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Reaching the Unreached: Highlights of Institution Village Linkage Programme of CMFRI

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National Agricultural Technology Project

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Dedicated to the Coastal Rural Fisherfolk

"I speak of an India on the move, on the cutting edge of economic, technological and developmental transformations. This is an India endowed with outstanding human resources and we are putting in place policies, which will respond to emerging and critical tasks. We have the capabilities and capacity to take these on, and to participate in the structuring of a just and dynamic world order."

— Dr. Manmohan Singh
Prime Minister of India

Speech in UN General Assembly
23rd September 2004

FOREWORD

Technology is one of the ideal means for material enrichment and self-improvement. The purpose of identifying appropriate technology and its diffusion is to promote living conditions and in the process, generate greater and better livelihood opportunities for people to enhance their life styles. More than any other, the coastal agro ecosystem plays a significant role in controlling the overall ecological balance on planet earth. The Indian Council of Agricultural Research (ICAR) has launched the National Agricultural Technology Project (NATP) with substantial assistance from the World Bank to upgrade the scientific research in key sectors to bring about all round development. The Institution Village Linkage Programme (IVLP) is one of the most important segments of NATP for testing, improving and refining the technologies generated for different production systems by the National Agricultural Research System (NARS). The CMFRI has been implementing the IVLP at Elamkunnapuzha Village of Ernakulam District since 2001 and has made significant impact on production methodologies and livelihoods of fisherflok.

I am happy that a document is brought out with highlights of the IVLP by CMFRI in the coastal agro-ecosystem in Ernakulam District. The results obtained and experience highlighted and shared through this publication will be useful in planning participatory development and farmer education programmes with focus on specific needs and aspirations of the farmers in similar areas.

I wish to record my appreciation of the efforts taken by Dr. R. Sathiadhas, Dr. L. Krishnan, Dr. D. Noble, Dr. A. Laxminarayana, Mrs. Sheela Immanuel, Mr. K. N. Jayan and Dr. Sindhu Sadanandan in the successful implementation of this project and bringing out this publication.

Kochi - 18
Date : 27-09-2004

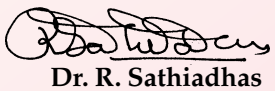
Prof. Dr. Mohan Joseph Modayil
Director, CMFRI

PREFACE

The CMFRI has been implementing the IVLP since 2001 to assess and refine the technologies applicable to coastal agro-ecosystem at Elamkunnapuzha Village of Vypeen Island in the Ernakulam District of Kerala. A series of need based location specific technology intervention plans have been introduced with focus on the social and biological problems identified in farming practices in fisheries, livestock and agriculture sector with the active participation of stakeholders. The basic knowledge of such scientific interventions was disseminated to the rural farmers through in-house training programmes and also through field visits to progressive farms.

The inferences drawn from the IVLP ultimately formed a package suitable for enhanced production in the coastal agro-ecosystem with similar characteristics. The present publication summarises an account of the treatment packages applied in the field and the consequent yield and benefits obtained. Apart from scientists, researchers, extension workers and social activists, the major target group of this publication would be farmers.

I wish to place on record my utmost gratitude to Dr. S. L. Mehta, National Director NATP, Dr. P. Das, DDG (Agrl. Extension), Dr. S. Ayyappan, DDG (Fisheries), Dr. Parshad, ADG (Agrl. Extn.), ICAR and Dr. S. Edison, Agro-Ecosystem Director (Coastal) for their guidance and support. I am highly thankful to Prof. Dr. Mohan Joseph Modayil, Director, CMFRI for his keen interest, timely advice and constant encouragements in the successful implementation of this programme and bringing out this publication. Thanks are also due to Dr. K. K. Appukuttan, Nodal Officer, NATP and my colleagues in SEETT Division, who supported me in the successful implementation of this project.



Dr. R. Sathiadhas
Head, SEETTD &
Principal Investigator of IVLP

Kochi - 18
Date : 29-09-2004

CONTENTS

LIST OF ABBREVIATIONS

ATIC	Agricultural Technology Information Centre
B-C	Benefit - Cost
BT	Bio - Technology
CASPS	Centre for Advanced Studies in Poultry Science
CVAS	College of Veterinary and Animal Science
CGP	Competitive Grant Programme
CMFRI	Central Marine Fisheries Research Institute
CIFT	Central Institute of Fisheries Technology
INM	Integrated Nutrient Management
IPNM	Integrated Plant Nutrient Management
ICAR	Indian Council of Agricultural Research
IVLP	Institution Village Linkage Programme
KAU	Kerala Agricultural University
KVK	Krishi Vigyan Kendra
MM	Mission Mode
NRM	Natural Resource Management
NARS	National Agricultural Research System
NATP	National Agricultural Technology Project
PSR	Production System Research
PHVA	Post Harvest Value Addition
PRA	Particiaptory Rural Appraisal
SAP	Scientific Advisory Panel
SE&P	Socio-Economic & Policy
SEETTD	Socio-Economic Evaluation & Technology Transfer Divison
SHG	Self Help Group
TAR	Technology Assessment and Refinement
TOE	Team of Excellence
TOT	Transfer of Technology

I. Introduction

The Indian Council of Agricultural Research (ICAR) in recent years has adopted the National Agricultural Technology Project (NATP) funded by the World Bank as one of the most effective approaches for intensified experiments for integrated development and transfer of technology. The research programmes under NATP are distributed among four major modes such as, Production System Research (PSR), Mission Mode (MM), Team of Excellence Mode (TOE) and Competitive Grant Programme (CGP). The Institution Village Linkage Programme (IVLP) for Technology Assessment and Refinement (TAR), a major component comes under production system research. The projects under this research system are location specific focussing on key local developmental needs, problems and opportunities. The IVLP has been undertaken in 70 different centres throughout the country. The Central Marine Fisheries Research Institute (CMFRI) is one among them which implemented the programme at Elamkunnapuzha Village in Ernakulam. These programmes are framed in such a way as to enhance inter-institutional and inter-disciplinary synergies.

Fig. 1. Dr. Mangala Rai, Secretary, DARE & D.G., (ICAR) releasing the publication of IVLP (CMFRI Spl. Pub. No. 75) on 26th April 2003

Fig. 2. Fisheries and coconuts are the mainstay of the village : an aerial view

The sensual link between rural primary production centres and the scientific technology generation centres should be strengthened for the efficient transfer of technologies from labs to rural farms. However the transfer of such test proven technologies is often constrained by routine social systems. Gunnar Myrdalls' *Asian Drama* theorises a cumulative change in this social system consisting of a great number of conditions that are causally inter-related, in the sense that a change in one will cause changes in others in a cumulative mode. The effectiveness of this cumulative change is influenced particularly by the magnitude and persistence of developmental efforts. The specific efforts taken as part of the IVLP in Elamkunnapuzha has made significant positive and cumulative changes in the production pattern under various micro-farming situations.

a) Locale of Village

The Vypeen Island, covering an area of 87.12 sq. km is spread out in six Panchayats. Elamkunnapuzha is a representative Panchayat having a total population of 51,197 with a total area of 11.52 sq.km. The area is known for its distinct eco-system of the co-existence of capture and culture fisheries with almost all kinds of

agricultural and animal husbandry practices. The techno-interventions of IVLP has made significant changes in the production methods, yield level, earnings, standard of living and overall socio-economic status of stakeholders.

Fig. 3. Tide - fed ponds : Advantage for aquaculture

Subsequently, these changes have made favourable impact upon the farming community, especially the fisherfolk towards providing a sustainable livelihood security. The micro-level techno-interventions in various rural farms are much in line with the "Keynesian euphoria of acceleratory and multiplier effect".

Fig. 4. Mr. Sylvi Figerado, a progressive farmer felicitated at a National Seminar

b) Brief Objectives

IVLP for technology assessment and refinement aims at joint diagnostic studies of production systems and to suggest alternative means for enhanced productivity. It introduces improvements in the existing production systems through better scientific management practices without endangering the stability

and sustainability of environment. It suggests possible and potential ways of innovative farm production systems with multiple options for implementation with genuine participation of the farmer community. It is obvious that rural farmers will adhere to the scientific inputs, only if they are assured with wider employment and income generating opportunities.

c) Participatory Rural Appraisal (PRA)

The extension strategy adopted in IVLP is participatory in nature with a vision of an integrated whole village development ensuring greater scientist-farmer linkage and accessibility for farmers to the technologies generated by the Institute and the National Agricultural Research System (NARS) of the country. This involves a multi-institutional team and an array of stake-holders with traditional wisdom. The programme began with a resource inventory of the Village and a detailed analysis of its agro-ecosystem. Participatory Rural Appraisal techniques are used in assessing the primary production pattern and its potentials. Five typical micro-farming situations such as tide-fed brackish water system, open sea-based coastal agro-ecosystem, homestead animal husbandry and poultry farming system, rainfed agri-horticulture system and low-lying

Fig. 5. Participatory mode for problem identification

seasonal paddy (*pokkali*) fields, are identified with the existing farming situations and potential solutions.

Various techno-interventions are planned to suit the identified micro-farming situations. The action plan of various techno-interventions under three broad categories such as fisheries, livestock and agriculture, are finalised by the Site Committee comprising experts from various fields. The implementation of the programme is scheduled in three phases, the first phase, initiated during 2000-2001 comprised 17 interventions, the second phase, during 2001-2003 with 15 interventions and the third phase, with horizontal expansion of profitable finfish culture technologies in five adjoining villages.

d) Problems and Potential Solutions

The techno-interventions addressed the biophysical and the socio-economic problems of different farm operations. In fisheries, unscientific farming practices, improper selection and overstocking of species and uneconomic utilisation of space are the major problems. Assessment experiments in fisheries include, polyculture / monoculture of finfish as well as shrimps, integrated farming of poultry and fish and monoculture of uniform sized juvenile crabs. Another major

Fig. 7. Value addition by women group

intervention addressed the problems in value-addition of fish products. Two women groups with 15 members each are identified for the assessment of rack drying of fish after dip-treatment technology imparted by the Central Institute of Fisheries Technology (CIFT).

In livestock, low productivity, parasitic infestations, micro-nutrient deficiencies, and inadequate health coverage are the major problems. Mineral/feed supplements, prophylactic vaccination and medication against gastro-intestinal parasites are provided to poultry, goats and dairy animals. Hybrid breed of poultry viz., *Gramalakshmi*, ducks of high genetic potential viz., *Kuttanadan*, *Grey giant* variety of broiler rabbit are introduced in this coastal ecosystem for performance assessment.

In agriculture, low productivity, high soil salinity, fertiliser/ nutrient deficiency and non-availability of improved variety of vegetable and paddy seeds are found to be the major constraints. The cultivation of improved variety of vegetable seeds, introduction of tissue cultured *Dwarf Cavendish* suckers of banana, application of scientific nutrient management practices (green manure and chemical fertiliser) for coconuts, assessment of amaranthus as an intercrop of banana, performance of bio-fertilizers in paddy farming, cultivation of improved variety of vegetable in the embankments along with paddy are the interventions.

The results of various techno-interventions are summarised below with a brief account of the biometric as well as economic output. Mainly, benefit-cost (B-C) ratio is used to highlight the level of profit that accrued from farming practices which is

conceptualised in terms of the ratio of net returns to the cost of production.

II. Techno-interventions: Brief Results

a) Monoculture of Crabs (NRM)

Farming of uniform sized juvenile mud crabs (*Scylla tranquebarica*) at a stocking rate of 4800 nos/ha having the size of 150-200g supplemented by recommended feeding schedule and pond management resulted in a 48 per cent increase in the gross yield. The survival rate has recorded an increase of 25 per cent. The average yield from the treatment is 3712 kg/ha, as against the yield of 2500 kg/ha. obtained through traditional farmer's practice. The benefit cost ratio is worked out to be 2.10:1 as against 1.36:1 in farmers' practice.

Fig. 8. Dr. Parshad, ADG (Extn.) with a crab farmer

b) Monoculture of Milkfish (NRM)

Uneven and simultaneous stocking of various species normally results in lower productivity. Farmers are not much aware of the location specific potential of monoculture practices.

Scientific monoculture of milkfish in tide-fed ponds has given a gross yield of 5500kg/ha, which is higher than the yield of 3750

kg/ha under traditional practice. Predators in the culture pond are eradicated using *mahua* oil cake. The recommended stocking density of *Chanos chanos* adopted is 15000/ha. The fish attained an average weight of 360g and an average length of 27.5 cm within the culture period of 11 months. The benefit-cost ratio is worked out to be 1.24:1 as against 0.53:1 under traditional practices.

Fig. 9. Harvesting of milk fish

c) Monoculture of *Mugil cephalus* (NRM)

Unscientific stocking pattern, especially overstocking of all available fish is the major problem under traditional farming practices. Non-eradication of predators before stocking and limited availability of quality seeds are other constraints confronted by farmers under traditional farming system. Further the poor water exchange coupled with low quality results in lower production than actual potential.

Fig. 10. Bio-metric observation

This intervention includes eradication of predators using *mahua* oil cake prior to stocking and stocking of seeds at the rate of 15,000 nos/ha. Water exchange is regulated through fabricated sluices for maintaining water quality. Fish feed constitutes wheat bran, rice bran and oil cakes. The intervention increased the yield by 55 percent. The benefit-cost ratio is 1.40:1, which is higher than the ratio of 0.64:1 for the traditional practice.

d) Polyculture of finfish (NRM)

In the traditional system of fish farming, fabricated sluices are not properly maintained and in some cases sluices are not used at all. In such cases, worn out wooden pieces are arranged and kept as temporary sluices. Predators in the ponds are rarely eradicated. Uneven stocking of various species of fish resulted in low level of productivity. Apart from this, natural entry of fish is also allowed resulting in overstocking and low growth rate.

Fig. 11. Interaction with the farmer

Polyculture of finfish in the tide-fed ponds for a specific period of culture obtained good results. Predators are eradicated using *mahua* oil cake. Water exchange is maintained through fabricated sluices and natural entry of fish is restricted. Combination of *Chanos chanos* and *Mugil cephalus* are stocked at the rate of

20,000/ha. The *Mugil cephalus* attained a mean weight of 440g and mean length of 35cm, whereas mean weight and length of *Chanos chanos* are 200g and 26.5cm respectively at the time of harvest, after 11 months. The average yield recorded is 7000 kg/ha. against the average yield of 5700 kg/ha. in ponds, which followed traditional practices. The survival rate of both the species recorded is around 90 per cent. The benefit-cost ratio of the techno-intervention is estimated to be 1.64:1.

e) Mud crab fattening (NRM)

Farmers usually sell water crabs for lesser prices. Hard-shelled crabs fetch about twice the price that of water crabs. The average price of hard-shelled crab is Rs.325/kg as against Rs.110/kg for water crabs, during the experimental period, at the farm gate. Hardening of crabs under controlled conditions is totally absent in the area.

Water crabs of *Scylla tranquebarica* variety is stocked at the rate of 5000nos/ha. and hardened following recommended feeding and management practices. An additional weight gain of 85-90g is observed within the fattening period of 35-45 days. The increase in yield would be about 3000kg/ha/year under fattening which is higher compared to the yield of 2500kg/ha under traditional culture practices. The benefit-cost ratio is 2.50:1 against 1.24:1 for traditional practice.

f) Integrated farming of fish and poultry (NRM)

Fish farming in the homestead ponds could be more income generating with the integration of poultry farming. Uneconomic utilisation of land is identified as one of the major problems in the

coastal-agro- ecosystem. An integrated approach in the farming system is found to be advisable to optimise the net farm income.

Poultry cages are fixed atop the fishpond enabling fertilization through poultry droppings enhancing the production of plankton and thereby the fish through direct and indirect utilisation of nutrients. The leftovers of poultry feeds are also useful to fish. The operational expenses of fish culture are reduced by 8-12 per cent through this integration. Supplementary feeding and inorganic fertilization are avoided to a considerable extent. *Gramasree* variety of poultry birds yielded, on an average 200 eggs/bird/year. The gross yield from fish farming is found to be 7500kg/ha. and the benefit-cost ratio from integrated farming practice is 1.85:1.

Fig. 12. Partial harvest - integrated farming system

g) Rack drying of dip-treated fish (PHVA)

Traditional ways of drying fish on coir mats, *palmirrah* mats, gunny bags and on plain grounds is replaced with iron racks of size: 4.5mx1mx0.75m, designed by the Central Institute of Fisheries Technology (CIFT). The shelf-life of the traditionally treated fish is hardly 7-10 days. The problem in the traditional drying practices is the use of poor quality water and often contaminated salt-solution before drying, resulting in microbial attack. This is mostly

carried out by fisherwomen as a part-time avocation. Two women groups viz., Janani and Trinity (15 members each) operating at Elamkunnapuzha is selected for assessing the technology of rack drying.

The major component of the technology is the dip-treatment of fish in saturated brine solution which contains 5% calcium propionate. The hygienically handled fish appeared very fresh with silver colour and gained good market. The treated fish is packed in Polyester polythene polyethylene packets (12 micron, Inner layer -50 micron) for sale. The treated fish resisted microbial attack and consequently increased the shelf life to an average of 125 days. The annual gross earnings per group increased from Rs.66,074 to Rs.76,500 and the annual per capita earnings of women increased from Rs.4,404 to Rs.5,100. Regarding employment, the average annual labour days increased from 70 to 90. The benefit-cost ratio increased from 1.37:1 in the traditional practice to 1.98:1. This intervention is providing self-employment opportunities to women and leads to their empowerment. However, the major constraint observed is the low consumer preference of dried products and the consequent marketing problems.

Fig. 13. Rack drying of fish by women SHG

h) Homestead dairy farming (SE&P)

Fig. 14. Dairy farming - an alternative avocation

Farmers follow a crude pattern of rearing cattle, which made the animals less adaptive to the specific coastal agro ecosystem. There is absence of scientific management practices in the breeding, feeding and disease control of dairy cattle. Soil salinity and waterlogged conditions coupled with the poor management resulted in widespread prevalence of diseases in cattle.

Scientific management practices in the breeding, feeding and disease control of dairy cattle are provided as part of the techno-intervention. The productive performance of cows has improved due to deworming, vaccination against Foot and Mouth Disease and mineral/vitamin supplementation. The milk yield has increased by 1.5litres/cow/day. The benefit-cost ratio is estimated to be 1.42:1 against 1.12:1 for traditional rearing practices.

i) Homestead farming of goats (SE&P)

Goats are observed to be less productive in this area mainly due to high parasitic infestation caused by the humid and waterlogged conditions. Traditional medication by the farmers

themselves causes severe problems to the health of the animal. Limited availability of natural feeding materials, poor knowledge of farmers about feeding, breeding, housing and disease are other associated problems. The average adult weight of goat in the selected area is about 15 kg. The meat yield is much lesser than the average optimum dressed meat yield of 50 percent of the live weight.

Fig. 15. Timely vaccination : a pre-requisite

Faecal samples were collected and tested for internal parasites. Oocysts of Coccidia are found in all samples. Eggs of *Monezia* species recovered and the infection observed to be moderate to heavy. Nematode eggs are also seen in all the samples. Deworming measures are taken to prevent the identified parasitic infestations. The intervention has improved the performance of goats that undergone de-worming, mineral / vitamin supplementation and vaccination against Foot and Mouth Disease. The gain in meat yield recorded a 25 per cent increase and disease incidence was controlled significantly. The benefit-cost ratio increased from 1:1 to 1.39:1 due to de-worming, micronutrient supplementation and disease control measures.

j) *Gramalakshmi* breed of poultry in homesteads (SE&P)

Locally procured chicks are of low quality and their egg laying capacity is much below the optimal average of 200 eggs per annum.

Lack of awareness of proper management practices and health cover is some of the problems in poultry farming

Gramalakshmi variety of poultry birds are found to be of superior quality and suitable for backyard rearing in the coastal agro ecosystem. The average egg yield of *Gramalakshmi* variety is higher (5 eggs for 10 birds/day) compared to country birds (3 eggs for 10 birds/day). Awareness of proper management practices and health cover measures have made good impact upon the farmers of poultry farming. The bird weight is also higher by 33 per cent for *Gramalakshmi* birds compared to local variety of birds. The benefit-cost ratio increased from 0.61:1 to 1.12:1 indicating immense potential of *Gramalakshmi* birds in the homesteads of coastal agro ecosystem.

Fig. 16. Distribution of Gramalakshmi breed

k) Farming of broiler rabbits (SE&P)

Farming of local breeds of poor productivity was the usual practice in the village. Lack of knowledge about improved breeds and scientific management practices including feeding pattern are the major problems. Timely medication was absent. Rabbit farming is not practised on commercial basis despite its vast potential.

Grey giant variety of rabbits is introduced for performance

Fig. 17. Dr. Mario Pedini, World Bank expert with the rabbit farmer

assessment. Rabbits attained a weight gain of 700g compared to the local breeds. The average weight of *Grey giant* is 3.2Kg. and that of local breed is 2.5Kg. The average number of offsprings per delivery is 6 for the improved variety and it is only 5 for the local variety. The disease incidence for the improved variety is found to be insignificant. The benefit-cost ratio also increased from 1.1:1 to 1.46:1 favouring the *Grey giant* variety.

l) Farming of ducks having high genetic potential (SE&P)

Rearing of local variety of birds of low genetic potential is the usual practice followed in the village. Practice of scientific feeding pattern is also not followed. There is good scope for duck rearing in this region as a supplementary occupation.

Fig. 18. Duck farming - a remunerative enterprise

Ducks of high genetic potential, viz., *Kuttanadan* is introduced with the recommended feeding

pattern. The egg yield of improved variety is 40 per cent higher than that of country birds. The benefit-cost ratio for the treatment and farmer's practice is worked out to be 1.33:1 and 1.05:1 respectively. Since women are mostly practicing this as a supplementary avocation, it enables them to enhance their household disposable income.

m) Cultivation of fodder grass (SE&P)

Paddy straw and *uppootha* are given as feed to cattle. With the decline in paddy cultivation in the region due to several social and economic reasons, paddy straw is becoming scarce and costlier. Farmer's have limited knowledge regarding nutritious and saline tolerant fodder grass. There is vast area of marshy land kept unutilised, which could be utilized for perennial fodder grass cultivation.

Fig. 19. Paragrass - a saline tolerant fodder grass

A perennial fodder grass variety, viz., *paragrass* is introduced for cultivation in unutilised marshy lands. It is observed to be saline tolerant, nutritious, high yielding and palatable forage grass. The average yield of *paragrass* is 10 t/ha fetching a net return of Rs.35,000 with a benefit-cost ratio of 1.16:1. Farmers are increasingly adopting the cultivation of fodder variety replacing paddy straw and *uppootha* as a source of roughage for cattle and goat.

n) Cultivation of Amaranthus [(*Kannara local*) - (IPNM)]

The general problem that is observed for all types of vegetable cultivation is uneven spacing pattern combined with uneconomic seed rate and lower output. Though there is vast potential for vegetable cultivation on commercial scale as seasonal and inter crop, it is not utilised to its full extent. To solve this intricate problem, improved varieties of vegetable seeds are introduced for assessment and refinement.

The improved variety of amaranthus, viz., *Kannara local* is found to be more productive than the local variety. It is resistant to leaf eating caterpillar and white spot disease. Adoption of recommended spacing and seed rate resulted in better returns per unit area. An increase in yield by 25.7% is recorded for the improved variety (8.8 t/ha) compared to local variety (7.0 t/ha). Farmers prepare ponds for fish culture by removing the pond bed soil to strengthen the embankments. The high manurial pond bed soil usually gives better yields for vegetable farming, with less operational cost. The benefit cost ratio for the recommended variety, *Kannara local* is 3.37: 1 as against the ratio of 2.61:1 for local variety.

o) Cultivation of Bittergourd [(*Preethi*) - (IPNM)]

Performance of improved variety of bittergourd, viz., *Preethi*, is assessed and found to be more productive

Fig. 20. Bitter gourd cultivation

than the local variety. The recommended spacing (2m x 2m) and seed rate (5 kg/ha) resulted in an increase in yield. *Preethi* variety yielded, an average 18 t/ha in place of local variety's yield of 10 t/ha. Fruit fly attack is not severe in *preethi*. The average weight of the fruit is 300g where as that of local variety is 195g only. Benefit-cost ratio for the *preethi* variety is worked out to be 6.80:1 where as it is 3.50:1 for the local variety.

p) Cultivation of Snakegourd [(*Kaumudi*) - (IPNM)]

Assessment of improved variety of snakegourd, *Kaumudi* proved that the variety is suitable for the cultivation on embankments. The recommended spacing (2m x 2m) and seed rate (16g/cent) resulted in better returns per unit area. The yield for *Kaumudi* variety is 21.2 t/ha. which is found to be higher than the yield of 16 t/ha. by local variety.
It is resistant to downy mildew and powdery mildew diseases. The benefit-cost ratio is worked out to be 2.93:1 for the *Kaumudi* variety as against 2.22:1 for the local variety.

q) Cultivation of Ridge gourd [(*Indam-1222*) - (IPNM)]

The techno-intervention carried out by five women groups that followed the recommended seed rate (12g/cent) and spacing pattern (2m x 2m) attained a gross yield of 11.3 t/ha with 3 per cent increase in

Fig. 21. Ridge gourd cultivation

the average weight of the fruit. The profit margin for the new variety also increased by 20 per cent due to its high marketability. The net returns is Rs.83,385/ha for *Indam-1222* as against Rs.63,790/ha for local variety. The crop duration is 90 days as against 110 days and the benefit-cost ratio is 3.94:1 as against 3.28:1 for *Indam-1222* and local variety respectively.

r) Cultivation of Salad cucumber [(*Poinsette*) - (IPNM)]

Performance of *Poinsette* is assessed and found to be suitable for the coastal agro ecosystem as it gained better yield of 10.2 t/ha against the yield of 7.7 t/ha for the local variety. The average weight of the fruit of *Poinsette* variety is 175g. The germination rate of the improved variety is 78 per cent as against 70 per cent for the local variety. Although the operating cost for the recommended variety is higher with Rs.18,875/ha as against Rs.17,375/ha, for local variety, the net returns obtained is higher with Rs.62,725/ha for the former as against Rs.44,225/ha for the latter. Besides, the variety has high resistance against pests and diseases. The benefit-cost ratio is worked out to be 3.32:1 for the *Poinsette* variety as against 2.55:1 for the local variety.

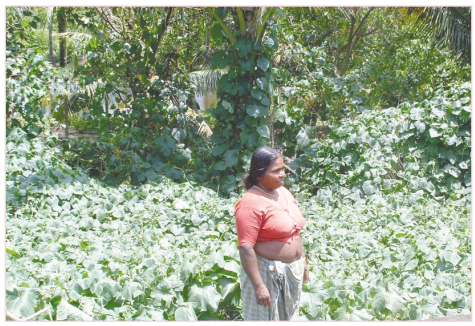


Fig. 22. Radha Karthikeyan - a vegetble farmer

s) Cultivation of Cowpea [(*Arka garima*) - (IPNM)]

Farming of *Arka garima* which followed the recommended seed rate (20g/cent) and spacing pattern (45cm X 30cm) increased the gross yield by 37 per cent (i.e., from 4 t/ha to 5.5 t/ha) and the benefit-cost ratio is estimated to be 2.16:1 against 1.40:1 of local variety. The net returns of recommended variety is Rs.41,380/ha and that of local variety is Rs.25,680/ha.

Fig. 23. Cowpea cultivation on embankments

t) Integrated farming of vegetables on embankments of paddy farms (IPNM)

Embankments of paddy fields lack optimal utilisation. There is a vast potential for cultivation of vegetables and other short term crops on these embankments. Organic cultivation of improved variety of vegetables is not practised mainly due to the lack of knowledge and timely availability of seeds.

Improved varieties of vegetable seeds of amaranthus and cowpea, viz., *Arun* and *Arka garima* respectively are introduced for cultivation on the embankments of paddy farms along with paddy farming. Hitherto unutilised embankments are largely put to use for vegetable farming in order to increase the returns per unit area of land. The benefit-cost ratio worked for cultivating paddy alone is 0.10:1, cultivating vegetable along with paddy

under traditional practices is 2.03:1 and cultivation of improved variety of vegetable amaranthus (*Arun)*, and cowpea (*Arka garima)* on embankments along with paddy is 2.70:1.

In Vypeen Island, paddy cultivation is slowly vanishing. The inter and intra-conflicts between the land holders, cultivators and labourers disturbs the farm scenario and most of the fields are left fallow due to increasing cost of production and diminishing returns. The B-C ratio clearly indicates that the paddy farming could be revived with the proper integration of organic farming of vegetables on embankments.

u) Paddy cultivation using bio-fertilizers (IPNM)

Use of bio fertiliser is not practised in the paddy fields of the study area. Some fertilisers are utilised in the initial stages of farming, but could not be done in the later stages due to the peculiarities of low lying *pokkali* fields. Hence the application of bio-fertiliser is recommended so as to minimise the operational cost of paddy cultivation and enhance the yield.

Application of *Azolla* in *pokkali* fields reduced the cost of paddy farming by 8 per cent. The use of *Azolla* in paddy fields has reduced the incidence of pest attack and the yield increased by 20 kg/ha. The

Fig. 24. Bio-fertilizer applied paddy field

net returns increased from Rs.790/ha to Rs.1578/ha and benefit-cost ratio from 0.10:1 to 0.22:1.

v) Cultivation of *Dwarf cavendish* banana (BT)

Though banana is cultivated on commercial basis, the potential is not fully utilsied. Varieties like *Palayankodan*, *Njalipoovan* and *Monthan* are usually cultivated in this region. Locally available suckers are mostly used. Uneven spacing and improper fertiliser application are the major problems identified.

Fig. 25. Supply of banana suckers from KAU

Dwarf Cavendish, a tissue culture variety is introduced and its performance assessed in comparison to the local varieties. *Dwarf Cavendish* is found to have high resistance to pests and diseases. The number of fingers obtained for *Dwarf Cavendish* variety (106), on average, is 8 per cent higher than that of local variety (97) and the price per bunch is Rs.220, which is higher than Rs.108 for the local variety. The benefit-cost ratio for *Dwarf cavendish is* 1.27:1 as against 0.32:1 for the local variety.

w) Nutrient Management Practices in Coconut Plantations (INM)

Coconut cultivation is a least cared practice, in which fertilizer application and irrigation are lacking in most cases. Soil test data

on coconut plantation reveals that the pH ranged between 6.15 to 7.05, organic nitrogen between 52 and 88 percent, phosphorus content varied between 31 to 120 ppm and potassium between 64 and 112 ppm.

Fig. 26. Nutrient management of coconut plantations

The recommended nutrient dosage per palm is lime-1kg, urea-2kg, super phosphate-2kg, muriate of potash-2kg and magnesium sulphate-1kg and sunhemp seed-500g. The number of bunches per palm increased from 7 to 9 and the number of nuts per bunch increased from 6 to 10. The benefit-cost ratio for the recommended practice is 2:1 as against 0.75:1 under traditional practices.

III. Functional Linkages: IVLP Model of Elamkunnapuzha

It is well known that the linkage developed between the institutes and the end users is a crucial factor for successful adoption and proliferation of any innovative technological interventions. The functional linkages and its operational mode of IVLP implemented at Elamkunnapuzha at sectoral, institutional and stakeholder level has been given in the flow chart (Fig. 27).

All the interventions are functionally linked with the stakeholders mainly through a pair of key informants, frequent

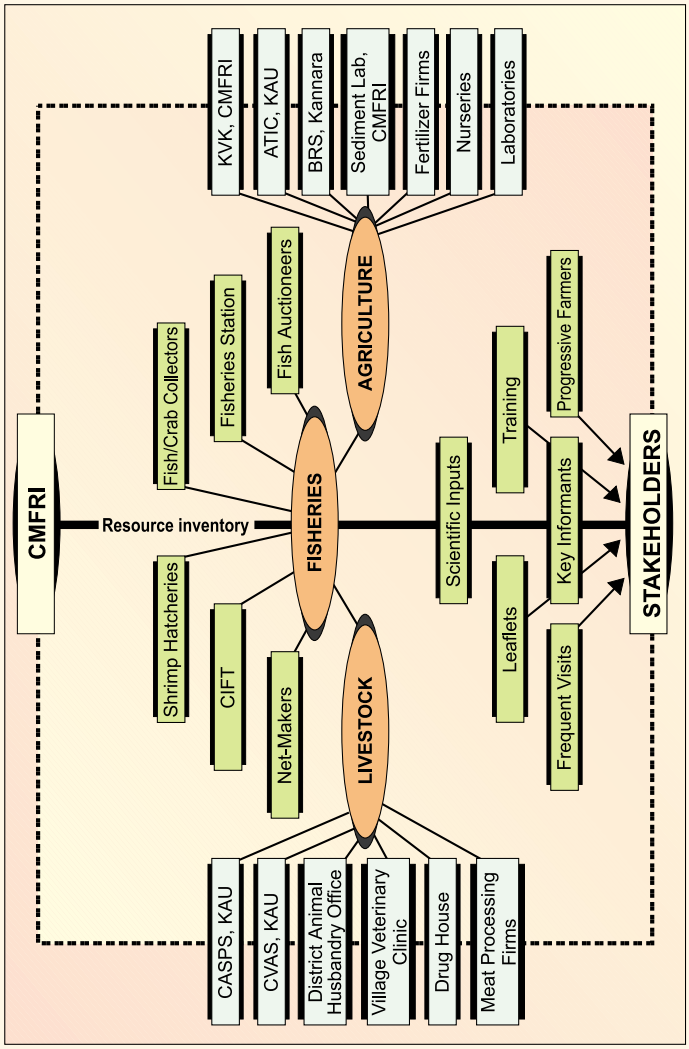


Fig. 27. IVLP Model of Elamkunnapuzha

visit of the scientific personnel and a projective group of progressive farmers. The key informants are from the same village and they possess adequate knowledge about the villagers as well as the economic and social fabric of the stakeholders. Frequent visits by the scientific personnel are seen as an impetus to the farming attitude of farmers. The recording of data on various parameters of farm inputs and outputs not only drives the farmers towards a result-oriented approach but also gives feedback information for further refinement. Visits to the farm sites of progressive farmers or a common place to share their experiences created a propelling effect among the identified stakeholders. Another set of factors which functions as the link between the institute and the primary stakeholders is the scientific information and advise imparted through a number of training programmes and leaflets.

In fisheries, the linkages between the institutions like Central Institute of Fisheries Technology (CIFT) and Fisheries Research Station, Puthuvyppu and input suppliers like shrimp hatcheries, fish/crab collectors, auctioneers and net-makers has been developed. The expertise of the Centre for Advanced Studies in Poultry Science (CASPS) and College of Veterinary and Animal Sciences (CVAS) of Kerala Agricultural University and District Animal Husbandry Office and Village Veterinary Clinic have been utilised for livestock based interventions. The linkages developed in this programme have enabled them to continue the efforts towards achieving a better output. For the agriculture-based interventions, the stakeholders are familiarised with the KVK of CMFRI, ATIC of Kerala

Agricultural University, Banana Research Station of KAU, laboratories and nurseries of various institutions and fertiliser firms for successfully undertaking techno-interventions and their sustenance.

IV. Site Committee

The Site Committee was constituted, as per the guidelines of NATP, for deciding on the techno-interventions and advising the Core Team. Three Site Committees were held for deciding the techno-interventions. The meetings were held on 8th December 2000, 18th June 2002 and 14th May 2004 respectively. The Committee consisted of persons from central and state research institutes, agricultural university, state departments of fisheries, animal husbandry and agriculture.

Fig. 28. Inaugural address by Prof. Dr. Mohan Joseph Modayil in the second Site Committee

Fig. 29. Thrid Site Committee meeting - 14th May, 2004

V. Training Programmes

Top priority has been accorded to impart training to participating farmers. The theme of each training programmes is developed based on need assessment conducted under Participatory Rural Appraisal. Participating farmers identified for various techno-interventions in view of their pond/land potential and occupational pattern are given training in their respective farm endeavours. Altogether 15 training programmes are conducted in which a total number of 576 farmers participated. It may be noted that more women (318 out of 576) are given training (Table 1). Visits to the agricultural and livestock farms of KAU have also been arranged as part of the training programmes.

Fig. 30. Dr. S. Ayyappan, DDG (Fy.) with selected stakeholders

Table 1 : Details of Training programmes

Intervention	No. of training programmes	Duration	No. of Participants		
			Male	Female	Total
Fisheries	6	1-2 days	49	51	100
Livestock	4	1-3 days	23	73	96
Vegetable	5	1-3 days	186	194	380
TOTAL	**15**	**1-3 days**	**258**	**318**	**576**

VI. Impact assessment and spread effect

a) Yield, Earnings and Profitability

The most important impact of IVLP is the adoption of diversified aquaculture practices by the farmers. The comparative yield levels of different fish culture under recommended practises have shown marked improvements (Figure 32). Hitherto the farmers are mostly concentrating only on shrimp-oriented aquaculture in the region. High price of shrimp coupled with export potential lead them blindly to go for this culture irrespective of its suitability and cost of production. Shrimp culture for most of the farms are not ideal but also less profitable than other fish/crab culture practices. Least cost combination of factors of production coupled with high suitability of ponds for monoculture of crabs, *Mugil cephalus*, *Chanos chanos* and polyculture of different types of finfishes has shown profitability ranging from Rs.2 lakh/ha for monoculture of milk fish to Rs.7 lakh/ha for monoculture of juvenile crabs. The only constraint in the spread effect of crab culture is the non-availability of hatchery produced seeds.

Fig. 31. A farmer harvesting fish

Farmers have shown much enthusiasm in continuing their efforts in commercialising the ventures. As far as fisheries-based

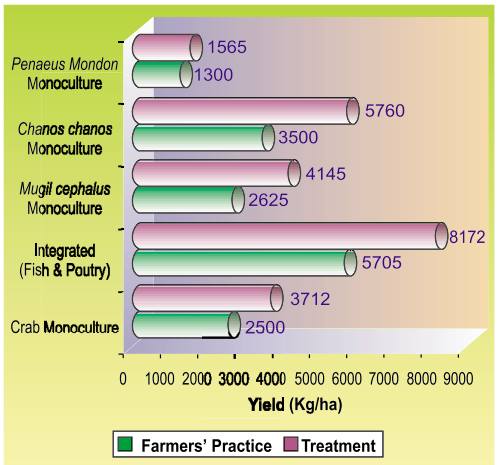


Fig. 32 : Comparative yield of fish/crab culture

interventions are concerned, around 30 per cent of the farmers are using leased ponds. The lease rate of ponds has increased from Rs.8,500/ha during 2000-01 to Rs.10,000/ha during 2003-04 in view of the diversified utilisation pattern and the consequent increase in demand for ponds. The seasonal employment pattern of fish/crab seed collectors also increased from about 80 to 120 labour days per annum. In the project village alone an area of 22.3ha, so far unutilised, has been brought under different fish culture practises.

The livestock interventions are proved as the most ideal supplementary avocation suitable for the coastal agro ecosystem. The benefit-cost ratios of various animal husbandry practices clearly indicate the need for adopting scientific management practices (Figure 33).

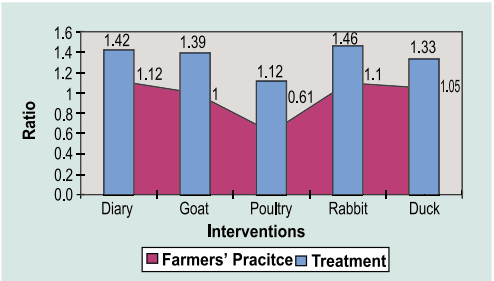


Fig. 33 : Comparative earnings under animal husbandry practices (B-C Ratio)

It provides maximum opportunity for optimum utilisation of backyards of homesteads and provides employment mostly to women. The annual household income could be enhanced by Rs.2,150 by growing 10 *Gramalakshmi* birds to Rs.10,000 by growing 5 broiler rabbits of *Grey giant* variety. The cultivation of paragrass in the unutilised marshy lands has shown a potential yield of 10t/ha, indicating higher pros-pects of livestock for the fodder-deficient Island eco-system.

In agriculture-based interventions, cultivation of vegetables of improved variety yielded better returns as monocrop and inter-crop along the embankments of fishponds and also along homesteads. Although the yield of snake gourd (*Kaumudi)* cultivation is better than all other vegetables, the net earnings (Rs.1,28,325/ha) are more for bitter gourds (*Preethi*). The impact of nutrient management in coconut plantation has shown an average increase of 30 nuts per annum per tree. This practice of nutrient management for all the coconut trees in the entire village may bring far reaching impact on the rural economy. Since there are about one lakh coconut trees in the study area alone, the impact of this simple management practice alone could fetch an additional revenue of about Rs.1 crore per annum in

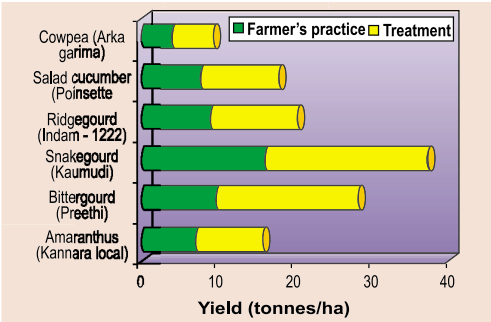


Fig. 34 : Comparative yield of vegetable crops

Elamkunnapuzha village, even if we assume an additional 20 nuts per tree per year with an average price of Rs. 5 per nut.

Fig. 35. Collection of socio-economic data

b) Socio-Economic Profile

Altogether 300 farmers in the village are surveyed (150 IVLP and 150 Others) to assess the socio-economic profiles and impact on attitude and adoption level. Eight socio economic indicators are used to compare the profile of IVLP farmers with other farmers (Table 2). The respondents are categorised into 'high' and 'low' taking mean score into consideration. More than 80 per cent of the IVLP farmers have high scientific and risk orientation with an annual employment of more than 120 labour days and savings of more than Rs.7500 per annum. More IVLP farmers are observed to have high socio-economic profile in all the eight indicators (Figure 36).

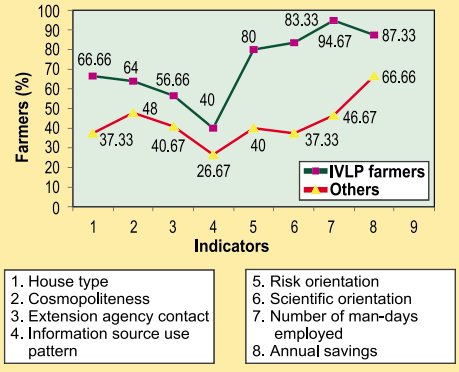


Fig. 36 : Distribution of 'High-Profile' farmers

Table 2 : Comparative socio-economic profile of farmers

Indicators	Category	IVLP FARMERS (N0. =150)		OTHER FARMERS (No.= 150)	
		F	P	F	P
House type	**High** (>2.00)	100	66.66	56	37.33
	Low (≤ 2.00)	50	33.34	94	62.67
Cosmopoliteness	**High** (>5.20)	96	64.00	72	48.00
	Low (≤ 5.20)	54	36.00	78	52.00
Extension agency contact	**High** (> 15.00)	85	56.66	61	40.67
	Low (≤ 15.00)	65	43.34	89	59.33
Information source use pattern	**High** (> 12.00)	60	40	40	26.67
	Low (≤ 12.00)	90	60	110	73.33
Risk orientation	**High** (>10.25)	120	80	60	40.00
	Low (≤ 10.25)	30	20	90	60.00
Scientific Orientation	**High** (> 5.00)	125	83.33	56	37.33
	Low (≤ 5.00)	25	16.67	94	62.67
No of labour days employed	**High** (>120)	142	94.67	70	46.67
	Low (≤ 120)	28	5.33	80	53.33
Annual savings	**High** (> 7,500)	131	87.33	100	66.66
	Low (≤ 7,500)	19	12.67	50	33.34

F. *Frequency*
P. *Percentage*

c) Attitude and Adoption Level

A total number of 100 farmers are surveyed in the fisheries-based programmes from IVLP and Others. Among the 50 IVLP farmers, 80 per cent have preferred scientific fish/crab culture practices, where as among 'Others', 64 per cent have favoured the

scientific farming practices. It could be inferred that training and other extension approaches in diffusing techno-interventions succeeded in bringing positive changes in the attitude level of farmers (Figure 37).

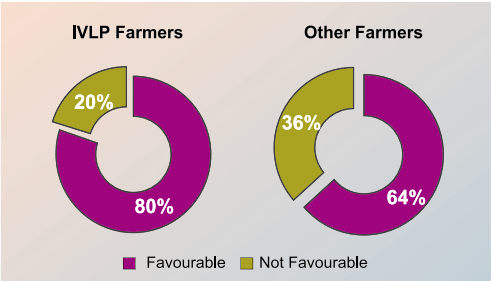


Fig. 37 : Attitude towards scientific fish/crab culture

Similarly, with regard to agricultural practices, 62 per cent of the IVLP farmers and 52 per cent of the Other farmers have favourable attitude towards scientific practices (Figure 38).

Level of adoption of scientific farming practices is analysed for three broad categories of techno-interventions, viz., fisheries, livestock and agriculture. It is observed that within the fisheries-based techno-interventions, all the scientific practices recorded more than 70 percent of adoption rate, except the practice of regularity in culture period, which was adopted only by 43 per cent of the farmers. The average culture period recommended was higher compared to the traditional period of culture. The extended period of culture though significantly improves the productivity,

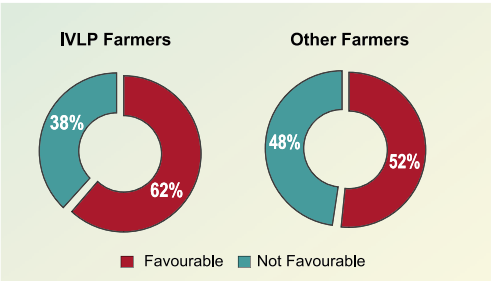


Fig. 38 : Attitude towards scientific agriculture practices

farmers preferred irregular harvest to meet their day-to-day requirements. Under the livestock based interventions, all the recommended practices are adopted by more than 83 per cent of the farmers, where as in agriculture, adoption level varied between 60 and 83 per cent for fertilizer application and embankment utilisation respectively. High cost of fertilizer may be the reason for the low adoption of fertilizer application (Figure 40).

Fig. 39. DDG (Fisheries) with farmers in group discussion

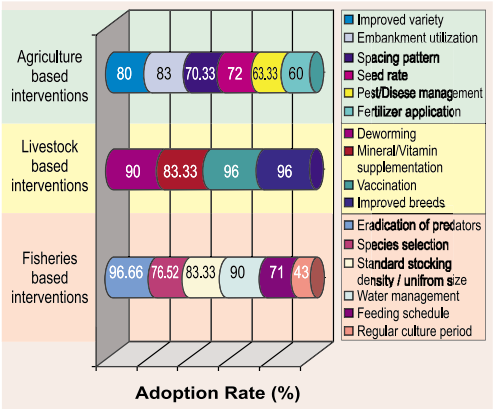


Fig. 40 : Adoption level of farmers

d) Women Empowerment

As part of the Participatory Rural Appraisal, gender analysis was done through choice matrix technique. The IVLP envisages gender specific strategies and interventions to empower the women community. While gender is inherent in the notion of participatory approach, it is often not addressed automatically.

Hence concerted and deliberate efforts are made to understand the gender issues and thereafter specific interventions are planned for addressing these issues by integrating them into the project.

Fig. 41. Dr. E. G. Silas, Member, SAP of NATP along with SHG members

The extent to which women in a community are able to make autonomous decisions is clarified with this analysis.

It is observed that men and women together make most of the decisions regarding farm and home activities (Table 3). Women take active role in livestock rearing and money management. It is also interesting that women initiate the social commitment activities and gender equity is observed in the decision-making and implementation processes. In children's education men play a dominant role.

Table 3 : Gender Involvement in Decision-Making and Implementation

Criteria	Who initiates	Who decides	Who implements
Enterprises selection	Both	Both	Men
Selection of fish seed	Both	Both	Both
Purchase/ Collection of seeds	Both	Men	Men
Feed	Both	Men	Women
Livestock management	Both	Both	Both
Vegetable cultivation	Women	Both	Both
Money management	Men	Men	Both
Social commitment	Women	Both	Both
Child education	Both	Men	Men

The implementation of location specific techno-interventions are commenced in February 2001 with the active participation of farmers. Out of 706 IVLP farmers, 367 are women.From among the 96 IVLP fisherwomen surveyed, majority of them are involved in one or other activities (Table 4). While women play independent role in feeding and post harvest activities, they play a supportive role in activities like pond preparation, transportation of live fish seeds, fish stocking, water exchange and harvest.

Table 4 : Women participation level in fisheries related activities

Activities	Involvement	Time spent (hrs)	Supporting men/ engaged in own right
Pond preparation	Yes	4	Support
Sluice gate preparation	Yes	1	Support
Eradication of predators	Yes	3	Support
Transportation of live Fish seeds	Yes	1	Support
Fish stocking	Yes	1	Support
Water exchange	Yes	½	Support
Feeding	Yes	1	Own
Harvest	Yes	1	Support
Post harvest activities	Yes	4	Own

In livestock management, the highest percentage of involvement of women is observed in case of deciding the "cleaning of animal shed" (60 percent). Although men play a

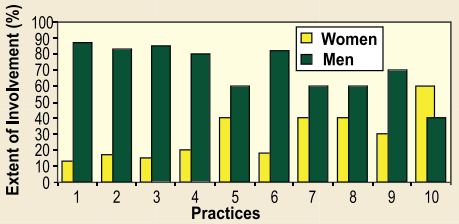


Fig. 43 : Role of women in decision making in animal husbandry practices

dominant role in most of the decisionmaking, the involvement of women is significant for fodder production, care and feeding and feed arrangements (Figure 43).

Extent of involvement of women farmers in agriculture based programmes is measured based on 13 standard practices (Figure 44). The percentage involvement of women in decision making about area to be sown, harvesting, labour management, grain storage and marketing were 61, 54, 60, 62 and 60 per cent respectively, which are more than men. The overall extent of involvement in decision-making shows that the women play a dominant role in decision making in the coastal agro-ecosystem.

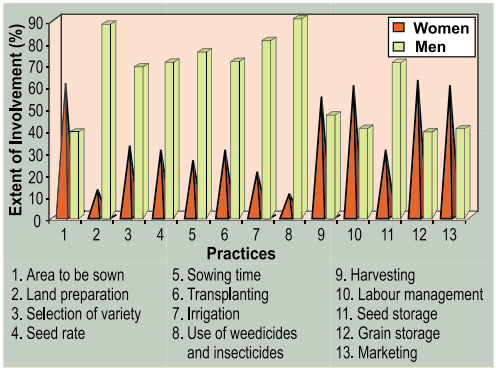


Fig. 44 : Role of women in agriculture

e) Horizontal Expansion

In the coastal agro ecosystem, the best scope for enhancing the livelihoods of stakeholders lies with the development of fish and fisheries based programmes. In the tide-fed brackish water system, the traditional shrimp/fish culture system has been gradually replaced with the scientific aquaculture practices. Already the highly remunerative shrimp culture practice had widespread adoption invariably supported by the hatchery and other infrastructure development. With the outbreak of disease

problems, farmers are frantically looking for alternative crops in their farms. With the rush to reap quick profits, even the less suitable ponds are also used for shrimp culture practices resulting into losses. The IVLP experiments at Elamkunnapuzha proved the suitability and economic feasibility of a number of location specific technologies to attain optimum and sustainable production. Monoculture of crabs and crab fattening offers immense scope for high profitability but lacks the support of hatchery-produced seeds. The monoculture and polyculture of finfish such as, *Mugil cephalus*, *Chanos chanos* and Etroplus need to be undertaken on a wider scale as it offers enormous potential for expansion in the unutilised and under-utilised water bodies.

Fig. 45. Parliamentary team discussing with Farmers

The potential area suitable for aquaculture in Kerala is 65,000ha. in which hardly 15,000ha are currently utilised. There are many techno-socio-economic constraints in spreading out the shrimp culture practices in most of these unutilised water bodies, which are highly congenial for finfish aquaculture. The experiments at Elamkunnapuzha proved that the average yield of *Mugil cephalus* is 4050kg/ha and *Chanos chanos* 5500kg/ha with the average farm-gate price of Rs.115/kg. and Rs.70/kg respectively. By bringing about at least 20,000ha of potential area under monoculture and polyculture of these varieties, an additional annual production of 60,000tonnes is

possible valuing at Rs. 420 crores, even if we assume an average production of 3000 kg /ha with an average price of Rs. 70/kg. Hence the urgency of horizontal expansion of finfish culture practices have been felt in the third Site Committee of IVLP and entire focus has been given for the same. Efforts are taken to propagate aquaculture of these varieties in five adjoining villages, such as Njarakkal, Nayarambalam, Edavanakkadu, Pallipuram and Kuzhippilly expecting far reaching socio-economic impact of fisherfolk.

VII. Conclusion

The IVLP model ensured the total involvement and participation of stakeholders in the experimentation process of technology assessment and refinement unlike the earlier TOT efforts and extension strategies. Participatory Rural Appraisal and livelihood analysis identified the location specific problems, potential solutions and the extent of blending the prevalent indigenous knowledge with the scientific practices to optimise the yield and earnings. The on-farm and verification trials proved beyond doubt the economic feasibility and high profitability of adopting improved farming practices. The demonstration effect has induced fisherfolk to diversify the aquaculture practices rather than entirely depending upon shrimp culture. Integration of aquaculture with agriculture and animal husbandry practices has shown the potential of generating additional employment opportunities and enhancement of disposable household income. The Elamkunnapuzha model of IVLP reveals that the aquaculture production of Kerala State can be easily developed and gives the vision of coastal rural prosperity by expanding the monoculture and polyculture of finfish varieties like *Mugil cephalus, Chanos chanos* and Etroplus spp. in unutilised and under utilised water bodies.