



Economics and Resource use Efficiency of small scale Fish Production in Manipur

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Abstract

The present study was taken up in Manipur state of north east hill region to examine the economics and resource use efficiency in fish production. Three districts viz., Bishempur, Imphal West and Thoubal were selected for the study and two villages were selected from each district. From each villages 25 fish farmers were randomly selected, altogether there were 150 respondents. The farmers were classified into marginal, small and semi-medium category based on pond size. Cobb-Douglas production function and marginal value productivity were employed to examine the resource use efficiency. Per hectare cost of fish rearing were the highest for the marginal category and decrease with increase in pond size category. The overall average yield of fish was 1078 kg ha⁻¹. Farmers in the marginal category obtained the highest yield with a production of 1611 kg ha⁻¹. The yield decrease with the increase in pond size. Net return obtained from fish production were Rs.125311 ha⁻¹ for marginal, Rs. 87010 ha⁻¹ for small and Rs. 29471 ha⁻¹ for semi medium category respectively. Fish production is profitable with a BC ratio of 1.60 but the productivity is very low and needs to be increased. It was found that fish seedling was underutilized for semi-medium category, feed was underutilized for marginal category and labour was underutilized for both small and semi-medium category farms. Floods, poor quality of pond water, incidence of pest and disease, high cost of feed and lack of skilled workers are five major problems faced by the fish farmers.

Keywords: Cost, return, Marginal Value Productivity, constraints, Manipur

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Introduction

India is the second largest inland water capture fish producing country in the world next to China with a production of 1.70 million tonnes (FAO, 2020). The fisheries sector is a major foreign exchange earner of the Indian economy with exports accounting to Rs 47,620 crore in 2018-19. Fisheries sector also provides livelihoods to about 16 million fishers and fish farmers at the primary level and almost twice the number along the value chain (Economic Survey, 2020). Due to its unique characteristics of generating employment, income and providing nutrition, this sector has the potential for transformation by addressing no poverty, zero hunger, good health and wellbeing and gender equality of the United Nations Global Sustainable Development Goals.

Fish production in the country has increased from 0.75 MMT in 1950-51 to 14.16 MMT in 2019-20. Fishery sector contributes 7.28% to Gross Value Added (GVA) to the agriculture sector and 1.24% to the total GVA of the country (Economic Survey, 2021). As compared to general crop cultivation, fish farming generates more profit and return from the same piece of land and has a huge potential for doubling farmer's income.

North Eastern states account for 4.96% of the total fish production of the country. Among the North Eastern states, Manipur is the third largest producer of fish after Assam and Tripura. Fish is the most widely consumed food item for the people of the state, particularly in the valley areas. Manipur is also the third highest fish consuming state in the country after Tripura and Kerala with an average consumption of 14.1 kg per capita per annum. The number of households reporting fish consumption in the state were 66 and 81% for rural and urban area respectively (Handbook of Fisheries Statistics, 2020). The state is having 56.461 thousand ha water resources comprising of ponds, tanks, natural lakes,

marshy areas, swampy areas, rivers, reservoirs, submerged cropped land and low-lying paddy fields. The total fish production of the state during the year 2018-19 was 32.57 thousand tonnes while the estimated requirement was 53.09 thousand tonnes (Economic Survey Manipur, 2020). There is a shortage of 20.53 thousand tonnes which accounts for 38.65% of the production which is met by importing fish from other states.

Fish farming in ponds and low-lying areas is an age-old tradition of the people of the state. It is a source of livelihood for a number of resource poor, small and marginal farmers practicing traditional methods with low investment and poor productivity. Increasing cost of inputs and constraints like flood and water shortage during carp rearing season pose a big challenge for the farmers involved in this enterprise. Both over and under utilization of scarce resources results in inefficiency and lowering of productivity (Das et al., 2016). Weak management coupled with obsolete techniques of production have resulted in low efficiency with respect to usage of inputs like feed, fertilizers and lime (Singh et al. 2015). There is a need to examine the production, productivity, cost, returns and resource use efficiency of fish farmers in the state. In this backdrop, the present study was undertaken to analyse the economics and resource use efficiency in fish production. The information generated will provide an insight to suggest policy measures for increasing the production and ways for utilization of scarce farm resources for increasing the profitability of carp farming in Manipur.

Materials and Methods

The study is based on primary data collected from three districts of Manipur *viz.*, Bishempur, Imphal West and Thoubal district. These three districts are the largest fish producing districts in the state, and account for more than 50% of the total fish production. Two fish producing villages were randomly selected from each district, altogether there were 6 villages *viz.*, Keinou and Oinam from Bishempur district, Khabi Bamdiar and Khaidem from Imphal West district and Thetha and Techan from Thoubal district. The detailed list of fish farmers of each village were obtained from KVKs and village representatives. From each village 25 fish farmers were randomly selected, and in total there were 150 sample fish farmers. Primary data were collected from the respondents during the year

2016-17 through personnel interviews using well-structured interview schedule. Data collected from respondents included age, educational level, number of ponds, pond size, type and species of fish reared, farm resources, etc. Details of various inputs used in fish rearing including feed, labour, their quantities and prices were collected. Based on the size of fish pond, the fish farmers were categorized into three categories *viz.*, marginal (< 1 ha), small (1 < 2 ha) and semi-medium (2 < 4 ha). In all there were 64 farmers in marginal category, 58 farmers in small category and 28 farmers in semi-medium category respectively.

In order to analyse the economics of fish production, the cost incurred on different inputs, total fish production, gross return and net returns were calculated on per hectare basis. Expenditure on fingerlings, manure, inorganic fertilizers, fish feed, hired human labour, miscellaneous and interest on working capital constitute the variable cost whereas depreciation on fixed assets, lease value of pond and interest on fixed capital constitute the fixed cost. Straight line method was used to calculate depreciation on fixed capital. Total costs comprise of fixed cost and variable cost. Gross return was worked out by multiplying quantity of fish produced with the price of fish while net return was obtained by subtracting gross cost from gross return. Further, to ascertain the return per rupee of investment, the benefit cost ratio was obtained by dividing the returns with the cost of fish production.

In order to examine the input-output relationship for fish production across the three categories Cobb-Douglas production function was employed (Suresh et al., 2006, Rahaman et al., 2015; Das et al., 2016; Nisar et al., 2017). The unique advantage of this production function is that the input coefficients constituted the respective elasticities. The Cobb-Douglas production function using dummy variable is given in eq (1).

$$Y = a X_1^{b_1} X_2^{b_2} X_3^{b_3} X_4^{b_4} X_5^{b_5} e^{(b_6D+u)} \dots\dots\dots (1)$$

where,

Y = Total revenue from carp production (Rs.ha⁻¹)

a = Constant term

X₁ = Expenditure in fish seedling (Rs. ha⁻¹)

X₂ = Expenditure in inorganic fertilizer (Rs. ha⁻¹)

X₃ = Expenditure in fish feed (Rs. ha⁻¹)

X_4 = Expenditure in manuring of pond (Rs. ha⁻¹)

X_5 = Expenditure in hired human labour (Rs. ha⁻¹)

D = Dummy variable for loan taken (1 if loan taken, 0 otherwise)

b_1 to b_6 = Partial regression coefficient to be estimated

u = Random error

e = Base of natural log

The Cobb-Douglas production function was converted into linear form by making logarithmic transformation of all the variables. The expressed in loglinear equation is given below.

$$\ln Y = \ln a + b_1 \ln X_1 + b_2 \ln X_2 + b_3 \ln X_3 + b_4 \ln X_4 + b_5 \ln X_5 + b_6 D + u \quad \dots\dots\dots (2)$$

Marginal value productivity (MVP) give the absolute output response per unit of input factor and helps in comparison of relative efficiency of various resource use in fish production (Singh et al., 2012; Rangnath et al., 2015; Lalrinsangpui et al., 2016; Meena et al., 2019).

Marginal value productivity was worked out using the relation, $MVP_i = \hat{b}_i \frac{\bar{Y}}{\bar{X}_i}$ where, $\bar{Y}$ and $\bar{X}_i$ are the geometric means of Y and i^{th} inputs and $\hat{b}_i$ is the estimated regression coefficient associated with the i^{th} input.

Resource use efficiency of inputs measure whether or not the inputs are used efficiently or not. In order to examine the resource use efficiency, the marginal value productivity (MVP) of inputs which have significant regression coefficients in the estimated fish production function were worked out and are compared with its unit price. The resource is said to be optimally used if $MVP_i = P_i$. Any deviation of MVP of input from its unit price is referred to as resource use inefficiency. If $MVP_i > P_i$ than there is underutilization of resources and increasing the use of that resource will enhance the output. If $MVP_i < P_i$ than there is overutilization of resource and reduction in use of that resource will increase the production or output. Higher the difference between MVP of an input and its unit price, the higher is the resource use inefficiency and vice versa.

Further, t-statistic given below was used to test the statistical significance of the difference between the MVP of an input and its unit price.

The formula to compute t-test is

$$t = \frac{MVP_i - P_i}{SE (MVP_i)}$$

where, SE (MVP_i) = Standard error of MVP of i^{th} input, which was worked out using the relation

$$SE (MVP_i) = SE (\hat{b}_i) \frac{\bar{Y}}{\bar{X}}$$

where, $\bar{Y}$ and $\bar{X}$ are the geometric means and SE ($\hat{b}_i$) is the standard error of estimated partial regression coefficients associated with the i^{th} input.

Garrett ranking technique was employed to identify the constraints faced by the farmers in fish production. For converting the scores assigned by the farmers towards the particular constraint, the percent position for each rank was worked out using the formula

$$\text{Percent Position} = \frac{100 (R_{ij} - 0.05)}{N_j}$$

where,

R_{ij} = Rank given for the i^{th} factor by j^{th} individual

N_j = Number of factors ranked by j^{th} individual

Results and Discussion

The socio-economic profile of fish farmers based on pond size categories are presented in table 1. It was found that the average age of the fish farmers were 47.15 years. Maximum of the farmers were in the age group of 36 to 50 years which shows that the active involvement of middle age farmers in fish farming. Study conducted by Singh et al. (2015) and Adeosun et al. (2019) also reported maximum fish farmers in the similar age group. The average household size was 5.71 for semi medium category compared to 5 for marginal and small household category. The overall average pond size was 1.23 ha and ranges from 0.51 ha for marginal to 2.81 ha for semi medium category respectively. Analysis of education level revealed that maximum of the farmers had completed high school and intermediate level followed by graduation and above. This shows that the fish farmers were educated and will be able to adopt scientific farming practices. The number of years of experience in fish farming indicates the level of expertise and skill in managing the enterprise which they learn over the years. Maximum of the fish farmers (46%) had experience

in fish farming of more than 10 years followed by 34% with experience in the range of 6 to 10 years and remaining 20% with experience upto 5 year. Studies conducted by Pandey & Upadhyay (2012) and Singh et al. (2015) also reported that maximum farmers have fish farming experience of more than 10 years. On an average 40% of the farmers have attended a training programme. As fish farming is capital intensive, availability of credit is very important. From the study, it was found that 42 % of the farmers have availed loan while the remaining 58% invested from their own resources. Social participation is an important feature for decision making and advancement in fish farming enterprise. From the study it was found that 52% of the farmers are members of social organization especially the farmers' club promoted by NABARD and KVKs.

In Manipur, fish farming is generally carried out in combination with other income earning activities. Table 2 shows the various income earning activities which the fish farmers are involved. Of the total farmers, only 3% have fish farming as the sole livelihood activity and the remaining 97% are involved in other income earning activities as well. Crop cultivation is the main enterprise combination accounting 39%, followed by combination of dairy and crop cultivation (19%). The other income earning activities include rural artisan, farm labour, business and others. It shows that farming activities are diversified and farmers get additional benefit through use of crop residue, cowdung and farmyard manure in fish farming. Aeschliman (2005) stated that occupational diversification by the farmers' act as a risk reducing and survival strategy in case of

Table 1. Socio economic profile of sample households according to pond size category

Characteristics	Marginal	Small	Semi medium	Overall
Age of respondent				
Up to 35 years (nos)	12	5	2	19 (13)
36 to 50 years (nos)	31	35	17	83 (55)
More than 50 years (nos)	21	18	9	48 (32)
Household size (nos)	5	5	5.71	5.11
Average pond size (in ha)	0.51	1.25	2.81	1.23
No. of farmers with lease in pond	4	3	22	29
Level of education				
Illiterate (nos)	1	1	2	4 (3)
Primary std (upto 5 th std)	1	2	7	10 (7)
Middle std (upto 8 th std)	14	9	3	26 (17)
High school and intermediate	40	32	10	82 (55)
Graduation and above	8	14	6	28 (18)
Experience in fish farming				
Upto 5 years (nos)	14	10	6	30 (20)
6 to 10 years (nos)	25	16	10	51 (34)
More than 10 years (nos)	25	32	12	69 (46)
Training attended (nos)	35 (55)	18 (31)	10 (36)	63 (42)
Source of fund for fish farming				
Own (nos)	38	37	12	87 (58)
Credit (nos)	26	21	16	63 (42)
Social participation				
No membership (nos)	27 (42)	38 (66)	7 (25)	72 (48)
Member of organization	37 (58)	20 (34)	21(75)	78 (52)

Figure in parenthesis indicate percentage to total

failure. Asamoah et al. (2012) reported that majority of the fish farmers are engaged in crop production which is also found in the present study.

The details of the category-wise cost of rearing fish is given in Table 3. Expenditure on fingerlings constitute 57.46 % of the total cost and accounts for

Table 2. Fish farmers according to enterprise combination

Enterprise combination	Marginal	Small	Semi medium	Overall
Fish only	4	1		5 (3)
Fish + Crop	30	17	12	59 (39)
Fish + Dairy	4	13	2	19 (13)
Fish + Dairy + Crop	1	15	12	28 (19)
Fish + Farm labour	6			6 (4)
Fish + Rural artisan	6	4	2	12 (8)
Fish + Business	4	2		6 (4)
Fish + Others	9	6		15 (10)
Total	64	58	28	150

Figure in parenthesis indicate percentage to total

Table 3. Cost of rearing fish according to pond size categories (Rs /ha/ annum)

Pond category	Marginal	Small	Semi medium	Overall
Fingerlings	84854 (54.18)	78878 (62.15)	44952 (54.29)	64800 (57.46)
Manure	1855.54 (1.18)	521 (0.41)	474 (0.57)	732 (0.65)
Inorganic fertilizers	4986 (3.18)	2814 (2.22)	1897 (2.29)	2782 (2.47)
Fish feed	38012 (24.27)	22668 (17.86)	9438 (11.40)	19575 (17.36)
Human labour	6421 (4.10)	4734 (3.73)	3144 (3.80)	4312 (3.82)
Misc	5923 (3.78)	4180 (3.29)	2385 (2.88)	3688 (3.27)
Interest on working capital	10654 (6.80)	8535 (6.72)	4672 (5.64)	7192 (6.38)
Total variable cost	152706 (97.50)	122330 (96.38)	66962 (80.88)	103081 (91.41)
Depreciation	1312 (0.84)	1976 (1.56)	1411 (1.70)	1599 (1.42)
Lease value of pond	1986 (1.27)	619 (0.49)	12943 (15.63)	6133 (5.44)
Interest on fixed assets	610 (0.39)	1992 (1.57)	1479 (1.79)	1954 (1.73)
Total fixed cost	3908 (2.49)	4587 (3.61)	15833 (19.12)	9686 (8.59)
Total cost	156614 (100)	126917 (100)	82795 (100)	112767 (100)

Figure in parenthesis indicate percentage to total

the highest expenses in fish rearing. Organized and institutional sources for sale of fingerlings are very limited in the state and farmers depend on fish breeders from nearby locality for purchase of fish fingerlings where the quality is not assured. Other researchers like Singh (2007) and Goswami et al. (2013) also reported that expenditure on fish fingerlings constitute the highest expenditure in cost of pond fish culture. The second important component is fish feed. The study revealed that expenditure on feed constituted 17.36% of the total cost of fish rearing. Pellet and branded feed are available in the state but the prices are high and only few farmers can afford it. Locally available rice bran, oil cake, crop residue and green grasses are the major feed used by the farmers in the study area. Expenditure on hired human labour account for only 3.82% of the total cost of fish rearing. Labour are used for maintaining pond bunds, weeding, drainage of pond, fish harvesting, etc. Inorganic fertilizers in the form of urea, di-ammonium phosphate, single super phosphate and lime were used in fish production by only a few farmers in limited quantities. Judicious use of these fertilizers as per the required dose helps in enhancing the fish production. Miscellaneous cost which comprises of expenditure on oil, lubricants, hiring fishing nets etc. accounts for 3.27% of the total cost of fish farming. The total fixed cost accounts for only 8.59 % of the total cost. The overall total cost of fish rearing per hectare per year was Rs. 1,12,767. The cost of fish rearing was highest for the marginal category and decreases with the increase in pond size category. The cost of fish rearing for marginal, small and semi medium category were Rs. 1,56,614, Rs. 1,26,917 and Rs. 82,795 respectively. Studies conducted by Goswami, et al. (2013) and Singh et al. (2015) also reported that total cost of fish farming decreases with the increase in pond size category.

Composite fish farming is being practiced by the fish farmers in the study area. The major fish species reared include rohu, mirgal, grass carp, silver carp, common carp and tilapia. The details of the yield and returns from fish production are given in Table 4. The overall average fish production was 1078 kg/ ha/annum. The production of fish was the highest for the marginal category with a production of 1611 kg per hectare followed by small with a production of 1281 kg/ ha/annum and least for the semi medium category with a production of only 693 kg/ ha/ annum respectively. The decrease in yield of fish with the increase in pond size was also observed in the study conducted by Goswami et al. (2013), Umameheswari et al. (2013) and Singh et al. (2015). The fishes were sold to local fish traders or nearby market. The average selling price of fish was found to be the highest for marginal category ie. Rs. 175 kg⁻¹ followed by Rs. 167 kg⁻¹ for small and Rs. 162 kg⁻¹ for semi medium category. The overall average gross return from fish production was Rs. 1,80,797. The return over variable cost was Rs. 77,716 while the net return was Rs. 68,030. Among the three categories, the net return was the highest for marginal farmers followed by small and least for the semi-medium category. The overall benefit cost ratio was 1.60 which varies from 1.36 for semi medium and 1.80 for marginal category respectively. Similar studies conducted by Singh (2007), Uddin et al. (2012) and Singh et al. (2015) reported B-C ratio of 1.27, 1.95 and 1.57 in carp production.

The input-output relationship in fish production was analysed using Cobb-douglas production function and the result was presented in Table 5. The overall R square was found to be 72% which revealed that 72% of the variation in return from fish production was explained by the variables taken in the model. For the overall category, expenditure on

Table 4. Variation in yield and return according to pond size category (Rs./ hectare/ annum)

Pond category	Marginal	Small	Semi Medium	Overall
Yield of fish (Kg/ ha/ annum)	1611	1281	693	1078
Av. selling price of fish (Rs/ kg)	175	167	162	168
Gross return (Rs)	281925	213927	112266	180797
Return over variable cost (Rs)	129219	91597	45304	77716
Net return (Rs)	125311	87010	29471	68030
B:C ratio	1.80	1.69	1.36	1.60

fish seedling, fish feed, labour and loan were found to be significant. The signs of the significant variables were positive indicating that their increase utilization will lead to increase in the return from fish production. The study revealed that one percent increase in expenditure in fish seedling will lead to 0.23% increase in return from fish production. One percentage increase in expenditure in fish feed will lead to 0.33% increase in return from fish production. Similarly, one percentage increase in expenditure in labour will lead to 0.55% increase in return from fish production. The study also revealed that access to loan lead to increase in return from fish production. There were differences in significance of variables among the pond size category but fish feed and labour were the common significant variables for all the categories. Similar findings were also reported by studies conducted by other researcher's like Singh (2007), Uddin et al. (2012), Unameheswari et al. (2013), Rahaman et al. (2015) and Singh et al. (2015).

In order to examine whether inputs were used efficiently or not, the value of marginal value productivity (MVP) was examined. Marginal value productivity was calculated for those inputs whose regression coefficient were significant in the estimated production function. Table 6 shows the MVP of different inputs along with their prices. Since, all the inputs except dummy for loan were expressed in monetary terms, the acquisition cost of the inputs was taken as Rs. 1. The estimated marginal value productivity of significant inputs was compared with unity in order to examine the resource use

efficiency. The resource use pattern was found to be different across the farmer's category. For marginal category, the MVP of feed was significant at one and is higher than the acquisition cost which indicate that feed was underutilized. The marginal category had the highest expenditure on fish seedlings which indicated higher stock density, thereby requiring more feed. So, more return can be generated by increasing the utilization of fish feed. In case of small category, among the three variables *ie* seedlings, feed and labour only labour was found to be significant and the MVP of labour was higher than the acquisition cost implying that labour was underutilized. As farm size increases more labour is required for its maintenance and management. So, small category farmers can increase the return by employing more labour in fish production. For semi marginal category, the MVPs of seedlings and labour were significant and its value were higher than the acquisition cost. It implies that seedling and labour were underutilized. The study shows that if more fish seedlings were used, the stocking density will increase which in turn will increase the fish production. Similarly, semi medium category can increase the utilization of labour for better management of fish farm for increasing the return. Thus, there is a scope for increasing the return from fish farming by higher utilization of these underutilized inputs. Study conducted by Uddin et al. (2012) indicate that human labour, fingerlings, feed cost, cowdung and manure and lime and medicine were underutilized which can be increase more to get more return.

Table 5. Estimates of parameters of Cobb- Douglas production function for fish production

Category	No of household	Fish seedling	Inorganic fertilizer	Fish feed	Manure	Labour	Dummy loan taken	R square
Marginal	64	0.005 (1.031)	-0.004 (0.007)	0.843*** (6.780)	-0.001 (0.006)	0.340** (0.168)	0.029** (2.061)	70
Small	58	0.519*** (0.110)	-0.004 (0.009)	0.330** (0.130)	-0.008 (0.006)	0.259*** (0.081)	0.055*** (0.012)	70
Semi Medium	28	0.742*** (0.105)	-0.016 (0.010)	0.124** (0.060)	-0.004 (0.005)	0.501*** (0.094)	0.017 (0.013)	94
Overall	150	0.225*** (0.048)	-0.003 (0.005)	0.328*** (0.064)	-0.002 (0.004)	0.547*** (0.068)	0.040*** (0.009)	72

Figure in parenthesis indicate standard error.

*** and ** indicate significant at 1% and 5% level of significance

Table 6. Marginal Value Productivity of inputs along with their prices

Category/ Input	Marginal	Small	Semi Medium
Seedlings			
MVP		1.3607 (0.2892)	1.7422 (0.2470)
Input Price		1	1
Difference in MVP and Price		0.3607	0.7422***
Nature of resource utilization			Underutilization
Feed			
MVP	5.9604 (0.8791)	2.9127 (1.1514)	1.5575 (0.7561)
Price	1	1	1
Difference in MVP and Price	4.9604***	1.9127	0.5575
Nature of resource utilization	Underutilization		
Labour			
MVP	13.4605 (6.6709)	11.4902 (3.6004)	16.9666 (3.2126)
Price	1	1	1
Difference in MVP and Price	12.4605	10.4902***	15.9666***
Nature of resource utilization		Underutilization	Underutilization

*** t -test significant at $p < 0.01$

Figure in parenthesis indicate Standard error of MVP

Though there are a number of waterbodies suitable for aquaculture in the state, the farmers are facing a number of problems in fish production. The state is landlocked and transportation of feeds and aquaculture inputs is a big challenge. Above this, due to climate change there are frequent irregularities in rainfall leading to dry spell or flood which cause huge damage and losses to the fish farmers. Moreover, the availability of credit facilities is also limited, though presently banks have started providing credit through initiatives from the government. Based on the information given by the fish farmers, the problems are ranked using Garrett score and is presented in Table 7. From the study it was found that flood was the most important problem faced by the farmers in the state with the highest score ie. 60.2. As fish farming is mainly practised in low-lying areas, it gets affected when there is heavy rainfall causing flood. This is a frequent phenomenon during rainy season where fishes are washed away along with the pond being damaged. The second important problem is deterioration in the quality of pond water. This may be due to improper liming, unscientific pond structure and non-availability of fresh water for pond recharge.

This affects the growth of fish leading to poor yield and quality. Incident of pest and disease is the third important problem with Garrett score of 36.2. If proper control measures and medication is not done than mortality of fish will be very high leading to

Table 7. Problem ranking of farmers in fish production

Problem	Garrett Score	Rank
Flood problem	60.2	1
Poor quality of pond water	38.07	2
Incident of pest and disease	36.2	3
High cost of feeds	19.77	4
Lack of skilled worker	19.43	5
Poor yield of fish	19.37	6
Lack of access to credit	16.83	7
Water shortage during dry season	16.43	8
Lack of technical know-how on carp farming	16.07	9
Non availability or lack of quality seed	7.63	10

great economic loss. High cost of feed is the fourth important problem. Most of the fish farmers are poor and couldn't purchase the quality feed. Lack of skilled worker is the fifth constraint. Skilled worker are required for handling fish fingerlings, maintaining water quality, feeding, detecting and removing fish predators, etc. The other constraints faced by the farmers in order of importance are poor yield of fish, lack of access to credit, water shortage during dry season, lack of technical knowledge in carp farming and non-availability of quality seeds.

From the study, it may be concluded that majority of the fish farmers belong to educated middle age group with own fund as the major source of investment in fish farming. The per hectare expenditure in fish farming were more for marginal and small category farmers compared to semi medium category. It was observed that the yield per hectare was the highest for marginal followed by small and semi- medium category. With better effort marginal category could sold the fish at a higher price and also obtained the highest net return compared to the other categories. The overall BC ratio 1.60 indicates that fish farming is profitable in the study area but the yield is far below the potential yield. So, better utilization of scares resources and adoption of scientific cultivation practices is very essential. Increasing stock density up to the prescribed level, use of improved feed, scientific pond management, better utilization of farm labour and access to credit are the way forward for making fish farming a sustainable and lucrative enterprise. Above this, the policy makers and related institutions need to work together to frame certain policy measures and strategies to solve the problems of fish farmers of the state. Self-sufficiency in fish production is a possibility in the state when scientific farming is backed up by good forward and backward linkages.

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