals Development Programme

This programme aimed at to increase the productivity of rice with an intervention of distribution of quality seed supply, SRI technology demonstrations and farmers' training on cluster basis, Integrated Pest Management through Farmers' field school and publicity.

Farmers' Interest Groups

The group based extension plays a major role in dissemination of latest technologies to the farmers and paves way for bottom up approach in planning and implementation of the scheme. So far 2,400 Farmer's Interest Groups have been formed for various crops including rained crops. These groups generate demand for new technologies for adoption in the village level besides, input requirement, information on market intelligence by following the participatory approaches.

Integrated scheme for Oilseeds, Pulses, Oilpalm and Maize (ISOPOM)

From the year 2004-05 Government of India have launched an integrated scheme of Oilseeds, Pulses, Oilpalm and Maize by integrating different programmes such as Oilseeds Production Programme (OPP), National Pulses Development Programme (NPDP), Oilpalm Development Programme (OPDP) and Accelerated Maize Development Programme (AMDP) to provide flexibility and focussed approach for implementation of the programme. The expenditure is shared between Government of India and State at 75:25 basis.

Under this scheme, essential inputs like Seeds, Biofertilizers, Gypsum, Biopesticide,

Plant Protection equipments are provided at subsidised rate to encourage farmers to adopt latest technologies to increase the production in Oilseeds, Pulses, Oilpalm and Maize.

Oilpalm

To increase the oil production by cultivation of oilpalm, five entrepreneurs have signed a Memorandum of Understanding with Government to establish Oil Crushing Unit in the districts of Villupuram, Tirunelveli, Theni, Thoothukudi and Vellore. During 2007-08, Oilpalm has been cultivated in an extent of 1300 hectares upto February 2008. During 2008-09 this crop will be cultivated in an extent of 5000 hectares.

Coconut Development Board Schemes (CDB)

Coconut Development Board scheme aims at improving productivity of coconut and to promote coconut based industries in Tamil Nadu through area expansion and technologies adoption. Subsidies are extended for establishment of private coconut nurseries, management of diseased palms and laying out demonstrations besides improving the soil status through organic manure units.

Seed Village Scheme

Seed is the vital input in Agriculture, which decides the production and productivity of crops. Major efforts have been taken in the supply of quality seeds to the farmers. The Government and private seed companies are contributing substantially in supply of quality seeds. However, the supply of quality seeds is not adequate to meet requirement especially under Pulses / Oil seeds.

Hence the farmers were trained on scientific method of seed production so as to improve quality ofseeds produced by them in achieving 100% seed requirement. Hence Government of India have introduced a 'Seed Village Scheme' during 2006-07 with an aim to improve the quality of farmer saved seeds.

Under this Scheme, Foundation/Certified seed of Paddy, Oilseeds, Pulses are distributed with 50% subsidy to the farmers besides training.

DEPARTMENT OF AGRICULTURAL ENGINEERING

Machinery support to farmers (State Scheme)

The Agricultural Engineering Department hires out bull dozers, tractors and combine harvesters to the farmers as per Government approved economic hire charges and execute Land Development works. Besides, Agricultural Engineering Department is engaged in reclamation of

waste lands to make them fit for cultivation. At present, 91 bull dozers, tractors and 4 combine harvesters are available in the Agricultural Engineering Department.

Demonstration of agricultural machinery and implements (Central Sector Scheme)

With a view to popularise improved agricultural machinery among the farming community, demonstration of newly developed agricultural equipments and machinery is taken up in the farmer's fields.

Training to farmers in handling and maintenance of Agricultural Machinery / Implements (Central Sector Scheme)

Various levels of manpower engaged in agriculture are imparted training on new technology components of agricultural machinery and implements to increase productivity, production and income of the farmers.

Scheme for replacing old pumpsets with new pumpsets (State Scheme)

With an aim of saving electricity, subsidy assistance is provided to farmers for replacing their old inefficient pump sets with new pumpsets and also for renewal of electrical accessories. Under this scheme, for replacing old pumpsets below 5 HP, subsidy of Rs.3500/- or 50% of the cost of the new pumpset whichever is less is given to SC/ST farmers and Rs.2500/- or 25% of the cost of the new pumpset whichever is less is given to other farmers. For replacing old pumpsets with 5 HP and above, subsidy of Rs.6000/- or 50% of the cost of the new pumpset whichever is less is given to SC/ST farmers and Rs.5000/- or 25% of the cost of the new pumpset whichever is less is given to other farmers. For renewal of electrical accessories and cost of panel, subsidy of Rs.1500/- or 50% of the cost of the installation whichever is less is given to all farmers.

Perarignar Anna Centenary Dairy Scheme for Rural Women (PACDSRW)

To increase the milk production in Tamil Nadu as well as to increase income of the Milk Producers, a new scheme called "Perarignar Anna Centenary Dairy Scheme for Rural Women" will be implemented. Under the scheme 10,000 cross bred milch animals will be provided to rural women self help groups at a cost of Rs.22.00 crore for a period of 2 years through Tamil Nadu Co-operative Milk Producers' Federation Limited which will
benefit 5,000 women in 200 villages.

It is proposed to create a welfare fund named "Peraringnar Anna Centenary Milk Producers' Welfare Fund" for the benifit of Milk Pouring Members from this financial year. The Milk Pouring Members have to pay Re.1/- per month for the fund and matching fund will be shared and paid by the MPCS and the District Unions. The fund will be utilized to help the Milk Pouring Members and their families during the time of dislocation in milk supplies to the Societies owing to fatal accidents, hospitalization of the members, disability and also expenses towards marriage of the member's daughter, education expenses of their children.

Construction of Fish Farm in own land

20% subsidy to fish farmers who construct fish pond in their own patta land. Maximum subsidy limited to Rs.40,000/- per ha. For Scheduled Caste and Scheduled Tribe 25% subsidy. Maximum subsidy limited to Rs.50,000/- per hectare.

Renovation of Tanks

20% subsidy to renovation of tanks. Maximum subsidy limited to Rs.12,000/- per hectare extended to fish farmers. For Scheduled Caste and Scheduled Tribe 25% subsidy. Maximum subsidy limited to Rs.15,000/- per hectare.

Fish culture input subsidy (to fingerlings and fish seed etc.)

20% maximum limited to Rs.6,000. For Scheduled Caste and Scheduled Tribe 25% subsidy. Maximum subsidy limited to Rs.7,500.

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