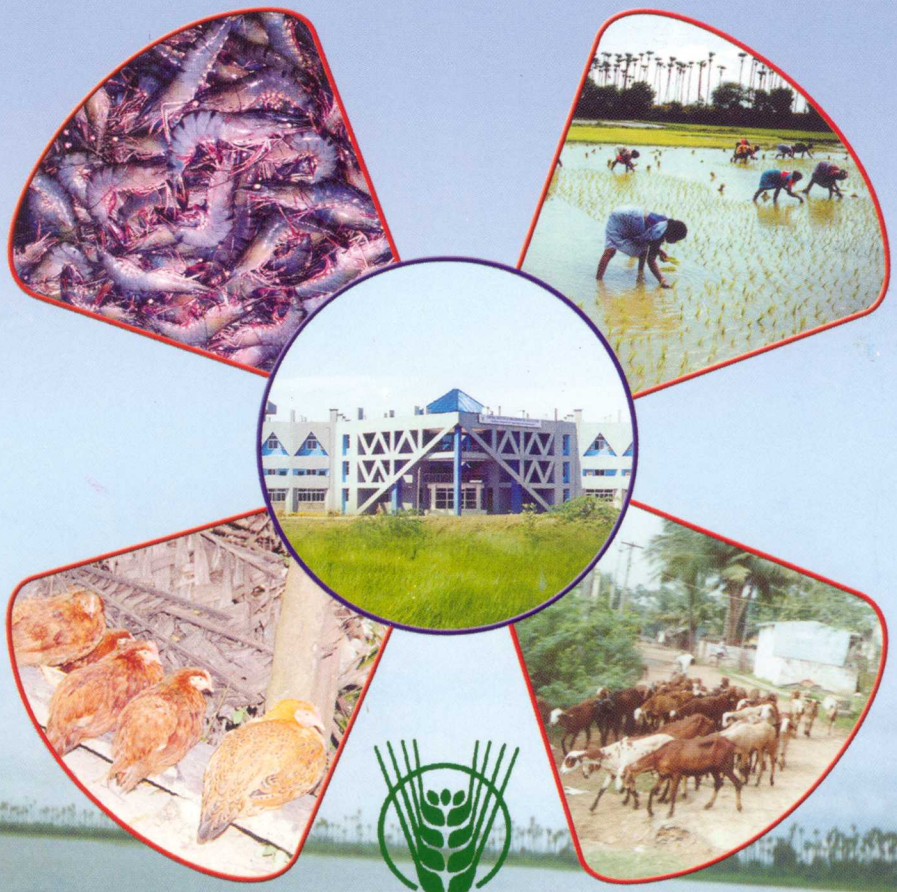
COASTAL AGRO-ECOSYSTEM ANALYSIS USING PARTICIPATORY RURAL APPRAISAL TECHNIQUES



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COASTAL AGRO-ECOSYSTEM ANALYSIS USING PARTICIPATORY RURAL APPRAISAL TECHNIQUES

NATIONAL AGRICULTURAL TECHNOLOGY PROJECT

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MESSAGE

" When you are in doubt or when the self becomes too much with you apply the following test. Recall the face of the poorest and the weakest man you have seen and ask yourself, if the step you contemplate is going to be of any use to him? Will he gain anything about it? Will it restore him to a control over his own life and destiny? In other words will it lead to swaraj for the hungry and starving millions? Then you will find your doubts and yourself melting away."

- M.K.Gandhi

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FOREWORD

On-station research is generally focussed towards finding out solutions to the production problems of farmers. This is a complex matter encompassing not only the technical aspects but also the socio-cultural, economic and managerial issues. Farmers are seldom valued as partners in progress. Extension system must take the lead in forging fruitful partnership for research prioritization as well as generation, validation, refinement and dissemination of technologies developed in the research laboratories to the fields for the benefit of farmers. The participatory technology transfer has been identified as a unique tool for greater interaction between scientists/researchers and farmers.

Indian Council of Agricultural Research has conceptualised the Institution Village Linkage Programme (IVLP), as an effective mechanism to translate the laboratory-oriented findings into the field. The Central Institute of Brackishwater Aquaculture (CIBA), Chennai formulated "Technology Assessment and Refinement in Coastal Agro-ecosystem" as an on-farm/field extension programme, funded by National Agricultural Technology Project (NATP).

Agro-ecosystem analysis using participatory rural appraisal techniques was carried out in Kattur village of Tiruvallur District by a multi-disciplinary team of scientists of CIBA. The team identified and prioritized the farmers' problems and prepared the action plan which will generate need-based technologies suited to local conditions on the basis of assessment of farmers' needs for different socio-economic domains. I congratulate Shri. K. Ponnusamy, Scientist and Principal Investigator of NATP-IVLP project, Dr. I.S. Azad, Senior Scientist, Dr. T. Ravisankar, Dr. M. Jayanthi, Scientists (Senior Scale), Dr. K. Ambasankar and Dr. M. Kumaran, Scientists for their effort in bringing out this bulletin for the benefit of farmers, planners, scientists and extension agents.

Chennai - 28.
27-03-2003

MATHEW ABRAHAM
Director

CONTENTS

I. INTRODUCTION

India has the largest formal agricultural research and extension systems. They are complex, both in terms of institutional arrangement and organizational management. The strategies of technology generation and dissemination have been top-down and centrist (Biggs, 1989). Agricultural extension in India has undergone several transformations since independence. The focus of extension reveals a steady progression towards technology transfer within the policy framework of food security. A significant development was the Training and Visit (T & V) extension management system in the mid seventies. However, there has been a growing recognition that though T & V approach has made an important contribution to agricultural development, it needs to be overhauled in meeting the technology requirements of farmer with reference to location-specific and socio-economic *milieu* in which they live and cultivate (Reddy, 2001). It has been recognized that the agricultural technology development and dissemination systems have to be reviewed allowing for greater location-specificity in programmes, secure greater farmer participation and strengthening linkage between research, extension and the end users. This requires major changes in attitude, approach and the role of researchers and extensionists ought to focus on demand-driven, location-specific and farmer-first paradigm (Chambers and Ghildyal 1985; Chambers, *et al.*, 1989).

Improved agricultural technologies, even though sound by technical standards, are of limited value if they can not be adopted due to their unsuitability to a particular agro-climatic and socio-economic situation. Inadequacy of the traditional discipline-oriented research strategies to solve the complex problems of small resource farmers working in less favourable natural environment had led to the evolution of a more holistic and systemic approach (Raman and Balaguru, 1992). Keeping this in view, the Indian Council of Agricultural Research (ICAR) has evolved a novel programme named Institution Village Linkage Programme (IVLP) for Technology Assessment and Refinement (TAR) formulated by its research institutes and state agricultural universities. The IVLP focus is on problem-based, system-oriented, multidisciplinary approaches capable of generating technologies that are profitable, sustainable, low risk and equitable through farmer-participatory research methodology. It will provide strong support both in terms of methodology and technology requirements to the farming community as well as serve as a feed back mechanism for further research.

The IVLP project also aims to fulfill the technological needs of farming systems in varied micro-farming situations and addresses the issues related to biophysical and socio-economic factors of identified micro-farming situations. Further, it provides an opportunity to work with the farmers as equal partners for validation of the technology

in respect of stability, replicability, cost effectiveness, social acceptance and sustainability. Appropriate technologies involving crop, trees, livestock, soil and water management techniques in an integrated farming system mode are expected to be developed under this programme.

2. Objectives

- To introduce technological interventions with emphasis on stability and sustainability along with productivity and profitability taking into account environmental issues in well-endowed and small production systems.
- To introduce and integrate appropriate technologies to increase the productivity with marketed surplus in commercial and off-farm production systems.
- To facilitate adoption of appropriate technologies for removal of drudgery, increased efficiency and higher income for farm women and appropriate post-harvest technologies for conservation and on-farm value-addition of agricultural products.
- To monitor socio-economic impact of the technological interventions for different production systems.
- To identify extrapolation domains for new technology modules based on environmental characterization at meso and mega levels.

3. Importance of Agro-Eco System Analysis

The agro-ecosystem analysis of the village using Participatory Rural Appraisal (PRA) techniques is the first step towards launching the programme. It provides information on resource availability, production practices and interaction within and amongst various resources and enterprises on spatial and temporal basis and throws light on the system properties, namely productivity, sustainability, stability and equitability.

4. Institution Village Linkage Programme (IVLP) of CIBA

The Central Institute of Brackishwater Aquaculture (CIBA) Chennai, Tamil Nadu, was identified as one of the centers for implementing the TAR-IVLP, under the coastal agro-ecosystem. A multidisciplinary core team was constituted for project implementation.

The IVLP Core Team

Shri. K. Ponnusamy, Scientist (Agricultural Extension), Principal Investigator.

Dr. I.S. Azad, Senior Scientist (Fish & Fishery science), Co-Investigator.

Dr. T. Ravisankar, Scientist (Senior scale) (Agricultural Economics), Co- Investigator.

Dr. K. Ambasankar, Scientist (Animal Nutrition), Co-Investigator (On study leave w.e.f. 29.10.2001).

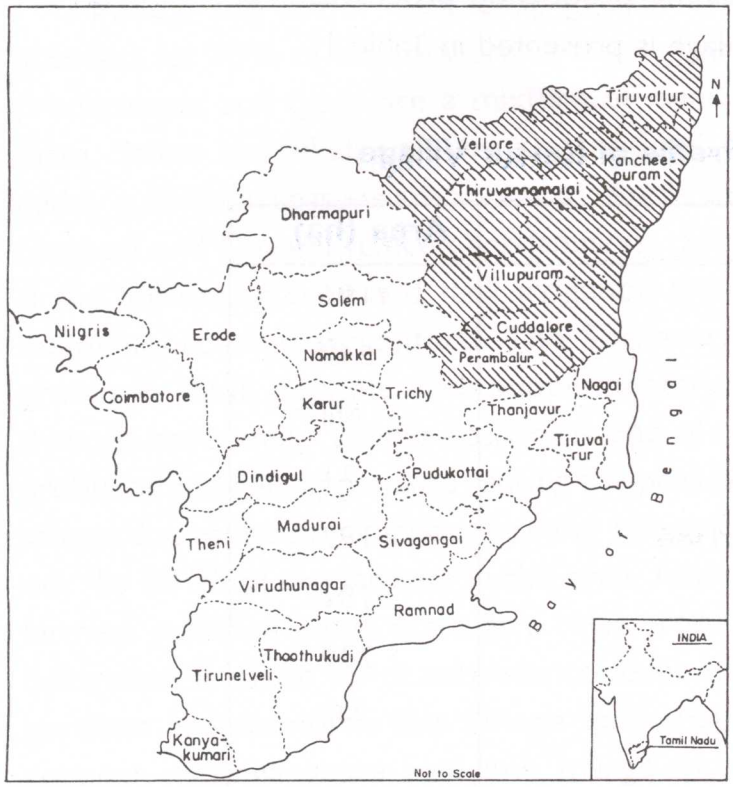
Dr. (Mrs.) M. Jayanthi, Scientist (Senior scale) (Agricultural Structures and Process Engineering), Co- Investigator (From 22.05.2002).

Dr. M. Kumaran, Scientist (Agricultural Extension), Co-Investigator.

4.1 Selection of Village

Kattur village situated 55 km north of Chennai in Minjur block of Ponneri taluk in Tiruvallur district of Tamil Nadu was selected by the team for carrying out the IVLP (Map 1 & 2). It represents a coastal agro-ecosystem with diverse production systems *viz*., aquaculture, arable farming and livestock farming. It is well connected with the neighbouring blocks and taluks with necessary transport and communication facilities. The aquaculture, agriculture and livestock production systems of Kattur village present a "not too optimistic" situation. As the per capita cultivated land is low, farmers practice small production systems with low external inputs. The major crops cultivated are paddy, green gram, chillies and coconut. Aquaculture of shrimp in this area suffers with various constraints resulting in poor yields. The farm families are dependent on on-farm and off-farm activities. The productivity and income levels are often unstable. Livestock (cows, buffaloes, sheep, goat) and poultry form an integral part of the traditional farming system of this area.

Map 1. North-Eastern Agro-Climatic Zone of Tamil Nadu



Map 2. IVLP implementation village - Kattur in Tiruvallur district, Tamil Nadu

Micro-level studies are necessary for understanding the constraints, which affect the production processes. The agro-profile of Kattur village is presented in Table 1.

Table 1. Agro Profile of Kattur Village

Category	Area (ha)
Total geographical area	1196
Cultivated area	547
Forest area	Nil
Uncultivable waste land	21
Land for non- agricultural use	197
Permanent pastures	182
Current fallows	239
Other fallows	Nil
Crops	
(a) Rice (Samba)	522
(b) Rice (Sornavari)	35
(c) Green gram	5
(d) Vegetables	3
(e) Orchard	5
(f) Shrimp	85
No. of households	870
Livestock population (No.)	1830

Source: Govt. of Tamil Nadu, Taluk office, Ponneri, Tiruvallur district (2000-2001).

4.2 Arable farming system

Paddy, the major field crop grown in this area accounts for 90% of the total arable farming system. The predominant soil types are a mixture of sand, clay and loam. Saline and alkali soils are also noticed. The main paddy cultivation seasons are Sornavari (April-May), Samba (August) and Navarai (December-January). Samba paddy is the life-saving crop and tank irrigation system is the major source for agriculture. The Sornavari paddy is grown in small pockets with supplementary irrigation through bore well. Labour scarcity is one of the major problems and gets aggravated during the peak agricultural season due to the simultaneous farming operations carried out by 80 % of the farmers in this area. About 30 % of farmers cultivate green gram as a relay crop. Vegetable cultivation is taken up at subsistence level. Homestead gardens are found in this village comprising mainly coconut, moringa, guava, acid lime, mango and papaya.

4.3 Animal based production system

The main livestock enterprise is dairy farming with cows and buffaloes. These are predominantly local breeds with low-milk yielding potential and maintained on locally available fodder and forage. Since the non-availability of labour is the prime constraint, livestock husbandry is not opted as the main enterprise by most of the farmers. The resource-poor farmers are not in a position to maintain any kind of improved livestock due to their lower economic status. However, most of the marginal and small farmers are having 2-3 goats, which are sold during periods of financial crisis. Poultry keeping is mainly taken as a backyard

venture. Small scale duckery is carried out by few farmers and the productivity is found to be low, especially in summer as they are fed with the chaff of paddy grains only.

4.4 Aquaculture

Kattur village is blessed with both inland and brackishwater resources. Tanks and ponds form the inland water resources. However, scientific fish farming is not carried out in the inland waters. The Buckingham Canal is the major brackishwater source for extensive and semi-intensive shrimp farming and mud crab farming. Monoculture of the tiger shrimp *Penaeus monodon* was largely followed. A few enterprising farmers have taken up fattening of mud crab (*Scylla tranquebarica*) on a small scale.

4.5 Rapport building

Rapport building with the villagers of Kattur was done through interpersonal interaction and group discussion supported by key informants. It involved meetings and discussions with a wide cross-section of the village community through Participatory Rural Appraisal (PRA) and participation in village events. In order to build a durable relationship with all sections of the village community, the project team committed itself to work with the people to collect baseline information on social and farm systems, identify and prioritize local problems and carry out the necessary PRA techniques. A variety of PRA techniques such as group and individual interviews, mapping of local resources, matrix ranking, transect walks, trend analysis, preparation of pie and bar diagrams and seasonalities were worked out with the active participation of the farmers.

5.0 Agro-Eco System Analysis (AESA)

AESA is one of the main methods for analysing problems related to the overall development and finding out the possible solutions. The concept is simple and basic involving a minimum set of assumptions acceptable to all the disciplines of agriculture and rural development. The properties of the agro-ecosystem *viz.*, productivity, stability, sustainability and acceptability were studied utilizing the information gained through application of PRA techniques. Further, this analysis will help in identifying micro-farming situations and problems faced by them, problem-prioritization, problem-cause relationship, identification of intervention points and development of interventions and modules for different socio-economic and natural resource conditions. Table 2 gives the items of AESA and the relevant PRA technique used.

Table 2. Methods and Techniques of Agro-Eco System Analysis (AESA)

S.No.	STEPS INVOLVED	PRA TOOL USED
1	Characterization of production systems/ micro-farming situations	Agro-eco system analysis (AESA) through Participatory Learning & Action (PLA) tools (space analysis/mapping/ modelling / transect)
2	Inventory of technologies being followed by the farmers and identifying technology gaps through farmers' practice	Technology mapping
3	Understanding variations with respect to time in various properties of agro-ecosystem analysis	Time analysis

S.No.	STEPS INVOLVED	PRA TOOL USED
4	Identifying the problems of different production systems and prioritisation	Matrix / problem ranking
5	Problem cause analysis	Flow analysis / problem tree
6	Locating the technology alternatives available at SAUs / ICAR institutes and deciding the alternatives for testing through discussion with target groups	Adoption of improved methodologies to suit the location-specific needs
7	Preparation of action plan	Decision analysis
8	Implementation of the project by designing suitable modules for the intervention	Conducting On Farm Trial / Verification Trial
9	Assessment of technological interventions as per the objectives of the project	Agronomical / statistical / economical and farmer's perspectives
10	Evaluation of technologies and identifying the needs for refinement	Rural peoples' knowledge
11	Repetition of steps from 7-10.	
12	Evaluation of technologies for stability, sustainability, productivity and equitability in different production system	Agronomical / Statistical / Economical / Social parameters
13	Impact analysis of refined technologies	Economical and Social parameters
14	Extrapolation of technologies to sustain production systems under irrigated and rain-fed agro-ecosystems	Application of extension methods

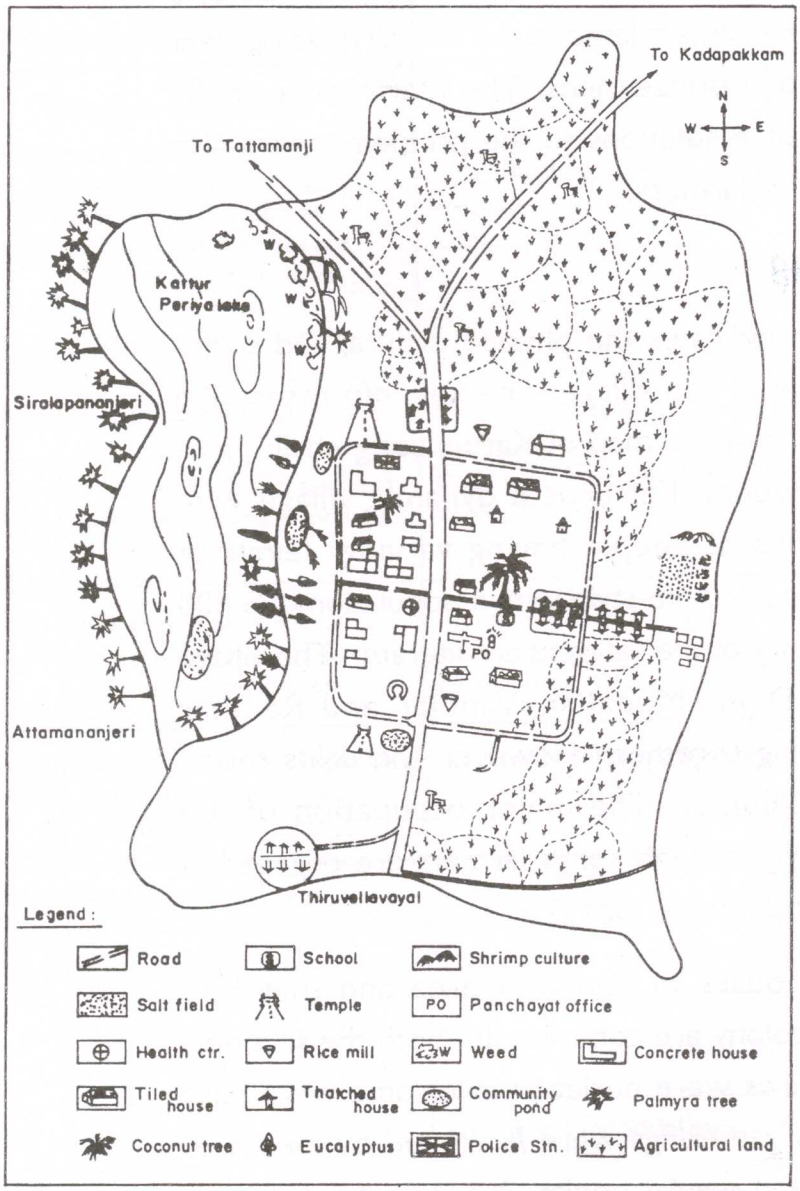
Participatory planning is a PRA tool, used to identify various problems in the village and the means through which they can be addressed. By this process, farmers were able to identify the problems related to the overall development of the village and prioritize them. The informations on the causes and possible solutions to the problems were also solicited from the farmers.

5.1 Social map

Social map indicates the physico-cultural and socio-economic profile of the village. The key informants and villagers drew the social map of Kattur using chalk piece and rangoli powders. Kattur is a dynamic village with different sections of people having varying levels of education, income and life-style with a population of 5,800 of which a majority of the villagers are literate. The village comprised of Dalit, Mudaliar, Vanniar and Reddiar communities living together. However, the dalits reside in a separate colony. The major occupation of the villagers is farming, though some farmers are engaged in petty business and private jobs (Fig. 1).

Terraced houses in non-dalit area and thatched houses in dalit colony are common. In both the sections, most of the families were nuclear, while some were joint families. Social gatherings were facilitated by means of temple festivals and regular poojas. A community hall with facilities for reading newspapers and magazines was also available. Education for the children is provided by two

Fig. 1 Social map of Kattur village



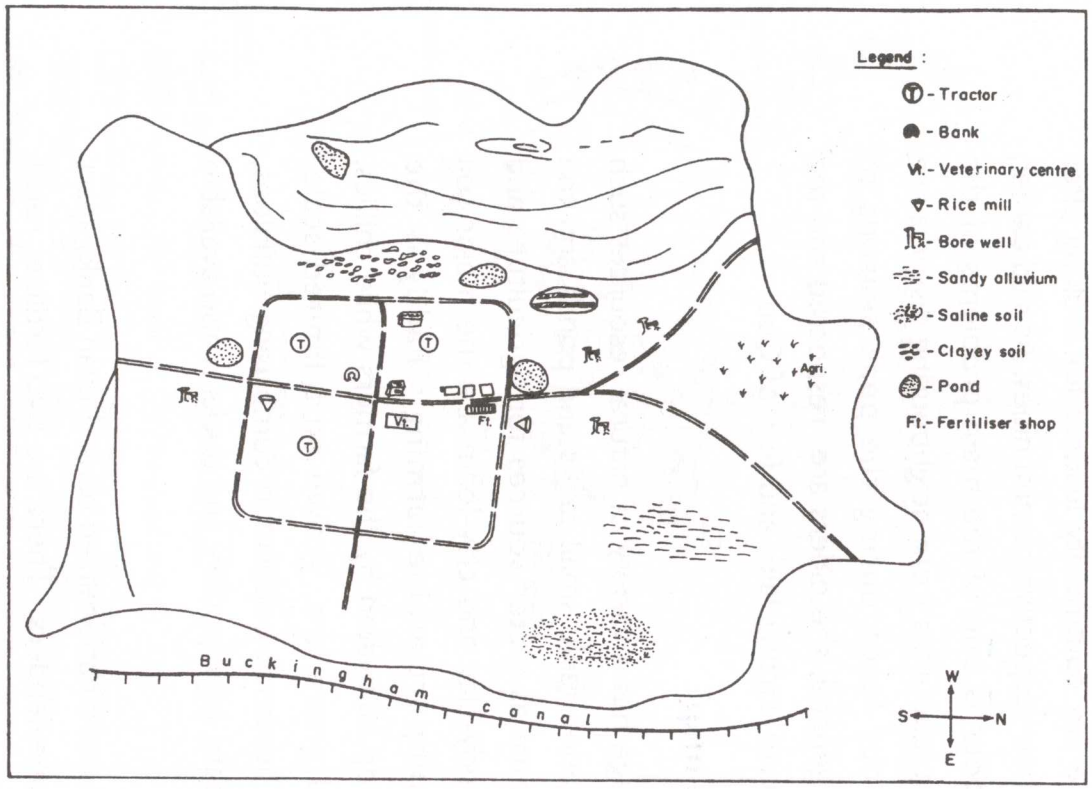
primary schools in each section of the community and a high school is located between the two sections. One youth club took care of the recreational and other social activities of the villagers. In addition to the village panchayat, there are community leaders for looking after the welfare of their respective communities. As said earlier, shortage of labour is one of the main problems of the village. Migrant labourers from neighbouring districts are the major labour force during the peak seasons of agriculture. In general, the elders are respected and the village people have strong faith and fear of God.

5.2 Resource map

Kattur village has a variety of natural resources such as a major irrigation tank, small tanks and ponds and the Buckingham Canal as water sources for agriculture and aquaculture. Sandy-clay and clay-loam are the major soil types which support arable farming. Paddy is the predominant crop cultivated by the farmers while chillies, vegetables and grams are grown on a limited scale. A considerable livestock population comprising buffaloes, cows, sheep, goats, pigs, poultry and ducks is also available (Fig. 2).

The village has a nationalized bank (Indian Bank) apart from private moneylenders. There are two fertilizer retail shops, three rice mills, one veterinary dispensary, one primary health centre, twenty-seven tractors, fourteen oil engines, twenty-two electrical motors and twenty-five bore-wells as supporting resources. The village has good

Fig. 2 Resource map of Kattur village



transport and communication facilities, which help the farmers to carry out their activities easily.

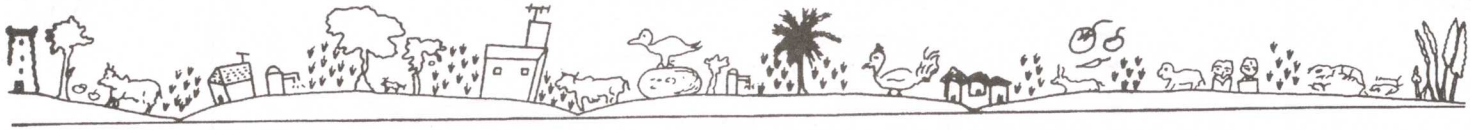
5.3 Village transect

The core implementation team of the project undertook three general transect walks across Kattur village with the aid of the local key informants, based on which a general transect map (Fig. 3) was prepared. The topography of the village is gently sloping towards the east. Paddy is the major crop and coconut, mango, tamarind and neem are the major trees. Tanks are the major sources of irrigation. The livestock components are cows, buffaloes, sheep, goats, poultry and ducks. The major problems observed were labour shortage, pest attacks, water scarcity and stray-cattle menace. Relay cropping, freshwater aquaculture, integrated farming, balanced fertilizer application, integrated pest management, dairy farming, availability of good quality seed and feed for shrimp farming are the major activities and opportunities available at the village.

5.4 Time analysis-Timeline

To understand the history of the Kattur village, a time line was prepared (Table 3) with the active participation of the villagers. A team of experts facilitated the villagers to bring out the history of village events and various developmental activities initiated within the village in chronological order. A chronicle of events that had taken place in the village related to agriculture and other developmental activities was prepared. The information was triangulated with other sources.

Fig. 3 Transect of Kattur village



Particulars	Tank irrigated upland	Irrigated upland (tanks & bore wells)	Coastal land with problematic soils
Soil type	Clay	Sandy clay & clay alluvium	Saline / clay
Land use	Houses, tanks, temple, paddy, coconut, sapota, lime, tamarind, etc.	House, prosopis, weeds, paddy, crop, pond	Ponds, forest, salt fields, aquaculture
Crops	Paddy, chillies, tomato, brinjal, kitchen garden, flowers	Paddy	Paddy, chillies, brinjal, tomato, shrimps, crabs, kitchen garden, flowers
Topography	Gentle slope towards eastern side	Gentle slope towards eastern side	Gentle slope towards eastern side
Trees	Palmyrah, coconut, tamarind, neem, banana, etc.	Coconut, acacia, eucalyptus, thespesia, etc.	Coconut, acacia, eucalyptus, palmyrah, neem, etc.
Livestock	Buffalo, duck, sheep, poultry, cow, goats, fish, etc.	Buffalo, bulls, duck, sheep, goat, cow, fish, poultry, etc.	Buffalo, cows, heifer, sheep, shrimp, crab, fish, etc.
Problems	Labour, pest & diseases, finance, lack of technical knowledge, stray cattle menace, etc.	Labour, pest attach, salinity, bore well, stray cattle menace, lack of technical knowledge, poor cooperation, etc.	Poaching, wild animal, lack of good quality seed & feed, soil & water quality, etc.
Opportunities	Introduction of short duration paddy variety, IPM, INM, bund crop, fodder and pasture, backyard poultry, dairy, goatery, etc.	Soil amendments, IPM, INM, rice fallow pulse, training, labour saving implements, dairy farming, weedicide, etc.	Availability of improved seed and feed, backyard poultry, alternative employment generation, value addition of fishes, etc.

Table 3. Timeline of Kattur village

Year	Event
1920	Casuarina cultivation
1930	Primary school
1949	Radio
1950	Cycle
1950	Rice-mill
1957	Electricity
1960	Dam construction
1960	Panchayat
1960	High school
1961	Motorcycle
1962	Primary Agricultural Co-op. Society
1962	Borewell and oil engine
1963	Tractor
1963	Iron plough
1964	Bus
1965	Post Office
1965	First Degree holder
1965	Fertilizers applied
1965	Metallic Road
1987	White ponni variety introduced (Ruling variety), *Azospirillum* applied
1987	First Artificial Insemination performed
1995	Out break of white spot virus disease in shrimp
1997	Cable TV
1997	Police station
1999	Mobile Phone

5.5 Trend analysis

A declining trend of rainfall in recent years was reported by farmers (Fig. 4). The tanks in the village were drying up faster than usual. There was a flood in 1992. The villagers also felt that the water table is receding. Farmers also complained about the increasing incidence of crop pests and diseases. Now a days, farmers were resorting to borewell irrigation for paddy. The area under aquaculture increased upto 1993 and thereafter it stagnated. The paddy yield/acre has increased from <1.0 tonnes in 1975 to 1.5 t in 1995. Fluctuating levels in shrimp production were observed. The cattle population has also decreased over a period of time due to shortage of fodder, migration of people to cities, etc. The scarcity of agricultural labour was reported by many farmers in recent times (Fig. 5).

5.6 Seasonalities

Seasonal information on rainfall, cropping patterns, labour shortage, grain and milk yield, etc., were provided by the farmers (Fig. 6, 7 & 8). Rainfall was generally high during October to December with a peak in November. The scarcity for labour was noticed in July-August, August-September, November-December and January-February, which coincides with peak agricultural operations like preparatory cultivation, transplanting, inter-cultural operations and harvesting of paddy, respectively.

Two shrimp crops were harvested in a year *viz.*, summer (March-June) and winter, (September-January). The increase in salinity of water during the summer months affected shrimp culture. Paddy was cultivated in two seasons *viz.*, Sornavari (April-June) and Samba (August-January). Green gram was cultivated as a rice-fallow crop during January to March.

Fig.4 Rainfall hyetograph 1993 - 2000 of Kattur village

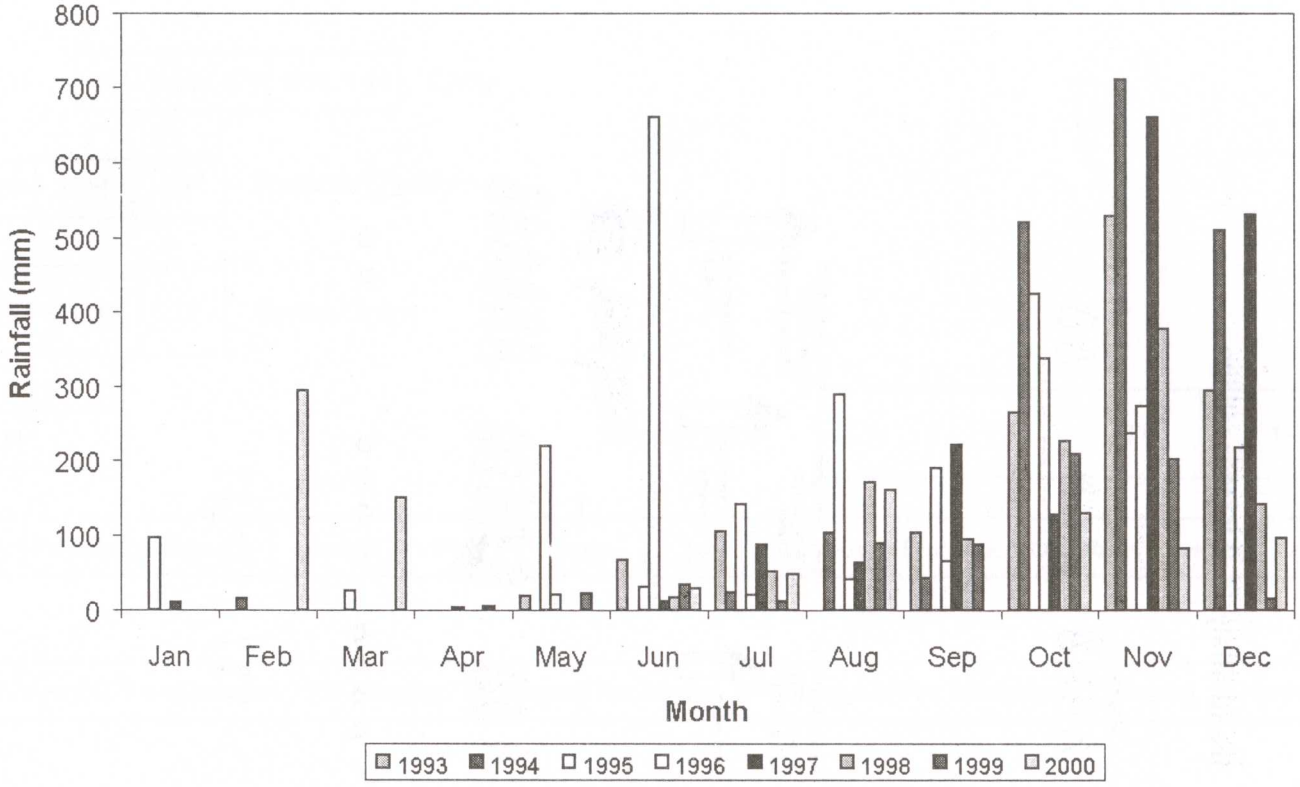


Fig. 5 Trend analysis of Kattur village

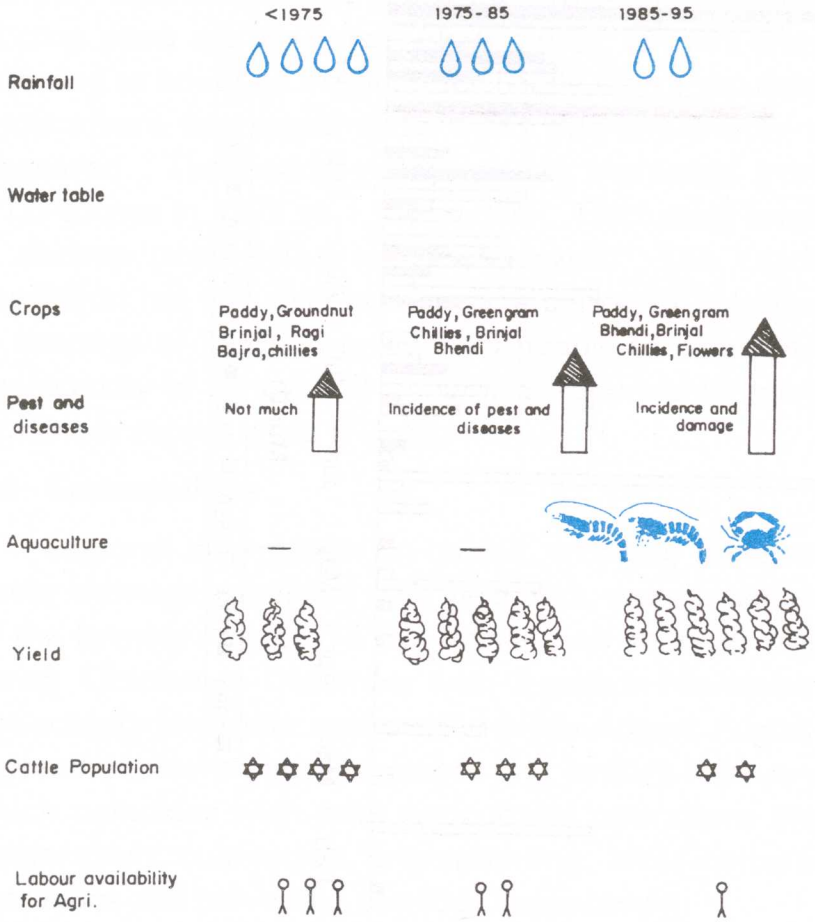
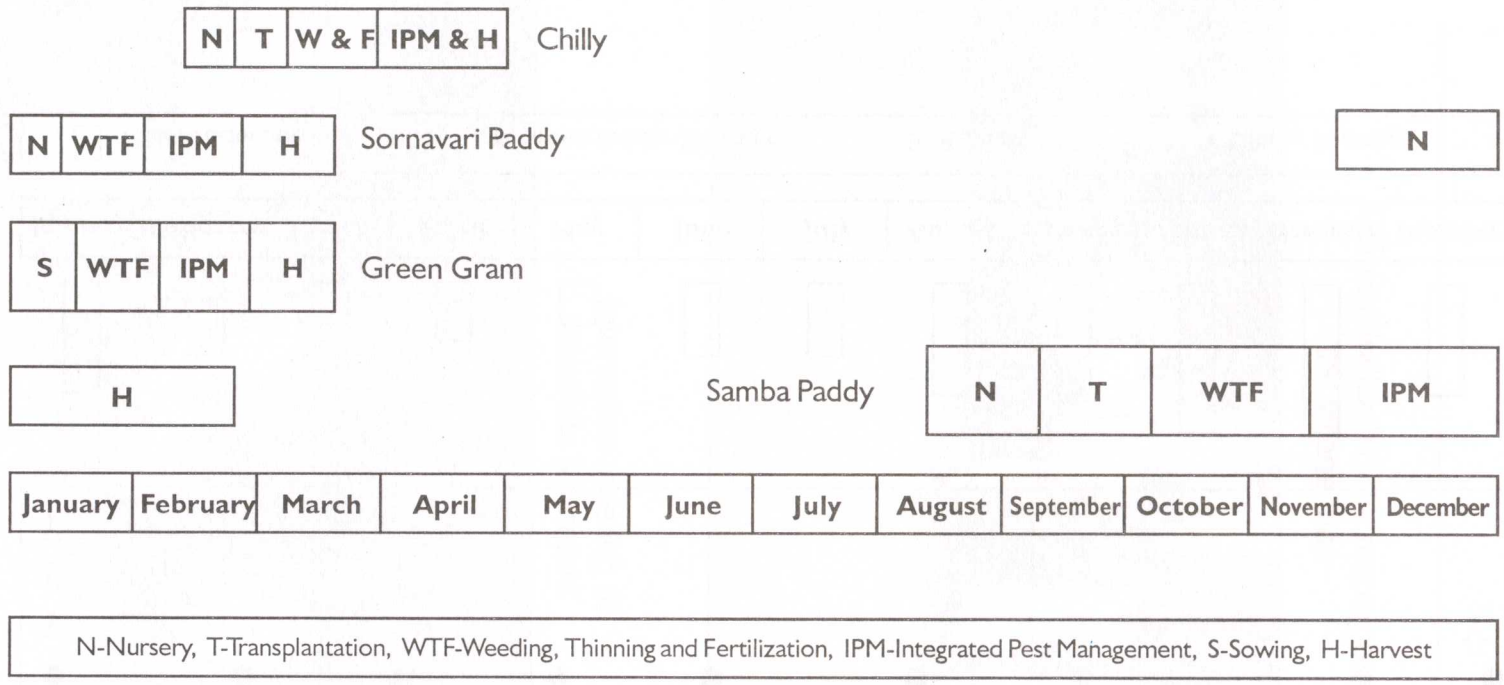
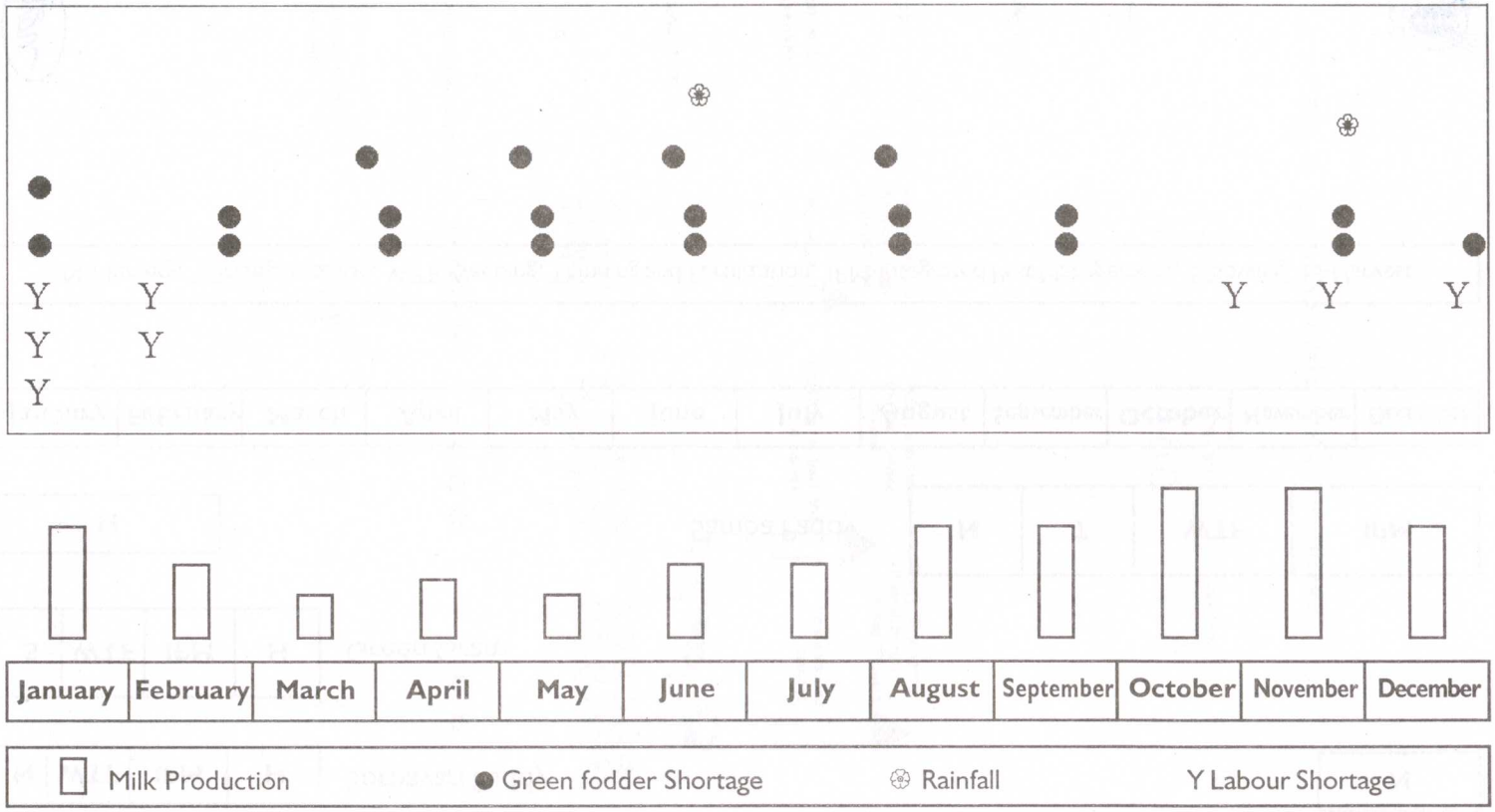


Fig. 6 Seasonality map (crops) of Kattur village



N-Nursery, T-Transplantation, WTF-Weeding, Thinning and Fertilization, IPM-Integrated Pest Management, S-Sowing, H-Harvest

Fig. 7 Seasonality map for livestock of Kattur village



A farmer indicating the resources in the village map

Interaction meeting of scientists & farmers

The irrigation tank
of Kattur village

A view of
shrimp pond

A farmer holding
harvested mud crabs

Temple tank for
freshwater fish culture

Leaf folder infestation
in rice

Green gram cultivation in
paddy fallow system

Cultivation of
local brinjal variety

A herd of local
sheep breed

A view of
Kattur
fish market

Scientists & farmers in discussion
to finalise the action plan

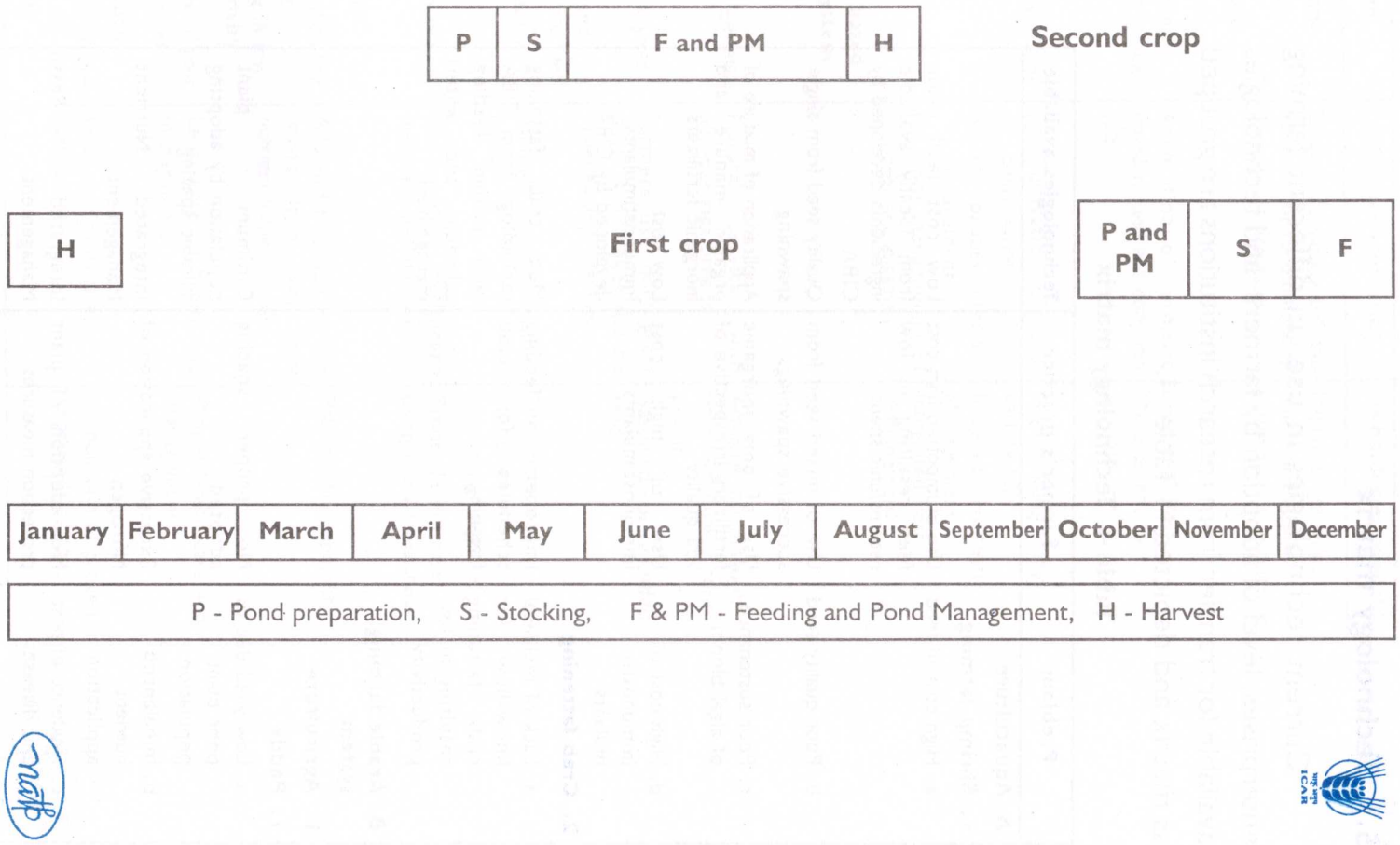
IVLP core
implementation team

The Director & Scientists of
CIBA interacting with farmers

Site committee meeting of
NATP-IVLP Project

Women engaged
in weeding rice field

Fig. 8 Seasonality map for shrimp culture of Kattur village



5.7 Technology matrix

Current technologies in use in different farming enterprises, level of adoption by farmers and technologies available for transfer from research institutions are grouped as matrix and depicted in Table 4.

Table 4. Technology matrix

Problem	Farmer's practice	Technologies available
A. Aquaculture		
1. Shrimp farming		
a. High cost of feed	Use of imported high cost feed resulting in low returns/unit spent	Low cost feed made from locally available ingredients developed by CIBA
b. Poor quality seed	Use of mixed seed from successive spawnings	Quality seed from single spawning
c. Poor sustenance of algal bloom	Use of only inorganic fertilizers irrespective of soil quality	Application of mixture of organic manure and inorganic fertilizers
d. High cost of immunosti-mulants	Use of high cost immunostimulants	Low cost immunostimulants developed by CIBA
2. Crab fattening		
a. Lack of technical know-how for crab fattening resulting in low productivity	Improper feeding schedules for crab fattening	Mud crab fattening technology from CIBA with proper feeding schedule and water management
B. Arable farming system		
I. Agriculture		
1. Paddy		
a. Low yield due to poor plant population	No proper spacing adopted	Optimum plant population by adopting suitable spacing
b. Imbalanced nutrient application	Excessive application of Nitrogen	Integrated Nutrient Management
c. Incidence of pest and diseases	Non-adoption of plant protection measures	Integrated Pest Management

Problem	Farmer's practice	Technologies available
2. Green gram		
a. Low yield	Use of local variety and non adoption of recommended package of practices.	Improved varieties, nutrition and plant protection management
II. Horticulture		
1. Coconut		
a. Rhinoceros beetle attack	Application of turmeric powder, sand and common salt	Integrated Pest Management for coconut
2. Chillies		
a. Low yield of chilly	(i) Cultivation of local chilly variety	High yielding chilly variety K2
	(ii) No proper nutrient management	Integrated Nutrient Management
	(iii) Poor management of pest and diseases	Integrated Pest Management
III. Livestock based farming system		
1. Cows and Buffaloes		
a. Poor genetic stock	Natural service with non-descript breeds	Artificial insemination with high quality germ plasm
b. Low milk yield due to imbalanced, concentrate feed	Farmers use only gram dusts & oil cakes and no minerals and vitamins	Balanced compounded feed
c. Poor quality fodder	Animals grazing on local grasses	Introduction of nutritious grasses and legumes.
d. High mortality of calves	No regular healthcare measures like deworming	Proper health care using latest know-how
2. Sheep/Goat		
a. Low availability of fodder resulting in low productivity	Allowed to graze on the waste land with low nutrient value grasses	Pasture development
b. Incidence of pest and diseases	Least care on health and management	Proper health care and management
3. Poultry/Ducks		
Poor quality strains resulting in low productivity	Local desi birds are maintained	Introduction of proven, improved varieties

5.8 Matrix ranking

Matrix ranking for various shrimp species, crop varieties and livestock (Table 5, 6 and 7) shows that farmers are not always profit-driven as they also consider the adaptability of different species to the area and availability of local resources for selecting the crops, species and varieties for culture. The shrimp is grown for profit, whereas the paddy is grown for both consumption and profit. Farmers take up livestock farming for supplementing their income.

Table 5. Matrix ranking for shrimp species

Parameter	Tiger shrimp	Indian white shrimp
Growth	***	**
Taste	***	**
Market value	***	**
Yield	***	**
Adaptability	***	**

* More number of star markings indicate more value and *vice versa*.

Table 6. Matrix ranking for rice varieties

Parameter	White Ponni	ADT-43	CO-43
Duration	**	*	***
Grain yield	**	*	***
Straw yield	****	**	*
Price (Rs./acre)	******	**	**
Straw quality	****	**	*
Water requirement	**	*	***
Resistant to disease	**	*	***
Cooking quality	*****	**	**

* More number of star markings indicate more value and *vice versa*

Table 7. Matrix ranking for livestock farming

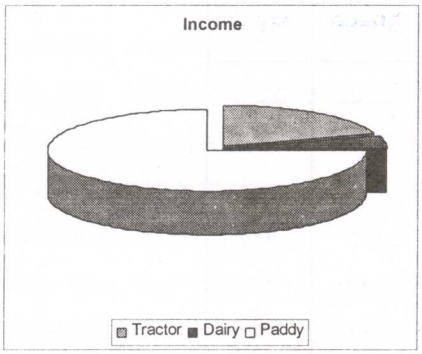
Parameter	Local cow	Cross breed	Buffalo	Poultry	Sheep	Goat
Milk yield	*	***	****	——	——	——
Easy maintenance	*****	**	***	*****	**	**
More income	*	***	*****	*	**	***
Labour requirement	**	***	***	****	***	***
Resistant to diseases	****	**	***	**	***	***
Less initial investment	***	*	**	*****	***	***

* More number of star markings indicate more value and *vice versa*

5.9 Livelihood analysis

Livelihood analysis explains the various sources of income and expenditure pattern of a farmer. Separate livelihood analyses were done for resource-rich farmer, medium-farmer and poor-farmer (Fig.9 a, b, c). Agricultural crops are the major source of income for the rich (75%) and the medium farmers (60%), whereas the wages earned by the labourers is the major source of income for the poor farmers. On the expenditure side, agriculture takes a major share from the rich (40%) and medium farmers (45%). Poor farmers spend equal amounts for food and crop cultivation. Other major sources of income include tractor operations, dairy and livestock farming. Clothes, social functions, medical expenses and education for children are the other expenditure items.

Fig-9a Livelihood Analysis - Rich Farmer



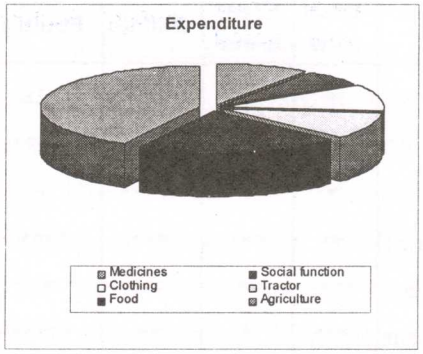
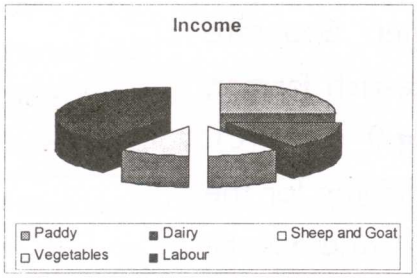


Fig-9b Livelihood Analysis - Medium Farmer



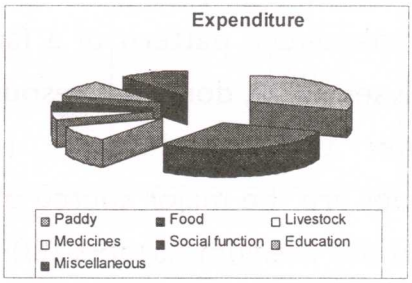
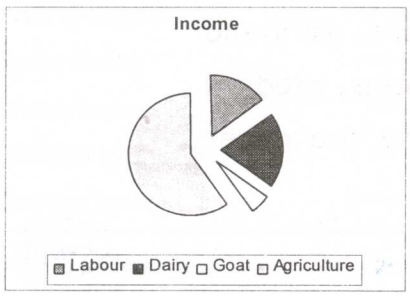
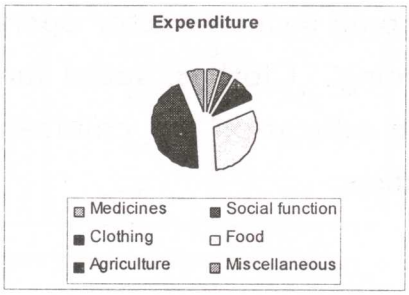


Fig-9c Livelihood Analysis - Poor Farmer





6. Micro-farming situations, major production problems and prioritization

Farming systems and problems in the existing production systems were identified using information elucidated through various PRA techniques, involving resource persons comprising of farmers and farmwomen. An array of problems relating to aquaculture, agriculture, animal husbandry and allied activities were listed and then prioritized considering their relative importance from the point of view of Agro-Eco System Analysis and following a holistic approach to the solutions as indicated below. If any one or more of the system properties *viz*., productivity, stability, sustainability and equitability were negatively affected, it was taken as a 'problem'. Thus, problems due to biotic and abiotic limiting factors, inefficient and insufficient use of inputs, stress and perturbation which could ultimately affect negatively the production system properties were identified and prioritized by the stake holders facilitated by the core team scientists.

The following micro-farming situations have been identified.

(A) Tiger shrimp aquaculture

(B) Mud crab farming

(C) Tank irrigated upland paddy

(D) Tank and bore-well irrigated upland paddy

(E) Homestead vegetable farming

(G) Livestock husbandry system

The prioritization of problems was done using the matrix ranking.

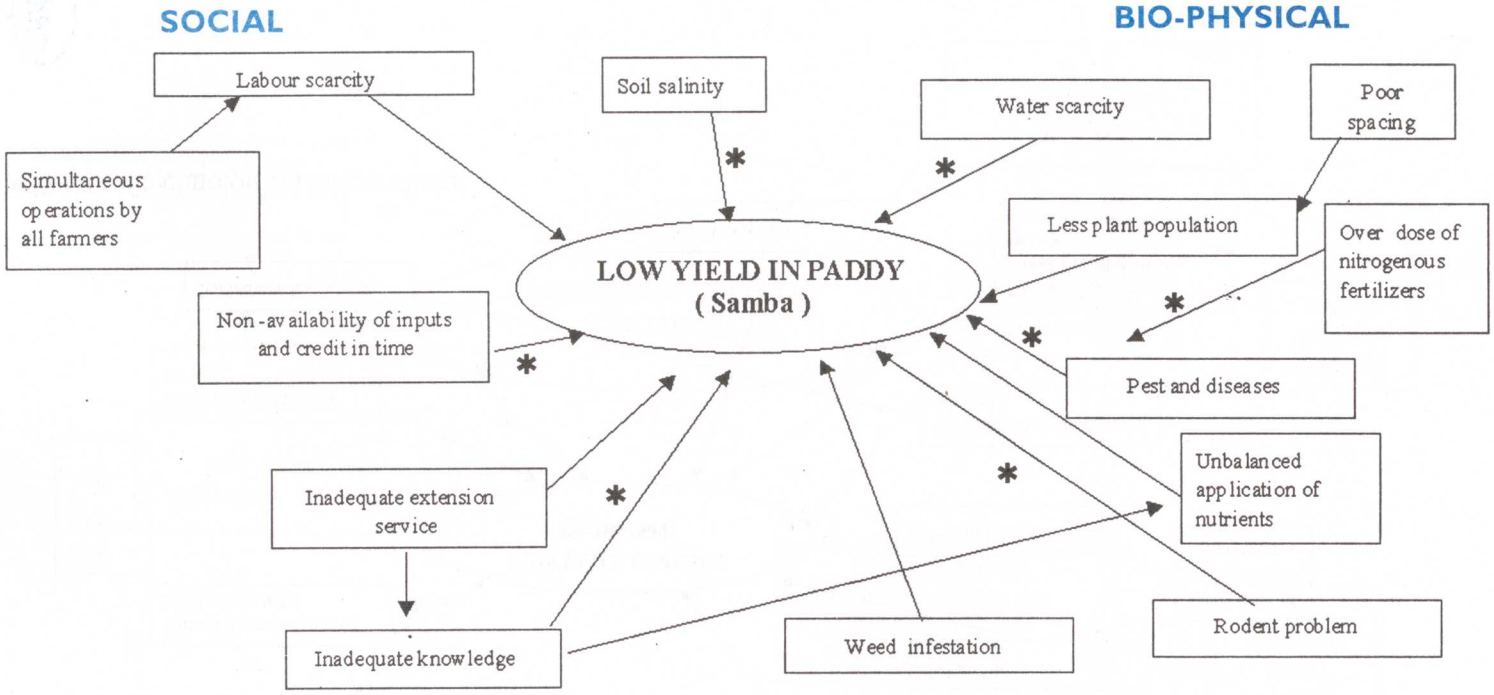
1. Instability in shrimp productivity
2. Low yield of tank irrigated upland paddy (July-December)
3. Low yield of tank and bore well irrigated upland paddy (February-April)
4. Low milk productivity in cows and buffaloes
5. Poor growth rate of mud crabs during fattening process
6. Low productivity in sheep and goat
7. Low productivity in poultry
8. Low productivity of coconut
9. Under utilization of available space in homestead garden
10. Low productivity in green gram
11. Low productivity in chillies
12. Under-utilized freshwater resources
13. Lack of stocking material for mud crab culture

7. Problem cause diagrams

It is the fact that problem does not exist in isolation. Multidisciplinary team of scientists facilitated farmers to relate different biophysical and socio-economic causes for farm level problems. The interventions are depicted by star markings.

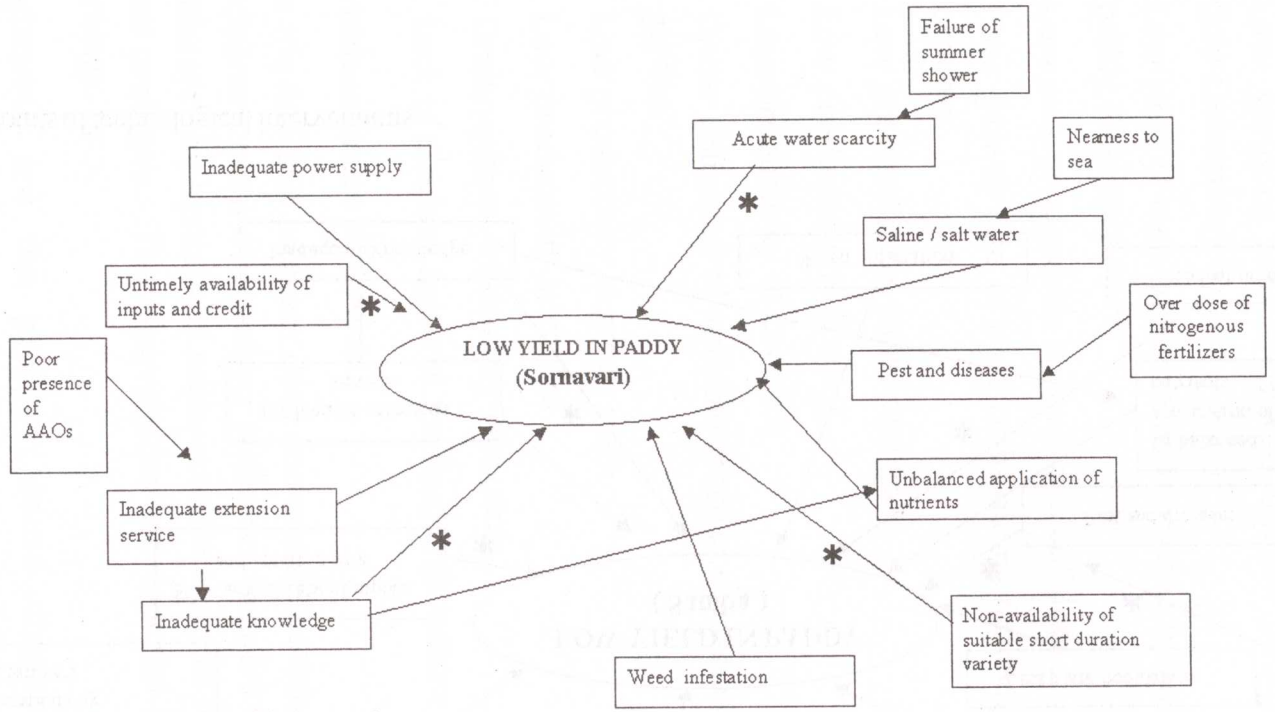
Following are the problem cause diagrams (Fig.10-19).

Fig. 10 Problem cause diagram for low yield of paddy (Samba)



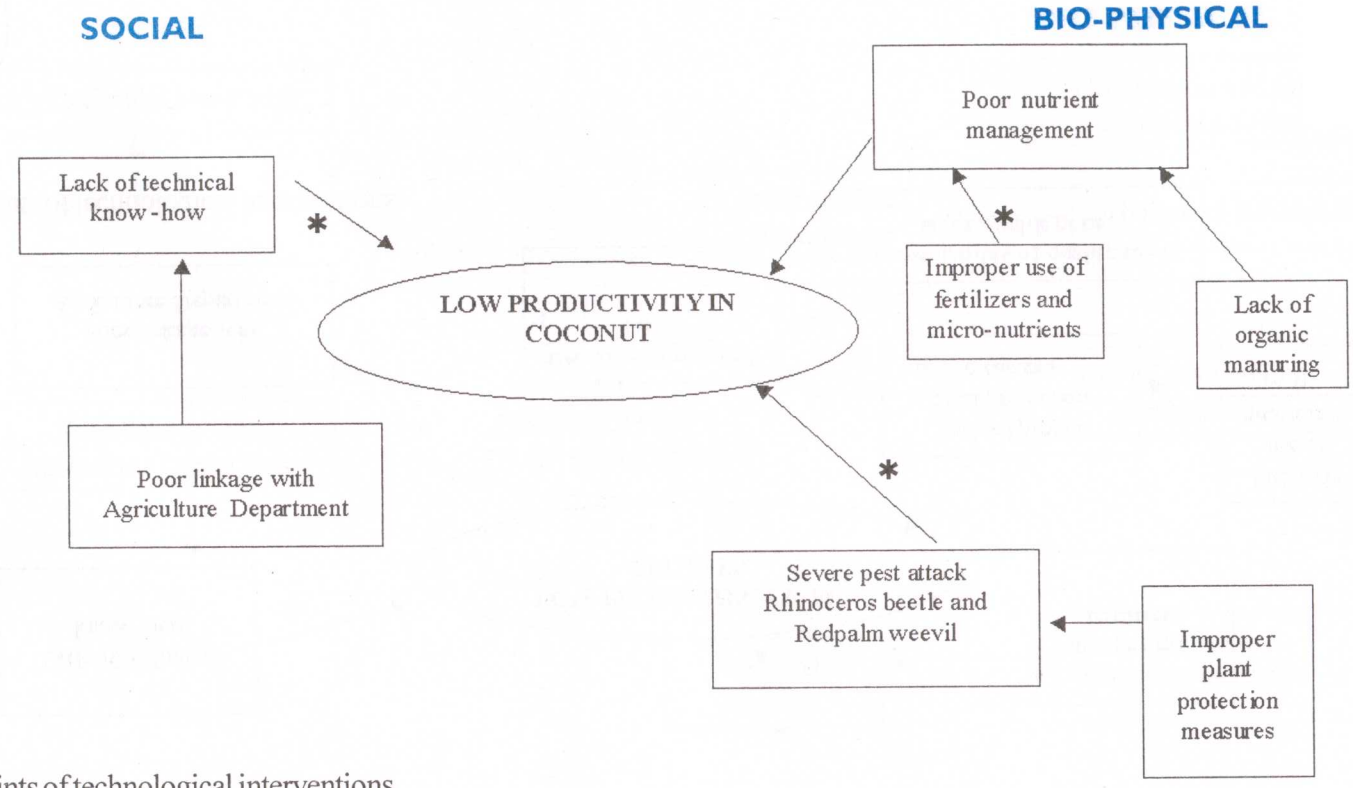
*Points of technological interventions

Fig. 11 Problem cause diagram for low yield of paddy (Sornavari)



*Points of technological interventions

Fig. 12 Problem cause diagram for low productivity in coconut



*Points of technological interventions

Fig. 13 Problem cause diagram for low productivity in chillies

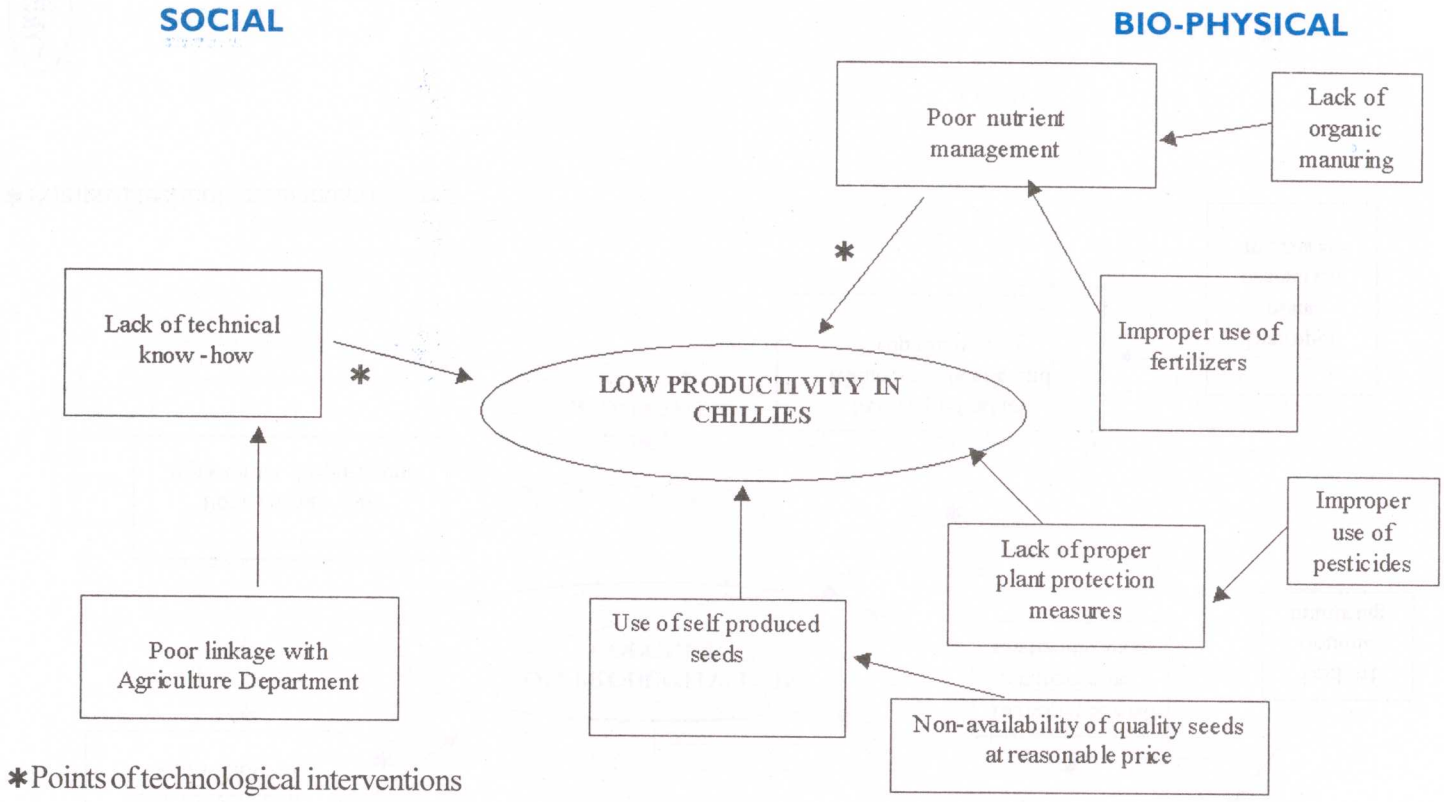
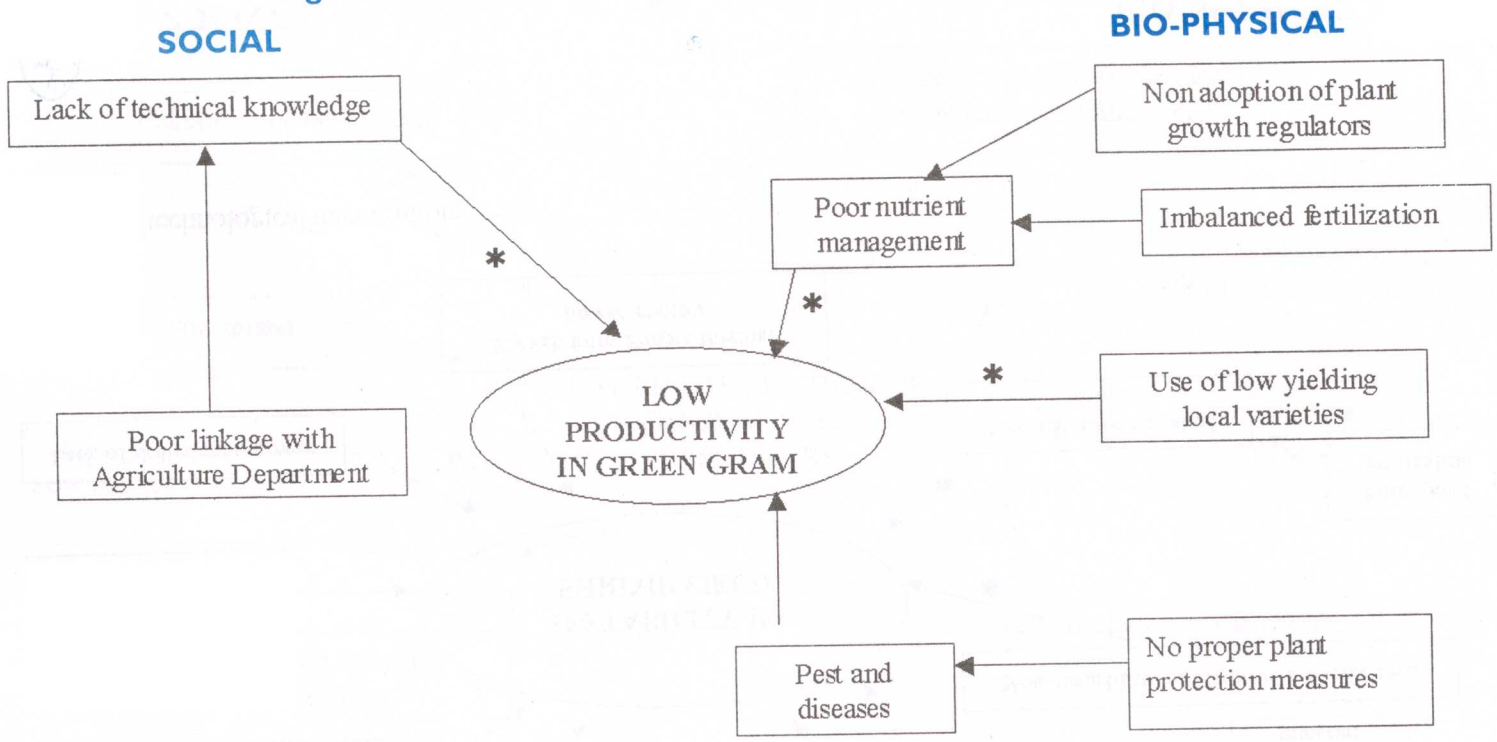
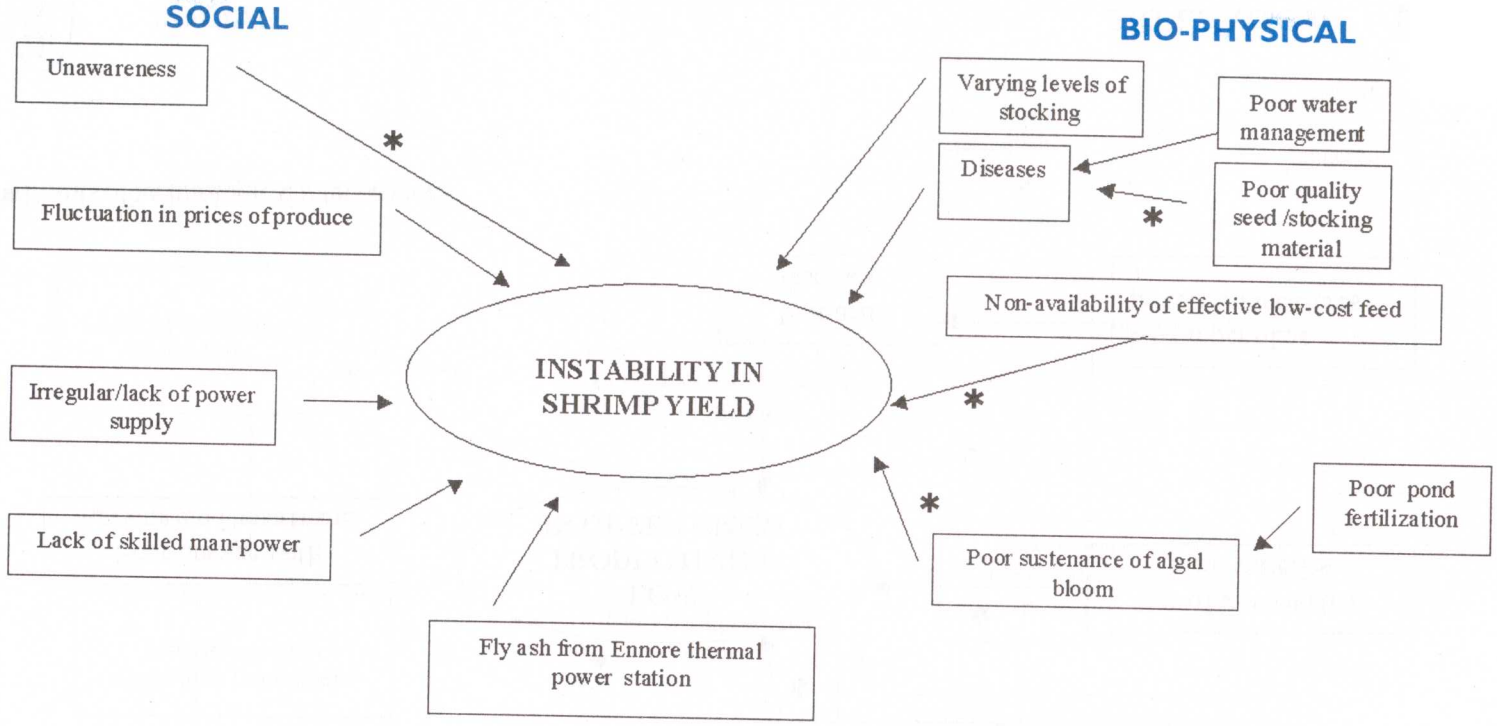


Fig. 14 Problem cause diagram for low productivity in green gram



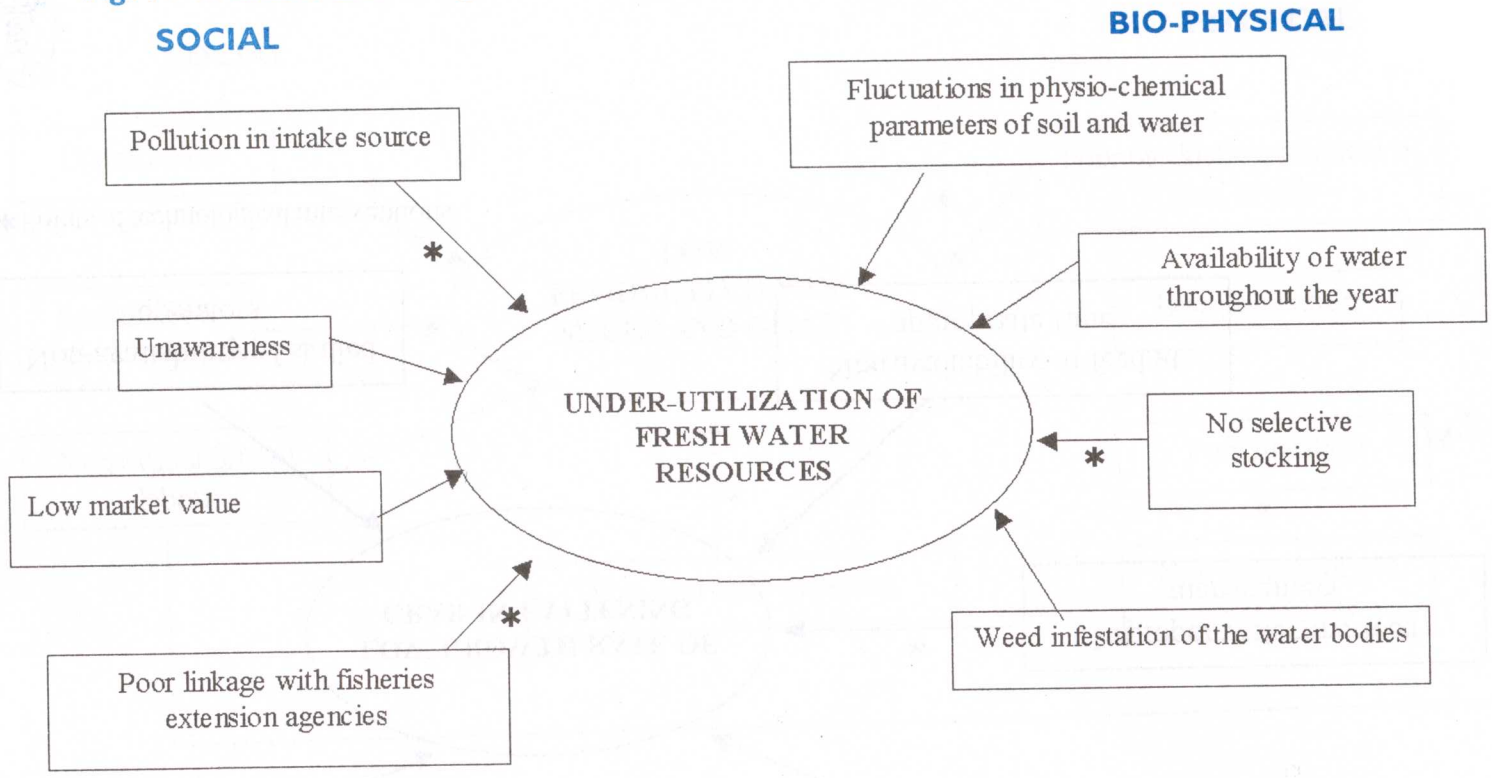
*Points of technological interventions

Fig. 15 Problem cause diagram for instability in productivity of shrimp



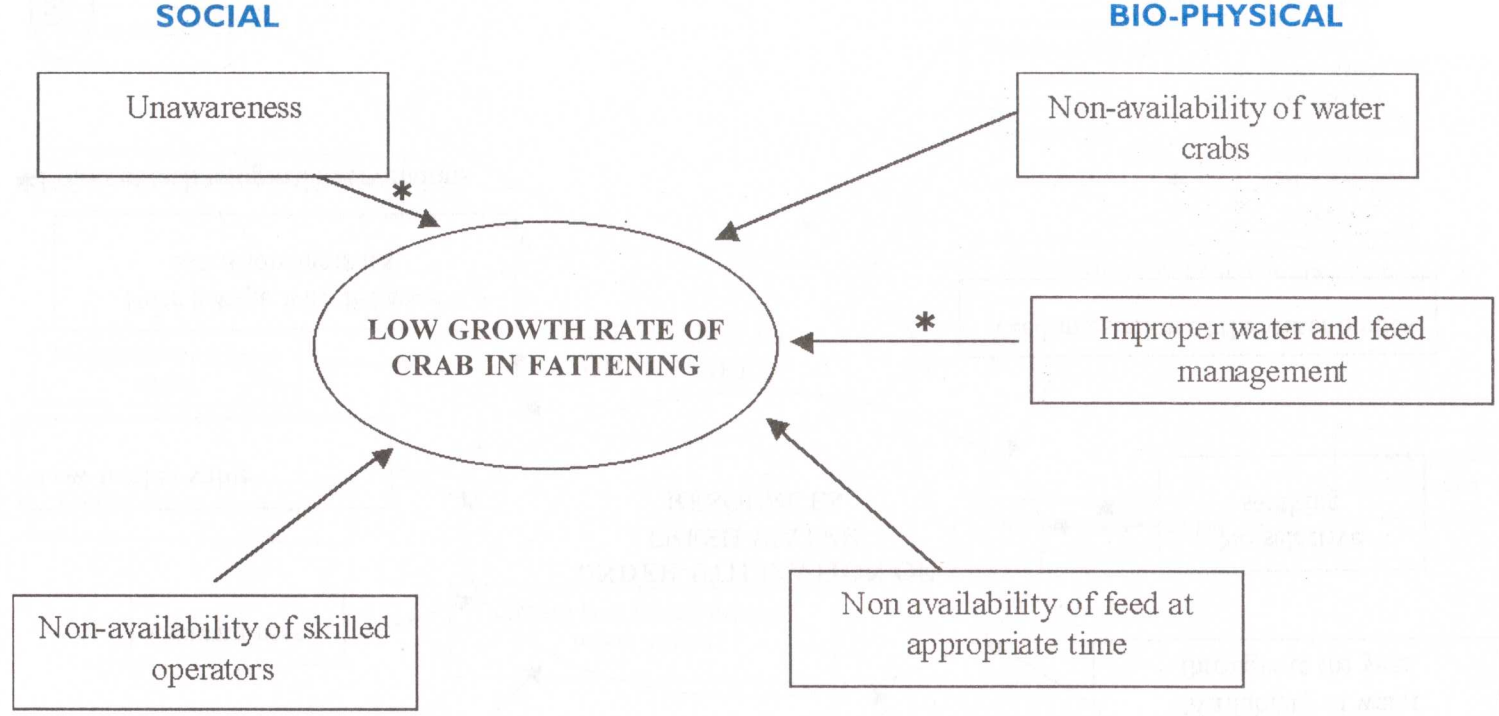
*Points of technological interventions

Fig. 16 Problem cause diagram for under-utilization of fresh water resources for aquaculture



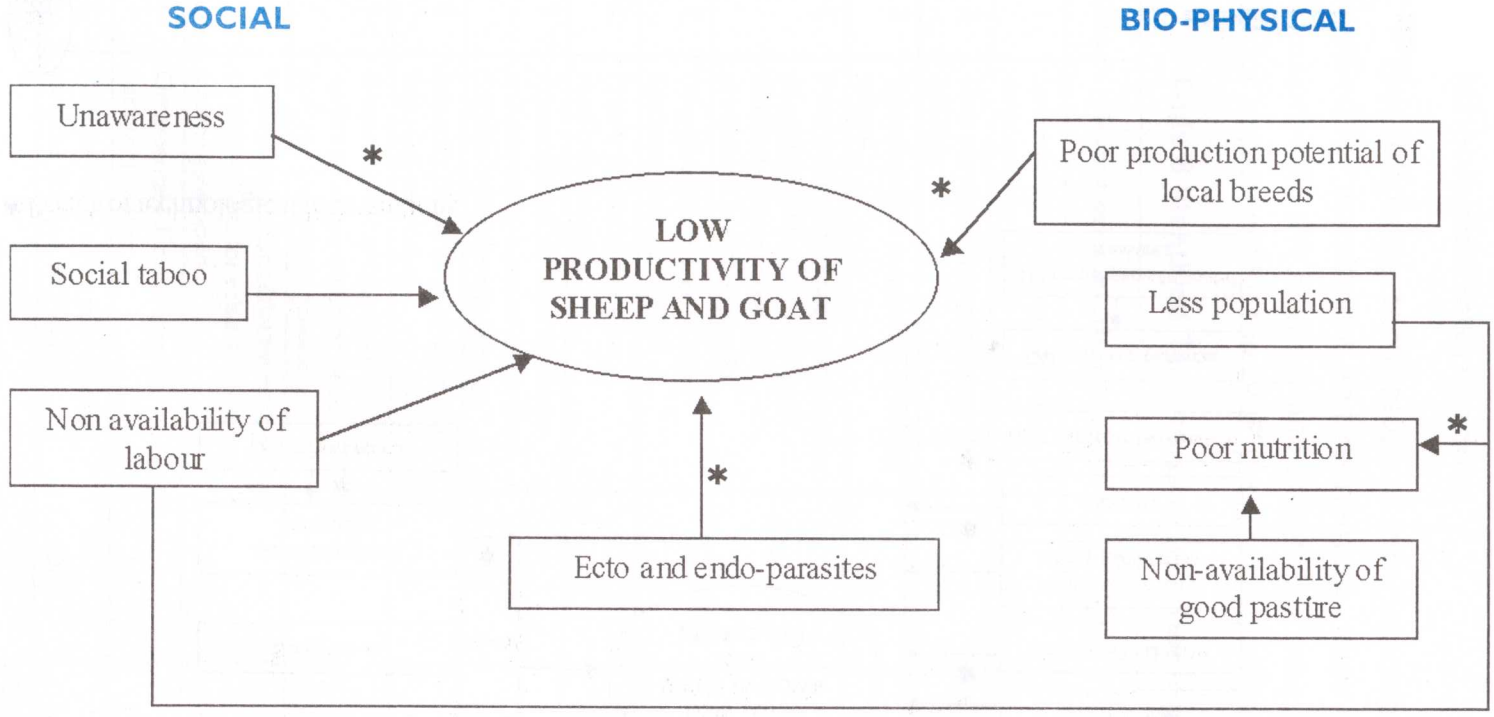
*Points of technological interventions

Fig. 17 Problem cause diagram for low growth rate of crab in fattening



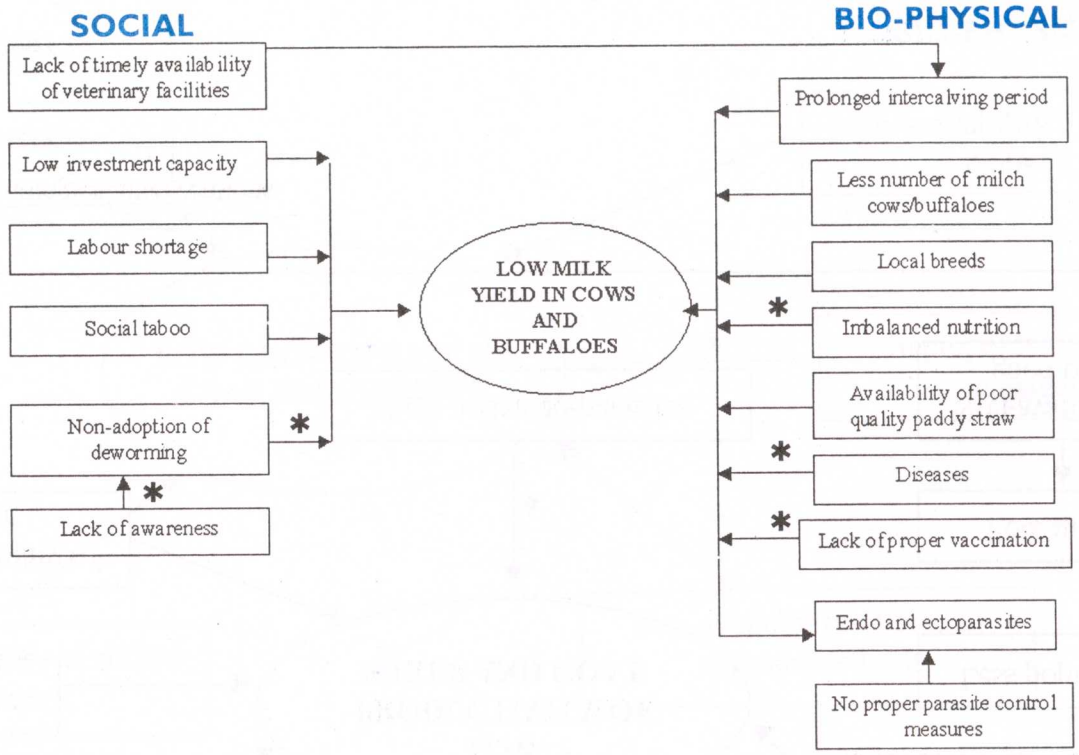
*Points of technological interventions

Fig.18 Problem cause diagram for low productivity of sheep and goat



*Points of technological interventions

Fig.19 Problem cause diagram for low milk yield in cows and buffaloes



*Points of technological interventions

8. Technological interventions

The following technological interventions were identified for assessment and refinement after detailed discussion with the farmers and scientists in the relevant field for implementing the IVLP project (Table 8).

Table 8 Identified Technological Interventions

S.No.	Technological interventions	Mode OFT / VT*	Thematic area*
1	Low cost shrimp immunostimulant developed by CIBA	VT	IPM
2	Cost effective indigenous shrimp feed of CIBA.	VT	IPNM
3	Periodic health monitoring of shrimp culture	VT	IPM
4	Pond fertilization using a combination of organic manures and inorganic fertilizers for sustained algal production in shrimp ponds	VT	IPNM
5	Growth performance of Asian Sea bass (*Lates calcarifer*)	VT	NRM
6	Proper feed scheduling for mud crab fattening	VT	IPNM
7	Preparation of pickles from fishes and prawns by housewives for value addition and income generation	VT	PHVA
8	Scientific preparation of dried fish from low cost fishes.	VT	PHVA
9	Preparation of fish murukku/fish wafers by house wives for value addition and income generation	VT	PHVA
10	Preparation of fish cutlet from fishes by house wives for value addition and income generation	VT	PHVA
11	Ornamental fish culture under backyard system	VT	NRM
12	Productivity of saline tolerant rice varieties Trichy-1 & Trichy-2	OFT	NRM

Table Contd....

S.No.	Technological interventions	Mode OFT / VT*	Thematic area*
13	Efficacy of various measures in controlling grain discolouration in rice	OFT	IPM
14	Efficacy of *Trichogramma japonicum* for the control of stem borer in rice	VT	IPM
15	Efficacy of *Trichogramma chilonis* for controlling the leaf folder in rice	VT	IPM
16	Efficacy of *Pseudomonas fluorescens* in controlling the disease in rice	VT	IPM
17	Effect of *Azolla* along with recommended fertilizers in increasing the productivity of rice	VT	IPNM
18	Effect of zinc sulphate in increasing the productivity of rice	VTI	IPNM
19	Efficacy of bromadiolone in controlling the rats in rice fields	VT	IPM
20	Productivity of green gram KM2	VT	NRM
21	Productivity of green gram Viringipuram-I	VT	NRM
22	Efficacy of foliar spraying of Diammonium phosphate and NAA in green gram	VT	IPNM
23	Effect of *Rhizobium* along with the recommended fertilizers in increasing the productivity of green gram	VT	IPNM
24	Impact of power sprayer in rice cultivation	VT	IPM
25	Effect of sack holder in reducing the drudgery	VT	PHT
26	Efficacy of solar lantern in harnessing the solar energy	VT	NRM
27	Balanced application of fertilizers in chillies	VT	IPNM
28	Performance of high yielding chilly variety K-2	VT	NRM
29	Efficacy of integrated pest management in controlling fruit borer in chillies	VT	IPM
30	Productivity of improved variety of brinjal PUSA-6	VT	NRM

Table Contd....

S.No.	Technological interventions	Mode OFT / VT*	Thematic area*
31	Productivity of annual moringa variety PKM-1	VT	NRM
32	Effect of neem seed powder in controlling the *Rhinoceros* beetle attack in coconut	VT	IPM
33	Effective utilization of backyard with suitable vegetables	VT	NRM
34	Economic benefit of vegetable cultivation under the spaces available in the homestead	VT	NRM
35	Performance of growing medicinal plants in the backyard spaces	VT	NRM
36	Effect of vermicompost on increasing the vegetable yield under backyard garden	VT	IPNM
37	Balanced application of fertilizers in coconut	VT	IPNM
38	Effective utilization of fruit trees in backyard spaces of house holds	VT	NRM
39	Efficacy of ectoparasiticide in control of ticks and mites in buffalo calves	VT	IPM
40	Efficacy of broad spectrum anthelmentic on growth and survival of lambs and kids	VT	IPM
41	Efficacy of oil adjuvant FMD vaccine to control foot and mouth disease in bovines	VT	IPM
42	Effect of salt lick in controlling vices in calves	VT	IPNM
43	Performance of compounded feed in increasing the milk yield of milch cattle	VT	IPNM
44	Mineral and vitamin supplements for improving growth and sexual maturity of heifers	VT	IPNM
45	Efficacy of vaccination against Raniket disease in country chicks (poultry)	VT	IPM

Table Contd....

S.No.	Technological interventions	Mode OFT / VT*	Thematic area*
46	Productive efficiency of Nandanam turkey birds under backyard system	VT	NRM
47	Effect of crossing local sheep with Madras Red Ram for improved productivity	VT	NRM
48	Effect of Hemorrahagic septicemic vaccine in cattle	VT	IPM
49	Productive efficiency of Nandanam chicks (RIR) under backyard system	VT	NRM
50	Efficacy of improved sickles in reducing the drudgery	VT	PHT
51	Efficacy of improved coconut dehusker in reducing the drudgery	VT	PHT
52	Efficacy of stored grain insect trap in controlling the storage pests in rice and green gram	VT	PHT

*OFT- On Farm Testing ; VT-Verification Trials ; NRM-Natural Resource Management; IPM- Integrated Pest Management; IPNM- Integrated Plant Nutrient Management; PHT-Post Harvest Technology; PHVA-Post Harvest Value Addition

9. Execution of technical programmes through technological interventions

Based on the agro-ecosystem analysis results, technical programme is formulated for each year in consultation with stakeholders – farmers and scientists. Technological interventions are implemented through On Farm Testing (OFT) and Verification Trials (VT). The major theme areas of the production system research programme are Natural Resource Management (NRM), Integrated Pest Management (IPM), Integrated Plant and Nutrient

Management (IPNM), Post Harvest Technology (PHT), Post Harvest Value Addition (PHVA) and Socio-Economic research (SE) and Water Management (WM).

Farmer should be made as much a key player in technology generation as much as hitherto assigned role of an adopter. Since under TAR-IVLP, the production system research addresses the location-specific problems, the assessment and refinement of technologies thus generated with farmers participation will help in solving the problems of agriculture, aquaculture and animal husbandry with focus on sustainability of farming so evolved.

10. Constitution of SITE Committee

SITE Committee was constituted with the following members to review the progress of technological interventions, apply mid-course corrections if any and to approve the annual action plan for implementation of technical programme by the core team.

1. Dr. G.R.M. Rao, Director, CIBA & Chairman, SITE Committee up to 28.02.2002 and

   Dr. Mathew Abraham, Director, CIBA & Chairman, SITE Committee (From 01.03.2002).

2. Agro-Ecosystem Director, NATP-Coastal Agro-Ecosystem.

3. Zonal Coordinator of ICAR, Zone-VIII, NDRI Campus, Adugodi, Bangalore.

4. Director of Fisheries, Govt. of Tamil Nadu.

5. Professor & Head, Rice Research Station, TNAU, Tirur, Tiruvallur district

6. Officer-in-Charge, Madras Research Centre of CMFRI, Chennai.

7. Dr. P. Ravichandran, Principal Scientist, CIBA, Chennai.

8. Shri. M. Kathirvel, Principal Scientist, CIBA, Chennai.

9. Dr. S. A. Ali, Principal Scientist, CIBA, Chennai.

10. Dr. N. Kalaimani, Principal Scientist, CIBA, Chennai.

11. Shri. K. Ponnusamy, Scientist & Member Secretary, Site Committee, CIBA, Chennai.

11. Acknowledgements

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