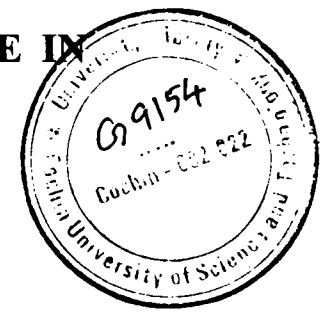
AN EVALUATION OF EXTENSION ACTIVITIES IN THE DEVELOPMENT OF AQUACULTURE IN KERALA



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CERTIFICATE

This is to certify that this thesis is an authentic record of research work carried out by Smt. Daisy. C. Kappen, under my supervision and guidance in the School of Industrial Fisheries, Cochin University of Science and Technology in partial fulfilment of the requirements for the degree of Doctor of Philosophy and no part thereof has been submitted for any other degree.

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CHAPTER I

INTRODUCTION

Aquaculture is one of the prime catalysts for the socio-economic development of Indian economy contributing to the nations food and nutritional security, export earnings, income and employment generation. Rapid expansion of aquaculture technologies the world over and the integration of major shrimp producing developing nations to international markets have made Indian aquaculture sector as one of the fastest growing primary producing sectors since nineteen seventies. Recognizing its economic significance, the private industry, development agencies and the state have been engaged in developing several new scientific and technologically superior research alternatives for the viable and fast adoption of various scientific aquaculture practices by entrepreneurs and primary producing communities. Workshops, symposia, conferences etc. have become very frequent, to highlight the importance of improved technological research, training of personnel and information dissemination for the development of the sector. However, the need for systematic efforts to link farmers with the research system to evolve economically and ecologically adaptable farming practices through transfer of research findings became highly essential.

Extension is the vital link connecting research systems and farmers. It is an instrument to bring about change, be it social or technological, and plays the dual role of disseminating technology to the farmers in the field and conveying back their problems to the research system. The innumerable technological developments and research findings could have been effectively utilized by farmers

through various extension activities. Extension is the machinery to channel technological developments and aims at improving the efficiency of the human beings in an effort to promote production and productivity. It is a multidimensional system with interrelationships, linkages, transactions between and among internal and external domains and aims at bringing about planned change in the target group. The fundamental objective of extension is to develop rural people economically, socially and culturally by means of education and thereby ensure higher quality of life for them[1]. Therefore any programme planning for development has to include extension system as an integral component.

Unfortunately, in fisheries, the need for offering extension services to farmers has not been adequately recognized and acted as the major bottleneck for the viable adoption of technologies. Modern fish farming technologies developed could not be propagated to the remote rural areas for want of a broad net work of extension services. In fact, the lacunae has been pointed out by the National Commission on Agriculture "Absence of adequate work in fisheries extension has been one of the principal reasons for the slow pace of inland fisheries development" (Seminar on Fisheries Extension :1980)

Taking these criticisms seriously, most of the states had started extension divisions under their Fisheries Departments. Today, fisheries extension programmes are planned both at central and state levels and

[1] Extension activities perform five major functions. i) dissemination of appropriate technology (education) ii) convincing the farming community to adopt such technologies (motivation) iii) collect the farmers responses (feed back) iv) refinement of technology to suit the farming situation (assessment and refinement) and v) act as a link between the research and user system (liaison) (Kumaran et al.2003).

are implemented mainly through the concerned State Department of Fisheries. The Fisheries Division in the Department of Agriculture and Cooperation under the Union Ministry of Agriculture is the nodal agency coordinating the developmental programmes and formulating the major policy guidelines for the states. Different programmes were planned both at central and state levels and implemented mainly through State Department of Fisheries. Exclusive agencies like Fish Farmers Development Agencies (FFDA) and Brackish water Fish Farmers Development Agencies (BFFDA) were started in an attempt to disseminate technologies[2]. These agencies motivated farmers by offering subsidies and other economic benefits[3]. Besides these, agencies like Marine Product Export Development Authority (MPEDA), Agency for Development of Aquaculture, Kerala (ADAK), ICAR institutes, State Agricultural Universities etc. are also doing extension activities in the field of fisheries.

During the early nineties the growth in aquaculture production has been driven by prawns and prawn farming became a capital/ technology intensive commercial enterprise. The economic liberalization policies initiated in 1991 combined with high profitability favored

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[2]The major objectives of Fish Farmers Development Agencies (FFDA) are 1) To arrange leasing of water body to fish farmers 2)To bring all the cultivable water area under the scheme 3)To create a new cadre of fish farmers 4) To popularize fish culture 5) To provide increased employment opportunities to rural people and 6) To improve rural economy through fish culture Similarly, the Brackish Water Fish Farmers Development Agency (BFFDA) working in the coastal districts of Kerala with the following objectives.1) To popularize shrimp farming 2) To provide technical, financial and extension support to prawn farmers 3) Survey and identification of areas suitable for prawn culture and 4) To impart training to prawn farmers.

[3] FFDA offered 20per cent subsidy for construction of ponds, renovation of ponds , purchase of inputs (fish feed , fish seed etc.), integrated fish culture, fish feed manufacturing unit and 25 percent subsidy for aerator. The BFFDA on the other hand offered 25 percent subsidy for prawn farm construction, 10 percent subsidy for establishment of shrimp hatchery, incentives for training in shrimp farming and cash subsidy of Rs.30,000 for construction of new ponds to under take semi-intensive prawn farming.

mushrooming growth of shrimp farms in the country. Government introduced subsidy schemes for new farms, establishing shrimp hatcheries and manufacturing shrimp feeds. The Government of India offered customs duty concession on imported shrimp feeds. State Governments too liberalized the leasing policies for brackish water aquaculture. As a result of these measures, area, production and export of shrimp increased many fold **(Jayaraman and Selvaraj 2000).**[4] The rate of return on shrimp farming was at an unparalleled level of 600 per cent **(Srinivasa Rao and Krishnan 2000).** There was also a tremendous development of ancillary and allied industries like hatcheries and manufacturing companies, processing companies, ice plants etc.

Most of these developments occurred, mainly through private initiatives in an attempt to capitalize on the growing international prawn markets, outside the domain of state sponsored extension activities. Farmers resorted to intensive culture practices with increased levels of feed, seed, fertilizer and chemicals, water exchange etc. However, this trend in brackish water aquaculture could not sustain for long. The environmental impacts of intensive shrimp culture like salinity intrusion, decline of freshwater table, monsoon floods in villages due to blocking/ diversion of drainage/ irrigation canals by prawn companies, effluents and pollution, white spot disease, adverse effect upon paddy fields, grazing lands, village ponds, tanks etc. became the major challenges for management authorities and extension officers **(Parthasarathy and Nirmala 2000; Ananthan, 1998).** The subsequent

[4] In Tuticorin, Tamilnadu, Victory Aquafarm reported to have harvested 16-17 tons/ha/annum from three crops, which compares well with levels of farmed shrimp - *Penaeus indicus* and *Penaeus monodon*.- production in other countries.

developments in the aquaculture sector like the Coastal Regulation Zone (CRZ) notifications, ban of intensive and semi-intensive farming in ecologically fragile coastal areas, setting up of National Coastal Management Authority to safeguard marine life and coastal areas and the constitution of an Aquaculture Authority to issue licenses for traditional and improved traditional aquaculture within CRZ provided greater challenges to the extension activities to evolve sustainable and eco-friendly production possibilities for Indian water bodies

The need for evolving sustainable aquaculture systems that promote local economic development, food security and environment has been emphasized increasingly by international agencies like the Food and Agriculture Organization (FAO)[5]. Sustainability soon became the bandwagon for extension officers and many State fisheries departments issued circulars to follow norms for ensuring sustainable culture systems. Economic efficiency should be coupled with ecological sustainability in both the development and dissemination of technology. Sustainable fisheries should be rich in technology and information with less intensive energy uses and market purchased inputs. The society should realize its mistakes of the past in the use of natural and other resources and rectify it. The control of natural resources by local community, participatory, open and democratic decision making will ensure sustainable development of aquaculture, the extension theorists argued.

Following these refined guidelines the Fisheries Department of Kerala restructured its approach to incorporate these modern challenges of

[5] FAO defined Sustainable development as "the management and conservation of the natural resources base and the orientation of technological and institutional change in such a manner as to ensure the attainment and continued satisfaction of human needs for present and future generation.".

dissemination in an attempt to evolve sustainable aquaculture practices. It started the People's fish culture programme called the *Janakeeya Matsya Krishi* Programme (JMK) in 1997 for creating awareness towards meaningful utilization of water bodies for the culture of fishes and shell fishes at the Panchayath level. Maintenance and utilization of available water bodies in an eco-friendly and sustainable manner and Co-operation and participation of local people and local bodies were the main features of this programme[6]. The Department conducted a resource survey at Panchayath level to get a strong database at the grass root level. Programmes were implemented through 14 Fish Farmers Development Agencies and six Brackish water Fish Farmers Development Agencies working all over the State. Financial and technical assistance were given to the local bodies for identifying, formulating and implementing projects. Seeds and other inputs were supplied at free of cost to the farmers. Department of Fisheries strengthened its extension activities by appointing professionally qualified personnel. These changes in fact has produced mixed responses both for farmers, coordinating agencies and the executing agencies and challenged the traditional claims of extension services.

Importance of the Study

As mentioned above the Department of Fisheries, Kerala is promoting aquaculture in the State through FFDA and BFFDA. Farmers are exposed to organized extension activities from time to time. Huge amounts of money and effort are involved in providing

[6] Creating awareness among people, demonstrating techno-economic feasibility of viable eco-friendly aquaculture models, augmenting fish production, mobilize voluntary participation of people, creating more employment opportunities, protecting and enriching healthy water environment of the State were the other objectives of the programme.

technical assistance, loan, subsidy and other inputs to these beneficiary farmers. Attempts have not yet been made to evaluate these extension activities carried out through these agencies in the development of aquaculture. Unless evaluation studies on the effectiveness of programmes are conducted, the impact of such activities will remain un assessed. A feed back from the farmers can clearly serve as an indication of its effectiveness. The results of the study would not only be useful for the planners and policy makers to review the effectiveness of the extension activities in the task of transfer of technologies but also serve as a guideline in formulating future policy for development of new programme for target groups. This will lead to concrete suggestions for future extension work. The study will reveal the level of knowledge and extent of adoption of improved practices in aquaculture which will indicate the effectiveness of the extension activities. It may also indicate the level of satisfaction the farmers have over extension services. The real problems faced by the beneficiary farmers will throw light on the real constraints in fish production at the grass root level. Delineation of these constraints under each category responsible for adopting the recommended technologies, will help research and extension systems to strengthen the efforts and bridge the gap between technology transfer and adoption. The perception of the extension officers about People's Fish Culture Programme and the constraints and limitations in technology transfer will also be analyzed to ensure smooth functioning of the extension system.

Under these circumstances an examination/evaluation of how various primary producer groups in the aquaculture sector respond to extension inputs is warranted. The main motive of the thesis is to make an attempt to explore the responses of local producers to the extension programs of the state with special reference to the aquaculture sector of Kerala, India.

Objectives

The specific objectives of the study are the following.

1. To study the extent of adoption of improved fresh water and brackish water culture practices of beneficiary farmers
2. To study their level of knowledge about such improved practices.
3. To study the extent of client's satisfaction with extension services.
4. To find out the relationship between socio-psychological and economic characteristics of beneficiary farmers with extent of adoption, level of knowledge and satisfaction.
5. To identify the constraints faced by beneficiary farmers in the adoption of improved aquaculture practices.
6. To study the perceptions of the fisheries extension officers about the peoples fish culture programme. or Janakeeya Matsya Krishi programme.

7. To identify the constraints faced by fisheries extension officers to deliver various extension services.

Hypotheses

The following hypotheses are proposed for the study:

Set A

In the case of fresh water and brackish water beneficiary farmers:

1. There would be no adoption of the recommended technologies.
2. There would be no knowledge about improved practices in aquaculture
3. There would be no satisfaction with extension services.

Set B

In the case of fresh water and brackish water beneficiary farmers:

4 There would be no significant relationship between the level of adoption and selected socio-psychological and economic characteristics of beneficiary farmers (age, education, occupation, experience, annual income, farm size, information source utilization, indebtedness, social participation, risk orientation, marketing orientation and extension participation)

5 There would be no significant relationship between the level of knowledge and selected socio-psychological and economic characteristics of beneficiary farmers.

6 There would be no significant relationship between the level of satisfaction and selected socio-psychological and economic characteristics of beneficiary farmers.

Set C

In the case of fresh water and brackish water beneficiary farmers:

7 There would be no significant contribution of selected socio-psychological and economic characteristics in the variation of the level of adoption.

8 There would be no significant contribution of selected socio-psychological and economic characteristics in the variation of the level of knowledge.

9 There would be no significant contribution of selected socio-psychological and economic characteristics in the variation of the level of satisfaction.

Scope of the study

The study has been conducted as a part of doctoral research with small sample size and coverage. Therefore grand generalizations are not attempted. The study is based upon the expressed opinion of the respondents, it may suffer from personal bias and prejudice. However, the researcher has ensured all possible efforts to uphold the scientific objectivity by carrying out a systematic and sincere study.

Presentation of the study

The thesis is presented in six chapters. The first chapter introduces the thesis and highlights the importance, objectives, hypotheses and scope of the study. The second chapter presents the theoretical orientation covering the review of literature pertaining to the study while the third chapter comprises the materials and methods dealing with location of the study, selection of respondents, selection and measurement of variables, methods of investigation, statistical tools used and operational definitions of the terms used. The fourth chapter presents results of the study and fifth chapter deals with the discussion of the results. The final chapter gives the summary and conclusions of the study. The references and appendices are given at the end.

CHAPTER II

REVIEW OF LITERATURE

As a body of scientific knowledge extension highlights the need and relevance of extension as an additional input for the effectiveness and success of any development programme. It highlights the level of adoption, knowledge and extent of satisfaction of farmers, among other things, as crucial variables determining effectiveness of extension services. However, a variety of constraints restrict farmers from benefiting from extension services. Apart from these, perception of extension workers about various development programmes and the personal limitations of extension workers could also influence the extension services.

Specific studies in the field of fisheries extension related to aquaculture are scarce. Hence studies conducted in the fields of agriculture and animal husbandry which were directly and indirectly connected with present study were summarized under the following heads.

1. Importance of aquaculture extension.

2. Effectiveness of extension activities on extent of adoption of farmers.

3. Effectiveness of extension activities on the level of knowledge of farmers.

4. Extent of satisfaction with extension services.

5. Constraints faced by the farmers in adoption of improved aquaculture practices.

6. Perception of extension officers about Janakeeya Matsya Krishi Programme.

7. Constraints and limitations of extension officers.

8. Relationship of socio-psychological and economic characteristics of farmers with their adoption, knowledge and satisfaction.

1. Importance of aquaculture extension

Many authors viewed the importance of aquaculture extension in different ways.

Mammen (1980) reported that "Extension has already been identified as the weakest link in fisheries development. If extension has not succeeded, it could be a case of half backed technology, absence of package approach, lack of economic benefits etc."

Haque and Ray (1983) highlighted the importance of aquaculture extension that the success of fish culture depended to a great extent on the adoption of proven new technology evolved for the purpose of obtaining higher yields and return. Adoption of information about any new farming practice and interaction with competent extension personnel are basic requirements to bring about desirable changes in human behavior in any programme of planned change.

Rao (1988) reported "Great gains in fish production can be realized through application of existing technology. Extension and training personnel operating through the various programme should critically review the existing research findings and identify areas

which are of immediate use to fish farmers. They should provide feed back information to the researchers".

Vasanthakumar (1988) revealed that "the development of a fishery depends on generation of innovation by researchers, diffusion by extension and adoption by clients. Development can be accelerated by gearing up research and extension efforts to result in increased adoption."

Kumar (1999) reported that the prime objective of aquaculture/ fisheries extension is to persuade and help aqua farmers and fishing communities to improve up gradation of socio-economic condition and quality of life through their farming practices for increased fish production and income.

2. Effectiveness of extension activities on the level of adoption of farmers.

Singh and Sing (1974) reported that the National Demonstrations were effective in helping scientifically oriented farmers in adoption.

Supe and Salode (1975) reported that National Demonstrations were effective in helping the scientifically oriented farmers in the adoption of demonstrated practices.

Kaleel (1978) revealed that high adopters of improved agricultural practices were more in Intensive Paddy Development Programme implemented areas than in other areas.

Pathak et al (1979) observed that National Demonstration was effective in increasing the adoption level of the farmers in relation to jute, paddy and wheat crops.

Samad (1979) found that extent of adoption of improved scientific practices was more in Coconut Package programme areas, than in other areas.

Kulhari (1980) found that the level of adoption of recommended practices of paddy and wheat by farmers of Training and Visit system (T&V) was significantly higher than the farmers outside the system.

Kamarudeen (1981) reported that the neighboring farmers of the National Demonstration plots were superior to the other farmers in relation to their extent of adoption of the recommended practices of paddy.

Gaurha and Pyasi (1983) revealed a good impact of National Demonstration Programme. The demonstrating farmers had high adoption than non demonstrating farmers.

Mangle (1983) analyzed the impact of extension activities on the overall agricultural development of the farmers from project affected villages at four stages viz. awareness, attendance, participation and adoption and reported more than fifty per cent of the farmers showed medium impact of extension activities. About one-fourth of the farmers had a high impact and remaining farmers had a low impact of extension activities.

Padmaiah (1983) studied the impact of Integrated Rural Development Programme (IRDP) on rural farm families and revealed there was significant difference among beneficiaries and non-beneficiaries in terms of extent of adoption of practices.

Hiravenkanagouder et al. (1984) found that the adoption index of participant farmers of National Demonstration was 65.85 per cent whereas adoption index of non-participant farmers was only 25.66 per cent with regard to their level of adoption of improved agricultural practices.

Kibey et al. (1984) reported that National Demonstration was very successful and effective in communicating important agricultural technology to tribal farmers and also in increasing their adoption of improved technologies

Krishnamoorthy (1984) observed most of the dry land farmers possessed medium level of adoption on different dry land practices.

Nikam and Singh (1984) from their study found that the adoption level of tribal farmers who participate in National Demonstration was superior to that of the non-participant tribal farmers.

Gaurha and Pathak (1985) reported that the impact of National Demonstration in improving the productivity of paddy on demonstrating farmers's fields had been encouraging. The average paddy yield obtained by demonstrating farmers was nearly six times the district average yield.

Ingle et al. (1986) studied impact of All India Scheduled Cast Area Research Project and reported substantial increase in the adoption of improved seeds and package of practices recommended for higher yields of different crops.

Ekanthappa (1987) studied the impact of selected schemes of IRDP and reported that there was an increase in the absolute number of days of employment for all the categories of beneficiaries after initiation of the IRDP.

Patil et al. (1987) studied the performance of T&V system of extension education and reported that there was an increase of seven to ten per cent in the adoption of improved agricultural practices of jowar cultivation by the contact farmers, where as in the case of non-contact farmers the increase in adoption of improved agricultural practices of jowar cultivation was comparatively less.

Ramalingam et al. (1987) reported that IRDP has improved the social status and economic status of the participants of the programme. But still most of the scheduled cast marginal farmers and agricultural labours could not participate in the programme in view of procedural difficulties.

Sankaran (1987) studied the impact of Groundnut Minikit Trials Programme and reported that there was significant difference in the extent of adoption between beneficiaries and non-beneficiaries.

Sharma et al. (1987) reported that the Lab to Land Programme had been able to motivate a large number of farmers to adopt the improved agricultural practices of wheat and paddy crops and also helped them in raising the farm production and income of farmers.

Sudha (1987) studied the impact of Lab-to-Land Programme on tribal and non-tribal participants and revealed there was significant

difference in the level of adoption of transferred technology between the participants and non-participants.

Ingole et al. (1988) evaluated the Intensive Cattle Development Project and reported that ICDP has succeeded considerably in diffusion and adoption of improved animal husbandry practices.

Syamala (1988) reported there was significant difference between the farmer demonstrators and the neighbouring farmers with respect to their adoption of the demonstrated cultivation practices in National Demonstration.

Verma et al. (1988) observed that the level of adoption of improved practices of summer moong cultivation has increased as a result of Lab-to-Land Programme. The initial adoption score was 29.45 and after the programme it was 52.92.

Singh (1990) studied the effectiveness of Training and Visit system of extension and revealed significant improvement in the adoption of modern methods of farming by all categories of farmers with different size holdings.

Ramachandran (1992) studied the impact of Rice Minikit trials on the adoption behavior of farmers and revealed that the level of adoption of recommended practices by the participant farmers was significantly higher than that of non-participant farmers.

Jnanadevan (1993) reported that the percentage of farmers having high level of adoption was more in the category of beneficiary farmers in Coconut Development Programme.

Mehta and Joshy (1993) found substantial increase of 27.96 per cent in the income of the families covered under IRDP where as in the case of non-IRDP families it was 6.71 per cent which was much less than the increase in national income during the same period.

Sing and Sharma (1998) reported that the majority of fish farmers applied lime in their ponds but they did not pay required attention to manure application. Only large farmers use balanced feed comprising both rice bran and oil cake whereas only 40 per cent small farmers resort to regular feeding with oil cake and rice bran. Small farmers providing only 37.5 per cent of the recommended quantity of feed in their pond.

Ashaletha (2000) studied the impact of National Agricultural Research Project (NARP) on agricultural development in the Southern Agro-Climatic Zone of Kerala and reported that extent of adoption of improved practices was fairly good.

Kumaran (2000) studied the effectiveness of agricultural extension services in an irrigation command area and reported that the majority of the respondents (60%) had medium level of adoption of water management practices.

Acharya and Tripati (2000&2001) studied the impact of Indo-Canadian Extension Project on adoption of improved farm practices in Rabi crops and found that farmers had relatively higher adoption level as compared to the other categories of farmers. The project motivated farmers for adoption of improved farm technology.

Kadam et al. (2001) analyzed the adoption of soil and water conservation practices in Watershed Development Project and reported that out of 12 practices under study only one-third, that is four to five practices were adopted by a notable number of the beneficiaries.

Baswarajaiah et al. (2002) reported that majority of the beneficiaries of the water shed development programme belonged to medium adoption category.

Dhyani et al. (2002) revealed that watershed management technologies had great potential in achieving food, environmental stability, economic development, employment potential and mitigation of climatic hazards.

Jha and Jha (2003) studied the adoption level of modern agro-techniques by tribal farmers under Government Organizations(GO) and Non Government Organizations(NGO) jurisdiction and revealed tribal farmers of the operational area of NGOs had higher level of adoption in comparison to those of operational area of GO.

Wasnik (2003) in his study on impact of technology transfer on sugarcane productivity revealed that there was significant improvement in adoption of recommended practices both in sugarcane and ratoon crop.

Padiyar et al. (2004) reported that the Better Management Practices (BMP) adoption rates in demonstration ponds were much higher than those in the non-demonstration ponds of surrounding villages. Adoption rates for some key BMP in the demonstrating ponds were sludge removal (99%), water filtration using twin bags of

300 micron mesh size (89%), PCR testing (98%), stocking of farm nursery released seed (83%), demand feeding using check trays (88%) and emergency harvesting of disease affected stocks (100%) whereas in the non-demonstration ponds the adoption of these key BMP was significantly low at 62%,15%,18%,23%,10% and 69% respectively.

Sultan (2004) studied the impact of development fish culture through Fish Farmers Development Agency (FFDA) and reported that total fish production as well as productivity per hectare has shown remarkable growth in last two decades. With the advent of modern technological inputs, entrepreneurial initiatives and financial investments pond productivity have gone up from 600kg/ha/year to 2550kg/ha/year.

3. Effectiveness of extension activities on the level of knowledge of farmers

A brief review of effect of development programme on knowledge about improved practices are presented below.

Supe and Salode (1975) reported that the National Demonstrations conducted by the change agents were effective in increasing the level of knowledge about improved agricultural practices of the participant farmers who were educated, scientifically oriented and had high socio-economic status.

Pathak et al. (1979) observed significant difference in the levels of knowledge between farmer demonstrators and neighbouring farmers in relation to improved practices of jute and wheat crops but in the case of rice cultivation it was not significant.

Samad (1979) found that in areas where pepper and coconut package programme where implemented, knowledge of farmers about improved scientific practices were more compared to other areas.

Kulhari (1980) reported that the contact farmers possessed significantly higher knowledge about paddy and wheat technologies than other farmers under T&V system.

Kamarudeen (1981) in his study on the impact of National Demonstration programme on paddy cultivation found that the neighboring farmers of the demonstration plots were superior to the control farmers in respect of their level of knowledge about demonstrated practices.

Gaurha and Pyasi (1983) analyzed the impact of National Demonstration and reported that 74 per cent of demonstrating and 70 per cent of non-demonstrating farmers fell in the group of high knowledge scores.

Pachori and Tripathi (1983) from their study on impact of Intensive Agricultural Extension and Research Programme reported that among the contact farmers quite a high percentage of respondents had high and medium knowledge whereas, amongst the non-contact farmers, a majority had low knowledge in 'Intensive Agriculture Extension and Research Programme'.

Padmaiah (1983) reported that IRDP had created significant impact in terms of knowledge of package of practices shown under demonstration.

Vijayakumar (1983) in his study on impact of Special Agricultural Development Units on the agricultural development of rural areas in Kerala reported that the beneficiaries had significantly higher level of knowledge than non-beneficiaries on improved practices of coconut cultivation.

Hiravenkanagouder et al. (1984) reported that the participant farmers of National Demonstration had significantly higher knowledge about demonstrated practices than non-participants.

Krishnamoorthy (1984) observed most of the dry land farmers possessed medium level of knowledge on different dry land practices.

Nikam and Singh (1984) studied the impact of National demonstration and found that demonstrating farmers had good knowledge whereas the non-demonstrating farmers had poor knowledge.

Ingle (1986) revealed that the knowledge of beneficiaries about high yielding varieties and its cultivation had been increased due to the implementation of various programmes of the All India Scheduled Caste Area Project.

Patil et al. (1987) revealed that majority of contact farmers had knowledge regarding their selection as contact farmers whereas most of the non-contact farmers had no knowledge about the implementation of T&V system in their village.

Thombre et al. (1987) studied the impact of home science extension on farm women's knowledge and revealed significant gain in

knowledge on improved practices of food and nutrition as a result of extension efforts.

Seenappa and Surendra (1988) studied the knowledge and attitude of fishermen trainees towards fish culture and observed 60 per cent of the trainees had low level of knowledge about fish culture prior to training programme. The majority of the trainees (91.4%) acquired high knowledge during the training course which was highly significant.

Sharma and Sharma (1988) reported that the T&V system of extension has only little impact on increasing the knowledge level of contact farmers.

Syamala (1988) found that the National Demonstration conducted was effective in changing the knowledge of the farmer demonstrators. The programme could not achieve the end of reaching out to the neighboring farmers to the desired extent.

Verma et al. (1988) studied the impact of Lab-to-Land programme and reported that the level of knowledge of farmers about summer moong cultivation had increased from 38.28 to 58.31.

Jnanadevan (1993) revealed that majority of the beneficiaries of coconut development programme possessed higher level of knowledge about the programme.

According to Reddy and Iqbal (1993) the level knowledge of majority of beneficiaries of the Watershed Development Programme was high while that of the non-beneficiaries was low.

Ashaletha (2000) revealed that the level of knowledge about improved practices of agriculture of the beneficiaries of NARP was fairly good.

Kumaran (2000) reported that almost half of the farmers (49.17%) possessed low level of knowledge on water management practices.

Kadam et al. (2001) reported out of the 12 water conservation practices only about one-third, that is four to five practices were known by a notable number of beneficiaries.

Baswarajaiah et al. (2002) revealed that majority of beneficiaries of the watershed development programme possessed medium level of knowledge.

Sharma et al. (2002) revealed that the impact of the visits of Agricultural Extension personnel on contact and non-contact farmers in terms of knowledge of low cost input technology(L.C.I.T.) was highly significant.

Rathore and Kalla (2002) reported that majority of the beneficiaries of the National Watershed Development Project had medium level of knowledge, comparatively the big farmers had 37.5 per cent higher level of knowledge as compared to marginal farmers. There was significant difference in the knowledge between and within categories of beneficiaries and non-beneficiaries about various selected knowledge components of NWDP.

Gakkhar et al. (2003) studied the impact of ICDS Programme and reported that the beneficiaries had significantly higher level of knowledge than the non-beneficiaries.

Podikunju et al. (2003) reported that the level of knowledge of the beneficiary farmers about interventions of Bajra introduced under IVLP Project was significantly higher than non-beneficiary farmers.

Wasnik (2003) studied the impact of technology transfer on sugarcane productivity and revealed that there was significant improvement in knowledge of recommended practices both in sugarcane and ratoon crop.

Yadav et al. (2003) reported that the majority of beneficiary farmers and non-beneficiary farmers had medium level of knowledge about watershed technology.

Sultan (2004) revealed that all fish farmers possessed desired working knowledge of pond management in composite fish culture.

4. Extent of satisfaction with extension services.

Ponnappan (1982) reported that 96 per cent of the beneficiaries of Fish Farmers Development Programme were satisfied with the functioning of the programme. About 86 per cent of the beneficiaries felt the impact of increased income due to participation in the programme.

Vasanthakumar and Singh (1991) reported that a large proportion of the respondents expressed little dissatisfaction regarding the present system of irrigation, quality of improved seeds, credit availability, storage facilities and transport facilities. About eighty five per cent of

the respondents were not at all satisfied with the existing marketing facilities while almost one-half of the small and marginal farmers expressed their complete dissatisfaction regarding non-availability of improved seeds of desired varieties. Majority of the small and marginal farmers expressed their satisfaction regarding the availability of fertilizers and plant protection chemicals.

Kumaran (2000) studied the effectiveness of agricultural extension services and reported that majority of the respondents(60.83%) had low level satisfaction over the agricultural extension services.

Sathiadhas et al. (2003) reported that majority of women involved in activities like peeling(65%), curing(75%), drying(60%) and fish vending(50%) had medium level of satisfaction where as 45 per cent among sorters and 60 per cent of women engaged in value addition had a high level of satisfaction.

5. Constraints faced by farmers in adoption of improved aquaculture practices.

Pathak et al. (1979) found that lack of timely supply of inputs, lack of irrigation facilities, lack of working skill in the farmers, lack of animal power, lack of technical assistance, lack of credit facilities, low purchasing power of farmers, unavailability of spare parts of implements, lack of repairing facilities and unstable prices of inputs and products were the problems in adoption of multiple cropping.

Haque and Ray (1983) studied fish farmer's perception of the problems in composite fish culture and reported that the scarcity of

seed of exotic carps as the number one problem in composite fish culture followed by lack of information about the technology of composite fish culture and lack of pure seed of indigenous carps.

Krishnamoorthy (1984) reported that high cost of the practices and uneven rainfall were the important constraints faced by dry land farmers.

Singh and Mathur (1984) analyzed the constraints in adoption of fertilizers and plant protection measures and revealed that the major bottleneck in adoption of hybrid bajra was the high incidence of diseases followed by high cost of nitrogenous fertilizer.

Bhoite and Thorat (1985) revealed that non-availability of seed in time, high prices of fertilizers and insecticides, mulching is not economic, high cost of weedicide, shortage of labour during harvesting period were the major constraints perceived by the farmers in adoption of rabi jowar technology.

Patel and Trivedi (1985) identified that higher price of feed and lack of finance were the major economic constraints in poultry farming. The important personal and family constraint was lack of power to look after whereas the important situational constraints were difficult poultry farming system, difficulty in getting electric supply and non-availability of inputs. Among all the constraints identified risk and uncertainty, higher price of feed, lack of finance, lack of manpower to look after and difficult poultry farming system were reported by majority of farmers.

Ram (1986) reported that the main constraint in adoption of improved varieties of wheat was lack of knowledge and technical guidance.

Joshy (1986) reported that untimely supply, unavailability of required fertilizer, need investment for longer period, inadequate supply and high price were the difficulties in adopting recommended doze of fertilizer in sugarcane production. The difficulties in adopting plant protection measures were lack of equipments, difficulties in spraying, ineffective as neighbours do not adopt, complicated method, low price of produce, lack of guidance and unawareness of disease and pests.

Krishna (1986) observed that the major constraints in adoption of scientific prawn farming practices were lack of availability of quality prawn seeds, perception of lack of periodical harvest and income and confusion among farmers about the right source of information.

Sing and Sing (1986) revealed that lack of credit to bear cost of user reclamation and other input, lack of technical knowledge, lack of suitable crop varieties and lack of irrigation facilities restrict the adoption of user reclamation technology.

Ogunfiditimi (1986) in his analysis of factors limiting Agricultural Extension services in developing countries reported that communication gap made the most significant contribution to problems facing or limiting the performance of the clientele.

Kothikhane et al. (1987) observed that unsuitability of use of improved farm implements, high cost of inputs, non-availability of inputs at proper time and inadequate quantities, low prices to farm

produce, non-availability of resources at farmers level were some of the constraints faced by farmers in adopting recommended practices under irrigation.

Patil and Jadav (1987) observed that majority of onion growers did not have correct knowledge of pest/disease and their control measures and recommended dozes of chemical fertilizers. Lack of technical guidance and finance were the other reasons for non-adoption of recommended practices of onion crop.

Sankaran (1987) studied the impact of Minikit Programme on knowledge and adoption of groundnut technology, and listed the following constraints as experienced by the participant and non-participant farmers. 1) failure of seasonal rains 2) inadequate supply of inputs 3) non-availability of inputs 4) fluctuations in market price 5) high cost of cultivation 6) difficulties in availing credit 7) more pests and disease attack 8) non-availability of labour during peak season and high cost of labour.

Sudha (1987) studied the impact of Lab-to-Land programme and reported that the important constraints perceived by non-tribal participants were inadequacy of capital, non-availability of credit, high cost of feed, uneconomic holding size etc. whereas the important constraints perceived by tribal participants were inadequacy of capital, uneconomic holding size, non-availability of credit, poor socio-economic status, and lack of knowledge about technology.

Suresh et al. (1988) observed that predator problem was the major production constraint in inland fish culture followed by poor quality and inadequate supply of water. The major marketing

constraints were un remunerative price followed by delayed payment, deceptive weights and measures.

Syamala (1988) found that lack of follow-up training, training conducted not based on farmer's needs and field days conducted not appropriate were the most-felt constraints by farmer demonstrators.

Verma et al. (1988) studied the impact of Lab to Land programme and revealed that lack of irrigation facilities during summer was the major constraint in adoption of moong cultivation.

Anitha Kumari (1989) identified lack of timely and adequate availability of inputs, high cost of inputs, unfavorable climate, lack of knowledge about recommended practices, high labour charges, and incidence of pests and diseases were the main constraints perceived by farmers in pulses and oil seed cultivation.

Yadav et al. (1989) found that lack of financial resources and lack of skills were the important constraints faced by rural women regarding participation in income generating activities.

Chander et al.(1990) observed that ignorance on some components of potato technology, high cost of inputs and their non-availability at proper time in the close vicinity of the villages, risk of damage of the crop in the cold storage without any compensation, non-availability of cold storages in the rural areas to enable the farmers to market their produce at remunerative prices and non-availability of the funds with the farmers to meet high cost of cultivation of potato were the important constraints in potato cultivation, storage and marketing.

Mohapatra (1990) reported that the need for all-weather roads, protecting embankments and supply of water and power were the infrastructural constraints in brackish water farming. The technological constraints include lack of feed, seed and micro level pilot studies whereas the environmental constraint was the need for conserving mangrove growth.

Singh (1990) found that high cost, unavailability, lack of money, untimely supply from co-operatives and lack of knowledge were the more pronounced problems in getting inputs under T&V system of extension. The other problems were labour shortage and high wages, irregular visit of the extension staff, lack of proper supervision by the higher officers and indifference of the contact farmers in receiving and spreading knowledge.

Selvaraj (1990) observed that the major bottlenecks for the development of aquaculture in Kerala were inadequate availability of quality seeds and feed, policy on lease allotment of state owned land to entrepreneur was not available for the development of aquaculture, need for micro survey, lack of insurance cover, lack of demonstration farms, lack of availability of mahua oil cake, lack of knowledge on scientific culture practices and low involvement of bank officials to motivate farmers to avail finance.

Shrivastava and Sing (1990) revealed that high price of fertilizer, lack of irrigation facilities, and erratic rainfall were the important constraints faced by all categories of cultivators in paddy production under rain fed condition.

Singh and Rajendra (1990) in their study on adoption of improved sugarcane variety reported that the major difficulty faced by farmers was non-availability of seed in time followed by lack of knowledge and proper guidance, lack of irrigation facilities, lack of money and non-availability of pesticides and fertilizer in time.

Upadhyay (1990) reported that the development of brackish water prawn farming in Orissa is slow because of unnecessary delay in allotment of suitable land for farming, non-availability of good quality prawn feed, lack of technical manpower and inaccessibility to potential sites in remote areas due to poor infrastructure.

Kher (1991) studied the major constraints in adoption of improved technology in rain fed maize and reported that lack of knowledge and non-availability of inputs were the major constraints in adopting improved technology

Ramachandran (1992) reported that the major constraints faced by participant farmers in conducting rice minikit trials were kits not supplied in time, lack of timely guidance and supervision, lack of information regarding the package of practices recommendations of the variety, other inputs not being supplied and poor quality of seeds.

Jnanadevan (1993) reported that the major constraints in adoption of recommended technology of coconut production by beneficiary and non-beneficiary farmers were higher labour charge, non availability of labour in time, inadequate and untimely supply of coconut seedlings, non-availability of climbers for carrying out plant protection operation and harvesting and lack of adequate financial assistance and subsidies which are at not given in time.

Susamma (1994) observed low price for cocoon, high cost of fertilizers, unfavorable climatic conditions, high labour cost, lack of marketing facilities and heavy disease incidence and mortality of worms were the important constraints perceived by sericulturists.

Babu (1995) reported that prohibitive cost of inputs was the most important constraint of homestead farmers followed by non-availability of labour and high labour cost. Inadequacy of capital, low price of produce and uneconomic holding size were the other constraints.

Mercikutty (1997) identified inadequate awareness about bio-fertilizers and lack of technical knowledge on the nutrients were the important constraints of the farmers. Lack of suitable technological recommendations and non-availability of quality materials during the crop season were the other important constraints in bio-fertilizer utilization.

Sindhu (1997) reported high price of planting materials, no standardized practices to follow and inability of small growers to find market were the important production, technological and marketing constraints respectively in commercial cutflower production.

Singh and Sharma (1998) in their study on economic analysis of carp culture identified the major problems of small fish farmers as the lack of adequate technical knowledge, lack of credit facilities, unfavorable pond leasing policy, non-availability of quality seed in required numbers in required time, plurality of ownership, poaching, deliberate poisoning and inefficient marketing system.

Jeeva and Ravichandran (1999) identified high cost of chemical insecticides followed by lack of adequate information, inadequate capital, adulteration and poor quality and non-availability of plant protection equipment in time as the major constraints in the utilization of plant protection chemicals. Lack of adequate guidance was the major constraint in utilization of chemical fungicides followed by inadequate knowledge and higher cost.

Singh and Jagadeeshwar (1999) reported lack of purchasing power of construction material and silting problem of the installed biogas plants as the primary constraints in adoption of biogas plants.

Ashaletha (2000) reported that high wage rate, scarcity of labours and high cost of inputs were the important problems restricting adoption of improved technologies.

Arunachalam (2000) identified the occurrence of pest and disease as the major biological constraint in paddy growing followed by non-availability of high yielding varieties and occurrence of weed growth. Among the physical constraints the most important one was poor maintenance of irrigation channels followed by lack of adequate drainage. Lack of economic support price, high labour cost and input cost were the socio-economic constraints faced by cent per cent of farmers. Infrastructural constraints were lack of threshing and processing facilities, lack of storage facilities, inadequate transport facilities etc.

Jayaraman and Selvaraj (2000) reported that small and marginal shrimp farmers face the problems of inadequate supply of quality

seeds and feed, lack of credit and marketing and other supporting infrastructure and services.

Kumaran (2000) reported that the major constraints experienced by the farmers in adopting water management practices were poor soil condition, distant location, water scarcity, topography of land, untrained farm labour, lack of knowledge, shortage of labour etc.

Kumar et al. (2000) found that high fluctuations in market prices, unavailability of suitable varieties, resources poor farmers, lack of cold storage and warehousing facility in the study area coupled with high cost of inputs were the major constraints experienced by turmeric growers.

Ramanna (2000) reported labour scarcity(60%) and high cost of inputs (56%) were the constraints faced by hybrid sunflower seed growers.

Paul et al. (2000&2001) identified poor and irregular production, complex technology for spawn production, lack of storage facilities, non-availability of quality raw material in the area, losses due to perishable nature of mushroom, malpractices of middlemen, lack of Governmental initiative and difficulty in borrowing loans were the major constraints encountered by tribal women in mushroom cultivation.

Paul et al. (2001) reported that lack of proper knowledge on composting, losses on account of perishable nature of mushroom, difficulty in borrowing loans, lack of education among villagers about

nutritional value of mushroom and lack of storage facilities were major constraints confronted by the selected mushroom cultivators.

Ghosh and Chand (2001) studied the constraints in adoption of recommended technologies for improved dairy farming and reported poor conception rate of artificial insemination and non-availability of veterinary medicines in the animal health centre as the most important technical constraint. Ignorance of cattle insurance facilities as well as lack of money for the insurance was the important economic constraint. The major socio-economic constraint was favorable attitude towards growing grain and other crops rather than growing fodder crops whereas the infrastructural/administrative constraint was complaints against the staff working at different centers do not yield fruitful results.

Kadam et al. (2001) observed lack of information/guidance, non-availability of inputs, material/labour etc. were the reasons for non-adoption of various practices recommended for watershed development.

Prakash and Bahal (2001) analyzed the constraints in adoption of recommendations of ICAR research in North Eastern Hill (NEH) region and reported lack of finance, lack of transportation, uneven topography, high cost of input, untimely supply of input etc. were the main constraints in adoption of hill agricultural technologies.

Meena and Chauhan (2002) reported that beneficiary and non-beneficiary respondents perceived maximum constraints related to marketing and general constraints. Constraints related to basal application of NPK fertilizer and constraints related to improved varieties of seed were the second and third problems perceived by

beneficiary farmers, whereas non-beneficiary respondents reported constraints related to improved varieties of seed and basal application of NPK fertilizers as the second and third problems respectively in adoption of improved production practices of groundnut.

Rai and Singh (2002) reported the major constraints faced by aonla growers towards adoption of improved cultivation practices were non-availability of planting materials and lack of knowledge about budding and grafting.

Rajput et al. (2002) observed non-availability of soil turning plough, lack of soil treatment, in balance use of fertilizers, infestation of several insect and disease and lack of good quality pesticides were the major economic constraints in adoption of cotton production practices.

Singh (2002) identified the main constraints in adoption of chemical fertilizesr were lack of knowledge, lack of irrigation facilities, lack of money, high cost of fertilizer and non-availability of fertilizer at proper time.

Singh et al. (2002) reported that high cost of inputs, non-availability of seeds, fertilizer, weedicides, pesticides etc. at required time and unfavorable weather condition were the major constraints related to sunflower production. In marketing the important constraints were low price of produce and lack of co-operative organization for marketing of produce.

Shekhawat and Sharma (2002) studied the constraints in getting the benefits under Employment Generation Programmes and reported

most important constraints of the beneficiary respondents were 'disbursal of assistance is delayed' followed by 'lack of managerial and technical guidance' and 'assistance given under EGP's is insufficient'. The important constraints for the non-beneficiary respondents were 'lack of awareness among people about these programmes', 'assistance given under EGP's is insufficient and lot of formalities'. The total respondents reported important constraints as 'disbursal of assistance is delayed', 'assistance given under EGP's is insufficient' and 'lack of managerial and technical guidance' respectively.

Bagle et al. (2003) identified lack of technical guidance and lack of information about integrated pest management were the main technical constraints in fruit production in tribal area of Gujarat. The major market constraint was lack of market facilities. High cost of pesticides, lack of propagating material and lack of irrigation facilities were the major resource constraints. The other constraints were occurrence of periodic drought, lack of Government subsidies and high wages of labourers.

Khajuria and Sharma (2003) reported that heavy initial investment was the most important economic constraint faced by farmers in adoption of sprinkler irrigation system. Lack of irrigation water, unavailability of technical guidance in time and irregular supply of electricity in the area were important climatic, technical and general constraints respectively.

Kalsaria et al. (2003) revealed that high cost of installing drip irrigation set, uneven distribution of water due to insufficient pressure,

drip irrigation system is not suitable for all important crops, difficulties in inter culturing and maintenance of drip irrigation sets were the major constraints faced by the farmers in utilization of drip irrigation system.

Naruka (2003) found that the important institutional constraint in adoption of bio-fertilizer by farmers was lack of assured irrigation, whereas the most perceived psychological constraint was more effectiveness of chemical fertilizers than bio-fertilizers. The important socio-economic constraint was lack of storage facility and technical constraint was poor response of bio-fertilizers due to unfavorable pH, high temperature and drought.

Sharma and Batra (2003) categorized the constraints as educational, economical, technological and situational constraints and reported that maximum number of women suffered from situational constraints followed by educational, technological and economical constraints in accepting drudgery reducing implements. Among the situational constraints the important one was non-availability of the implement followed by inadequate facilities for repair. The important educational constraint was lack of skill to handle and awareness about cost and procurements.

Sharma and Sharma (2003) reported that high cost of crucial inputs like seed, fertilizer and plant protection chemicals were the serious constraints in adoption of recommended gram production technology.

Wasnik (2003) identified the important constraints in adoption of sugarcane management practices as non availability of quality seed,

machineries, late payment, pests and disease, lack of technical know-how, lack of extension contact, lack of extension educational activities, lack of training and lack of media exposures.

Kumar et al. (2004) revealed that high cost of farm inputs, adulteration in seeds, fertilizer, insecticides and pesticides and low support price of the farm produce were the most serious constraints faced by the farmers regarding adoption of cotton production technology. They also perceived failure of crop due to unfavorable weather condition and inadequate insect pest control as serious constraints.

6. Perception of Extension officers about the Janakeeya Matsya Krishi programme(JMK)

Chakravarthy (1981) reported that small farmers perceived the indigenous farm practices to be more simple, profitable, cheap, physically compatible and flexible than the medium and big farmers.

Shivakumar (1983) studied the perception of farmers about research stations and research workers and found that there was significant difference in perception about research stations and research workers between the surrounding farmers and distant farmers. A more favorable perception was found to be associated with neighboring farmers than the distant farmers.

Paulmer (1984) studied the organizational effectiveness of KVK and reported that the staff and conveners did not differ in their perception regarding the overall existing and expected organizational effectiveness but they had a totally different perception in their

rankings on the organizational characteristics and their importance to effect organizational effectiveness.

Balan (1987) reported that majority of the farmers have got medium perception about the utility of soil test recommendations.

Haque and Ray (1987) observed that fish farmers perceive silver carp as the most profitable one followed by catla, rohu and grass carp. With respect to the taste three indigenous species of fish were considered to be superior than three exotic species and their order of preference was rohu, catla and mrigal respectively.

Ramachandran (1992) revealed that profitability was the most striking innovation characteristic as far as minikit varieties were concerned. The requirement of the labour was perceived to be more or less equal in the cultivation of paddy irrespective of the variety.

Radhakrishna et al. (1993) reported that AEO's in general have positive perceptions regarding VEW visits. Village extension worker's visits encouraged exchange of ideas among farmers, helped to change attitudes of farmers, in identifying field problems, field requirements and farmer's needs, in carrying relevant and timely technical message, helped to improve farmer's technical knowledge and change in practices and increased production.

Ashaletha (2000) found that the perception of scientist on NARP was generally good except on some items like laboratory facilities, transportation facilities etc. The perception of extension personnel on the extension components of NARP like farm trials, demonstrations and workshops was comparatively good

7. Constraints and limitations of extension officers.

Ogunfiditimi (1986) reported that poor remuneration and financing contributed most highly to the problem, limiting extension agent performances.

Singh (1990) found too many farm families to contact, larger area under jurisdiction and unavailability of contact farmers were the major problems faced by extension workers in T&V system. The other problems were lack of independent office facility, lack of promotional opportunity, lack of transport facility and non-cooperation of input agencies.

Singh and Roy (1991) reported that lack of funds, lack of facilities for field visits, lack of facilities for skill teaching and lack of audio-visual aids in the monthly workshops were the common problems faced by coordinators, master trainers and trainees in conducting monthly workshop of T&V system.

Devassia (1992) reported main constraints in the development of inland fisheries in Karnataka were leasing out of irrigation tanks for short period ranging from 1-3 years by FFDA and Department of Fisheries, non-availability of quality seeds, lack of adequate short term training, lack of sufficient extension work and no organized marketing support.

Ramachandran (1992) in his study on impact of rice minikit trials on adoption behaviour of farmers found that the major constraints faced by extension personnel in conducting trials were kits not being supplied in time, absence of literature on package of

practices recommendations of the variety along with the kit, lack of provision to give financial assistance or additional inputs along with the kit, poor quality of seeds and too many programmes being implemented.

Jnanadevan (1993) reported that lack of proper linkage and co-ordination between various agencies involved in the implementation of coconut development programme, procedural complexities in sanctioning the assistance under the programme, inadequacy of infrastructure of placed Krishi Bhavan level, lack of good rapport between the implementing and sanctioning agencies, non-availability of good quality seedlings during the planting season were the important constraints perceived by Agricultural Officers for implementing coconut development programme.

Madukwe (1993) reported that work overload, understaffing and assignment to jobs other than those in the job description were the major problems of Agricultural Extension supervisors.

Mercikutty (1997) revealed that the major constraints experienced by extension personnel were lack of adequate technical competence among the extension workers on bio-fertilizer technology, lack of training for extension workers on bio-fertilizers, inadequacy of field level demonstrations and lack of adequate awareness programmes for the farmers by the development agencies.

Sundarambal and Annamalai (1999) reported lack of participation of farmers in terms of presence and responds to meetings and trainings, lack of timely supply of inputs, delay in taking action for

some problems brought out through feed back as the major problems in transfer of dry land technology.

Ashaletha et al. (1999) identified the important constraints in effective role performance of Agricultural Assistants as frequent transfer, too much work load, lack of promotion chances, lack of conveyance facilities etc.

Ashaletha (2000) reported that lack of peoples participation in the project activities and lack of attention given for income generating occupations by the researchers were the major constraints perceived by extension personnel.

Kumaran (2000) observed too many scheme targets, lack of infrastructure, too much paper work, non-availability and poor quality of inputs, poor knowledge and training, lack of financial resources, lack of encouragement and lack of new and location specific technologies were the constraints experienced by the extension personnel in carrying out their work.

Sharma and Kalla (2000&2001) reported that the vast area of jurisdiction under single supervisor, lack of training programmes for the staff members, by-laws of union are not followed faithfully, communication gap between the board of directors, lack of coordination and co-operation with other agencies were the major constraints perceived by field functionaries of dairy co-operative societies in northern Rajasthan.

Prakash and Bahal (2001) identified lack of input, untimely input supply, poor credit system, lack of communication, difficult

approachability etc. were the main constraints perceived by KVK staff in adoption of improved hill agricultural practices.

Sharma and Singh (2001) reported that the important constraints perceived by the extension personnel in discharge of their duties were illiteracy among the farmers, irregular supply of electricity at village level and poor housing facilities for extension workers. Other important constraints expressed by them were lack of women extension workers, lack of need based researches, scarcity of money at farmer's level and traditional nature of farmers.

Popat et al. (2002) observed that non-availability of vehicle, more of reporting work and paucity of funds to prepare teaching aids were the major administrative constraints faced by Subject Matter Specialists. The technical constraints like inadequate and proper technical guidance from supervisors, lack of vehicle facility to arrange field trips and lack of new research recommendations and need based research were most felt by large majority of Subject Matter Specialists.

Gakkar et al. (2003) reported heavy work load, less poshahar, storage problems, lack of educational material at Anganvadi centers, irregular supply of medicines, negative attitude of beneficiaries towards ICDS and lack of salaries were the major constraints perceived by different functionaries of ICDS programme in its implementation.

Anilkumar et al. (2003) reported that untimely receipts of planting materials, dumping of seeds/seedling material without assessing the actual requirement and suitability and non-availability of

vehicles to travel were the important constraints perceived by the agricultural officers in the effective performance of duties.

Rahman and Hazarika (2003) revealed that inadequate drugs and equipment supply from department, lack of in-service training, lack of co-operation from co-workers, inadequate supervision by the immediate supervisors and improper communication in the department are the main problems faced by the Veterinary field Assistants in carrying out their duties.

8. Relationship of socio - psychological and economic characteristics of farmers with their adoption, knowledge and satisfaction.

Various studies were conducted on the nature of relationship existing between the socio-economic characteristics of farmers and extent of adoption, level of knowledge and satisfaction with extension services. An attempt was made to review these works to give an orientation to the study.

Table 1 : Relationship of age with the extent of adoption

Sl.No.	Name	Year	Kind of relationship
1.	Balasubramanian and Kaul	1982	Not significant
2.	Gaurha and Pyasi	1983	No relationship
3.	Mangle	1983	Significant
4.	Padmaiah	1983	Negative & Significant
5.	Krishnamoorthy	1984	Significant
6.	Das et al.	1988	Negative
7.	Ingole et al	1988	No relationship
8.	Anithakumari	1989	,,
9.	Singh and Rajendra	1990	Positive and Significant

10. Rao and Mathur	2002	No relationship
11. Motamed and Singh	2003	Negative and significant

Table 2 : Relationship of age with level of knowledge

Sl.No.	Name	Year	Kind of relationship
1.	Kamarudeen	1981	Negative and non-significant
2.	Pachori and Tripathi	1983	Significant
3.	Padmaiah	1983	No relationship
4.	Sinha et al.	1983	Non-significant
5.	Vijayakumar	1983	Negative and significant
6.	Krishnamoorthy	1984	Significant
7.	Mundhwa and Patel	1987	Positive
8.	Sharma and Sharma	1988	,,
9.	Syamala	1988	Positive and non-significant
10.	Singh et al.	2002	Non-significant
12.	Gakker et al.	2003	Non-significant
13.	Singh et al.	2003	Negative and significant

Table 3 : Relationship of education with extent of adoption

Sl. No.	Name	Year	Kind of relationship
1.	Singh and Singh	1970	Significant
2.	Kaleel	1978	Positive and significant
3.	Rajendran	1978	,,
4.	Kamarudeen	1981	,,
5.	Balasubramaniam& Kaul	1982	Not significant
6.	Gaurha and Pyasi	1983	Positive
7.	Mangle	1983	Significant association
8.	Padmaiah	1983	No relationship

9.	Krishnamoorthy	1984	Significant
10.	Sharma et al.	1987	Significant
11.	Das et al.	1988	Positive relationship
12.	Ingole et al.	1988	Positive
13.	Singh and Rajendra	1990	Positive and significant
14.	Babu	1995	Significant
15.	Dutt and Mishra	2002	Positive and significant
16.	Rao and Mathur	2002	No relationship
17.	Jha and Jha	2003	Positive and significant
18.	Motamed and Singh	2003	Positive and significant
19.	Naruka and Bangarva	2004	Positive and significant

Table 4 : Relationship of education with level of knowledge

Sl.No.	Name	Year	Kind of relationship
1.	Kaleel	1978	Positive and significant
2.	Kamarudeen	1981	,,
3.	Padmaiah	1983	No relationship
4.	Krishnamoorthy	1984	Significant
5.	Mundhwa and Patel	1987	Positive
6.	Sharma and Sharma	1988	No relationship
7.	Babu	1995	Positive and significant
8.	Mercikutty	1997	,,
9.	Ashaletha	2000	,,
10.	Singh et al.	2002	Positive and significant
11.	Gakkar et al.	2003	Significant
12.	Singh et al.	2003	Positive and significant

Table 5: Relationship of occupation with extent of adoption

Sl.No.	Name	Year	Kind of relationship
1.	Balasubramaniam& Kaul	1982	Not significant
2.	Singh et al.	1985	Positive and significant
3.	Anithakumari	1989	Not significant

Table 6: Relationship of occupation with level of knowledge

Sl.No.	Name	Year	Kind of relationship
1.	Sankaran	1987	Positive
2.	Anithakumari	1989	Not significant
3.	Singh et al.	2002	Non significant

Table 7 : Relationship of experience with extent of adoption

Sl.No	Name	Year	Kind of relationship
1.	Rajendran	1978	Not significant
2.	Balasubramaniam& Kaul	1982	„
3.	Krishnamoorthy	1984	Significant
4.	Das et al.	1988	Positive
5.	Jnanadevan	1993	Positive

Table 8 : Relationship of experience with level of knowledge

Sl.No.	Name	Year	Kind of relationship
1.	Krishnamoorthy	1984	Significant
2.	Mundhwa and Patel	1987	Positive
3.	Jnanadevan	1993	Positive and significant

Table 9 : Relationship of annual income with extent of adoption

Sl.No.	Name	Year	Kind of relationship
1.	Balasubramaniam& Kaul	1982	Not significant
2.	Mangle	1983	Positive
3.	Anithakumari	1989	Not significant
4.	Babu	1995	Significant
5.	Motamed and Singh	2003	Positive and significant

Table 10 : Relationship of annual income with level of knowledge

Sl.No.	Name	Year	Kind of relationship
1.	Kamarudeen	1981	Negative and non-significant
2.	Mundhwa and Patel	1987	Positive
3.	Singh et al.	2002	Positive and significant

Table 11 : Relationship of farm size with extent of adoption

Sl.No.	Name	Year	Kind of relationship
1.	Bhaskaran	1978	Not significant
2.	Kaleel	1978	Positive and significant
3.	Rajendran	1978	,,
4.	Gaurha and Pyasi	1983	Positive
5.	Mangle	1983	Positive
6.	Sharma et al.	1987	Significant
7.	Ingole et al.	1988	No relationship
8.	Anithakumari	1989	Not significant
9.	Singh and Rajendra	1990	Positive and significant
10.	Babu	1995	Significant
11.	Rao and Mathur	2002	No relationship
12.	Jha and Jha	2003	Positive and significant

13.	Motamed and Singh	2003	negative and non significant
14.	Naruka and Bangarva	2004	,,

Table 12 : Relationship of farm size with level of knowledge

Sl.No.	Name	Year	Kind of relationship
1.	Kamarudeen	1981	Negative and non-significant
2.	Sinha et al.	1983	Positive and Significant
3.	Mundhwa and Patel	1987	Positive
4.	Sharma and Sharma	1988	Positive and significant
5.	Mercykutty	1997	,,
6.	Singh et al.	2002	,,

Table 13 : Relationship of information source utilization with extent of adoption

Sl.No.	Name	Year	Kind of relationship
1.	Athimuthu	1990	Positive and significant
2.	Ashaletha	2000	,,
3.	Motamed and Singh	2003	,,
3.	Naruka and Bangarva	2004	,,

Table 14 : Relationship of information source utilization with level of knowledge

Sl.No.	Name	Year	Kind of relationship
1.	Babu	1995	Significant
2.	Mercykutty	1997	Positive and significant
3.	Ashaletha	2000	,,

The literature highlighting the relationship between indebtedness with level of adoption and knowledge of the respondents were not available.

Table 15 : Relationship of social participation with extent of adoption

Sl.No.	Name	Year	Kind of relationship
1.	Bhaskaran	1978	Not significant
2.	Gaurha and Pyasi	1983	No relationship
3.	Mangle	1983	Positive
4.	Sharma et al.	1987	Significant
5.	Anithakumari	1989	Not significant
6.	Singh and Rajendra	1990	Positive and significant
7.	Jnanadevan	1993	,,
8.	Dutt and Mishra	2002	,,
9.	Jha and Jha	2003	,,
10.	Motamed and Sigh	2003	,,
10.	Naruka and Bangarva	2004	,,

Table 16 : Relationship of social participation with level of knowledge

Sl.No.	Name	Year	Kind of relationship
1.	Pachori and Tripathi	1983	Significant
2.	Sinha et al.	1983	Positive and significant
3.	Mundhwa and patel	1987	No relationship
4.	Sharma and Sharma	1988	Positive and significant
5.	Jnanadevan	1993	,,
6.	Mercykutty	1997	,,
7.	Singh et al.	2002	,,

Table 17 : Relationship of risk orientation with extent of adoption

Sl.No.	Name	Year	Kind of relationship
1.	Singh and Singh	1970	Significant
2.	Rajendran	1978	Positive and significant
3.	Kamarudeen	1981	,,
4.	Mangle	1983	Positive
5.	Jayakrishnan	1984	Positive and significant
6.	Krishnamoorthy	1984	Significant
5.	Rao and Mathur	2002	Positive and significant
6.	Jha and Jha	2003	,,

Table 18 : Relationship of risk orientation with level of knowledge

Sl.No.	Name	Year	Kind of relationship
1.	Kamarudeen	1981	Positive and significant
2.	Jayakrishnan	1984	,,
3.	Krishnamoorthy	1984	,,
4.	Mercykutty	1997	,,
5.	Ashaletha	2000	,,
6.	Singh et al.	2003	Positive and significant

Table 19 : Relationship of marketing orientation with extent of adoption

Sl.No.	Name	Year	Kind of relationship
1.	Singh and Singh	1970	Positive and significant
2.	Singh and Ray	1985	Not significant

Studies showing the relationship between marketing orientation and level of knowledge could not be revealed .

Table 20 : Relationship of extension participation with extc adoption

Sl.No.	Name	Year	Kind of relationship
1.	Padmaiah	1983	Not related
2.	Singh and Rajendra	1990	Positive and significant
3.	Motamed and Singh	2003	Positive and significant
4.	Rao and Mathur	2003	Positive and significant

Table 21 : Relationship of extension participation with level of knowledge

Sl.No.	Name	Year	Kind of relationship
1.	Kamarudeen	1981	Positive and significant
2.	Padmaiah	1983	Not related
3.	Sinha et al.	1983	Significant
4.	Krishnamoorthy	1984	Significant
5.	Mundhwa and Patel	1987	Positive
6.	Sinha et al.	1987	Positive and significant
7.	Sankaran	1987	Not related
8.	Syamala	1988	Positive and significant
9.	Singh et al.	2002	„
10.	Sigh et al.	2003	„

Even after an in depth thorough review, the literature indicating the relationship between the selected socio-psychological and economic characteristics of the respondents and satisfaction with extension services were not available.

CHAPTER III

MATERIALS AND METHODS

The materials and methods used in the study are given under the following sub-heads.

1.Location of the study

2.Selection of samples

a) Selection of fresh water and brackish water beneficiary farmers.

b) Selection of fisheries extension officers.

3.Selection and measurement of variables

4.Methods of investigation

5.Statistical tools used

6.Operational definitions of the terms used.

III.1. Location of the study

Kerala State is selected for the present study. The state lies in the south -west corner of Indian peninsula between 08" and 12" 48' north latitudes and 74" 52' and 77" 22' east longitudes as a long narrow strip of land. In the south the state is bounded by Tamil Nadu and in the North by Karnataka, with a geographical area 38,863 of sq.km. The total coastline is 590 km. and the number of rivers flowing through the state is 44. The number of inland and marine fishing villages are 113 and 222 respectively. The extensive inland water resources of the state provides greater scope for the development of aquaculture both fresh water farming and brackish water farming. The fresh water resources for the development of inland fisheries in Kerala consists of private ponds, panchayath ponds,

quarry ponds, holy ponds, village ponds, irrigation tanks, rivers reservoirs etc. The brackish water resources include brackish water prawn filtration fields, public sector brackish water fish farms etc. There are 14 Fish Farmers Development Agencies (FFDA) and six Brackish Water Fish Farmers Development Agencies (BFFDA) are actively engaged in promoting fish farming through out the state and to make full use of the above resources. The state contributes 2.5 per cent of the total fish production of the country. The per capita consumption of the fish is 15.5 kg which is much higher than other states.

III.2. Selection of samples

a) Selection of fresh water and brackish water beneficiary farmers.

The total number of beneficiary farmers in fresh water farming and brackish water farming of the department of fisheries, Kerala State during the year 2000-2003 constituted the population for the study. The number and address of the beneficiary farmers during the above period was collected from the Fish Farmers Development Agencies and Brackish Water Fish Farmers Development Agencies working in each district. Thus the population in fresh water farming was 13454 and brackish water farming was 874. From this population 100 farmers each from fresh water farming and brackish water farming was selected using proportionate random sampling technique which constituted the sample for the present study. The details are given in table.

Table 22 : Details of the fresh water beneficiary farmers during 2000-2003

Sl.No.	Name of the district	No. of beneficiaries 2000-01	2001-02	2002-03	Total no. of beneficiaries	No. of Beneficiaries selected
1.	Thiruvananthapuram	2041	412	21	2474	18
2.	Kollam	168	108	34	310	2
3.	Pathanamthitta	400	674	53	1127	8
4.	Alappuzha	1525	250	135	1910	14
5.	Kottayam	-	-	516	516	4
6.	Idukki	545	545	132	1222	9
7.	Ernakulam	-	32	40	72	1
8.	Thrissur	-	17	27	44	-
9.	Palakkad	2152	-	21	2171	16
10.	Malappuram	2031	-	219	2250	17
11.	Kozhikode	297	151	164	612	5
12.	Wayanad	-	270	240	510	4
13.	Kannur	-	155	59	214	2
14.	Kasargod	-	-	22	22	-
	Total	9159	2614	1683	13456	100

Table 23 : Details of the brackish water beneficiary farmers during 2000-2003

Sl.No.	Name of the district	No. of beneficiaries 2000-01	2001-02	2002-03	Total no. of beneficiaries	No. of Beneficiaries selected
1.	Kollam	27	49	48	124	14
2.	Alappuzha	152	-	-	152	18
3.	Ernakulam	-	32	39	71	8
4.	Thrissur	291	4	13	308	35
5.	Kozhikode	90	-	-	90	10
6.	Kannur	99	-	30	129	15
	Total	659	85	130	874	100

b) Selection of Fisheries Extension Officers

Extension officers working in the Department of Fisheries, Kerala were selected for the study. There are 24 Inspector of Fisheries (IF), 86 Sub Inspectors (SI), 10 Assistant Extension Officers (AEO), 20 Technical Assistants and two Fish culture Officers working in the Fisheries Department which constituted the population for the study. From this total population of 142 extension officers a sample of 60 respondents were selected using simple random method.

III.3.Selection and measurement of variables

Based on the objectives of the study and after discussion with experts in the field of fisheries a list of variables were prepared. The variables selected for the study are given below.

a) Dependent variables
   1. Adoption of improved aquaculture practices
   2. Knowledge of improved aquaculture practices.
   3. Satisfaction with extension services

b) Independent variables
   1. Age
   2. Education
   3. Occupation
   4. Experience in farming
   5. Annual income
   6. Farm size
   7. Information source utilization
   8. Indebtedness
   9. Social participation
   10. Risk orientation
   11. Marketing orientation
   12. Extension participation

c) Constraints faced by the farmers

d) Perception of Fisheries Extension Officers about Janakeeya Matsya Krishi Programme.(JMK)

e) Constraints and limitations of extension agency

III.3.a. Dependent variables

III.3.a.1. Adoption of improved aquaculture practices

Chattopadhyay (1963) used adoption quotient for measuring adoption which is a ratio scale that measures a farmers behaviour on dimensions of applicability, potentiality, extent, time, consistency and different nature of innovations.

Supe (1969) developed a scale namely cotton practices adoption scale. He stated ten practices of cotton and for each practice a score of six was assigned for complete adoption. The practice which were divisible had assigned partial score for partial adoption.

Sing and Sing (1974) also used an adoption quotient which was a modification of the one developed by Chattopadhyay (1963). According to this, the adoption quotient of each respondent was calculated by using the following formula.

$$\text{Adoption quotient} = \leq \frac{e/p}{N} \times 100$$

Where

e = Extent of adoption of each practice

p = Potentiality of adoption of each practice

N = Total number of practices selected

For measuring the level of adoption of improved practices by the fresh water beneficiary farmers, a package of improved practices in fresh water farming is developed as follows.

A comprehensive list of important practices in fresh water farming was prepared after reviewing various literature related to subject and detailed discussion with experts. The list consisted of 16 practices in fresh water farming.

The above practices were given in the form of a closed questionnaire to scientists working in the field of aquaculture. The judges were asked to rate the relevancy of each practice on a three point continuum as under

Degrees of relevancy	Score
Most relevant	3
Relevant	2
Not relevant	1

All the 16 practices in fresh water farming were rated as most relevant. So all these practices were selected for including in the final questionnaire. In brackish water farming the 19 practices already identified by Sasikumar (1990) after relevancy rating by the judges was used for measuring the level of adoption. Adoption of each practice both in fresh water farming and brackish water farming was given in a three point continuum as fully/partially/nil. For quantifying data, each practice was given score of zero for nil, one for partial and two for fully. Thus total score secured by an individual was the obtained adoption score. The adoption quotient was worked out for each respondent and it was taken as the adoption score for the individual respondent.

$$\text{Adoption quotient (A.Q)} = \frac{\text{Adoption score obtained by respondent}}{\text{Maximum possible adoption score}} \times 100$$

Overall adoption level was worked out by calculating the arithmetic mean of the adoption quotient of all the respondents as given below.

$$\text{Overall adoption level} = \frac{\sum_{i=1}^{N} A.Q}{N}$$

Where,

A.Q = Adoption quotient for ith respondent.
N = Total number of respondents.

Based on the mean adoption index the respondents in fresh water farming and brackish water farming were classified as

Fresh water farming

Sl.No.	Category	Adoption index
1.	Low < mean-1 SD	below 39
2.	Medium (mean ± 1 SD)	between 40 and 70
3.	High > (mean + 1SD)	above 71

Brackish water farming

Sl.No.	Category	Adoption index
1.	Low < mean-1 SD	below 71
2.	Medium (mean ± 1 SD)	between 72 and 88
3.	High > (mean + 1SD)	above 89

III.3.a.2. Knowledge about improved aquaculture practices

Shankariah and Singh (1967) measured the knowledge of farmers on improved method of vegetable cultivation based on teacher made test.

Equal weights were given to all items included, presuming that they are equally difficult to understand, apply, and recall. Then they calculated the knowledge index as follows.

$$\text{Knowledge Index} = \frac{X_1+X_2+X_3+.....+Xn}{N} \times 100$$

X_1 = Number of correct answers of one practice which include more than one question

X_2 = Number of correct answers of second practice

N = Total number of questions put to a respondent to test her/ his knowledge

Singha et al. (1968) adopted the method of self-appraisal to determine the level of knowledge of Agricultural Officers. It was based on the assumption that the individual will improve only if he recognizes his own capacities and needs for improvement.

Jha and Sharma (1973) in order to know the amount of knowledge gained after training compared the scores of the respondents before-after and difference between these scores for each respondent was worked out. Per cent increase in knowledge was computed for each of the respondent using the formula $\frac{B-A}{A} \times 100$

Where A and B were the scores before and after the training respectively.

Singh and Prasad (1974) measured knowledge by working out knowledge quotient as follows

$$\text{Knowledge quotient} = \frac{\text{Obtained knowledge score}}{\text{Actual total score}} \times 100$$

This scoring technique was adopted for the present study.

Singh and Singh (1974) measured the knowledge of farmers using the following formula.

$$\text{Total score for each respondent} = \frac{X_1}{n} \times 100$$

X_1 = number of correct answers
n = Total number of questions

Gill and Sandhu (1981) measured the knowledge of farmers by calculating the average knowledge score of each area/sub area using following formula.

$$\text{Average knowledge score (out of 1.00)} = \frac{\text{Total knowledge score}}{\text{Number of questions} \times \text{Number of respondents}}$$

Here a correct answer was assigned a score of one and a wrong answer was assigned a score of zero.

Popat et al. (1985) developed a test to measure knowledge of farmers about groundnut production and this procedure was adopted in this study with slight modifications as given below.

All the available literature related to aquaculture practices were collected to compile a question bank. Finally a set of 50 questions each from fresh water farming and brackish water farming was prepared. The questions were dichotomous with correct/incorrect type and yes/no type.

Item Analysis

Thirty experts from different fisheries institutions were selected as judges for relevancy rating. They were asked to differentiate these 100 questions into three categories as most relevant, somewhat

relevant, and not relevant with weights 3, 2, and 1 respectively. The judged materials were tabulated and items with relevancy ratio above mean were selected for pre-testing among the farmers. The range relevancy ratio in fresh water farming and brackish water farming were 1.4 to 3 and 1.36 to 3 respectively. Items with relevancy ratio above 2.6 (mean) in fresh water farming and above 2.74 (mean) in brackish water farming were selected. (Appendix I &II). In this way 37 items from fresh water farming and 44 items from brackish water farming were selected for pre-testing and administered to 30 fresh water beneficiary farmers and 30 brackish water beneficiary farmers prior to the preparation of the final schedule. The respondents were selected at random from Ernakulam district. The responses of these farmers were used for item analysis.

Item analysis yielded two kinds of information viz. index of item difficulty, index of item discrimination. The index of item difficulty indicated the extent to which an item was difficult, while the index of discrimination indicated the extent to which an item discriminates the well informed individual from the poorly informed ones.

Scores of value one and zero were given to correct and incorrect responses respectively for the dichotomous question. The maximum scores were 37 in fresh water farming and 44 in brackish water farming and minimum score was zero in both cases. (Appendix III & IV). After computing the total score obtained by each of the respondents for 37 items in fresh water farming, they were arranged in the descending order of magnitudes on the basis of total scores. These 30 respondents in fresh water farming were divided into three

equal groups. Thus each group consisted of ten respondents and the group were named as G1, G2 and G3 respectively. For the purpose of item analysis the middle group was eliminated keeping the two extreme groups with high and low scores. The same procedure was done in brackish water farming and the score range of these groups in fresh water farming and brackish water farming was as follows.

Fresh water farming	Brackish water farming
G1 = 34 to 30	G1 = 40 to 34
G2 = 27 to 22	G2 = 33 to 25
G3 = 20 to 14	G3 = 24 to 18

The data pertaining to correct responses for all the items in respect of the two groups G1 and G3 were tabulated and difficulty and discrimination indices were calculated.

Table 24 : Calculation of difficulty and discrimination indices of knowledge items

Item No.	Frequencies of correct answer S1 S3	Total frequencies *S1+S2+S3	Percentage of respondents giving correct answer (P)	E1/3
1.	8 4	18	60	.4
2.	10 3	18	60	.7

*S1, S2, and S3 are frequencies of correct answer in the group G1, G2, and G3 respectively, where

P = Index of item difficulty
E1/3 = Index of item discrimination
$E1/3 = \frac{S1 - S3}{N/3}$
N = Total number of respondents in the sample.

E1/3 for the item 5 $= \frac{8-4}{30/3} = .4$

Final selection of items

The selection of items in the format of the knowledge test was based on the following two criteria.

a) Difficulty index - P

b) Discrimination index - E 1/3

The index of item difficulty was worked as the percentage of the respondents answering an item correctly. The assumption in item index of difficulty was that the difficulty is linearly related to the level of respondent's knowledge about aquaculture practices. The item with P – value ranging from 56.66 to 86.66 in fresh water farming and 50 to 83.33 in brackish water farming were considered for final selection of the knowledge test.

The items with E1/3 value between 0 .3 to 0 .8 in fresh water farming and brackish water farming were considered for final format of knowledge test.

The final selection of items for knowledge test was made on the aforesaid criteria and finally 25 items in fresh water farming and 22 items in brackish water farming were selected which formed the actual format of the knowledge test. (Appendix V and VI).

Reliability

The split half method was used to test the reliability of the test. The 25 items in fresh water farming were divided into two halves

with odd numbered in one half and even numbered in the other. These were administered to 25 respondents randomly selected from the population exclusively for this purpose. Two sets of knowledge scores were obtained. The correlation co-efficient between these two sets of scores was computed (r = .83) which was found significant at one per cent level.

The above method was used in brackish water farming also and computed the correlation co-efficient (r = .78) which was found significant at one per cent level.

Scoring

The test consisted of 25 items in fresh water farming and 22 items in brackish water farming. Each correct answer was given a score of one and the wrong answer a score of zero. The summation of scores for the correct answers for all items of a particular respondent indicated his level of knowledge in aquaculture practices.

$$\text{Knowledge Index} = \frac{\text{Total score obtained by respondent}}{\text{Total number of statements}} \times 100$$

Based on mean knowledge index and standard deviation obtained by beneficiary farmers in fresh water farming and brackish water farming, the respondents were classified into three groups as follows.

Fresh water farming

Sl. No.	Category	Knowledge Index
1.	Low < (Mean – 1SD)	below 69

2.	Medium (mean ± 1SD)	between 70 and 84
3.	High > (mean + 1SD)	above 85

Brackish water farming

Sl. No.	Category	Knowledge Index
1.	Low <(Mean – 1SD)	below 78
2.	Medium (mean ± 1SD)	between 79 and 91
3.	High > (mean + 1SD)	above 92

III.3.a.3. Farmers' satisfaction with extension services

Kumaran (2000) developed a scale to measure farmers' satisfaction with extension services on selected dimensions such as provision of appropriate technical information: frequency and modes of communication: timeliness of communications: training of farmers: supply of inputs: solving field problems and providing advisory services: fairness of extension personnel and overall impact of extension services. This scale was adopted in the present study with slight modifications. The farmers' satisfaction of extension services was measured by an index developed for that purpose. The index consisted of 24 statements against which the respondents were asked to give the responses in a five point continuum as follows.

Strongly agree	-5
Agree	-4
Neither agree nor disagree	-3
Disagree	-2
Strongly disagree	-1

In the case of negative statements the scoring pattern was reversed. The responses were added to get a respondent's satisfaction score. The satisfaction index was calculated as follows.

$$\text{Client satisfaction index} = \frac{\text{The individual's obtained score}}{\text{Maximum Score ie. 120}} \times 100$$

Based on mean satisfaction index and standard deviation obtained by beneficiary farmers in fresh water farming and brackish water farming, the respondents were classified into three groups as

Fresh water farming

Sl.No.	Category	Satisfaction index
1.	Low < mean-1 SD	below 47
2.	Medium (mean ± 1 SD)	between 48 and 67
3.	High > (mean + 1SD)	above 68

Brackish water farming

Sl.No.	Category	Satisfaction index
1.	Low < mean-1 SD	below 49
2.	Medium (mean ± 1 SD)	between 50 and 67
3.	High > (mean + 1SD)	above 68

Calculation of Extension Effectiveness Index

Extension effectiveness index was defined as extent of client's satisfaction with extension services, knowledge of farmers and adoption of improved practices in the study area. It was calculated for every respondent in fresh water farming and brackish water farming by using the extension effectiveness index developed by Kumaran (2000) as follows.

$$\text{Extension Effectiveness Index} = \frac{(CSI*WI) + (KI*W2) + (AI*W3)}{100}$$

Where,

CSI = Client Satisfaction Index score of an individual.
KI = Knowledge Index score of an individual.
AI = Adoption Index score of an individual.

W1, W2 and W3 are the average weightages (29, 32 and 39) of the above mentioned components given by the judges.

Based on mean extension effectiveness score and standard deviation the fresh water and brackish water beneficiary farmers were classified into three groups.

Fresh water farming

Sl.No.	Category	Extension effectiveness index
1.	Low < mean-1 SD	below 54
2.	Medium (mean ± 1 SD)	between 55 and 71
3.	High > (mean + 1SD)	above 72

Brackish water farming

Sl.No.	Category	Extension effectiveness index
1.	Low < mean-1 SD	below 70
2.	Medium (mean ± 1 SD)	between 71 and 80
3.	High > (mean + 1SD)	above 81

III.3.b. Independent variables

III.3.b.1. Age

The chronological age of the respondent was calculated as the number of years completed from his/her date of birth to the date of interview.

III.3.b.2. Education

For this study education is operationalised as the level of formal education undergone by the respondent till the time of investigation. Education was measured using the socio-economic status scale developed by Trivedi (1963).

Education	Score
Illiterate	0
Can read only	1
Can read and write	2
Primary	3
Middle School	4
High School	5
College and above	6

III.3.b.3. Occupation

The occupation of the farmers was quantified following the scoring adopted by Athimuthu (1990) with modification.

Occupation	Score
Farming alone	1
Farming + Labour	2
Farming + Business	3
Farming + service (govt./private)	4

III.3.b.4. Experience

Experience was considered as the number of years the respondent had been engaged in aquaculture and related works. This years of experience was taken as score.

III.3.b.5. Annual income

Annual income has been operationally defined as the total earning of the respondent in an year expressed in rupees obtained from doing different occupations. The gross annual income was taken and respondents were classified as follows.

Category	Income Score
Upto Rs. 50000	1
50001 to 100000	2
100001 to 150000	3
150001 to 200000	4
200001 to 250000	5
200001 to 300000	6
Above 300000	7

III.3.b.6. Farm size

It is referred to the number of acres cultivated by the respondent at the time of enquiry. In brackish water farming one score was assigned to every one acre of land. An extent of .5 acre and above were rounded to the next whole number for assigning score. In fresh water farming, size of the farm of beneficiary farmers showed a wide range from few cents to acres of land. So the respondents were categorized into the following groups on the basis of the farm size.

Size of the farm	Score
Upto 25 cents	1
25 to 50 cents	2
51 to 1 acre	3
1.1 to 2 acre	4
2.1 to 3 acre	5
3.1 to 4 acre	6
4.1 to 5 acre	7

Above 5 acre	8

III.3.b.7. Information Source Utilization

The scale developed by Sanjeevachandran (1989) was used for measuring this variable with slight modifications. The scale consisted of 24 sources of information, which were classified under impersonal sources, formal personal sources, informal personal sources, commercial sources and other channels of communication.

Each respondent was asked to indicate how often he got information on fisheries technology from each of the listed sources. Responses were collected and scores were given as 2, 1 and zero for regularly, sometimes and never respectively.

Response scores on all items were added together to get the information utilization score of a respondent.

III.3.b.8. Indebtedness

Indebtedness was operationally defined as the total loan in terms of a beneficiary farmer owes to various money lending sources at the time of investigation.

A simple schedule was developed to measure the indebtedness. The respondents were categorized into the following groups on the basis of the total debt they had at the time of interview and the scores assigned are as follows.

Item	Score
No debt	- 0

Debt upto Rs. 50,000	- 1
Debt upto Rs. 1,00,000	- 2
Debt upto Rs. 1,50000	- 3
Debt upto Rs. 2,00000	- 4
Debt upto Rs. 2,50000	- 5
Debt upto Rs. 3,00000	- 6
Debt above Rs. 3,00000	- 7

III.3.b.9. Social Participation

This is referred to the degree of involvement of the respondent in formal organization either as a member or as an office bearer. The scale developed by Trivedi (1963) was used for measuring this variable. Score 3, 2, and 1 were assigned for attending meetings regularly, occasionally and never. To obtain the final score of a respondent, the scores secured as a member or office bearer were summed up for all the social organization in which participation was reported.

III.3.b.10. Risk orientation

Risk orientation was quantified with the help of a risk preference scale developed by Supe (1969). The scale consists of six statements of which two are negative. The response was collected on a five point continuum ranging from "strongly agree" to "strongly disagree". The scores assigned for positive statements were as follows

Response	Score
Strongly agree	5
Agree	4
Undecided	3
Disagree	2
Strongly disagree	1

For negative statements the scoring procedure was reversed. The total score obtained by a respondent indicates his score for risk orientation.

III.3.b.11. Marketing orientation

It is defined as the degree to which a farmer is oriented towards market information and manipulations in marketing strategies as to achieve maximum price for the purpose. It was measured using the scale developed by Samantha (1977). The original scale of Samantha (1997) for management orientation has three dimensions viz. Planning orientation, production orientation and marketing orientation.

In the present study marketing orientation was measured using Samantha (1997) scale with slight modifications to suit the present study. The scale consisted of six statements of which three were negative and three were positive. In the case of positive statement score one was given for agreement and zero for disagreement. For a negative statement the scoring pattern was reversed. The sum of scores obtained for all statements was taken as the score of marketing orientation.

III.3.b.12. Extension participation

It refers to the degree of participation of the farmers in various extension activities organized by development agencies. This was measured by the procedure suggested by Bhaskaran (1978) with slight modifications.

The respondents participation in each of the activities was recorded on a three point continuum and the scores given were

Response	Score
Always	2
Occasional	1
Never	0

III.3. c. Constraints faced by farmers

Based on discussion with farmers and extension personnel and also through review of relevant literature 31 constraints faced by the farmers were listed. These constraints were classified as technical constraints, economic constraints, and infrastructure/administrative constraints. Seven technical constraints, 12 economic constraints and 12 infrastructure/administrative constraints were identified in this way. All these constraints were weighed on a three point continuum scale viz. very serious, serious and not so serious with weightage as 3, 2 and 1 respectively, depending upon the nature of the constraints from the view point of the respondents. The constraint-wise total scores were worked out. The total scores thus obtained in each of the column were multiplied by their allotted weights. The weighted cumulative frequency method was used for computing the rank order of the constraints in each section.

III.3.d.Perception of the Extension Officers about the impact of "Janakeeya Matsya Krishi Programme. (JMK)

It was measured using the scale developed by Ashaletha (2000) with modifications. The scale developed by Ashaletha (2000) for evaluative

perception of extension personnel has five dimensions viz. perception about impact of NARP on farmers, NARP workshops, demonstrations, farm trials, and linkage among scientists, extension personnel, farmers and input dealers.

In the present study only the first dimension viz. perception about impact of JMK on farmers was studied. The scale consisted of 10 statements depicting the impact of JMK on farmers. These statements were rated on a 5-point continuum as strongly agree, agree, undecided, disagree and strongly disagree with scores 5, 4, 3, 2 and 1respectively. In the case of negative statement the scoring pattern was reversed. The score obtained for each item was added together to get the total perception score of the respondent.

An attempt was also made to find out which item is perceived as most important by all the respondents. For this the total score for each item of all the respondents were added and ranked based on their magnitude.

III.3.e. Constraints of Extension Officers to deliver various extension services.

Sharma and Sohal (1989) developed a scale for measuring constraints of Field Veterinarians in Cattle Development Programme and this procedure was adopted in this study with slight modifications as given below.

An inventory of items constituting constraints in carrying out the programmes of fisheries development was prepared by contacting Extension Officers working in fisheries department. The items collected from literature and experts through discussions were also added to this. The items of inventory was subjected to thorough scrutiny and

editing. Thirty statements constituting constraints in promoting the programmes were finally retained in the inventory.

To assess the degree of seriousness of each of the items constituting constraints these were referred to 30 judges. The judges were requested to indicate the level of seriousness of each constraints for inclusion in the scale on three point continuum ranging from 'very serious, 'serious' to ' not so serious'. The panel of judges selected for this study comprised experts, extension specialists and official possessing specialized qualification and considerable practical experience.

The responses of the judges to items on the three point continuum 'very serious', ' serious' or 'not so serious' were given weightage of 3, 2 and 1 respectively. On this basis the mean scores of each item was computed.

To standardize raw mean scores of the items, these were transferred into 'Z' scores. The actual standard scores were Z+K, where K was an appropriate constant added to 'Z' scores so that the scores of the different items to be included in the study were positive.

Final selection of the items

Since the scale to be developed was required to measure constraints which may either be 'serious' or ' very serious' it was necessary to eliminate such of the items from the inventory which did not constitute a constraint or 'not so serious' in the jury opinion. To achieve this 'K' value .75 was added to Z scores of each of the items. By adding the 'K' values to Z scores, such of the items which constituted 'serious constraints' but otherwise had negative Z scores,

now had positive Z scores and all those items which in jury's opinion constituted 'not so serious' constraints still had negative values.

The items were arranged in descending order, on the basis of Z+K values. Since the 'K' values were so adjusted that Z+K scores will be positive for important items only, the items having negative Z+K values were dropped and items having positive values were retained for inclusion in the scale. Based on these 23 statements were finally selected for measuring the constraints of extension workers. The minimum score which a respondent could obtain was 23 and maximum score was 69.

Reliability of the scale

Split-half technique was used for testing the reliability of scale. The scale was administered to 30 Extension Officers. Coefficient of correlation between even and odd numbered statements of the scales were calculated as a measure of reliability. The correlation coefficient was .85 which was found to be significant at one per cent level. The extension personnel rated the constraints on a three point continuum as follows.

Most serious	3
Somewhat serious	2
Not serious	1

III.4.Methods of investigation

Separate interview schedules were prepared for fresh water and brackish water farmers. The draft interview schedules were pre-tested and with necessary modification it was used for the investigation. The schedule was translated into Malayalam before administering to the

respondents. Questionnaire for extension personnel was distributed in person along with stamped and self addressed envelope to send the filled up questionnaire. The interview schedules for freshwater farmers and brackish water farmers and the questionnaire for Extension Officers were given in appendix VIII, IX and X respectively.

III.5.Statistical tools used

Percentage,

Simple comparisons were done using percentage values.

Simple correlation analysis

Linear correlation co-efficient was calculated to find out the association between the dependent variables (Y) and independent variables (X). The formula used was

$$r = \frac{\Sigma xy - \frac{(\Sigma x)(\Sigma y)}{n}}{\sqrt{\left[\Sigma x^2 - \frac{(\Sigma x)^2}{n}\right]\left[\Sigma y - \frac{(\Sigma y)^2}{n}\right]}}$$

The significance of r was also tested.
x = Independent variables
y = Dependent variables
n = Number of observations

Multiple correlation and regression analysis

The multiple correlation co-efficient (R) represented the zero order correlation between the actual dependent variable scores and predicted dependent variable scores obtained from the independent variables under consideration. If the predicted dependent variable score for each respondent would exactly correspond to his/her actual

dependent variable score obtained in the study, the multiple correlation coefficient would be unity.

The square of the multiple correlation coefficient (R) indicated the proportion of the total variation explained by the independent variables in the regression equation taken together.

Since simple relationship of variables could not give an evidence of how much they actually contribute to the dependent variable, the multiple regression analysis was worked out.

The partial regression coefficients or partial b's were obtained for the variables included in the regression equation. The following prediction equation was used to determine the multiple regression.

$$Yi = a + b_1x_1 + b_2x_2 + b_3x_3 + b_4x_4 + b_5x_5 + b_6x_6 + b_7x_7 + b_8x_8 + b_9x_9 + b_{10}x_{10} + b_{11}x_{11} + b_{12}x_{12}$$

Where,

a = constant

bi = the coefficient which appears in the equation which represents the amount of change in yi (i = 1,2) that can be associated with unit increase in xi (i = 1, 2, 3.....12) with the remaining independent variables held fixed. This is referred to as partial regression coefficient or partial 'b'.

y_1 = Adoption about improved practices

y_2 = Knowledge of improved practices

x_1 = age

x_2 = education

x_3 = occupation

x_4 = experience

x_5 = income

x_6 = farm size

x_7 = information source utilization

x_8 = indebtedness

x_9 = social participation

x_{10} = risk orientation

x_{11} = marketing orientation

x_{12} = extension participation

Step-wise regression analysis

This was done to find out the relative effect of the independent variables in predicting the dependent variable and for elimination of unimportant variables. The best fitting regression equation of dependent variables on independent variables was predicted by applying step-wise regression as suggested by Draper and Smith (1966).

Operational definitions of the terms used

Fresh water beneficiary farmers : Fish farmers who availed inputs through the Department of Fisheries as kind or cash or both, intended to raise the fish Production

Brackish water beneficiary farmers : Shrimp farmers who availed inputs through the Department of Fisheries as kind or cash or both, intended to raise the fish Production.

Extent of adoption : The extent to which the recommended improved practices of fish/shrimp farming are put into practice by the beneficiaries of the Department of Fisheries.

Knowledge : Knowledge is operationally defined as acquaintance with theoretical and practical understanding of improved fish/shrimp farming practices recommended through the Department of Fisheries.

Satisfaction with extension services : The degree to which the fresh water and brackish water beneficiary farmers are satisfied with extension services provided by the extension agency.

Constraints of farmers : The bottlenecks or items of difficulty faced by the fish/shrimp farmers in the process of adoption of improved or recommended practices.

CHAPTER IV

RESULTS

The results of the study in accordance with the objectives are presented under the following sub-heads in this chapter.

A. Fresh water farming

1. Socio-psychological and economic characteristics of fresh water farmers.
2. Extent of adoption of fresh water farmers.
3. Level of knowledge of fresh water farmers.
4. Level of satisfaction of fresh water farmers
5. Effectiveness of extension services in fresh water farming.
6. Influence of socio-psychological and economic characteristics of fresh water farmers on the level of adoption
7. Influence of socio-psychological and economic characteristics of fresh water farmers on the level of knowledge.
8. Influence of socio-psychological and economic characteristics of fresh water farmers on the level of satisfaction .
9. Constraints faced by fresh water farmers.

A.1. Socio-psychological and economic characteristics of fresh water beneficiary farmers

The socio-psychological and economic profile of the fresh water beneficiary farmers included in the study were age, education, occupation, experience, annual income, farm size, information source utilization, indebtedness, social participation, risk orientation, marketing orientation and extension participation.

Table 25: The socio-psychological and economic profile of the fresh water beneficiary farmers. (n = 100)

Sl.No.	Attributes	F&P	Mean
1.	Age		
	Young	12	
	Middle	69	45.69
	Old	19	
2.	Education		
	Illiterate	-	
	Can read only	-	
	Can read & write	-	
	Primary	11	
	Middle school	17	
	High school	40	
	College and above	32	
3.	Occupation		
	Farming alone	17	
	Farming + labour	26	
	Farming + business	45	
	Framing + service	12	
4.	Experience		
	Low	2	
	Medium	88	5.76
	High	10	
5.	Annual income		

	Upto Rs. 50000	17	
	50001 to 100000	42	
	100001 to 150000	23	
	150001 to 200000	9	
	200001 to 250000	5	
	250001 to 300000	2	
	above 300000	2	
6.	Farm size		
	Low	13	
	Medium	72	3.66
	High	15	
7.	Information source utilization		
	Low	11	
	Medium	70	15.17
	High	19	
8.	Indebtedness		
	No debt	79	
	Upto Rs. 50000	11	
	50001 to 100000	9	
	100001 to 150000	-	
	150001 to 200000	1	
	200001 to 250000	-	
	250001 to 300000	-	
	above 300000	-	
9.	Social participation		
	Low	2	
	Medium	74	3.46
	High	24	
10.	Risk orientation		
	Low	8	
	Medium	83	14.15
	High	9	
11.	Marketing orientation		
	Low	23	

Medium	60	5.77
High	17	

12. Extension participation

Low	2	
Medium	82	5.22
High	16	

F&P = frequency and percentage

The data presented in table 25 reveals that majority of the respondents, in fresh water farming belonged to middle aged group. All the farmers had received formal education at or above primary level in fresh water farming. Forty five per cent of them are engaged (45%) in farming and business and they belonged to medium experienced group. Regarding their annual income 42 per cent had annual income between Rs. 50000 to 100000 and their average annual income is Rs. 1,03816. Majority of them in fresh water farming possessed medium land holdings. Average size of the farm is 3.66 acres. They are had medium level of information source utilization. Seventy nine per cent of the respondents had no debt at all. Majority of the beneficiaries had medium level of social participation and risk orientation. Regarding marketing orientation and extension participation majority belonged to medium level category.

A.2. Extent of adoption of fresh water farmers.

The distribution of fresh water farmers according to their extent of adoption is shown in table 26

Fig 1 :Distribution of fresh water beneficiary farmers based on extent of adoption

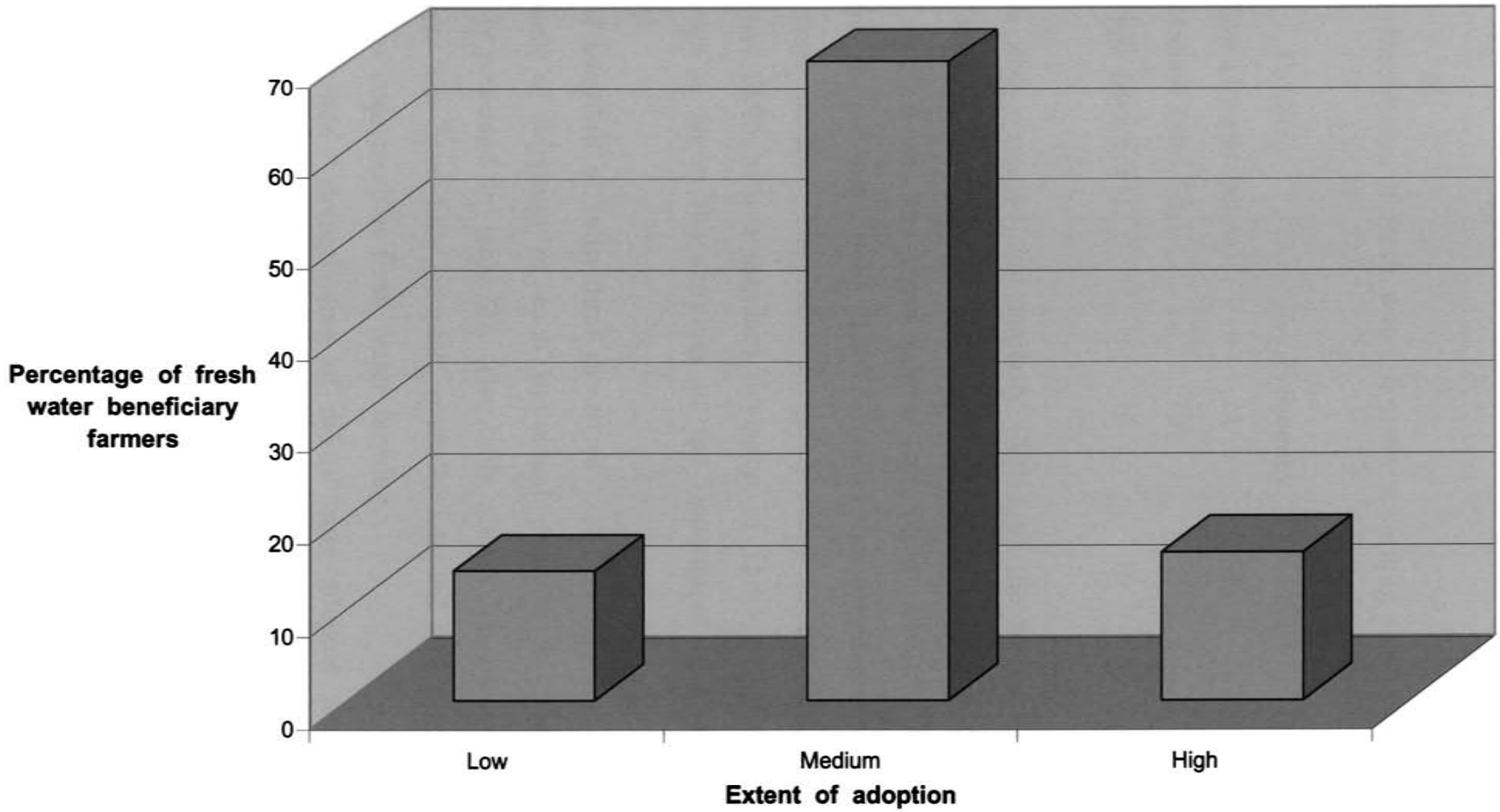


Table 26 : Distribution of fresh water farmers according to adoption.

Sl.No.	Category	Frequency	Percentage
1.	Low (39 and below)	14	14
2.	Medium (40 – 70)	70	70
3.	High (above 71)	16	16

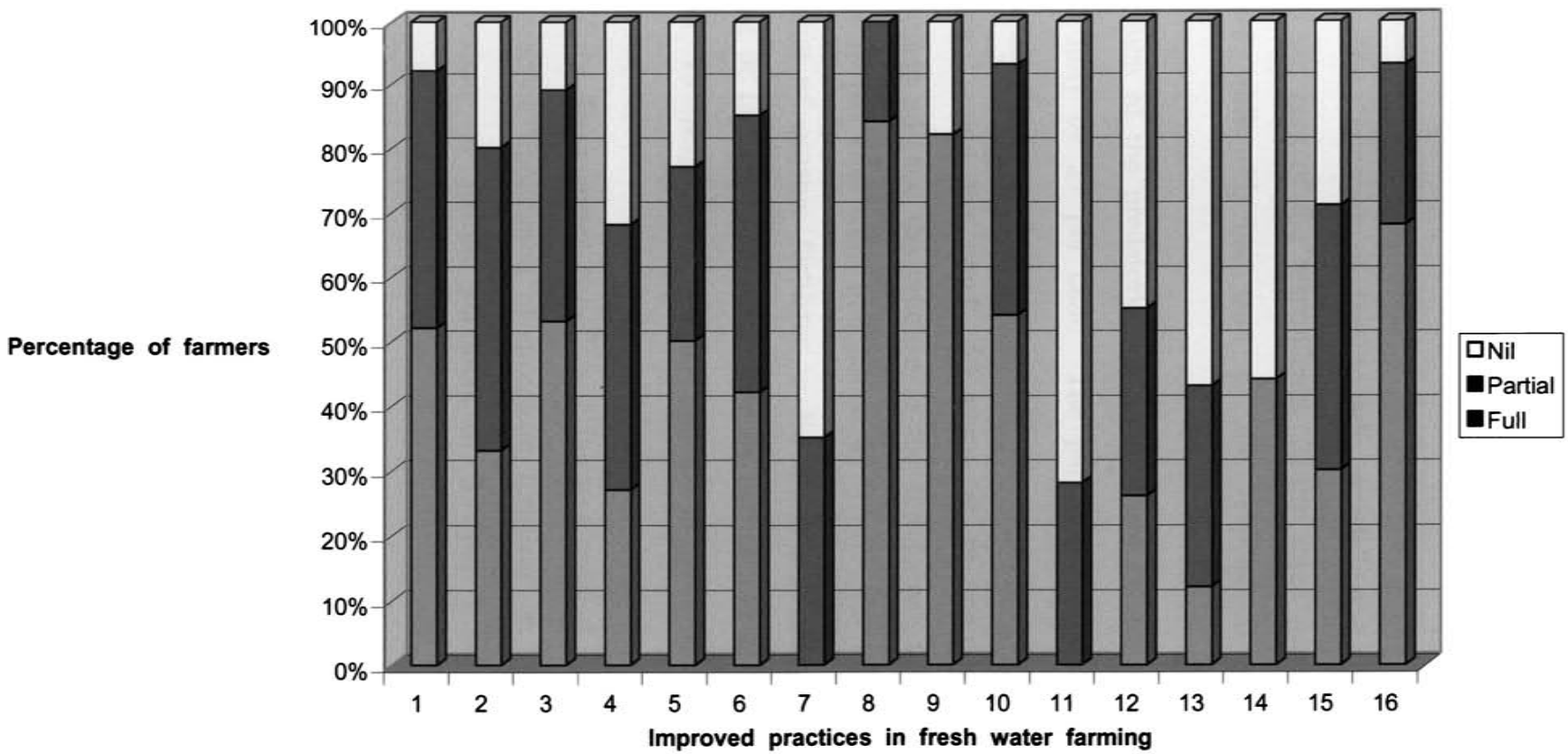
The study revealed that majority (70%) of the respondents had medium level of adoption. Fourteen per cent of respondents had low level of adoption and the farmers who had higher level of adoption constituted 16 per cent only. The diagrammatic presentation of the data is made in fig 1. The mean adoption score of the fresh water farmers was 55.16 with a standard deviation of 15.63 which is not a healthy sign as far as the activities of the Department of Fisheries is concerned.

Extent of adoption of individual practices

Extent of adoption of each individual practice in fresh water farming is presented in table 27. The table shows the percentage of respondents who have fully adopted, partially adopted and not adopted the practices concerned in fresh water farming.

The practice " strengthening of dykes" was adopted to the full extent by 52 per cent of fresh water beneficiary farmers. Forty per cent adopted it partially and eight per cent did not adopt it.

Fig : 2 Freequency and percentage of full-adopters, partial adopters and non-adopters of improved practices in fresh water farming. (n = 100)



Only 33 per cent of the fresh water beneficiary farmers were found having fully adopted the practice draining and drying the pond. Forty seven per cent of the farmers adopted it partially and the remaining 20 per cent were not adopted the practice.

The practice "removal of the aquatic weeds" was found fully adopted by 53 per cent of the respondents. Thirty three per cent were partial adopters while 11 per cent of the respondents were non adopters.

"Eradication of the predatory and weed fishes of the pond" was found adopted fully by 27 per cent. The partial adopters constituted 41 per cent while the non adopters were 32 per cent.

Regarding "liming the pond" 50 per cent of the fresh water beneficiary farmers adopted the practice to the full extent, 27 per cent partially while 23 per cent were non adopters.

Application of organic fertilizer in the pond was adopted fully by 42 per cent of farmers. The percentage of partial and non adopters were 43 and 15 respectively. This practice is recommended for improving the nutritional status of the pond.

None of the fresh water beneficiary farmers studied were found adopting the practice "application of inorganic fertilizer" in the pond to the its full extent. A partial adoption of 35 per cent could be observed.

The practice "stocking the pond with selected species" was followed by 84 per cent of respondents to the full extent and the remaining 16 per cent to the partial extent.

The full adopters of the practice "acclimatization of the seeds" in fresh water farming was 82 per cent while the remaining 18 per cent were non adopters.

The practice supplementary feeding based on biomass was adopted by 54 per cent of the respondents. Thirty nine per cent were partial adopters and 7 per cent were non adopters.

The practice "maintenance of dissolved oxygen level" was less popular among the fish farmers. Majority of the respondents were non adopters and the remaining 35 per cent were partial adopters. None of the fresh water farmers studied were found fully adopting the practice.

Adoption of the practice "monitoring and control of PH" in fresh water farming is low. The full adopters, partial adopters and non adopters constituted 26 per cent, 29 per cent and 45 per cent respectively.

The full adopters of the practice "control of algal blooms" were 12 per cent only. Partial adopters and non adopters were 31 per cent and 57 per cent respectively. The algal blooms which may develop in the ponds cause oxygen depletion and become a threat to the fauna. Hence it is important to prevent the outbreak of blooms in the ponds.

Percentage of full adopters of the practice "control of disease and parasites" was 44. Fifty six per cent of the farmers were non adopters. The practice periodic assessment of growth and biomass is adopted fully by 30 per cent of the farmers. Forty one percentage of the farmers were partial adopters while the remaining 29 per cent were non adopters.

Majority of the respondents in fresh water farming were full adopters of the practice " harvesting crop at most economic size". Partial adopters and non adopters of the practice were 25 per cent and 7 per cent respectively.

Table 27 : Frequency and percentage of full adopters, partial adopters and non adopters of improved practices in fresh water farming.

Sl.No.	Improved practices	Full adopters F&P	Partial adopters F&P	Non adopters F&P
1.	Strengthening of dykes	52	40	8
2.	Draining and drying the field	33	47	20
3.	Removal of aquatic weeds	53	36	11
4.	Erradication of predatory and weed fishes	27	41	32
5.	Liming the pond	50	27	23
6.	Application of organic fertilizer	42	43	15
7.	Application of inorganic fertilizer	0	35	65
8.	Stocking the pond with selected species	84	16	0
9.	Acclimetization	82	0	18
10.	Supplimentary feeding based on biomass	54	39	7
11.	Maintenance of dissolved oxygen level	0	28	72
12.	Monitoring and control of PH	26	29	45
13.	Control of algal blooms	12	31	57
14.	Need based control of disease and parasites	44	0	56
15.	Periodic assessment of growth & biomass	30	41	29
16.	Harvesting crop at most economic size	68	25	7
	Average	41.06	29.87	29.06

F & P = Frequency and Percentage

Table 28 : Mean adoption scores of fresh water farmers

Sl.No.	Improved practices	Mean scores	Rank
1.	Strengthening of dykes	1.44	V
2.	Draining and drying the field	1.13	IX
3.	Removal of aquatic weeds	1.42	VI
4.	Eradication of predatory and weed fishes	.95	XI
5.	Liming the pond	1.27	VII
6.	Application of organic fertilizer	1.27	VII

Fig 3 : Extent of Adoption of fresh water beneficiary farmers

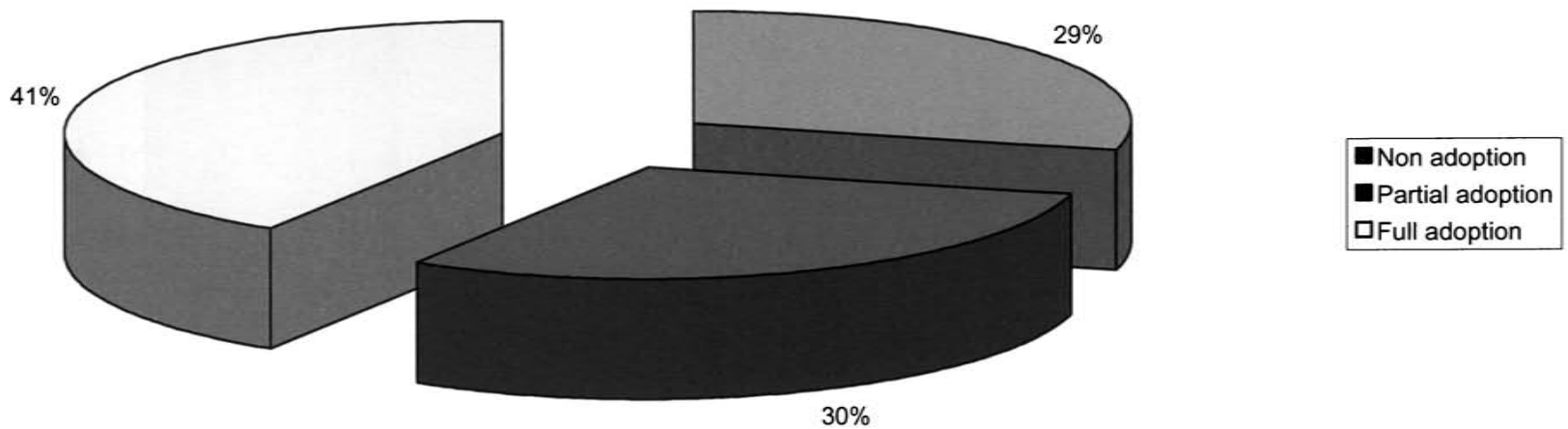
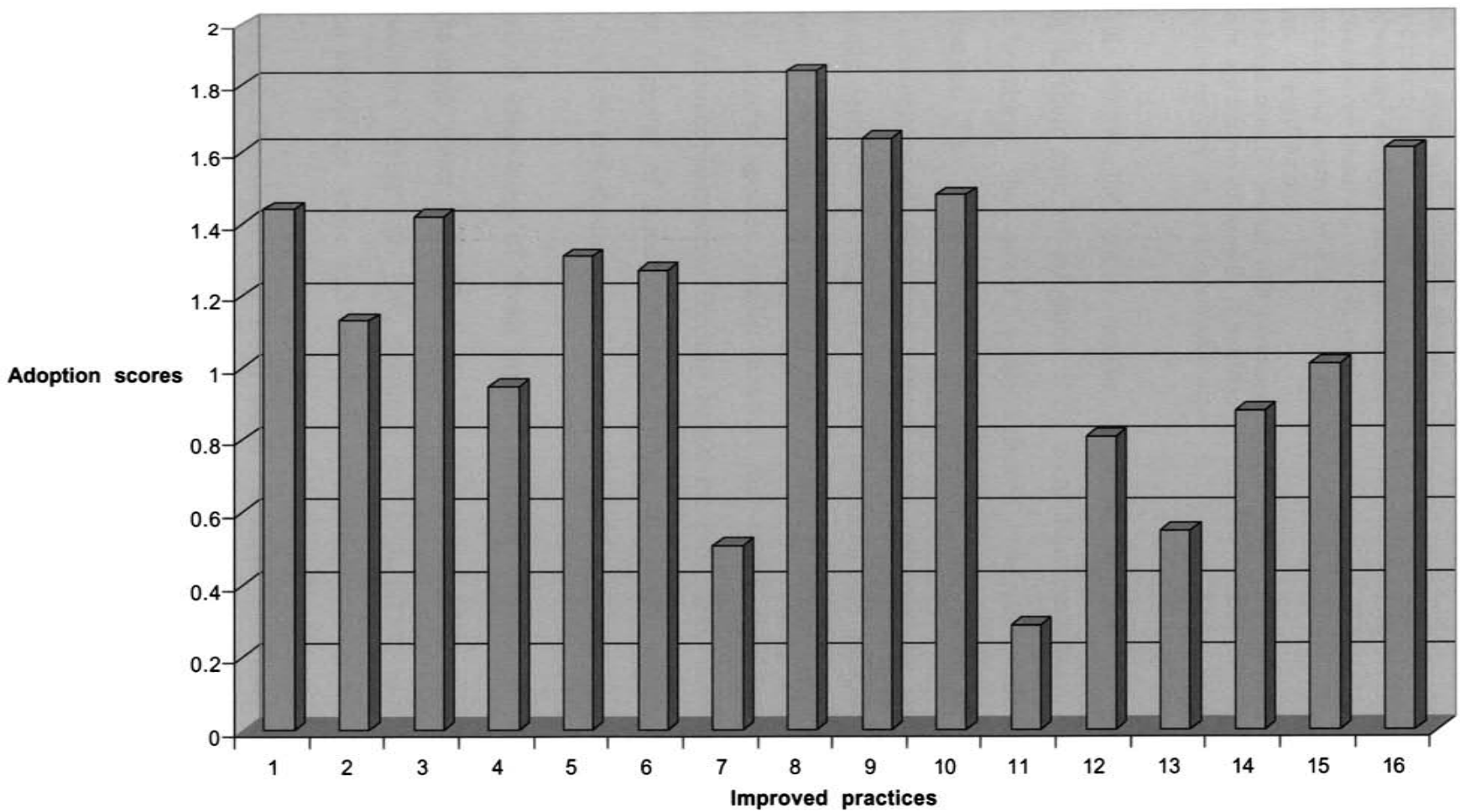


Fig 4 :Mean adoption scores of fresh water beneficiary farmers



7. Application of inorganic fertilizer	.35	XV
8. Stocking the pond with selected species	1.84	I
9. Acclimatization	1.64	II
10. Supplementary feeding based on biomass	1.48	IV
11. Maintenance of dissolved oxygen level	.28	XVI
12. Monitoring and control of PH	.81	XIII
13. Control of algal blooms	.55	XIV
14. Need based control disease and parasites	.88	XII
15. Periodic assessment of growth & biomass	1.01	X
16. Harvesting the crop at most economic size	1.61	III

Table shows the mean scores obtained for the 16 practices according to their rate of adoption It is clear that maximum adoption was in stocking the pond with selected species followed by acclimatization. The least amount of adoption was observed in the case of maintenance of dissolved oxygen level followed by application of inorganic fertilizer. Among the given practices the adoption score was above mean value in case of nine practices namely stocking the pond with selected species, acclimatization, harvesting the crop at most economic size, supplementary feeding based on bio- mass, strengthening of dykes, removal of aquatic weeds, liming the pond, application of organic fertilizer and draining and drying the field.

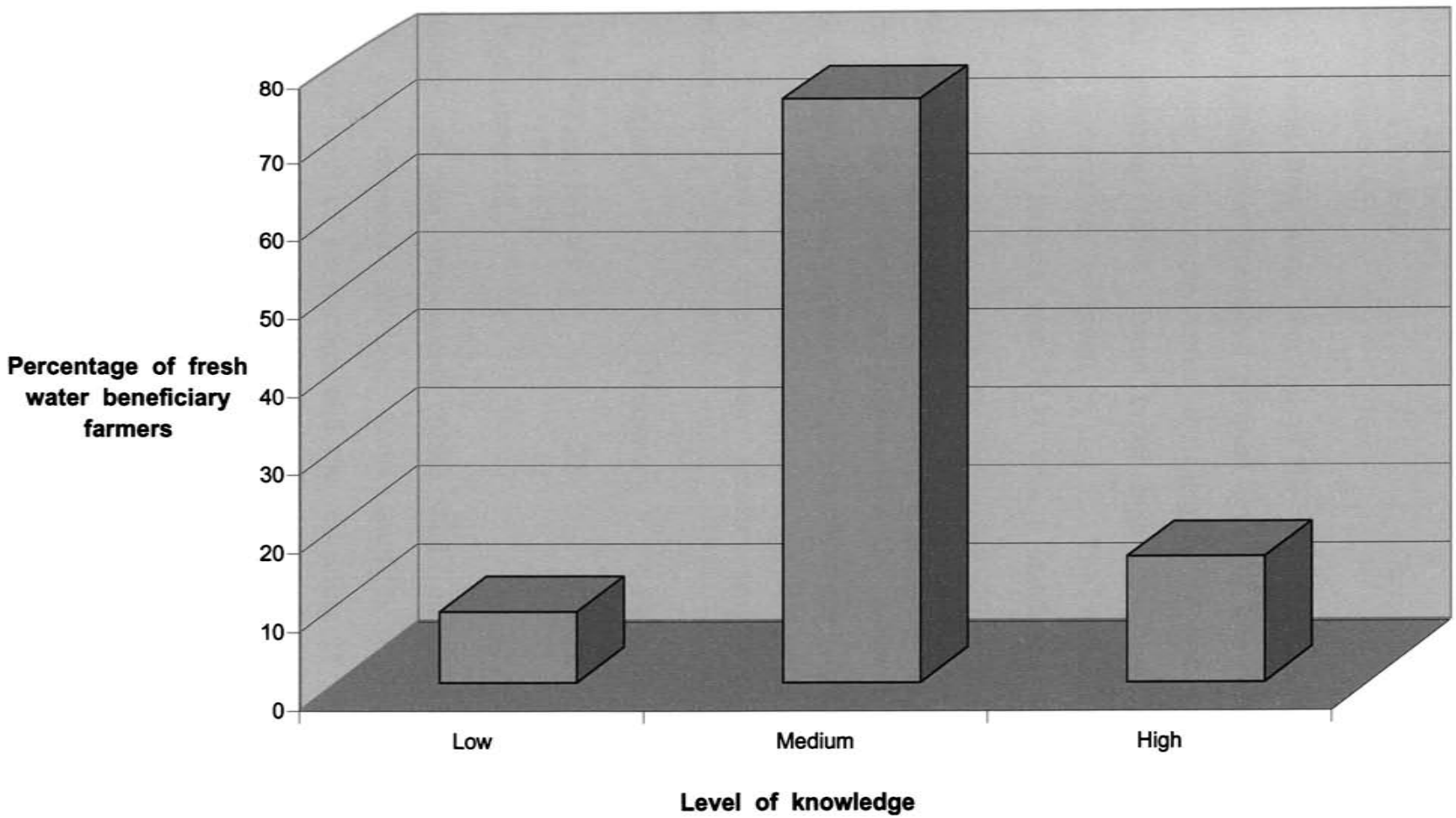
A.3. Level of knowledge of fresh water farmers

The fresh water beneficiary farmers were classified according to their knowledge levels into low, medium and high taking into account the mean knowledge score and standard deviation.

Table 29 : Distribution of fresh water farmers according to level of knowledge

Sl.No.	Category	Frequency	Percentage

Fig 5 : Knowledge levels of fresh water beneficiary farmers



1.	Low (69 and below)	9	9
2.	Medium (70 – 84)	75	75
3.	High (above 85)	16	16

It is evident from table that out of the total respondents 75 per cent of the beneficiaries possessed medium level of knowledge. Only a small per cent (9%) came under the category of low knowledge level. The remaining (16%) came under high knowledge level. The diagrammatic presentation is given in fig 5. The mean knowledge score of fresh water farmers was 76.71 with a standard deviation of 7.53.

4.4. Level of satisfaction of fresh water farmers

The extent of farmers' satisfaction over the extension services measured by client satisfaction index is presented in the table 30.

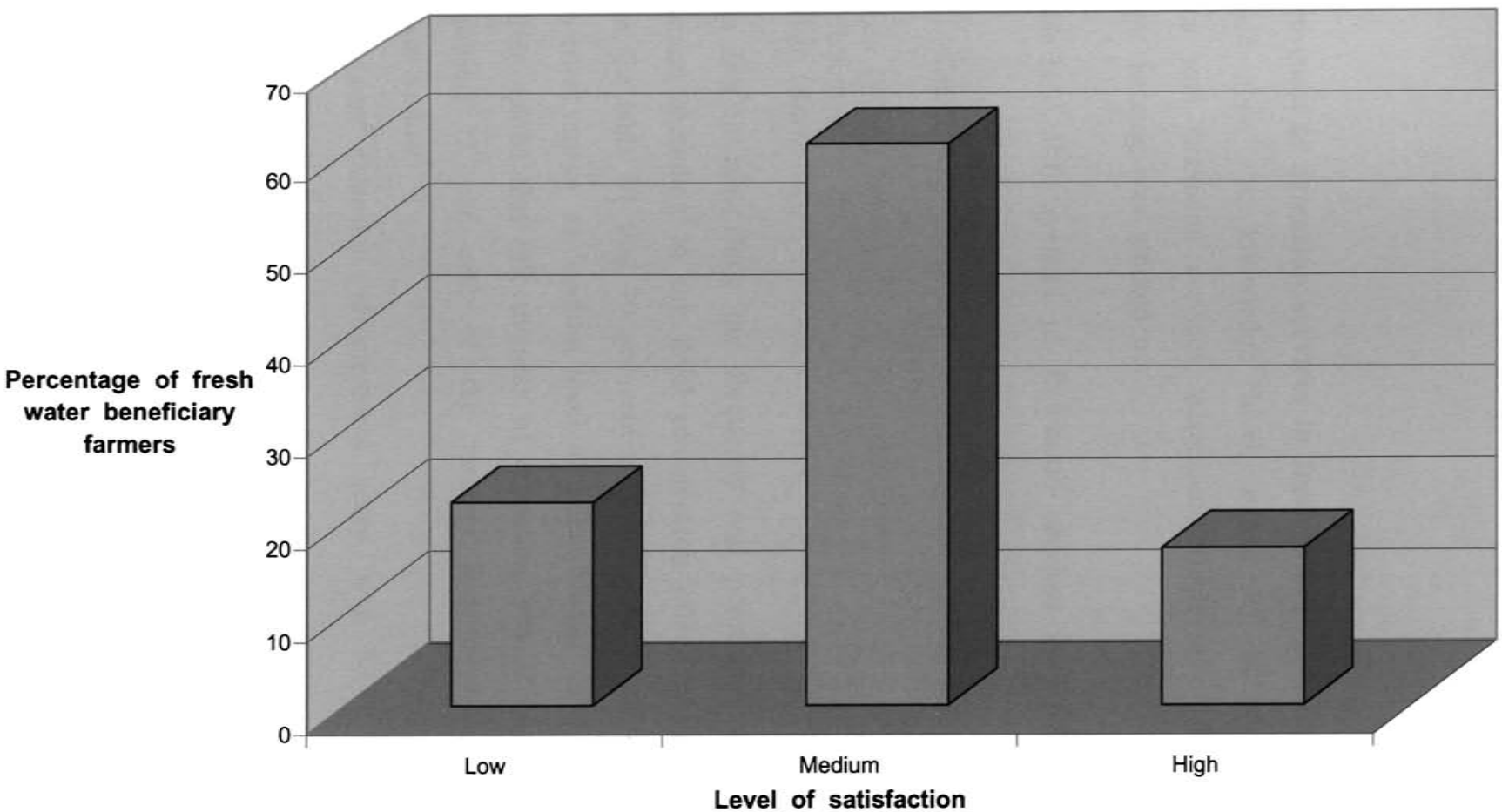
Table 30 : The extent of fresh water farmers satisfaction over the extension services.

Sl.No.	Category	Frequency	Percentage
1.	Low (47 and below)	22	22
2.	Medium (48 – 67)	61	61
3.	High (above 68)	17	17

Majority of the respondents (61%) had medium level of satisfaction over extension services. About one-fifth of the farmers (22%) had low level of satisfaction and the remaining 17 per cent of the farmers expressed a high level of satisfaction with the extension services.

The mean satisfaction score of fresh water beneficiaries was 57.31 with a standard deviation of 8.83.

Fig 6 : Distribution of fresh water beneficiary farmers based on extent of satisfaction



A.5.Effectiveness of extension services in fresh water farming

Based upon the knowledge level, extent of adoption and satisfaction with extension services, extension effectiveness index in fresh water farming was worked out.

Table 31 : Effectiveness of Extension services in fresh water farming.

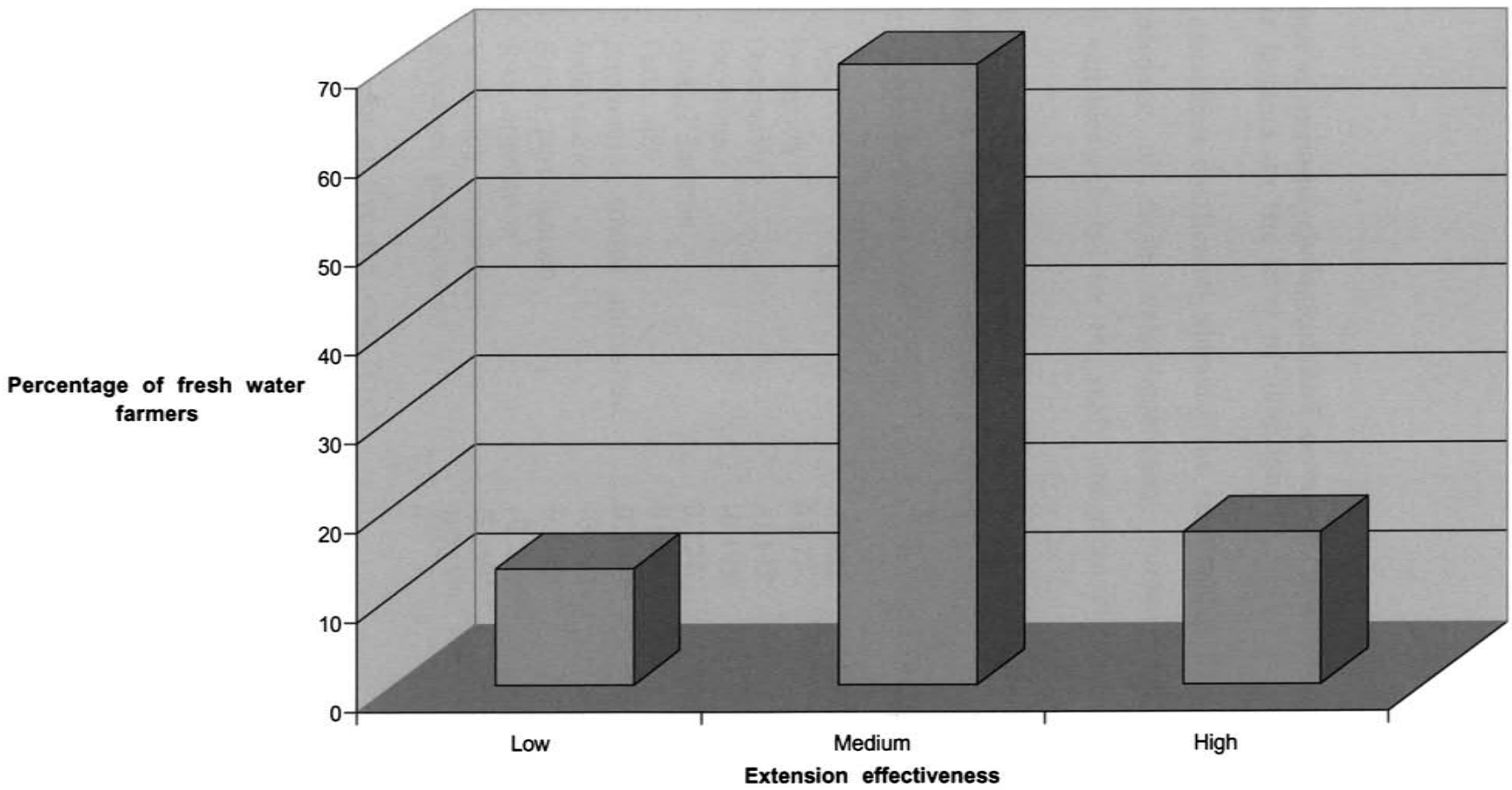
Sl.No.	Category	Frequency	Percentage
1.	Low (54 and below)	13	13
2.	Medium (55 – 71)	70	70
3.	High (above 72)	17	17

The data in table show the frequency and percentage of fresh water farmers according to the level of extension effectiveness. It is clear from the table 31 that 70 per cent of the farmers had rated the extension effectiveness as medium level of effectiveness. Only 17 per cent of them opined that effectiveness of extension was at high level. The remaining 13 per cent of the farmers had rated extension effectiveness as low.

The mean extension effectiveness score was 63.19 with a standard deviation of 8.47.

The over all picture from the above analysis reveal a fair performance of extension services. Majority of the farmers in fresh

Fig 7 : Distribution of fresh water beneficiary farmers based on extension effectiveness



water farming had rated extension effectiveness either as low or medium.

4.6. Influence of socio-psychological and economic characteristics of fresh water farmers on the level of adoption.

The correlation coefficients showing the relationship between the level of adoption of fresh water beneficiary farmers and twelve independent variables selected for the study are given in table 32

Table 32 : Correlation between the independent variables and the level of adoption of fresh water farmers.

Variable no.	Independent variables	Correlation coefficient
X_1	Age	-0.062
X_2	Education	0.077
X_3	Occupation	-0.142
X_4	Experience	-0.176
X_5	Annual income	0.124
X_6	Farm size	0.005
X_7	Information source utilization	0.341**
X_8	Indebtedness	-0.102
X_9	Social participation	0.402**
X_{10}	Risk orientation	-0.239*
X_{11}	Marketing orientation	0.259**
X_{12}	Extension participation	0.737**

* Significant at five per cent level
** Significant at one per cent level

NS Non Significant

The variables age, education, occupation, experience, annual income, farm size and indebtedness of fresh water beneficiary farmers

indicated non significant association with level of adoption of improved practices.

Information source utilization, social participation, marketing orientation and extension participation showed positive and significant association with level of adoption of the respondents, while risk orientation was negatively and significantly correlated.

Multiple linear regression analysis showing the contribution of the independent variables acting together, in the variation in adoption of fresh water beneficiary farmers were also worked out and the results are furnished in table 33

Table 33 : Regression coefficients for the level of adoption of the fresh water farmers and independent variables (n = 100)

	Variables	Regression Coefficients	S.E. of 'b'	t value
X_1	Age	0.168	0.143	1.177
X_2	Education	1.396	1.193	1.169
X_3	Occupation	-2.460	1.200	-2.049**
X_4	Experience	-0.337	0.284	-1.183
X_5	Annual income	0.480	0.768	0.625
X_6	Farm size	0.039	0.629	0.06
X_7	Information source utilization	0.336	0.170	1.967
X_8	Indebtedness	1.265	1.380	0.916
X_9	Social participation	0.345	0.689	0.501
X_{10}	Risk orientation	-0.565	0.197	-2.863**
X_{11}	Marketing orientation	1.794	0.652	2.750**
X_{12}	Extension participation	6.819	0.678	10.049**

R2 = .7148 F = 18.17079

It was found that 71 per cent of the variation in the adoption of the fresh water beneficiary farmers was due to 12 variables

included as indicated by the coefficient of determination (R2). This variation was found to be significant as explained by F- value.

The regression equation is $Y_1 = 2.702 + 0.168 X_1 + 1.369 X_2 - 2.460 X_3 - 0.337 X_4 + 0.480 X_5 + 0.039 X_6 + 0.336 X_7 + 1.265 X_8 + 0.345 X_9 - 0.565 X_{10} + 1.794 X_{11} + 6.819 X_{12}$

The best fitting regression equation was obtained through the step- wise regression analysis, the results of which are given in table 34.

Table 34 : Step-wise regression analysis showing the final step with all the significant variables included in the study of the level of adoption of fresh water farmers.

	Variables	Partial regression Coefficients	S.E. of 'b'	t- value
X_3	Occupation	-2.104	.994	-2.117**
X_7	Information source utilization	0.422	.078	5.398**
X_{10}	Risk orientation	-0.646	.182	-3.547**
X_{11}	Marketing orientation	1.506	.606	2.486**
X_{12}	Extension participation	6.935	.637	10.882**

R2 = .700 F = 43.923

* Significant at five per cent level of probability

** Significant at one per cent level of probability

Of the total variation of 71 per cent explained by all the variables together 70 per cent was contributed by five variables namely occupation (X_3), Information source utilization (X_7), risk orientation (X_{10}), marketing orientation (X_{11}), and extension participation (X_{12}). The variation contributed by these five variables were

ignificant as indicated by F- value. The final regression equation is as ollows.

$Y = 18.4 - 2.104 X_3 + 0.422 X_7 - 0.646 X_{10} + 1.506 X_{11} + 6.935 X_{12}$

The results showed that a unit increase in the occupation of resh water farmers resulted a decrease of 2.104 unit in the adoption of mproved practices, other factors being kept constant. A unit increase n the information source utilization resulted an increase of .422 unit f their adoption. Similarly with a unit increase in risk orientation heir adoption would decrease by .646 unit and an increase of 1.506 nd 6.935 unit in adoption would be brought by a unit increase in narketing orientation and extension participation respectively.

4.7. Influence of socio-psychological and economic characteristics of fresh water farmers on level of knowledge .

Simple correlation was worked out to see whether there exists ny relationship between selected characteristics of farmers with their evel of knowledge.

The correlation coefficients showing the relationship between the evel of knowledge of fresh water beneficiary farmers and twelve ndependent variables selected for the study are given in table 35

Table 35 : Correlation between the independent variables and the evel of knowledge of the fresh water beneficiary farmers.

Variable no.	Independent variables	Correlation coefficients
X_1	Age	-0.052
X_2	Education	0.139
X_3	Occupation	-0.001

X_4	Experience	-0.040
X_5	Annual income	-0.001
X_6	Farm size	0.059
X_7	Information source utilization	0.156
X_8	Indebtedness	-0.144
X_9	Social participation	0.253*
X_{10}	Risk orientation	-0.154
X_{11}	Marketing orientation	0.336**
X_{12}	Extension participation	0.598**

* Significant at five per cent level
** Significant at one per cent level
NS Non Significant

Age, education, occupation, experience, annual income, farm size, information source utilization , indebtedness and risk orientation showed non significant association with level of knowledge of the respondents.

The results of the multiple regression analysis showing the contribution of the independent variables acting together in the variations in level of knowledge of the fresh water beneficiary farmers are furnished in table 36

Table 36 : Regression coefficients for the level of knowledge of fresh water farmers and independent variables. (n = 100)

	Variables	Regression Coefficients	S.E. of 'b'	t value
X_1	Age	0.144	0.094	1.534
X_2	Education	1.254	0.787	1.593
X_3	Occupation	-0.071	0.791	-0.089
X_4	Experience	-0.035	0.187	-0.188
X_5	Annual income	-0.568	0.506	-1.122
X_6	Farm size	0.307	0.415	0.740
X_7	Information source utilization	0.022	0.112	0.204
X_8	Indebtedness	-0.361	0.910	-0.397
X_9	Social participation	0.542	0.454	1.194

X_{10}	Risk orientation	-0.165	0.130	-1.268
X_{11}	Marketing orientation	1.133	0.430	2.635**
X_{12}	Extension participation	2.438	0.447	5.451**

R2 = .4668 F = 6.347

* Significant at five per cent level of probability

** Significant at one per cent level of probability

As evident from table 36, 46.68 per cent of the variations in the dependent variable was explained by the 12 independent variables taken together (R2 = 0.4668). This variation was found to be significant as explained by F- value. The multiple regression equation obtained was

$$Y_2 = 46.064 + 0.144\ X_1 + 1.254\ X_2 - 0.071\ X_3 - 0.035\ X_4 - 0.568\ X_5 + 0.307\ X_6 + 0.022\ X_7 - 0.361\ X_8 + 0.542\ X_9 - 0.165\ X_{10} + 1.133\ X_{11} + 2.438\ X_{12}$$

The result of the step-wise regression analysis is given in table 37

Table 37 : Step-wise regression analysis showing the final step with all the significant variables included in the study of the level of knowledge of fresh water farmers.

	Variables	Partial regression Coefficients	S.E. of 'b'	t- value
X_9	Social participation	.524	.215	2.443**
X_{11}	Marketing orientation	.972	.393	2.427**
X_{12}	Extension participation	2.561	.426	6.024**

R2 = .420 F = 23.192

* Significant at five per cent level of probability

** Significant at one per cent level of probability

Of the total variation of 46.68 per cent explained by 12 variables together 42 per cent of the variation in the dependent variable was explained by social participation (X_9), marketing orientation (X_{11}) and extension participation (X_{12}).

The final regression equation is as follows

$Y_2 = 56.452 + .524\ X_9 + .972\ X_{11} + 2.561\ X_{12}$

The results indicated that a unit increase in social participation of fresh water beneficiary farmers resulted an increase of .524 unit of their level of knowledge, other factors being kept constant. Likewise an increase of .972 unit and 2.561 unit in the dependent variable was brought out by a unit increase in marketing orientation and extension participation respectively for the fresh water beneficiary farmers.

A.8. Influence of socio-psychological and economic characteristics of fresh water farmers on the level of satisfaction.

The correlation coefficients showing the relationship between level of satisfaction of fresh water beneficiary farmers and twelve independent variables are given below. The variables age, education, occupation, annual income, indebtedness, risk orientation and extension participation showed non significant association with level of satisfaction with extension services. Experience, farm size, and marketing orientation were negatively and significantly correlated. Social participation and information source utilization showed positive and significant relationship with level of satisfaction of the respondents.

Table 38 : Correlation between the independent variables and the level of satisfaction of fresh water farmers.

Variable no.	Independent variables	Correlation coefficients
X_1	Age	-0.022
X_2	Education	-0.086
X_3	Occupation	-0.181

X_4	Experience	-0.461**
X_5	Annual income	0.025
X_6	Farm size	-0.417**
X_7	Information source utilization	0.442**
X_8	Indebtedness	-0.147
X_9	Social participation	0.243*
X_{10}	Risk orientation	0.150
X_{11}	Marketing orientation	-0.423**
X_{12}	Extension participation	-0.050

* Significant at five per cent level
** Significant at one per cent level
NS Non Significant

The relationship between the independent variables and the level of satisfaction of the fresh water beneficiary farmers and the efficiency of these variables in predicting the variations on the dependent variable are presented in table 39

Table : 39 Regression coefficients for the level of satisfaction of the fresh water farmers and independent variables.

	Variables	Regression Coefficients	S.E. of 'b'	t value
X_1	Age	-0.090	0.115	-0.783
X_2	Education	-1.419	0.965	-1.470
X_3	Occupation	-2.076	0.970	-2.139**
X_4	Experience	-0.627	0.230	-2.724**
X_5	Annual income	0.460	0.621	0.740
X_6	Farm size	-1.248	0.509	-2.451**
X_7	Information source utilization	0.412	0.138	2.984**
X_8	Indebtedness	-0.499	1.116	-0.447
X_9	Social participation	-1.232	0.557	-2.210**
X_{10}	Risk orientation	0.200	0.159	1.254
X_{11}	Marketing orientation	-1.934	0.527	-3.665**
X_{12}	Extension participation	0.355	0.548	0.647

R2 = .5408 F = 8.5401

* Significant at five per cent level of probability
** Significant at one per cent level of probability

Twelve variables taken together for the multiple regression analysis jointly explained 54.08 per cent of the variation in the level of satisfaction of fresh water beneficiary farmers which was found significant as explained by F value. The regression equation is

$Y_1 = 85.92 - 0.090 X_1 - 1.419 X_2 - 2.076 X_3 - 0.627 X_4 + 0.460 X_5 - 1.248 X_6 + 0.412 X_7 - 0.499 X_8 - 1.232 X_9 + 0.2001 X_{10} - 1.934 X_{11} + 0.355 X_{12}$

The results of the step-wise regression analysis is shown in table 40

Table 40 : Step-wise regression analysis showing the final step with all the significant variables included in the study of the level of satisfaction of fresh water farmers.

	Variables	Partial regression Coefficients	S.E. of 'b'	t- value
X_3	occupation	-2.292	.854	-2.682**
X_4	Experience	-.615	.217	-2.833**
X_6	Farm size	-1.317	.457	-2.881**
X_9	Information source utilization	.426	.130	3.263**
X_{10}	Social participation	-1.163	.531	-2.189**
X_{11}	Marketing orientation	-1.746	.476	-3.665**

R2 = .514 F = 16.372

* Significant at five per cent level of probability

** Significant at one per cent level of probability

NS Not significant

Of the total variation of 54.08 per cent explained by all the variables together 51.4 per cent was contributed by six variables namely

occupation (X_3), experience(X_4), farm size(X_6), information source utilization (X_7), social participation (X_9) and marketing orientation (X_{11}).

The final regression equation is $Y_3 = 79.676 - 2.292 X_3 - 0.615 X_4 - 1.317 X_6 + 0.426 X_7 - 1.163 X_9 - 1.746 X_{11}$

The results showed that a unit increase in occupation, experience, farm size, social participation and marketing orientation contributed a decrease of 2.292, .615, 1.317, 1.136, 1.746 unit and a unit increase in information source utilization contributed an increase of .426 unit in the level of satisfaction of fresh water beneficiary farmers.

A.9. Constraints faced by fresh water farmers.

The major constraints experienced by the respondents in adopting recommended practices in fresh water farming were ranked for their relative importance on the basis of weighed cumulative frequency score. The data regarding various constraints have been presented in table 41

Table 41 : Constraints of fresh water farmers

Sl.No.	Constraints	Category	Score	Frequency	weighed frequency	cumulative frequency	rank order
	Technical constraints						
1	Lack of knowledge	vs(3)		4	12	12	
		s(2)		46	92	104	
		nss(1)		50	50	154	I
2	Non availability of quality seeds	vs(3)		4	12	12	
		s(2)		44	88	100	
		nss(1)		52	52	152	II
3	Lack of skill	vs(3)		-	-	-	

	s(2)	40	80	80	
	nss(1)	60	60	140	IV
4.Non availability feed, fertilizer etc.	vs(3)	1	3	3	
	s(2)	31	62	65	
	nss(1)	68	68	133	V
5.Lack of availability of water for	vs(3)	2	6	6	
entire culture period	s(2)	21	42	48	
	nss(1)	77	77	125	VII
6.Infection of disease	vs(3)	11	33	33	
	s(2)	22	44	77	
	nss(1)	67	67	144	III
7.Labour scarcity	vs(3)	8	24	24	
	s(2)	13	26	50	
	nss(1)	79	79	129	VI

Economic constraints

1.Poor market value of the product	vs(3)	25	75	75	
	s(2)	34	68	143	
	nss(1)	41	41	184	IV
2.High cost of feed	vs(3)	35	105	105	
	s(2)	24	48	153	
	nss(1)	41	41	194	I
3.Lack of money for construction	vs(3)	6	18	18	
work	s(2)	42	84	102	
	nss(1)	52	52	154	IX
4.High cost of fertilizer	vs(3)	11	33	33	
	s(2)	29	58	91	
	nss(1)	60	60	151	X
5.Lack of credit supply	vs(3)	33	99	99	
	s(2)	27	54	153	
	nss(1)	40	40	193	II
6.Lack of insurance facilities	vs(3)	28	84	84	
	s(2)	26	52	136	
	nss(1)	46	46	182	V
7.Exploitation of farmers by	vs(3)	7	21	21	
commission agents	s(2)	28	56	77	
	nss(1)	65	65	142	XII
8.Perishable commodity results	vs(3)	8	24	24	
in lossess	s(2)	31	62	86	
	nss(1)	61	61	147	XI
9.Erratic local demand for fish	vs(3)	21	63	63	
	s(2)	29	58	121	
	nss(1)	50	50	171	VI

10.Lack of transportation facilities	vs(3)	5	15	15	
	s(2)	29	58	121	
	nss(1)	50	50	171	VI
11.High labour charge	vs(3)	16	48	48	
	s(2)	33	66	114	
	nss(1)	51	51	165	VIII
12.Poaching	vs(3)	28	84	84	
	s(2)	30	60	144	
	nss(1)	42	42	186	III

Infrastructure/Administrative

1.Lack of timely and adequate supply of seeds	vs(3)	23	69	69	
	s(2)	27	54	123	
	nss(1)	50	50	173	VIII
2.Lack of trained officials	vs(3)	49	147	147	
	s(2)	29	58	205	
	nss(1)	22	22	227	II
3.Lack of frequent technical supervision and guidance	vs(3)	49	147	147	
	s(2)	36	72	219	
	nss(1)	15	15	234	I
4.Untimely supply of inputs and other materials	vs(3)	13	39	39	
	s(2)	36	72	111	
	nss(1)	51	51	162	X
5.Lack of communication regarding the services and other facilities available for fish farming	vs(3)	22	66	66	
	s(2)	48	96	162	
	nss(3)	30	30	192	VII
6.Location of fish collection centers at distant places.	vs(3)	9	27	27	
	s(2)	27	54	81	
	nss(1)	54	54	145	XII
7.Lack of demonstration and training on recommended practices	vs(3)	35	105	105	
	s(2)	38	76	181	
	nss(1)	27	27	208	VI
8.Lack of literature in simple language	vs(3)	8	24	24	
	s(2)	42	84	108	
	nss(1)	50	50	158	XI
9.Lack of storage facilities	vs(3)	19	57	57	
	s(2)	34	70	127	
	nss(1)	46	46	173	VII
10.Poor transfer of technologies	vs(3)	41	123	123	
	s(2)	36	72	195	
	nss(1)	23	23	218	IV
11.Lack of practical oriented training	vs(3)	47	141	141	
	s(2)	31	62	203	
	nss(1)	22	22	225	III

Lack of facilities for testing soil and water quality.	vs(3)	32	96	96	
	s(2)	45	90	186	
	nss(1)	23	23	209	V

vs very serious
s serious
nss not so serious

Technical constraints

The table 41 reveals that among the technical constraints lack of knowledge ranked at the top with their cumulative score of 154 followed by non availability of quality seeds, infection of disease, lack of skill, non availability of feed, fertilizer etc., labour scarcity and lack of availability of water for entire culture period.

Economic constraints

It is evident from the table that high cost of feed was the major economic constraint with a cumulative score of 194. The second important constraint is lack of credit supply. The third problem is poaching. Fourth,5th , 6th, 7th, 8th,9th,10th,11th and 12th problems were poor market value of the product, lack of insurance facilities, erratic local demand of fish, lack of transportation facilities, high labour charge, lack of money for construction work, high cost of fertilizer, perishable commodity results in losses and exploitation of farmers by commission agents. Infrastructure/administrative constraints

An examination of the table further indicates that the respondents identified lack of frequent technical supervision and guidance as the most important infrastructure/ administrative constraint. Lack of trained officials is the second important constraint. The other constraints were in the order of lack of practical oriented training,

poor transfer of technology, lack of facilities for testing water and soil quality, lack of demonstration and training in recommended practice, lack of communication regarding the services and other facilities, lack of timely and adequate supply of seeds, lack of storage facilities, untimely supply of inputs and other services, lack of literature in simple language, and location of fish collection centers at distant places and lack of trained officials.

B. Brackish water farming

1. Socio-psychological and economic characteristics of brackish water farmers.
2. Extent of adoption of brackish water farmers.
3. Level of knowledge of brackish water farmers.
4. Level of satisfaction of brackish water farmers .
5. Effectiveness of extension services in brackish water farming
6. Influence of socio-psychological and economic characteristics of brackish water farmers on the level of adoption.
7. Influence of socio-psychological and economic characteristics of brackish water farmers on the level of knowledge.
8. Influence of socio-psychological and economic characteristics of brackish water farmers on the extent of satisfaction.
9. Constraints faced by brackish water farmers.

B. 1. Socio-psychological and economic characteristics of brackish water farmers.

The socio-psychological and economic profile of brackish water beneficiary farmers included in the study were age, education,

occupation, experience, annual income, farm size, information source utilization, indebtedness, social participation, risk orientation, marketing orientation and extension participation.

Table 42 : The socio-psychological and economic profile of brackish water farmers.(n = 100)

Sl.No.	Attributes	F&P	Mean
1.	Age		
	Young	17	
	Middle	67	46.96
	Old	16	
2.	Education		
	Illiterate	-	
	Can read only	-	
	Can read & write	-	
	Primary	21	
	Middle school	21	
	High school	31	
	College and above	27	
3.	Occupation		
	Farming alone	62	
	Farming + labour	8	
	Farming + business	28	
	Framing + service	2	
4.	Experience		
	Low	13	
	Medium	76	5.34
	High	11	
5.	Annual income		
	Upto Rs. 50000	17	
	50001 to 100000	31	
	100001 to 150000	6	

150001 to 200000	22	
200001 to 250000	13	
250001 to 300000	8	
above 300000	3	
Farm size		
Low	2	
Medium	91	4
High	7	
Information source utilization		
Low	3	
Medium	65	17.18
High	32	
Indebtedness		
No debt	47	
Upto Rs. 50000	22	
50001 to 100000	15	
100001 to 150000	2	
150001 to 200000	10	
200001 to 250000	2	
250001 to 300000	1	
above 300000	1	
Social participation		
Low	16	
Medium	60	5.43
High	24	
Risk orientation		
Low	10	
Medium	77	26.59
High	13	
Marketing orientation		
Low	5	
Medium	75	4.78

	High	20	
12.	Extension participation		
	Low	19	
	Medium	65	8.69
	High	16	

F&P = frequency and percentage

The table reveals that majority of the respondents in brackish water farming belonged to middle aged group. All the farmers were literate and have received education at or above primary level. Majority of the respondents were engaged in farming alone (62%). They belonged to medium experienced group. Thirty one per cent of the brackish water beneficiary farmers had annual income between Rs. 50000 to 100000 with average annual income of Rs. 150960 . Majority of them had medium land holdings and average size of the farm is four acres. The respondents were having medium level of information source utilization and 47 per cent of them had no debt at all. They had medium level of social participation and risk orientation. Regarding marketing orientation and extension participation most of them belonged to medium level category.

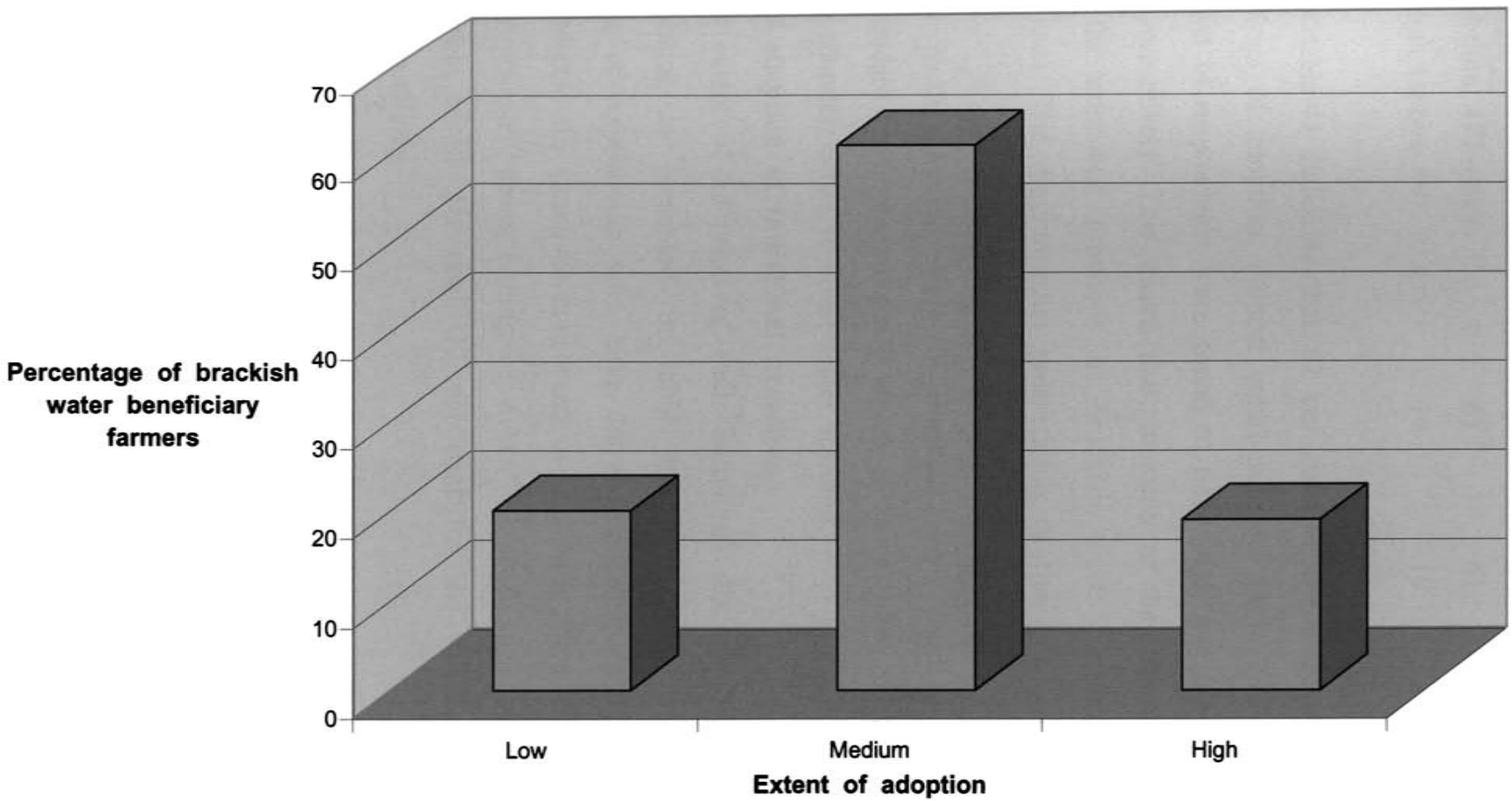
B.2. Extent of adoption of brackish water farmers.

The distribution of brackish water beneficiaries according to their extent of adoption is shown in table 43

Table 43 : Distribution of brackish water farmers according to adoption.

Sl.No.	Category	Frequency	Percentage

Fig 8 : Distribution of brackish water beneficiary farmers based on extent of adoption



1.	Low (71 and below)	20	20
2.	Medium (72 – 88)	61	61
3.	High (above 89)	19	19

The table 43 indicates that 61 per cent of the respondents had medium level of adoption. Almost equal numbers ie. 19 per cent and 20 per cent of respondents were found to have high and low level of adoption respectively. This means that majority of the respondents had adopted the improved practices in brackish water farming to the medium level. The diagrammatic presentation of the data is given in fig.

The mean adoption score in brackish water farming is 79.65 with a standard deviation of 8.81, which is more when compared to the mean adoption score in fresh water farming.

Extent of adoption of individual practices.

The extent of adoption of each individual practice in brackish water farming is presented in table 45. The table shows the percentage of respondents who have fully adopted, partially adopted and not adopted the practices concerned in brackish water farming.

The practice "strengthening of dykes" showed an adoption rate to the extent of 83 per cent, 17 per cent for the full and partial adoption respectively.

" Draining and raking of pond bottom" showed the rate of adoption of 29, 47 and 24 per cent for the full, partial and non adoption respectively.

"Drying the pond" was followed to the full extent by 23 per cent of the respondents only. Seventy seven per cent of them were

non adopters. Majority of the farmers (71 per cent) were full adopters of the practice fixing and repairing of the sluice gate. The remaining 29 per cent were partial adopters.

Draining and raking of the pond bottom was followed to the full extent by 29 per cent of the farmers. Forty seven per cent and 24 per cent were partial and non adopters respectively.

The practice drying the pond was adopted to the full extent by 23 per cent only. Non adopters constituted 77 per cent.

An adoption rate of 62 per cent and 38 per cent could be observed for the full and partial adoption of the practice "removal of aquatic weeds". Sixty seven per cent of the respondents were full adopters of the practice "eradication of the predatory and weed fishes". The remaining 33 per cent were partial adopters.

Regarding "liming the pond" 74 per cent of the brackish water beneficiary farmers adopted the practice to the full extent and 26 per cent adopt it partially.

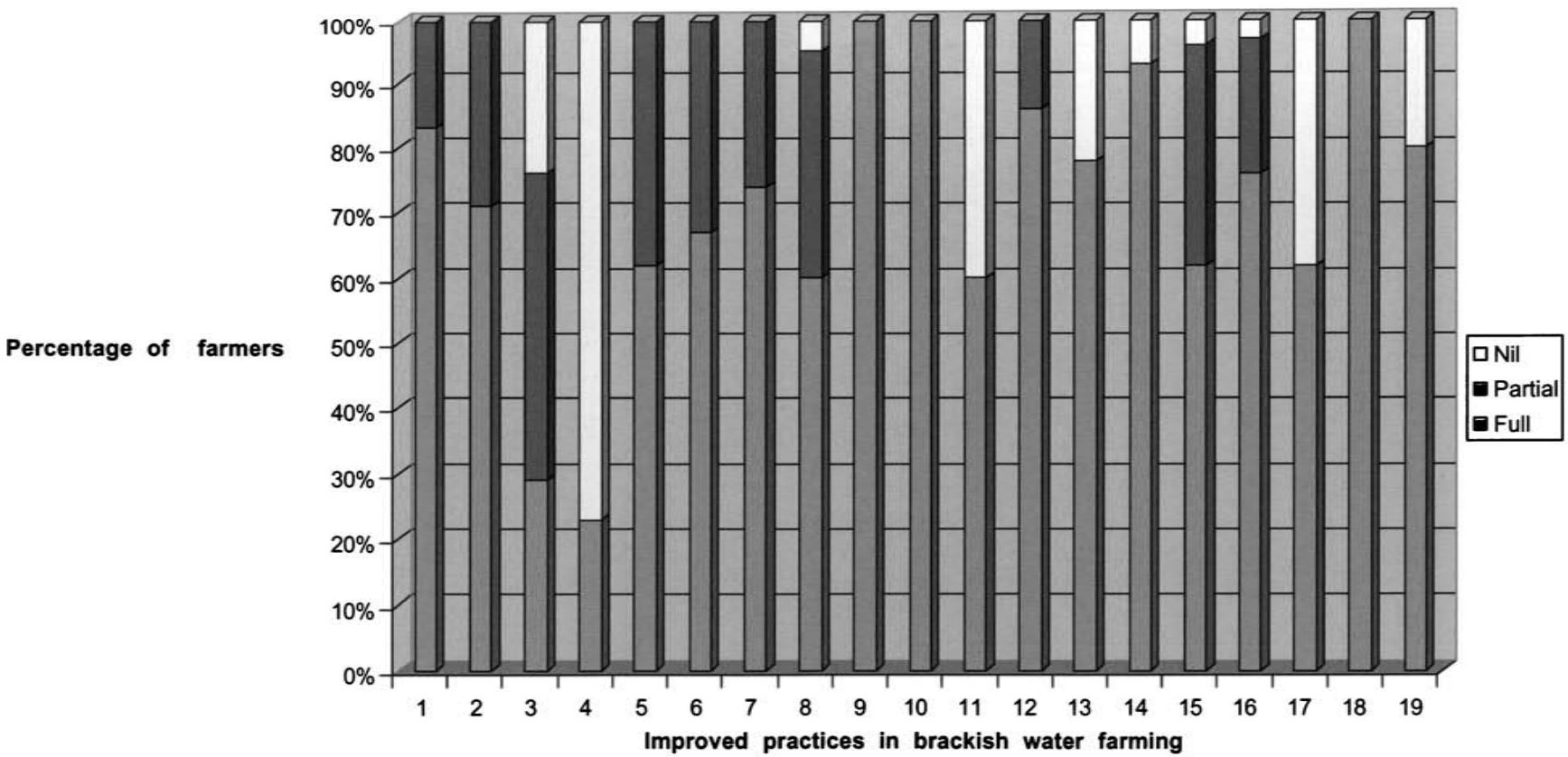
Application of organic fertilizer in the pond was adopted fully by 60 per cent of farmers. 40 per cent were partial adopters.

All the respondents were full adopters of the practices "stocking the pond with selected species" and "acclimatization of the seeds".

Sixty per cent of the brackish water farmers were full adopters of the practice nursery rearing of seeds. The remaining 40 per cent were non adopters.

An adoption rate of 86 per cent and 14 per cent for full and partial adoption could be observed for the practice "supplementary feeding based on biomass".

Fig :9 Frequency and percentage of full-adopters,partial adopters and non-adopters of improved practices in brackish water farming. (n = 100)



The Practice "maintenance of dissolved oxygen level" was adopted fully by 78 per cent, 22 per cent were non adopters.

Majority (93%) of the respondents were full adopters of the practice "monitoring and control of PH". Only 7 per cent did not adopt the practice.

The full adopters of the practice "control of algal blooms" were 62 per cent in brackish water farming. Partial adopters and non adopters were 34 per cent and four per cent respectively.

In brackish water farming, the practice need based water exchange was done to the full extent by 76 per cent, partial 21 per cent and three per cent did not adopt the practice.

Percentage of full adopters of the practice "control of disease and parasites" was 62. Thirty eight per cent of the respondents were non adopters.

All farmers studied were full adopters of the practice "periodic assessment of growth and biomass".

Majority of the respondents (80%) in brackish water farming were full adopters of the practice " harvesting crop at most economic size". Only 20 per cent were partial adopters.

Table 44 :Frequency and percentage of full adopters, partial adopters and non adopters of improved practices in brackish water farming.

No.	Improved practices	Full adopters F&P	Partial adopters F&P	Non adopters F&P
	Strengthening of dykes and deepening of channels	83	17	0
	Fixing and repairing of sluice gate	71	29	0

3. Draining and raking of pond bottom	29	47	24
4. Drying the pond	23	0	77
5. Removal of aquatic weeds	62	38	0
6. Eradication of existing fishes, crustaceans and other unwanted organisms	67	33	0
7. Liming the pond	74	26	0
8. Application of organic fertilizer	60	35	5
9. Stocking the pond with selected species	100	0	0
10. Acclimatization of seeds	100	0	0
11. Nursery rearing of seeds	60	0	40
12. Supplementary feeding based on biomass	86	14	0
13. Maintenance of dissolved oxygen level	78	0	22
14. Monitoring and control of PH	93	0	5
15. Control of algal blooms	62	34	4
16. Need based water exchange	76	21	3
17. Need based control disease and parasites	62	0	38
18. Periodic assessment of growth & biomass	100	0	0
19. Harvesting crop at most economic size	80	0	20
Average	71.89	15.47	12.53

Table 45 : Mean adoption scores of brackish water farmers

Sl.No.	Improved practices	Mean adoption score	Rank
1	Strengthening of dykes and deepening of channels	1.83	VI
2	Fixing and repairing of sluice gate	1.71	IX
3	Draining and raking of pond bottom	1.05	XVIII
4	Drying the pond	.46	XIX
5	Removal of aquatic weeds	1.62	XI
6	Eradication of existing fishes, crustaceans and other unwanted organisms	1.67	X
7	Liming the pond	1.74	VII
8	Application of organic fertilizer	1.55	XV
9	Stocking the pond with selected species	2	I
10	Acclimetization of seeds	2	I
11	Nursery rearing of seeds	1.2	XVII
12	Supplimentary feeding based on biomass	1.86	IV
13	Maintenance of dissolved oxygen level	1.56	XIV
14	Monitoring and control of PH	1.86	IV
15	Control of algal blooms	1.58	XIII
16	Need based water exchange	1.73	VIII
17	Need based control disease and parasites	1.24	XVI
18	Periodic assessment of growth & biomass	2	I
19	Harvesting crop at most economic size	1.6	XII

Fig 10 : Extent of Adoption of brackish water beneficiary farmers

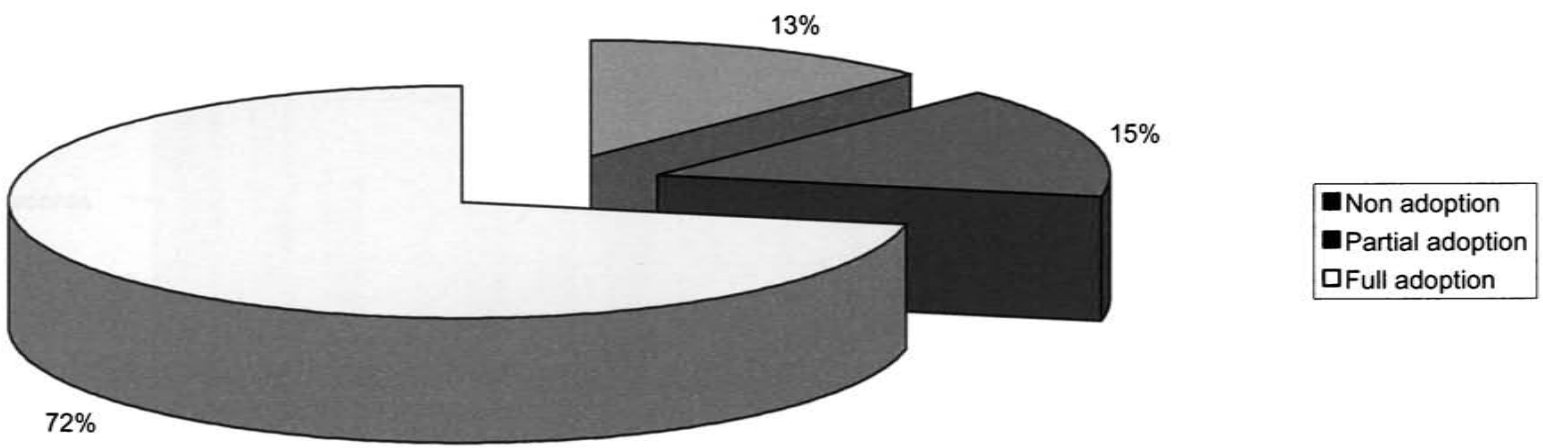


Fig 11 Mean adoption score of brackish water beneficiary farmers

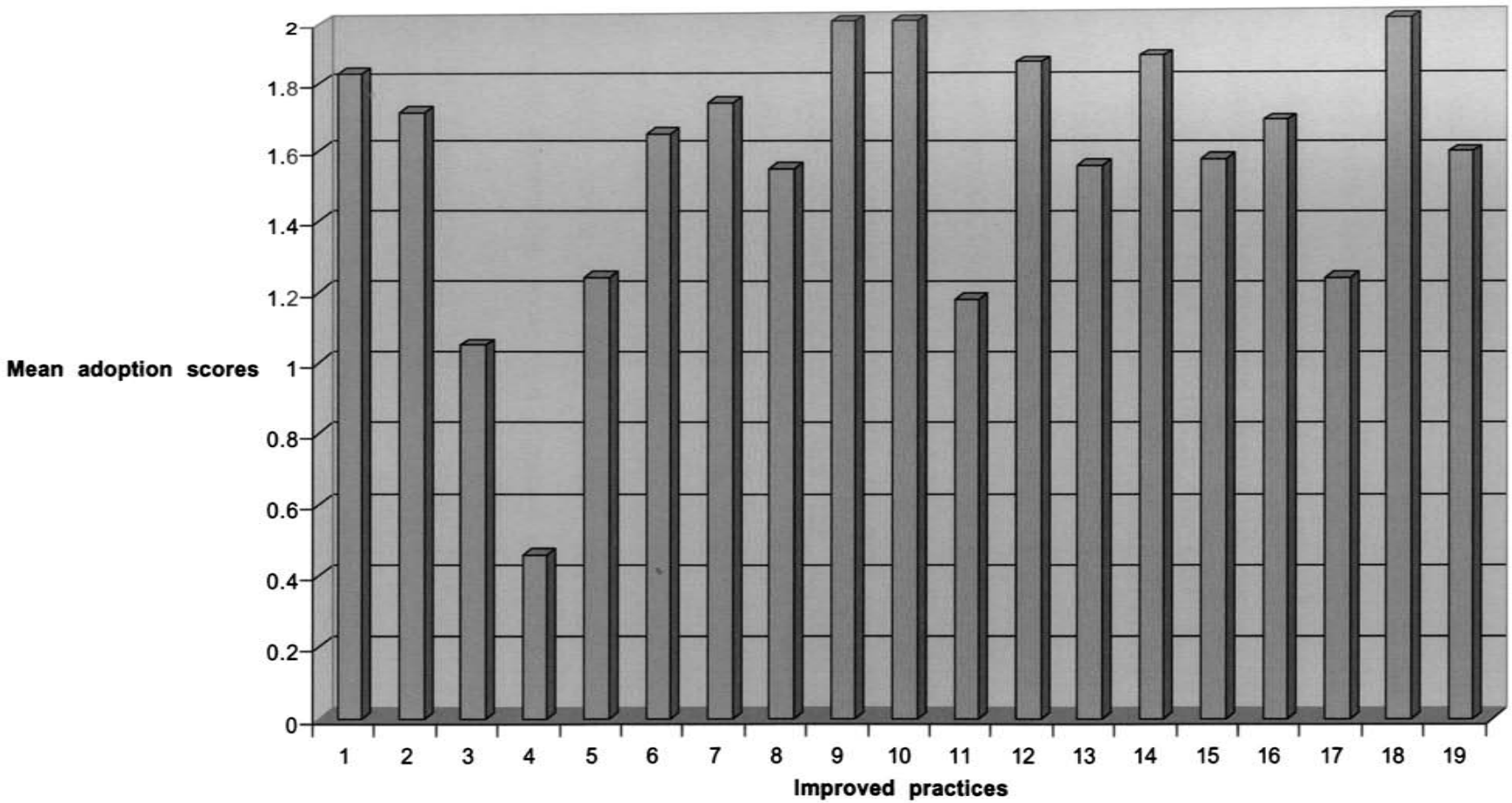


Table 45 shows the mean scores obtained for the 19 practices : brackish water farming. Full adoption was observed in the practices ocking the pond with selected species, acclimatization of the seeds nd periodic assessment of growth and bio-mass. Least amount of doption was noticed in the practice drying the pond followed by raining and raking of the pond bottom. In the case of the practices ocking the pond with selected species, acclimatization of the seeds, eriodic assessment of growth and bio-mass, monitoring and control of H, supplementary feeding based on bio-mass, strengthening of dykes nd deepening of canals, liming the pond, need based water exchange, ixing and repairing of sluice gate, eradication of existing fishes, rustaceans and other unwanted organisms, removal of aquatic weeds nd harvesting crop at most economic size the adoption score was ove mean values.

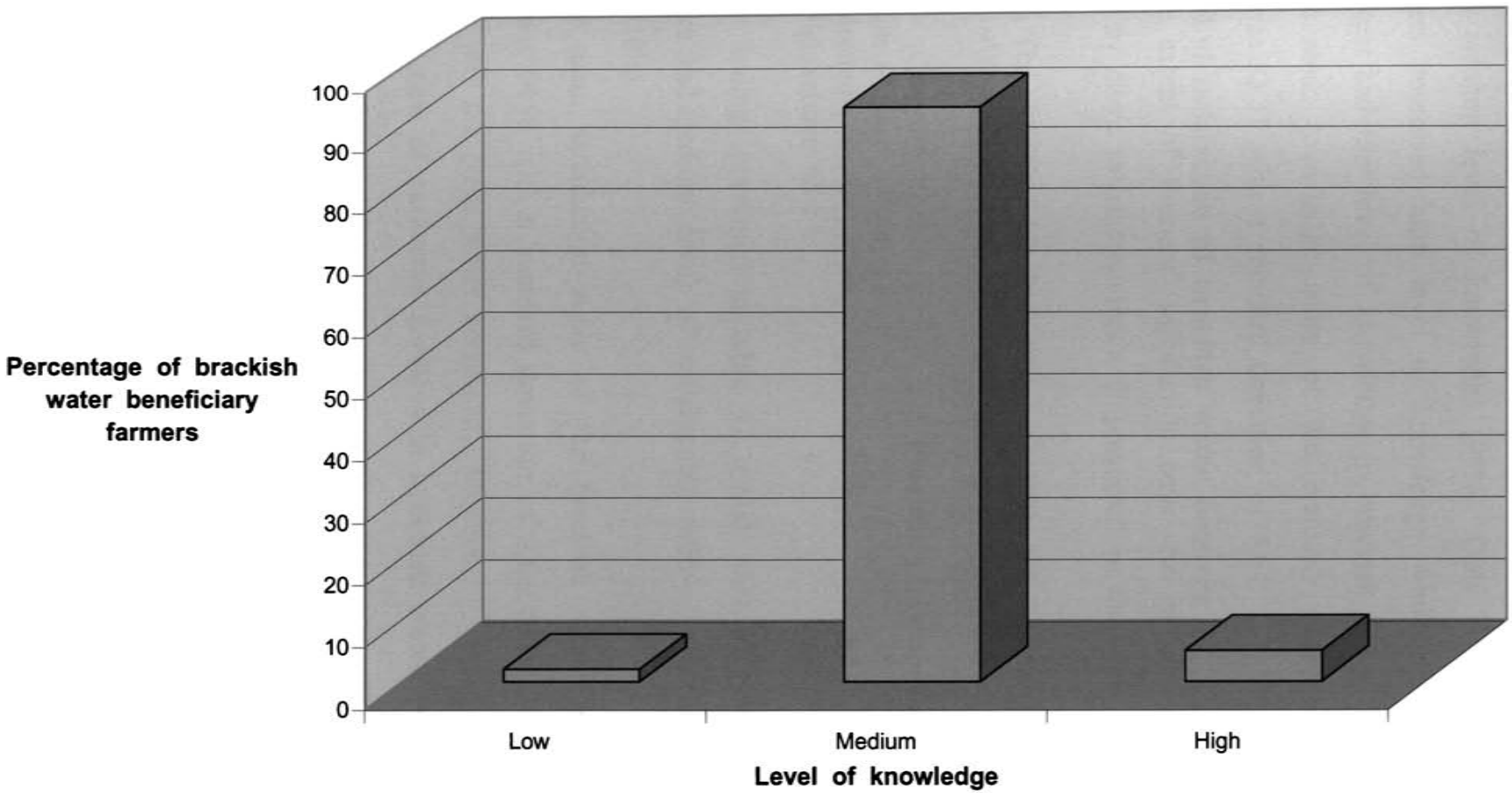
13. Level of knowledge of brackish water farmers

The brackish water beneficiary farmers were classified according : their knowledge levels into low, medium and high taking into ccount the mean knowledge score and standard deviation.

Table 46 : Distribution of brackish water farmers according to vel of knowledge

S.No.	Category	Frequency	Percentage
	Low (78 and below)	2	2
2	Medium (79 – 91)	93	93
3	High (above 92)	5	5

Fig 12 . Knowledge levels of brackish water beneficiary farmers



The data in table 47 shows that majority of the respondents possessed medium level of knowledge (93%). Only five per cent of the farmers possessed high level of knowledge while the remaining two per cent had low level of knowledge in brackish water farming.

The mean knowledge score of the brackish water beneficiary farmers was 85.31 with a standard deviation of 6.61.

B.4. Level of satisfaction of brackish water farmers

The extent of farmers' satisfaction over the extension services measured by client satisfaction index is presented in the table 48

Table 47 : The extent of brackish water farmers satisfaction over the extension services.

Sl.No.	Category	Frequency	Percentage
1.	Low (47 and below)	16	16
2.	Medium (48 – 67)	67	67
3.	High (above 68)	17	17

The findings presented in table 47 reveals that 67 per cent of the farmers had medium level of satisfaction followed by high (17%) and low (16%).

The mean satisfaction score of the brackish water beneficiary farmers was 58.58 with a standard deviation of 8.63 which is more or less same with the fresh water beneficiary farmers.

B.5. Effectiveness of extension services in brackish water farming

Based upon the knowledge level, extent of adoption and satisfaction with extension services, extension effectiveness index in brackish water farming was worked out.

Table 48 : Effectiveness of Extension services in brackish water farming.

Fig 13 : Distribution of brackish water beneficiary farmers based on extent of satisfaction

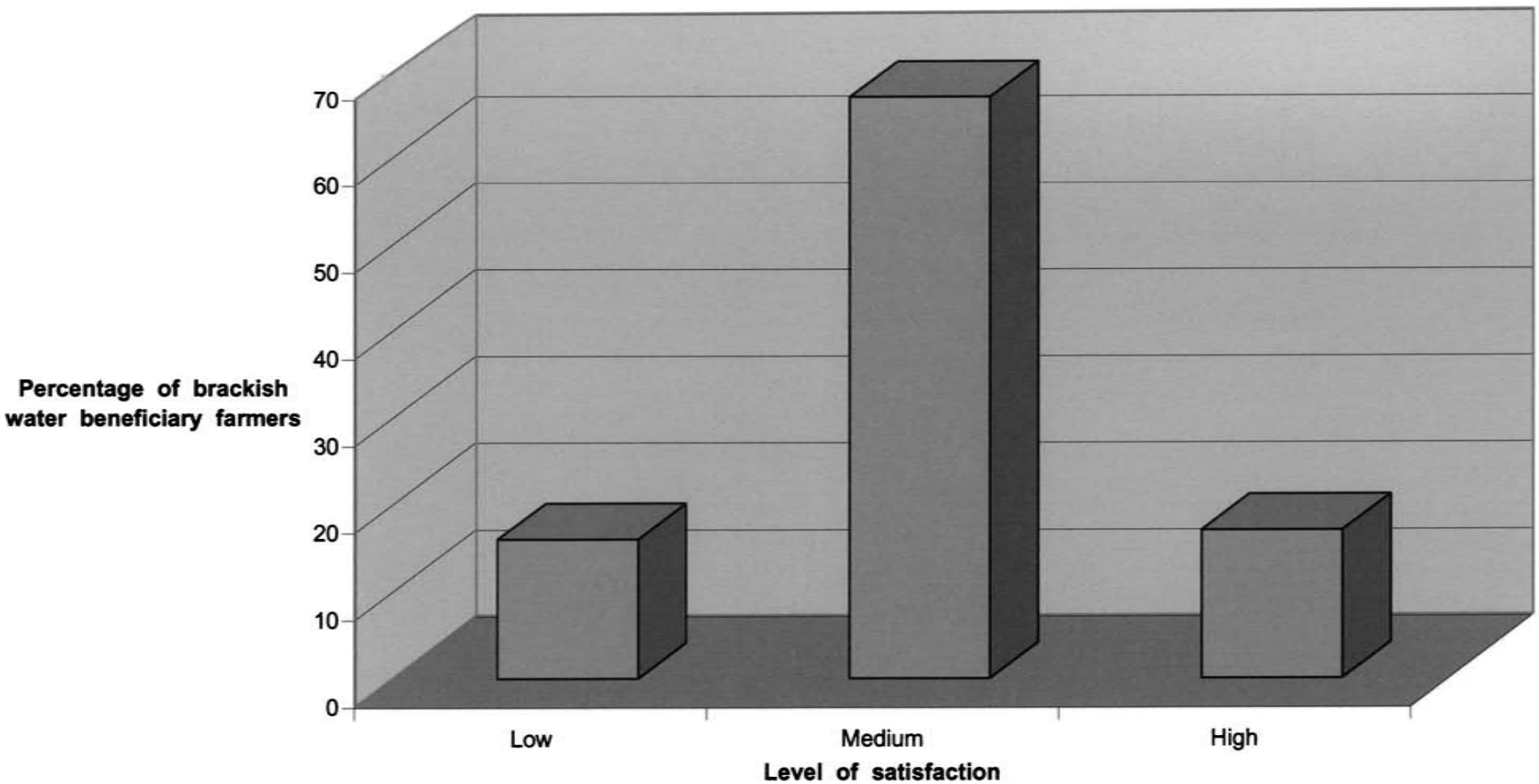
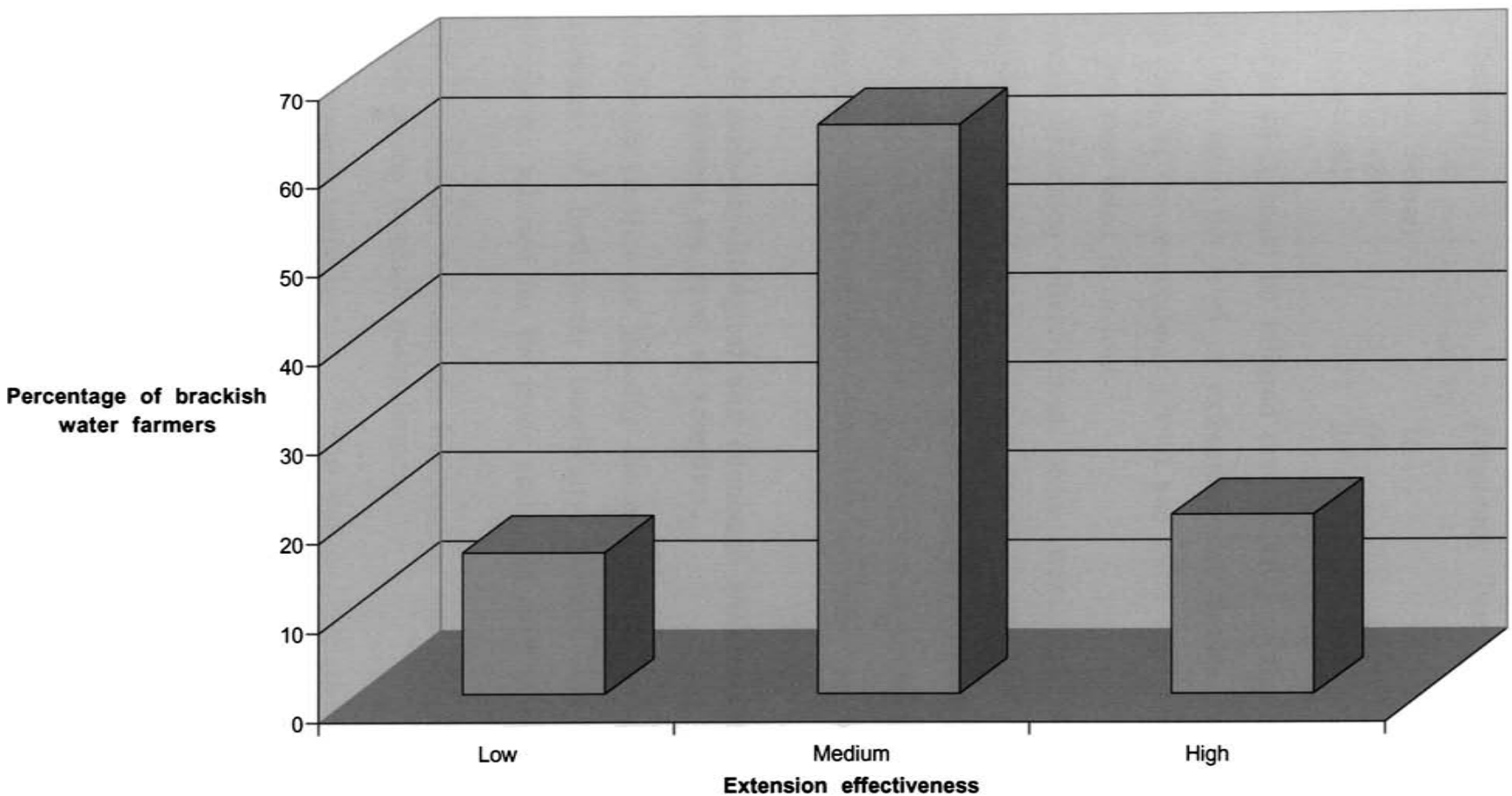


Fig 14 Distribution of brackish water beneficiary farmers based on extension effectiveness



Sl.No.	Category	Frequency	Percentage
1.	Low (70 and below)	16	16
2.	Medium (71 – 80)	64	64
3.	High (above 81)	20	20

From table 48 it could be inferred that majority of the brackish water farmers had rated the level of extension effectiveness to be of medium. One fifth of the respondents (20%) had rated it as high. The remaining 16 per cent rated it as low.

The mean extension effectiveness score was 75.34 with a standard deviation of 5.

The over all picture from the above analysis reveals a fair performance of extension services. Majority of the farmers in brackish water farming had rated extension effectiveness either as low or medium.

B.6. Influence of socio-psychological and economic characteristics of brackish water farmers on level of adoption.

The correlation coefficients showing the relationship between the level of adoption of fresh water beneficiary farmers and twelve independent variables selected for the study are given in table 49.

Table 49 : Correlation between the independent variables and the level of adoption of the brackish water farmers.

Variable no.	Independent variables	Correlation coefficient
X_1	Age	-0.062
X_2	Education	-0.11
X_3	Occupation	-0.011
X_4	Experience	0.016

	Annual income	-0.062
	Farm size	-0.001
	Information source utilization	0.569**
	Indebtedness	0.061
	Social participation	0.626**
	Risk orientation	0.142
	Marketing orientation	0.519**
	Extension participation	0.793**

* Significant at five per cent level
** Significant at one per cent level
NS Non Significant

The variables age, education, occupation, experience, annual ncome, farm size indebtedness and risk orientation of the farmers ndicated non significant association with level of adoption of mproved practice. Information source utilization, social participation, arketing orientation and extension orientation showed positive and gnificant association with level of adoption of the respondents.

The relationship between the independent variables and adoption brackish water beneficiary farmers and the efficiency of these ariables in predicting the variations on the dependent variable are resented in table

Table 50 : Regression coefficients for the level of adoption of the brackish water farmers and independent variables.

Variables	Regression Coefficients	S.E. of 'b'	t value
Age	-0.067	0.073	-0.916
Education	-0.057	0.569	-0.100
Occupation	-0.087	0.591	-0.147
Experience	0.115	0.220	0.524
Annual income	-0.056	0.348	-0.162

X_6	Farm size	0.376	0.280	1.343
X_7	Information source utilization	0.292	0.073	3.997**
X_8	Indebtedness	-0.308	0.359	-0.859
X_9	Social participation	-0.017	0.253	-0.068
X_{10}	Risk orientation	0.014	0.325	0.043
X_{11}	Marketing orientation	1.815	0.839	2.163**
X_{12}	Extension participation	2.072	0.278	7.451**

R2 = .7435 F = 21.0153

* Significant at five per cent level of probability

** Significant at one per cent level of probability

Twelve variables taken together for the multiple regression analysis jointly explained 74.35 per cent of the variation in the adoption of brackish water beneficiary farmers which was found significant as explained by F value. The regression equation is

$Y_1 = 50.168 - 0.067 X_1 - 0.057 X_2 - 0.087 X_3 + 0.115 X_4 - 0.056 X_5 + 0.376 X_6 + 0.292 X_7 - 0.308 X_8 - 0.017 X_9 + 0.014 X_{10} + 1.815 X_{11} + 2.072 X_{12}$

The results of the step-wise regression analysis is shown in table 51.

Table 51 : Step-wise regression analysis showing the final step with all the significant variables included in the study of the level of adoption of brackish water beneficiary farmers.

Variables		Partial regression Coefficients	S.E. of 'b'	t- value
X_7	Information source utilization	0.294	.229	8.704**
X_{11}	Marketing orientation	1.979	.053	5.555**
X_{12}	Extension participation	1.992	.656	3.018**

R2 = .734 F = 88.249

* Significant at five per cent level of probability

** Significant at one per cent level of probability

It could be seen from the table that out of the total 74.35 per cent variations explained by the independent variables together, 73.4

per cent was explained by information source utilization (X_7), marketing orientation (X_{11}), and extension participation (X_{12}). The final regression equation is

$$Y_1 = 47.831 + 0.295\ X_7 + 1.979\ X_{11} + 1.992\ X_{12}$$

The above results showed that a unit increase in information source utilization, marketing orientation and extension participation resulted an increase of .294, 1.976 and 1.992 unit of their adoption of improved practices, other factors being kept constant.

B.7. Influence of socio-psychological and economic characteristics of brackish water farmers on the level of knowledge.

Simple correlation was worked out to see whether there exist any relationship between selected characteristics of farmers with their level of knowledge.

The correlation coefficients showing the relationship between the level of knowledge of beneficiary farmers and twelve independent variables selected for the study are given in table 52.

Table 52 : Correlation between the independent variables and the level of knowledge of the brackish water farmers.

Variable	Independent variables	Correlation coefficients
X_1	Age	0.043
X_2	Education	0.342**
X_3	Occupation	0.142
X_4	Experience	0.015
X_5	Annual income	0.097
X_6	Farm size	-0.0001
X_7	Information source utilization	0.218*

X_8	Indebtedness	0.017
X_9	Social participation	0.336**
X_{10}	Risk orientation	0.302**
X_{11}	Marketing orientation	0.370**
X_{12}	Extension participation	0.510**

* Significant at five per cent level
* Significant at five per cent level
NS Non Significant

Age, occupation, experience, annual income, farm size, and indebtedness showed non significant association with level of knowledge of brackish water beneficiary farmers whereas education, information source utilization, social participation, risk orientation, marketing orientation and extension participation were positively and significantly correlated.

The results of the multiple regression analysis showing contribution of the independent variables acting together in the variations in the level of knowledge brackish water beneficiary farmers are given in table 53

Table 53 : Regression coefficients for the level of knowledge of brackish water farmers and independent variables. (n = 100)

	Variables	Regression Coefficients	S.E. of 'b'	t value
X_1	Age	0.052	0.082	0.636
X_2	Education	2.063	0.639	3.183**
X_3	Occupation	0.892	0.664	1.343
X_4	Experience	0.017	0.247	0.070
X_5	Annual income	0.506	0.391	1.293
X_6	Farm size	-0.092	0.314	-0.294
X_7	Information source utilization	0.111	0.082	1.354
X_8	Indebtedness	0.185	0.403	0.460

X_9	Social participation	-0.091	0.284	-0.320
X_{10}	Risk orientation	0.098	0.365	0.269
X_{11}	Marketing orientation	0.022	0.942	0.023
X_{12}	Extension participation	1.253	0.312	4.013**

R2 = .4259 F = 5.3794

* Significant at five per cent level of probability b = regression coefficient

** Significant at one per cent level of probability S.E = standard error

Table 53 reveals that 12 independent variables taken together explained the variation to the extent of 42.59 per cent (R2 = .44259). This variation was proved significant by F-values.

The multiple regression equation is

$Y_2 = 55.15 + 0.052\ X_1 + 2.036\ X_2 + 0.892\ X_3 + 0.017\ X_4 + 0.506\ X_5 - 0.092\ X_6 + 0.111\ X_7 + 0.185\ X_8 - 0.091\ X_9 + 0.098\ X_{10} + 0.022 X_{11} + 1.253\ X_{12}$

Table 54 : Step-wise regression analysis showing the final step with all the significant variables included in the study of the level of knowledge of brackish water farmers.

Variables	Partial regression Coefficients	S.E. of 'b'	t- value
X_1 Education	2.103	.481	4.369**
X_{12} Extension participation	1.338	.208	6.439**

R2 = 0.382 F = 29.95

* Significant at five per cent level of probability

** Significant at one per cent level of probability

The final result evidenced that out of the total variation of 42.59 per cent explained by 12 independent variables together, 38.2

per cent of the variations in the dependent variable was explained by the variable education (X_2) and Extension participation.

The final regression equation in the prediction of dependent variable is $Y_2 = 63.926 + 2.103\ X_2 + 1.338\ X_{12}$

It can be predicted that other factors being kept constant, one unit change in the independent variable of education and extension participation leads to corresponding change of 2.103 and 1.338 in knowledge level of brackish water beneficiary farmers.

8.8. Influence of socio-psychological and economic characteristics of brackish water farmers on the level of satisfaction

The correlation coefficients showing the relationship between level of satisfaction of brackish water beneficiary farmers and twelve independent variables are given below. The variables age, occupation, experience, farm size, indebtedness, risk orientation, marketing orientation and extension participation showed non significant association with level of satisfaction with extension services. Education was positively correlated. Annual income, information source utilization and social participation showed significant but negative correlation.

Table 55 : Correlation between the independent variables and the level of satisfaction of brackish water farmers.

Variable no.	Independent variables	Correlation coefficients
1	Age	0.067
2	Education	0.301**
3	Occupation	0.046
4	Experience	0.150
5	Annual income	-0.215*
6	Farm size	-0.055

X_9	Information source utilization	-0.502**
X_8	Indebtedness	0.135
X_9	Social participation	-0.315**
X_{10}	Risk orientation	0.054
X_{11}	Marketing orientation	-0.048
X_{12}	Extension participation	-0.069

* Significant at five per cent level
* Significant at five per cent level
NS Non Significant

Multiple linear regression analysis showing the contribution of the independent variables in the variations in the level of satisfaction of brackish water beneficiary farmers are given in table 56.

Table 56 : Regression coefficients for the level of satisfaction of the brackish water farmers and independent variables (n =100)

	Variables	Regression Coefficients	S.E. of 'b'	t value
X_1	Age	0.025	0.108	0.234
X_2	Education	2.809	0.844	3.325**
X_3	Occupation	0.367	0.877	0.418
X_4	Experience	-0.113	0.327	-0.346
X_5	Annual income	-1.387	0.517	-2.680**
X_6	Farm size	0.055	0.415	0.133
X_9	Information source utilization	-0.468	0.108	-4.312**
X_8	Indebtedness	0.416	0.532	0.786
X_9	Social participation	-0.111	0.376	0.297
X_{10}	Risk orientation	-0.515	0.483	-1.066
X_{11}	Marketing orientation	-2.069	1.244	-1.662
X_{12}	Extension participation	0.642	0.412	1.558

R2 = .4119 F = 5.079

As evident from table 56, 41.14 per cent of the variations in the dependent variable was explained by the 12 independent variables

aken together (R2 = 0.4119). This variations was found to be gnificant as explained by F- value. The multiple regression equation btained was

$Y_3 = 73.4901 + 0.0254\ X_1 + 2.8098\ X_2 + 0.3676\ X_3 - 0.1134\ X_4 - 1.3872\ X_5 + 0.0556\ X_6 - 0.4680\ X_7 + 0.4186\ X_8 + 0.1118\ X_9 - 0.5151\ X_{10} - 1.069\ X_{11} + 0.6428\ X_{12}$

The result of the step-wise regression analysis is furnished in able 57.

Table 57 : Step-wise regression analysis showing the final step with all the significant variables included in the study of the level of satisfaction of brackish water farmers

	Variables	Partial regression Coefficients	S.E. of 'b'	t- value
X_2	Education	1.762	.663	2.655**
X_5	Annual income	-1.315	.415	-3.167**
X_7	Information source utilization	-0.420	.076	-5.542**

R2 = 0.357 F = 17.783

* Significant at five per cent level of probability

** Significant at one per cent level of probability

The final result evidenced that out of the total variation of 41.19 per cent explained by all independent variables together, 35.7 er cent of the variations in the dependent variable was explained by ne variable education (X_2) annual income (X_5), and information ource utilization (X_7).

The final regression equation in the prediction of dependent ariable is $Y_3 = 61.761 + 1.762\ X_2 - 1.315\ X_5 - 0.420\ X_7$

Other factors being kept constant, an increase of 1.762 and a ncrease of 1.315 and .420 unit were brought about by a unit increase n education, annual income and information source utilization espectively.

8.9. Constraints faced by brackish water farmers.

The major constraints experienced by respondents in adopting ecommended practices were ranked for their relative importance. The ata regarding various constraints have been presented in table 58.

Technical constraints

On the basis of weighed cumulative frequency score, all the echnical constraints faced by farmers were ranked.

Table 58 : Constraints of brackish water farmers

Sl.No. Constraints order	Category Score	Frequency	weighed frequency	cumulative frequency	rank
Technical constraints					
1.Lack of knowledge	vs(3)	14	42	42	
	s(2)	16	32	74	
	nss(1)	70	70	144	II
2.Non availability of quality seeds	vs(3)	1	3	3	
	s(2)	4	8	11	
	nss(1)	95	95	106	V
3.Lack of skill	vs(3)	10	30	30	
	s(2)	21	42	72	
	nss(1)	69	69	141	III
4.Non availability feed, fertilizer etc.	vs(3)	-	-	-	
	s(2)	2	4	4	
	nss(1)	98	98	102	VII
5.Lack of availability of water for entire culture period	vs(3)	1	3	3	
	s(2)	3	6	9	
	nss(1)	96	96	105	VI
6.Infection of disease	vs(3)	100	300	300	
	s(2)	-	-	-	

	nss(1)	-	-	-	I
Labour scarcity	vs(3)	-	-	-	
	s(2)	26	52	52	
	nss(1)	74	74	126	IV
Economic constraints					
Poor market value of the product	vs(3)	50	150	150	
	s(2)	21	42	192	
	nss(1)	29	29	221	III
High cost of feed	vs(3)	44	132	132	
	s(2)	38	76	208	
	nss(1)	18	18	226	I
Lack of money for construction	vs(3)	6	18	18	
work	s(2)	38	76	94	
	nss(1)	56	56	150	VIII
High cost of fertilizer	vs(3)	7	21	21	
	s(2)	46	92	113	
	nss(1)	47	47	160	VI
Lack of credit supply	vs(3)	29	87	87	
	s(2)	24	48	135	
	nss(1)	47	47	182	IV
Lack of insurance facilities	vs(3)	54	162	162	
	s(2)	16	32	194	
	nss(1)	30	30	224	II
Exploitation of farmers by	vs(3)	2	6	6	
commission agents	s(2)	22	44	50	
	nss(1)	76	76	126	X
Perishable commodity results	vs(3)	1	3	3	
in lossess	s(2)	13	26	29	
	nss(1)	86	86	115	XI
Erratic local demand for fish	vs(3)	2	6	6	
	s(2)	26	52	58	
	nss(1)	72	72	130	IX
Lack of transportation facilities	vs(3)	1	3	3	
	s(2)	9	18	21	
	nss(1)	90	90	111	XII
High labour charge	vs(3)	30	90	90	
	s(2)	21	42	132	
	nss(1)	49	49	181	V
Poaching	vs(3)	1	3	3	
	s(2)	54	108	111	
	nss(1)	45	45	156	VII
Infrastructure/Administrative					

Lack of timely and adequate	vs(3)	15	45	45	
supply of seeds	s(2)	1	2	47	
	nss(1)	84	84	131	IX
Lack of trained officials	vs(3)	44	132	132	
	s(2)	26	52	184	
	nss(1)	30	30	214	III
Lack of frequent technical	vs(3)	47	141	141	
supervision and guidance	s(2)	29	58	199	
	nss(1)	24	24	223	I
Untimely supply of inputs and	vs(3)	10	30	30	
other materials	s(2)	9	18	48	
	nss(1)	81	81	129	X
Lack of communication regarding	vs(3)	17	51	51	
the services and other facilities	s(2)	40	80	131	
available for fish farming	nss(3)	43	43	174	VII
Location of fish collection	vs(3)	4	12	12	
centers at distant places.	s(2)	15	30	42	
	nss(1)	81	81	123	XI
Lack of demonstration and training	vs(3)	40	120	120	
on recommended practices	s(2)	25	50	170	
	nss(1)	35	35	205	IV
Lack of literature in simple	vs(3)	17	51	51	
language	s(2)	43	86	137	
	nss(1)	40	40	177	VI
Lack of storage facilities	vs(3)	6	18	18	
	s(2)	7	14	32	
	nss(1)	87	87	119	XII
0.Poor transfer of technologies	vs(3)	32	96	96	
	s(2)	28	56	152	
	nss(1)	40	40	192	V
1.Lack of practical. oriented	vs(3)	49	147	147	
training	s(2)	20	40	187	
	nss(1)	31	31	218	II
2.Lack of facilities for testing	vs(3)	31	93	93	
soil and water quality.	s(2)	10	20	113	
	nss(1)	59	59	172	VIII

vs very serious
s serious
nss not so serious

The results presented in table 60 shows that among the technical constraints in brackish water farming " infection of disease" ranked at the top with maximum cumulative score of 300 which indicates the

seriousness of the particular constraint in shrimp farming. The table further shows that constraints lack of knowledge, lack of skill, labour scarcity, non availability of quality seeds, lack of availability of water for entire culture period and non availability of feed, fertilizer etc. were ranked 2nd , 3rd , 4th ,5th ,6th and 7th respectively by the respondents with cumulative frequency score of 144, 141, 126, 106, 105 and 102.

Economic constraints

It is evident from the table that high cost of feed was the major economic constraint in brackish water farming with a cumulative score of 226. The second rank was accorded to the constraint lack of insurance facilities. The third problem in brackish water farming was poor market value of the product followed by lack of credit supply, high labour charge, high cost of fertilizer, poaching, lack of money for construction work, erratic local demand for fish, exploitation of farmers by commission agents, perishable commodity results in losses and lack of transportation facilities.

Infrastructure/administrative constraints

An examination of the table 58 further indicates that the respondents identified lack of frequent technical supervision and guidance as the most important infrastructure/ administrative constraint. The second infrastructure constraint in brackish water farming is ' lack of practical oriented training'. The other constraints were in the following order, lack of trained officials, lack of demonstration and training on recommended practice, poor transfer of technologies, lack of literature in simple language, lack of communication regarding the services and other facilities available for fish farming, lack of facilities for testing soil and water quality, lack of timely and adequate supply

f seeds, untimely supply of inputs and other materials, location of sh collection centers at distant places and lack of storage facilities.

C. Perception of the fisheries extension officers about 'Janakeeya Matsya Krishi programme'. (JMK)

Table 59 : Evaluative perception of extension officers on the impact of JMK

S.No.	Statements		SA	A	UD	D	SD
1	JMK has helped to improve the production.	F	43	17	-	-	-
		P	71.7	28.3			
2	After the implementation of JMK, the	F	35	22	3	-	-
	farmers participation has increased.	P	58.3	36.7	5	-	-
3	Location specific problem is given	F	-	-	8	25	27
	sufficient significance in JMK	P	-	-	13.3	41.7	45
4	As a consequence the farmers are	F		9	9	20	22
	adopting advanced technique.	P		15	15	33.3	36.7
5	JMK helped to strengthen the linkage	F	-	10	18	18	14
	between farmers and researchers.	P		16.7	30	30	23.4
6	JMK has not helped to increase the	F	-	7	13	18	22
	income of farmers	P	-	11.7	21.7	30	36.7
7	The ultimate use of the programme	F	-	-	7	21	32
	for the researchers, not for farmers.	P	-	-	11.7	35	53.3
8	The technology transferred through	F	13	9	9	20	9
	JMK is not successful at farmers	P	21.7	15	15	33.3	15
	Field situation.						
9	JMK helped to strengthen the linkage	F	23	23	9	5	-
	between farmers and extension workers	P	38.3	38.3	15	8.3	-
10	JMK was successful in creating mass	F	30	24	3	3	-
	awareness about improved technology	P	50	40	5	5	-
	in aquaculture.						

Majority of the extension officers agreed that the Janakeeya Matsya Krishi programme has helped to improve the production. In their opinion the farmers participation have been increased after the implementation of the programmme. They perceived that it was also successful in creating mass awareness about improved technology in aquaculture. Majority of them agreed that it helped to strengthen the

linkage between farmers and extension officers but failed to strengthen the linkage between farmers and researchers. The extension personnel disagrees that location specific problem is given sufficient significance in JMK and agreed that the ultimate use of the programme is for farmers and not for researchers.

D. Constraints perceived by fisheries extension officers.

Constraints faced by the extension officers in the effective performance of their duties are given in table 62

An analysis of the constraints faced by extension officers in their effective performance of the duties revealed that lack of need based research was the most important constraint.

Table 62 : Constraints of extension officers in the effective performance of duties.

Sl. No.	Constraints	category/ score	frequency	weighed frequency	cumulative frequency	rank order
1.	Extensive work area which is difficult to manage	ms(3)	2	6	6	
		ss(2)	33	66	72	
		ns(1)	25	25	97	XX
2.	No provision of fish collection centers at the convenient point of farmers	ms(3)	8	18	18	
		ss(2)	14	28	46	
		ns(1)	40	40	86	XXIII
3.	Excessive load of work due to multifarious duties	ms(3)	11	33	33	
		ss(2)	25	50	83	
		ns(1)	24	24	107	XV
4.	Lack of suitable Audio-visual aids for education of farmers in improved practices	ms(3)	15	45	45	
		ss(2)	15	30	75	
		ns(1)	30	30	105	XII
5.	Limited touring of the area for want of sufficient fund	ms(3)	12	36	36	
		ss(2)	18	36	72	
		ns(1)	30	30	102	XVIII
6.	Inadequate transportation facilities to go to field	ms(3)	20	60	60	
		ss(2)	25	50	110	
		ns(1)	15	15	125	III
7.	Lack incentives for good and	ms(3)	16	48	48	

effective field work.	ss(2)	26	52	100	
	ns(1)	18	18	118	V
8.Lack of facilities for skill	ms(3)	12	36	36	
teaching	ss(2)	28	56	92	
	ns(1)	20	20	112	XI
9.Lack of feed back from	ms(3)	10	30	30	
farmers.	ss(2)	28	56	86	
	ns(1)	22	22	108	XIII
10.Interference by village	ms(3)	6	18	18	
organizations	ss(2)	29	58	76	
	ns(1)	25	25	101	XIX
11.Lack of need based research	ms(3)	22	66	66	
	ss(2)	30	60	126	
	ns(1)	8	18	144	I
12.Subject matter specialists are	ms(3)	10	30	30	
failure to effectively diagnose	ss(2)	28	56	86	
the farmers problems.	ns(1)	22	22	108	XIV
13.Lack of co-operation from	ms(3)	13	39	39	
local leaders in promoting	ss(2)	29	58	97	
the programme.	ns(1)	18	18	115	VIII
14. Lack of transport facilities	ms(3)	4	12	12	
for fish.	ss(2)	28	56	68	
	ns(1)	28	28	96	XXI
15.Lack of funds for preparation	ms(3)	10	30	30	
of teaching aids.	ss(2)	25	50	80	
	ns(1)	25	25	105	XVII
16.Inadequate facilities for	ms(3)	14	42	42	
keeping seeds in hatcheries.	ss(2)	25	50	92	
	ns(1)	21	21	113	X
17.Inadequate follow up by	ms(3)	12	36	36	
superior officers.	ss(2)	30	60	96	
	ns(1)	18	18	114	IX
18.Lack of contact with research	ms(3)	11	33	33	
scientists	ss(2)	24	48	81	
	ns(1)	25	25	106	XVI
19.Lack of promptness in filling	ms(3)	18	54	54	
up posts which fall due	ss(2)	30	60	114	
to transfer or promotion.	ns(1)	12	12	126	II
20.Supply of poor quality seeds	ms(3)	19	57	57	
for use in the field.	ss(2)	23	46	103	
	ns(1)	18	18	121	IV
21.Inadequate supply of feed,	ms(3)	14	42	42	
fertilizer etc.	ss(2)	29	58	100	
	ns(1)	17	17	117	VI
22.Lack of credit facilities for	ms(3)	8	24	24	

the farmers.	ss(2)	40	80	104	
	ns(1)	12	12	116	VII
3.Inadequate education for the	ms(3)	3	9	9	
farmers on the utility of fish	ss(2)	22	44	53	
farming.	ns(1)	35	35	88	XXII

ms most serious
ss somewhat serious
ns not serious

Lack of promptness in filling up posts which fall due to transfer r promotion was the next important constraint. Supply of poor quality f seeds for use in the field was the fourth problem faced by the xtension officers. Fifth problem was lack of incentives for good and ffective field work followed by inadequate supply of feed , fertilizer tc., lack of credit facilities for the farmers, lack of cooperation from he local leaders in promoting the programme, inadequate follow up by he superior officers, inadequate facilities for keeping seeds in the atcheries, lack of facilities for skill teaching, lack of suitable audio isual aids for education of farmers in improved practices, lack of feed ack from farmers, Subject Matter Specialists are failure to effectively iagnose the farmers problems, excessive load of work due to ultifarious duties, lack of contact with research scientists, lack of und for preparation of teaching aids, limited touring of the area for ant of sufficient fund, interference by village organizations, extensive ork area which is difficult to manage, lack of transport facilities for sh, inadequate education for the farmers on the utility of fish farming nd no provision for fish collection centers at the convenient point of armers.

CHAPTER V

DISCUSSION

The study was mainly concentrated in finding out the extent of adoption, level of knowledge, satisfaction with extension services and the constraints faced by the fresh water and brackish water beneficiaries. The perception of the fisheries extension officers about "Janakeeya Matsya Krishi" programme and the constraints faced by them in effectively discharging their duties were also probed into. Besides this, the relationship between socio-psychological and economic characteristics of the respondents with extent of adoption, level of knowledge and satisfaction with extension services were also analysed.

The study revealed that majority of the respondents both in fresh water farming and brackish water farming had medium level of adoption of improved practices in aquaculture. This is in conformity with findings of Ashaletha (2000), Kumaran (2000) and Basawarajaiah et al. (2002). Therefore the hypotheses that the extent of adoption of the respondents would be poor is rejected. The mean adoption score of the fresh water farmers was only 55.16 whereas in the brackish water sector it was 79.65. This is not a healthy sign as far as the activities of the Department of Fisheries are concerned in fresh water sector. The intensification of extension activities in the field of fresh water farming has started recently compared to brackish water sector. This might be the reason for the low adoption score in this field. The

results suggest a need for greater extension effort to provide knowledge on the importance of fresh water farming to respondents so that their adoption level is enhanced. The higher extension participation and more information source utilization of the beneficiary farmers in brackish water farming might be attributed to the better level of adoption. Brackish water prawn farming which plays a major role in country's total export, though risky is highly profitable compared to fresh water farming. It is the main item of seafood export, continuous decline in shrimp production may threaten the sustainability of Indias' seafood export. Because of this export potential, the Government and other state and central institutions are providing subsidies in kind or cash and other inputs and extending technical guidance more compared to fresh water sector which might have motivated the shrimp farmers for more adoption of different practices.

More than 80% of the farmers in brackish water farming were full adopters of the practice " strengthening of dykes" whereas only half of the respondents in fresh water farming adopted it to the full extent. This calls for a concerted effort by the extension agency in fresh water farming than the brackish water farming.

Majority of the farmers were full adopters of the practice fixing and repairing of the sluice gate in brackish water farming. Nearly one - fifth of them were partial adopters. High cost involved in fixing and repairing sluice gate acts as a limiting factor in adopting the technology to full extent. Efforts must be made for designing cheap and durable sluice gate.

A low rate of adoption of the practice "draining, raking and drying the pond" could be observed by the respondents in aquaculture. Perennial nature of the fresh water pond together with the use of water in the pond for agriculture and allied activities other than aquaculture alone might be the reason for low adoption of this practice. Moreover the severe droughts in Kerala during the recent years calling for the need for conservation of water resources, may also be a reason. Lack of drainability of the field in brackish water farming acts as a constraint in adoption. The fields which are low lying and perennial in nature could not be drained and dried to the desired extent as recommended by the research station. Moreover, draining the pond using pumps adds to the input cost.

The practice "removal of the aquatic weeds" was found fully adopted by nearly half of the respondents in fresh water farming. The perennial nature of the pond together with higher depth as in quarry ponds in fresh water area acts as a major constraint in adoption of this particular practice. Partial removal of the aquatic weeds, mainly floating weeds could be possible in such areas. 'Lack of knowledge about improved practices' indicated by the fresh water farmers as the most important technical constraint also substantiates the above finding. Extension agency should concentrate their efforts in promoting culture of grass carp in such ponds. It acts as a biological control of submerged aquatic weeds. In brackish water farming a full adoption rate of 62 per cent could be observed. Following the manual and mechanical methods as recommended by the research system is ineffective for the complete removal of aquatic weeds especially the submerged weeds. This is a severe problem in brackish water farming

since it causes sudden changes in dissolved oxygen level, PH etc. effecting the cultured shrimp which are more sensitive to changes in ecological parameters than fresh water fishes. This indicates the failure of the research system in realizing the field problems of the farmers and the need for giving priority to the "need based research". Suitable method has yet to be developed.

Full adoption of the practice "Eradication of the predatory and weed fishes of the pond" could not be observed in both sectors. Drying the field, use of organic poisons like mahua oil cake, tea seed cake etc. are some of the methods for complete removal of predatory and weed fishes. Here also the perennial nature of the pond, use of water for other purposes other than aquaculture might be the reason for the low rate of adoption in fresh water farming. Unwanted organisms, if not completely eradicated from fish ponds, will cause destruction of the stock by preying on or by competing with stocked fish or shrimp. The farmers could not realize the importance of this practice. Extension agency should take more effort in this direction to increase the level of knowledge of the farmers.

Regarding "liming the pond" half of the respondents in fresh water farming and nearly three – fourth of the respondents in brackish water farming were full adopters. This is an important practice in aquaculture since it causes sudden drop in PH which may lead to mass mortality of cultured species. It plays an important role in neutralizing the acidity of the soil and water. Extension agency should focus their attention to this matter and necessary steps may be taken to popularize this practice. More over it does not cause any financial burden to the farmers.

The practice "application of organic fertilizer in the pond" was adopted fully by 42 per cent of farmers in fresh water farming where as in brackish water farming it was 60 per cent. This practice is recommended for improving the nutritional status of the pond. Lack of awareness together with use of water for human needs acts as a constraint in fresh water farming.

None of the fresh water beneficiary farmers studied were found adopting the practice "application of inorganic fertilizer" in the pond to its full extent. In most of the areas studied the application of the organic fertilizer in the pond will be sufficient to enhance the productivity of pond. This might be the reason for the low rate of adoption of the practice.

Eighty four per cent of the respondents in fresh water farming were full adopters of the practice "stocking the pond with selected species". In brackish water farming all the respondents were full adopters. The adoption of this particular practice as recommended by the research station depends upon the productivity at various levels and subsequent availability of natural food. The nature of the soil and water plays a major role in productivity of the pond. Here, a wide variation in the above factors could be observed in fresh water sector from place to place which might be the reason for low rate of adoption. Lack of knowledge as a technical constraint as reported by the farmers in fresh water sector may also be a reason.

The full adopters of the practice "acclimatization of the seeds" in fresh water farming was 82 per cent. In brackish water farming it was 100 per cent. Here also, lack of knowledge about the importance of acclimatization may be the reason for the above situation in fresh

ater farming. But in brackish water farming the adoption of this ractice was dependent on the adoption of the practice "stocking the ond with selected seeds". Hence, this practice was applicable to all rmers who have adopted selective stocking. Thus, non adoption of is practice may result in heavy mortalities to the stocked prawn eds. This practice being complimentary to the previous practice, ose who adopt the former practice must adopt this practice too, for tting full advantage. So full adoption could be observed in both the ractices.

Majority of the brackish water farmers were full adopters of the ractice "nursery rearing of seeds". Full adopters of the practice upplementary feeding based on biomass" was only 54 per cent in esh water farming. But in brackish water farming an adoption rate 86 per cent was observed. Good production can be ensured if fficient feed is given to supplement the natural food available in e pond. The feed and fertilizer agents of various companies play a ajor role in influencing the farmers to adopt this practice, which ght be attributed to better rate of adoption in brackish water rming. Here, the net returns is also high compared to the fresh water rming. That is, those practices which yield the greatest marginal turns per rupee invested and in the shortest time seem to be adopted ost readily by the farmers.

The Practice "maintenance of dissolved oxygen level" was less pular among the fish farmers. Majority of the respondents were non opters. None of the fresh water farmers studied were found fully opting the practice whereas in brackish water farming 78 per cent opted it fully. Depletion of oxygen content in fresh water pond is

not a severe problem. Usually the oxygen content does not fall below the recommended level of 4ppm and if so, the fishes cultured are more hardy in nature and are able to survive slight variations from this level. But cultured shrimp is more sensitive to the physical and chemical parameters of the environment, hence more care is needed, resulting higher rate of adoption.

Adoption of the practice "monitoring and control of PH" in fresh water farming is low as compared to brackish water farming as evident from table 27. Future programme should concentrate in educating the farmers about the importance of this practice. In brackish water farming majority of them (93%) were full adopters. It is very important as there is sudden changes in PH which can lead to heavy mortalities. Erratic monsoon in summer season during the month of November-April causes sudden fall in PH, thereby adversely effect the cultured shrimp. This is more severe in brackish water farms where the depth and volume of water is less compared to fresh water sector. That more care is required to the sensitive species attributed higher rate of adoption of this practice in this sector.

Only 12 per cent of the respondents in fresh water farming were full adopters of the practice "control of algal blooms", whereas it was 62 per cent in brackish water farming. The algal blooms which may develop in ponds cause oxygen depletion and become a threat to the fauna. Hence, it is important to prevent the outbreak of blooms in the ponds. More attention is required in this sector and the extension agency can take necessary steps to increase the level of knowledge of the farmers, and there by leading to more adoption.

In brackish water farming, the practice need - based water exchange was done to the full extent by 76 per cent of the respondents. The fear of spread of disease from nearby water bodies and canals is the reason for the low level of adoption of this practice.

Percentage of full adopters of the practice "control of disease and parasites" was 44 and 62 in fresh water farming and brackish water farming respectively. The incidence of white spot disease has been a major set back for the shrimp industry, causing mass mortalities and washing out whole crop at a time. With present level of technology, treatment of disease is hardly possible, yet precautionary methods can be taken to prevent the onset of diseases and attack of parasites. In fresh water farming it is not so serious as compared to brackish water farming though there are outbreaks of the disease "Epizootic ulcerative disease syndrome" occasionally. No field level treatment for various fish/shrimp diseases is available at present. Farmers were unable to diagnose and treat the diseased fish. What is required is a package of practices for effective disease diagnosis and treatment at the field level.

The practice periodic assessment of growth and biomass is adopted fully by 30 per cent of fresh water beneficiary farmers. In brackish water farming all the farmers studied were full adopters of the practice.

Majority of the respondents in fresh water farming were full adopters of the practice " harvesting crop at most economic size". Most of the brackish water farmers were also full adopters of this practice. Perennial nature together with the higher depth of the fresh

water pond, some times to the extent of 6-7 meters as in quarry field, acts as a barrier in adopting this practice to full extent by the fresh water beneficiary farmers while the fear of out break of disease forces the shrimp farmers to harvest the crop earlier than reaching it at the most economic size.

Regarding the level of knowledge, the results of the study indicated that majority of the respondents in aquaculture possessed medium level of knowledge. This finding is supported by the findings of Baswarajaiah et al. (2002) and Kalla (2002). Hence the hypotheses that the knowledge of the respondents about improved practices would be poor is rejected.

The results further indicated that mean knowledge score of the brackish water beneficiary farmers was 85.31 and that of fresh water beneficiary farmers was 76.71. The increased mean knowledge score of brackish water beneficiary farmers compared to fresh water beneficiary farmers might be due to the increased extension participation in brackish water sector as indicated by the mean extension participation score of 8.69 and 5.22 respectively for the brackish water and fresh water beneficiary farmers.

Regarding the level of satisfaction majority of the respondents in both sectors belonged to medium level category. Only 17 per cent of the beneficiaries possessed high level of satisfaction. Hence the hypotheses that there would be no satisfaction with extension services among the respondents was rejected. The mean satisfaction score of both categories of respondents were more or less same which shows they derive same level of satisfaction with extension services. The results suggests the need to strengthen the extension activities and

providing services and other inputs at the right time to the farmers in order to satisfy them. The end product of the extension activities is the satisfaction that comes from the farmer and it acts as a strong motivating force for further activities.

An overall analysis of the extension effectiveness in fresh water farming showed mean score of 63.17 only which indicates the poor performance of extension agency in this area. However it showed a better score of 75.34 in brackish water farming which reveals a fair performance of the agency.

The variables age, education, occupation, experience, annual income, farm size and indebtedness of both fresh water and brackish water beneficiary farmers indicated non significant association with level of adoption of improved practices. Therefore the hypothesis that there would be no significant association between these variables and level of adoption of improved practices is accepted.

The variable 'information source utilization' showed positive and significant association with level of adoption of both categories of respondents. This is due to the fact that increased use of different types of information sources like personal, impersonal etc. enhances the aquaculture information input. Greater use of various sources helped the respondents to gather more information on the subject and to understand and analyze the benefits of the technology, leading to higher adoption. Hence, the positive relation between information source utilization and level of adoption is self explanatory. This is in conformity with the findings of Athimithu (1990), Ashaletha (2000) and Naruka and Bangarva (2004).

Social participation was found to have positive and significant association with level of adoption of both fresh water and brackish water beneficiary farmers. Better social participation of the respondents enable them to contact various sources of information for adoption and culminating in accumulation of relevant details about practices resulting in more adoption. This finding is in consonance with the findings of Sharma et al. (1987) Singh and Rajendra (1990) Jnanadevan (1993) Dutt and Mishra (2002) Jha and Jha (2003) and Naruka and Bangarva (2004).

Risk orientation indicated non significant relationship with level of adoption of brackish water beneficiary farmers. But in the case of fresh water beneficiary farmers it showed a negative and significant association. This is not in conformity with the findings of Rajendran (1978), Kamarudeen (1981),Mangle (1983), Jayakrishnan (1984), Krishnamoorthy (1984), Rao and Mathur (2002) and Jha and Jha (2003).

Marketing orientation of both categories of respondents showed positive and significant relationship with level of adoption of improved practices. It is quiet natural that people having more marketing orientation will show more interest in the technology generated and is motivated to adopt more number of practices with the aim of deriving maximum monetory returns. Hence a positive and significant relation between marketing orientation and level of adoption could be observed. This finding is supported by Singh and Singh (1970).

The positive and significant association of the extension participation with level of adoption of improved practices of both fresh water and brackish water beneficiary farmers was supported by

the findings of Singh and Rajendra (1990) and Rao and Mathur (2002). Extension participation acts as a powerful tool, instrumental in making the farmers to adopt the technology. Usually a decision to adopt a technology is influenced by the extent to which the individual participates in extension activities like meetings, seminars etc. which are effective means of transfer of technology. This will provide necessary information to a farmer which in turn leads to adoption. Hence, the positive and significant relation between extension participation and level of adoption is justified.

The independent variables together showed significant contribution in the variation of the extent of adoption of both the categories of respondents. So the hypotheses that there would be no significant contribution of the selected socio-psychological and economic characteristics in the variation in the extent of adoption of the respondents is rejected.

Age, occupation, experience, annual income, farm size, and indebtedness showed non significant association with level of knowledge of both fresh water and brackish water beneficiary farmers. Hence in the case of these variables, the hypothesis that there would be no significant association between the selected socio-psychological and economic characteristics and level of knowledge of farmers was accepted.

Education was found to have positive and significant association with level of knowledge of brackish water beneficiary farmers, while it did not show any significant association with level of knowledge in the case of fresh water beneficiary farmers. Education is the process of acquiring knowledge and habits through instruction or study and it

widens the vision of the people, helping them to orient towards new experiences. It also enables the respondents to have an effective interaction with other information sources helping to acquire more information about improved practices. More knowledge can be gained through print media and he/she can go through literature which will help to clarify doubts. The positive and significant relationship between the variable education and level of knowledge above agrees with the findings of Kaleel (1978), Kamarudeen (1981), Krishnamoorthy (1984), Babu (1995), Mercikutty (1997), Ashaletha (2000), Singh et al. (2002) and Gakkar et al. (2003).

Information source utilization showed non significant association with level of knowledge of the fresh water beneficiary farmers, whereas it showed positive and significant association in the case of brackish water beneficiary farmers. An individual tends to acquire more information when he is exposed to different sources. This is supported by the findings of Mercykutty (1997) and Ashaletha (2000).

Social participation of both categories of respondents showed positive and significant relationship with level of knowledge. Social participation provides an opportunity for farmers to interact with one other, thereby sharing the knowledge and experiences, which in turn increases the level of knowledge. This relationship is indicated through the positive and significant association observed between social participation and level of knowledge. The above result is supported by the findings of Sinha et al. (1983), Sharma and Sharma (1988) Chandevan (1993) Mercikutty (1997) and Singh et al. (2002).

Risk orientation indicated non-significant relationship with level of knowledge of fresh water beneficiary farmers whereas it showed a

positive and significant relation in the case of brackish water farmers. Persons with high risk orientation quality are of the opinion that one should cultivate different crops, shall be ready to take risk, should face challenges etc. Such individuals usually possess high awareness about advances in technology. Hence, a farmer with high risk orientation will be having good knowledge about technology, which other farmers may not necessarily possess. This fact substantiates the positive and significant relation between risk orientation and level of knowledge. The above ersult is supported by the findings of Kamarudeen (1981), Jayakrishnan (1984), Krishnamoorthy (1984), Mercykutty (1997) and Ashaletha (2000).

Marketing orientation of both categories of respondents showed positive and significant relationship with level of knowledge. Farmers with high marketing orientation would place a high value on economic ends. He would be enthusiastic in getting some means to increase his production and thereby income level. Naturally they are eager to know the new recommendations and improvements made by research workers with the intention of increasing income. So the level of knowledge will high and this fact substantiate the positive and significant relationship between marketing orientation and level of knowledge.

Extension participation showed positive and significant relationship with level of knowledge of fresh water and brackish water beneficiary farmers. A farmer who attended the programmes like meetings, seminars etc. would get a chance to know about the research activities and developments for increasing his level of knowledge in the field of aquaculture. This in turn increases his level of knowledge. Observations of Kaleel (1978), Kamarudeen (1981), Krishnsmoorthy

(1984), Sankaran (1987), Syamala (1988), Mercikutty (1997) and Singh et al. (2002) also conform the above findings.

The twelve independent variables together indicated significant contribution in the variation of the level of knowledge of both the categories of respondents. So, the hypotheses that there would be no significant contribution of the selected socio-psychological an economic characteristics of the respondents is rejected.

The variables age, occupation, indebtedness, risk orientation and extension participation showed non significant association with level of satisfaction with extension services. Hence in the case of these variables, the hypothesis that there would be no significant association between these socio psychological and economic characteristics and level of satisfaction with extension services is accepted.

Education showed non significant relationship with level of satisfaction of fresh water farmers while in the case of brackish water beneficiary farmers it was found to have positive and significant association.

Experience indicated negative and significant relationship with level of satisfaction for fresh water beneficiary farmers whereas in the case of brackish water beneficiary farmers it was non significant.

Farm size had negative and significant association with level of satisfaction of fresh water beneficiary farmers; but it indicated a non significant association for brackish water beneficiary farmers.

The variable 'information source utilization' and 'social participation' showed positive and significant relationship with level of satisfaction of fresh water beneficiary farmers. But, in the case of

brackish water beneficiary farmers these variables showed significant negative relationship. Both these variables provides an opportunity for respondents to get more/additional information in a particular field of his own interest. In fresh water sector a very small per cent of farmers is doing fish farming as a major occupation as evidenced from table 25. They were satisfied with whatever they had. But in brackish water farming majority of farmers were doing 'farming alone' as their major occupation and livelihood. Hence they try to maximize profits by increasing production and income, although such type of achievement motivation puts them in a state of frustration and dissatisfaction. So, a negative relationship is observed between these variables and satisfaction. The above point also substantiates the negative and significant relationship of the variable annual income with level of satisfaction of the brackish water beneficiary farmers.

In fresh water farming, marketing orientation showed a negative and significant relationship with level of satisfaction. In the case of brackish water sector, however, it was non significant. This implies that as farmers are exposed more to market fluctuations in an effort to gets maximum profits, they are trapped in a state of dissonance, leading to dissatisfaction.

The independent variables together indicated significant contribution to the variation in the level of satisfaction of both the categories of respondents. So, the hypotheses that there would be no significant contribution of selected socio-psychological and economic characteristics of respondents in the variation of level of satisfaction is rejected.

The constraint analysis indicated that lack of knowledge was the most important technical constraint of fresh water beneficiary farmers. similar results were also reported by Patil and Jadhav (1987) and Singh et al.(1987). The result suggests the need for greater extension efforts to provide technical - know how of improved practices to fresh water farmers so that their adoption level is increased. Non availability of quality seeds at required time was considered as the next common constraint and this findings is supported by Singh et al. (2002), Haque and Ray (1983), Ajore (1986), Bhoite and Thorat (1985). The Department of Fisheries could therefore take some favorable decisions to supply good quality inputs at correct time.

The results further shows that among the technical constraints in brackish water farming " infection of disease" ranked at the top with maximum cumulative score of 300 which indicates the seriousness of the particular constraint in shrimp farming. Similar results were reported from other sector also. For instance, Mathur (1984) reported that major bottleneck in adoption of hybrid bajra was high incidence of diseases. Anithakumari (1989) Susamma (1994) Arunachalam (2000) Wasnik (2003) also reported similar constraints. Farmers are unable to diagnose and treat diseased fish/shrimp since no field level treatment for various diseases are developed by research institutes. A package of practices for effective diagnosis and treatment at field level is yet to be developed and this will act as a solution to the above most serious problem faced by shrimp farmers. Better management practices (BMP) developed by MPEDA/NACA, though effective to control disease out break to some extent, do not promise complete prevention. Future research works can be more oriented towards this

end. The table further shows that constraints, lack of knowledge, lack of skill, labour scarcity, non availability of quality seeds, lack of availability of water for entire culture period and non availability of feed, fertilizer etc. were ranked 2^{nd}, 3^{rd}, 4^{th}, 5^{th}, 6^{th} and 7^{th} respectively by respondents with cumulative frequency score of 144, 141, 126, 106, 105 and 102.

High cost of feed was the major economic constraint both in fresh water and brackish water farming. About 60 per cent of the total working capital expenditure of the farmer accounts for the cost of feed, which is a major constraint in aquaculture. This finding is in accordance with the finding of Patel and Trivedi (1985) who reported that high price of feed is a major constraint in poultry farming. Sudha (1987) also identified high cost of feed as one of the constraint in Lab to Land programme . Generation of low cost technologies and preparation of the feed using locally available ingredients together with suitable Government policies will help to remedy this. The second important constraint in fresh water farming is lack of credit supply. This is supported by the findings of Singh and Singh (1986), Sudha 1987), Pathak (1979), Patel and Trivedi (1984). Linkage with credit organization should be strengthened, so that unnecessary delay in giving credit could be reduced. In brackish water farming the second rank was accorded to the constraint 'lack of insurance facilities' which was supported by the finding of Selvaraj (1990) who observed that lack of insurance cover was one of the major bottlenecks for aquaculture development in Kerala. Ghosh and Chand (2001) also realized ignorance of cattle insurance facilities as well as lack of money for insurance as an important economic constraint. Shrimp

farming, a capital intensive industry though profitable, is highly risky in nature due to the sudden outbreak of disease especially in recent years. It causes total loss to the farmers. Lack of insurance cover in this field is a major problem which should be seriously looked into.

The third problem viz. poaching in fresh water farming is supported by the finding of Singh and Sharma (1998) who reported that poaching is one of the constraints of small farmers in carp culture. Unlike agricultural commodities fish is viewed as a public property by the society. Creating awareness to the public and organizing farmers on a cooperative basis which can monitor the entire activities will act as a remedy to the above mentioned problem. The third problem in brackish water farming was poor market value of the product whereas it had been viewed as the 4^{th} problem in fresh water farming. Fifth, 6^{th}, 7^{th}, 8^{th},9^{th},10^{th},11^{th} and 12^{th} problems were lack of insurance facilities, erratic local demand of fish, lack of transportation facilities, high labour charge, lack of money for construction work, high cost of fertilizer, perishable commodity results in losses and exploitation by commission agent. In brackish water farming these were in the order of lack of credit supply, high labour charge, high cost of fertilizer, poaching, lack of money for construction work, erratic local demand for fish, exploitation of farmers by commission agents, perishable commodity results in losses and lack of transportation facilities.

An examination of results further indicated that both categories of respondents identified lack of frequent technical supervision and guidance as the most important infrastructure/ administrative constraint. This can be well correlated with another findings in this study ie. The

realization of the constraint by the extension workers as ' promptness in filling up posts which fall due to transfer or promotion and inadequate transportation facilities to go to field as the second and third problem respectively by them in carrying out their duties. Perhaps this might be the reason for the identification of the above constraint by fresh water and brackish water beneficiary farmers. This is supported by the findings of Pathak (1979), Patil and Jadav (1987), Ramachandran (1992) and Kadam et al.(2001). Lack of trained officials is the second constraint in fresh water farming where as in brackish water farming it was realized as the 3rd problem. This is supported by Rao (2000) who reported that lack of trained manpower is one of the contributing factors for the recent setback in aquaculture. This could be due to the fact that unlike other fields, professionalization in fisheries field started very late. The second infrastructure constraint in brackish water farming is ' lack of practical oriented training' but it was perceived as 3rd constraint in fresh water farming. The other constraints in fresh water farming were poor transfer of technology, lack of facilities for testing water and soil quality, lack of demonstration and training in recommended practice, lack of communication regarding the services and other facilities, lack of timely and adequate supply of seeds, lack of storage facilities, untimely supply of inputs and other services, lack of literature in simple language, and location of fish collection centers at distant places. In brackish water farming it was in the following order, lack of demonstration and training on recommended practice, poor transfer of technologies, lack of literature in simple language, lack of communication regarding the services and other facilities available for

ish farming, lack of facilities for testing soil and water quality, lack f timely and adequate supply of seeds, untimely supply of inputs nd other materials, location of fish collection centers at distant places nd lack of storage facilities.

Majority of the Extension Officers agreed that the Janakeeya Matsya Krishi programme has helped to improve the production. In their opinion the farmers' participation have been increased after the implementation of the programmme. This result is in conformity with the finding of (Ashaletha 2000). They perceived that it was also successful in creating mass awareness about improved technology in aquaculture. Majority of them agreed that it helped to strengthen the linkage between farmers and extension workers but failed to strengthen the linkage between farmers and researchers. An analysis of the constraints faced by Extension Officers in their effective performance of duties revealed that 'lack of need based research' was the most important constraint. This finding is in conformity with the finding of Sharma and Singh (2001) who reported that lack of need based research as one of the constraints of the extension personnel in discharge of their duties There is need to strengthen research-extension-farmer linkage. Conveying field problems act as a path finder for need based research. Extension Officers faces difficulties since they are unable to provide solutions, information and guidance to farmers in a right manner at the right time. Lack of promptness in filling up posts which fall due to transfer or promotion was the next important comstraint. This is supported by the finding of Madukwe (1993) who revealed that understaffing and assignment to jobs other than those in the job description was a major problem of agricultural extension

officers. The third problem was inadequate facilities to go to field. Sing (1990), Anilkumar et al.(2003) also reported similar findings. Supply of poor quality of seeds for use in the field was the fourth problem faced by the Extension Officers. This is supported by the findings of Devania (1992), Jnanadevan (1993) and Ramachandran (1992). Establishing more hatcheries and improving the facilities of the existing hatcheries is the need of the hour.