



PROSPECTS OF FISH FARMING IN SALINE AREA OF RICE-WHEAT CROPPING SYSTEM OF THE PUNJAB

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ABSTRACT

The present study was conducted at Social Sciences Research Institute (PARC Unit), Ayub Agricultural Research Institute, Faisalabad, Pakistan during the year 2014 to estimate the profitability of fish farming in saline area of Hafizabad district. Overall Rs. 50595.24 were spent for establishing one-acre fish pond with annual repair of Rs. 11051.28 for use in the next year. Rohu with average number of 500 population was the dominant specie raised by the fish farmers followed by Mori and Silver Carp species with average number of 252 and 212, respectively. Relatively higher price and demand of these species in the market was the main reason for higher percentage in seed. Grass Carp, Thalla and Ghulfam were the other species raised by the fish farmers. Overall price paid by the fish farmers was Rs. 15.06 per seed. Overall fish production was 34.20 maunds per acre in the area. Higher cost of fish production on per acre basis was estimated at Rs. 199310.70 on large farms as compared with medium and small farms. The average feed cost was estimated at Rs. 84801.20 on overall basis with relatively lower cost among small farmers. The fish farmers were earning net profit of Rs. 59298.3 per acre. Benefit cost ratio of fish farming in saline area of Hafizabad was 1.0:1.3 showing earning of Rs. 1.3 on every rupee spent in the fish farming. These results show better prospects of fish farming in saline soils of the Punjab.

KEYWORDS: Fish culture; saline soil; prospects; profitability; Pakistan.

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INTRODUCTION

The fishery is one of the important sub-sector of agriculture which contributes 0.3% to GDP and 1.0% to national employment and a major share in the food security. It contributes directly to food supplies, a source of livelihood for the coastal inhabitants, export earnings and boosting the economy. Fishery products are one of the most traded foods and feed commodities. Apart from marine fisheries, inland fisheries (based in rivers, lakes, ponds, dams, etc.) is also an important activity throughout the country. Pakistan's major buyers are China, Thailand, Malaysia, Middle East, Sri Lanka, Japan, etc. During the year 2013-14 (July-March), a total of 103,833 metric tonnes of fish and fish preparations were exported earning US\$ 253.1 million. During same year (July- March), total marine and inland fish production was estimated at 514,500 metric tonnes out of which 349,500 metric tonnes was marine production and the remaining catch came from inland waters (GoP, 2014).

Presently, 66% of our population is protein deficient. The requirement of protein per head per day is 102.7g whereas available protein for consumption per head

per day is 69.61 g. The gap in requirement of protein per head per day is 33.09 g (Maqbool *et al.*, 2005). Fish is used as a substitute for mutton, poultry and beef. Per capita consumption of fish products in Pakistan is one of the lowest in the world. It was only 1.99 kg per head per year in the year 2010 as compared with 54.5 kg in Japan, 33.1 kg in China, 22.6 kg in Canada, 21.7 kg in USA, 9.0 kg in Brazil and 6.4 kg in India (Statistica, 2015; GoP, 2014). The overall world average consumption of fish products was 18.6 kg per head per year in 2010 which reached 18.8 kg per head per year by the year 2011 (FAO, 2012). Although the consumption of fish has reached upto 2.03 kg per head per year in Pakistan but, till very low as compared with other countries and world average consumption. The meat per capita consumption in Pakistan is 18.51 per head per year (GoP, 2014). To overcome the deficiency of proteins in addition to increasing cattle and poultry population the development of fish farming is necessary.

Fish farming can also be adopted on land that is not suitable for agriculture. It can flourish on land where water is mostly saline. The saline areas of the Punjab

can play important role in this aspect. Saline soils of this area do not allow proper production of field crops and also the ground water is unfit for irrigation. Quality fish can be raised in these saline areas of central Punjab without any opportunity cost. Districts Hafizabad has large saline/waste lands alongwith suitable climatic conditions for fish farming. As a consequence, more farmers are expected to enter into this profession. Research on economics of fish farming seems to play an important role in the development of fish farming. It provides a basis not only for decision-making among farmers but also formulating government aquaculture policies.

Keeping in view the importance of fish farming in saline soils, the present study was designed to see the profitability of fish farming in saline area of rice-wheat cropping system.

MATERIALS AND METHODS

The present study was conducted at Social Sciences Research Institute (PARC Unit), Ayub Agricultural Research Institute, Faisalabad, Pakistan during the year 2014. The data for the study were collected from saline area of district Hafizabad of rice-wheat cropping system of the Punjab. Pre-tested interviewing schedule was used to get detailed information about fish farming through personal contacts with farmers. In total 50 fish farmers were interviewed randomly. Descriptive and partial budgeting techniques were applied for data analysis. The cost estimates were computed by adding different costs involved in fish production such as fish seed cost, feed cost, water cost, labour cost and fishing cost. Actual amount spent in purchasing fish seed was taken seed cost. Actual amount paid on purchase of green fodder was taken as fodder cost irrespective of owned or purchased. Actual amount spent on purchase of farm yard manure (FYM), poultry drops, rice power and different fertilizers was taken into account while calculating feed cost. Water cost actually paid by the fish producers and actual amount spent in fishing and transportation to fish markets were taken. The total revenue was calculated by multiplying actual fish production (maunds/acre) by actual price received per maund. The net profit was calculated by subtracting total cost of fish production from total revenue using the following formula:

$$NP = TR - TC$$

NP = Net profit
TR = Total revenue
TC = Total cost

Benefit cost ratio (BCR) is the amount of profit on the cost of one rupee. This was computed using formula:

$$BCR = TR/TC$$

RESULTS AND DISCUSSION

Socio-economic characteristics of sample fish farmers

The information about the socio-economic characteristics of the sample farmers is important for decision making at various levels of farm operations. These include age, family size, education, operational land holding, fish farming experience and tenancy status. The average age of the sampled fish farmers was 43.78 years (Table 1). The large farmers were significantly more aged (49.08 years) as compared with small and medium farmers. The average family size in the area was 6.08 numbers. There was no significant variation in family size across farm size categories. The average fish farming experience was 8.80 years. Fish farming experience was significantly more among large farmers (14.25 years) as compared with other farm size categories. Average farm size operated by the fish farmers was 21.15 acres. Majority (78.0 %) of the sampled fish farmers was owner operators whereas remaining 22 percent was tenant operators. The owners operated farms were significantly more in medium farms as compared with large and small farms. The education level of the fish farmers in study area was comparatively very good as compared with general farmers. More than 85 percent of the farmers were having matric and above level education. The reason behind this trend is because of more involvement of educated person in fish farming.

Pond establishment and annual repair cost

Overall Rs.50596.24 were spent for establishing one-acre fish farm in the area. The pond establishment cost was comparatively low among medium farmers (Table 2). There was no significant variation in pond establishment cost across farm size categories. The fish farmers of the area on an average spent Rs.11051.28 for annual repair of pond on per acre basis. The annual repair of pond cost was relatively more among small farmers as compared with medium and large farmers.

Land rent and type

The average land rent of one acre pond was Rs.43200.00 in the study area. There was no significant variation in land rent across farm size categories (Table 2). Overall 92 percent farmers established fish farms on saline soils while remaining 8 percent on cultivable land. All the medium and large farmers established fish on saline soils while more than 16 percent of the small farmers raised fish farms on cultivable land.

Table 1. Socio-economic characteristics of the sampled farmers by farm size.

Characteristics	Farm size categories			Overall	Significance
	Small	Medium	Large		
Age (year)	44.13 (10.63)	38.64 (9.87)	49.08 (11.76)	43.78 (11.15)	.054
Family size (members)	5.96 (2.35)	6.50 (3.70)	5.83 (4.73)	6.08 (3.36)	.860
Fish farming experience (years)	7.67 (4.29)	6.07 (2.13)	14.25 (9.39)	8.80 (6.30)	.001
Operational holding (acres)	6.81 (3.47)	18.21 (5.01)	53.25 (22.50)	21.15 (21.94)	.000
Tenancy status					
Owner (%)	62.5	100.0	83.3	78.0	0.023
Tenant (%)	37.5	.0	16.7	22.0	
Education					
Illiterate (%)	8.3	.0	.0	4.0	0.562
Upto middle (%)	12.5	7.1	.0	8.0	
Matric & FA	41.7	35.7	50.0	42.0	
BA & above (%)	37.5	57.1	50.0	46.0	

*The figures in parenthesis are standard deviation

Table 2. Farm characteristics by farm size.

Characteristics	Farm size categories			Overall	Significance
	Small	Medium	Large		
Pond establishment cost (Rs./acre)	50588.24	48214.29	53636.36	50595.24	0.745
Land rent (Rs./acre)	42916.67	43214.29	43750.00	43200.00	0.972
Annual repair of pond (Rs./acre)	12333.33	10357.14	10100.00	11051.28	0.130
Type of land used					
Saline land (%)	83.3	100.0	100.0	92.0	0.095
Cultivable land (%)	16.7	.0	.0	8.0	
Reasons for starting fish farming					
Profitability (%)	54.2	7.1	16.7	32.0	0.006
Saline soil (%)	37.5	92.9	83.3	64.0	
Family profession (%)	8.3	.0	.0	4.0	

Reasons for starting fish farming

Majority (64 %) of the farmers reported that ownership of saline was the main reason for starting fish farming followed by 32.0 percent reported regular profitability of fish farming as main reason for opting fish farming as profession. More than 8 percent farmers reported family profession of fish farming as reason for starting fish farming (Table 2).

Fish seed population and mortality rate

Overall number of fish seeds used by the fish farmers was 1171.8 per acre in the area (Table 3). Rohu with

average number of 500 was the dominant species raised by the fish farmers followed by Mori and Silver Carp species with average number of 252 and 212, respectively. Relatively higher price and demand of these species in the market were the main reasons for higher percentage in seed. Inter farm size comparison shows that Rahu specie population was relatively more in small farmers ponds as compared to medium and large farmers. Mori and Silver Carp species population was more in the pond of medium farmers as compared with large and small farmers.

Table 3. Fish seed number and purchase price (count per acre) by farm size.

Fish breed	Farm size categories						Overall	
	Small		Medium		Large		No.	Rate/No.
	No.	Rate/No.	No.	Rate/No.	No.	Rate/No.		
Rahu	537.5	14.71	467.9	15.00	462.5	15.42	500.0	14.96
Mori	237.5	14.05	275.0	14.64	254.2	15.17	252.0	14.50
Thalla	89.6	14.83	64.3	14.11	50.0	17.20	73.0	15.04
Ghulfam	25.0	12.50	57.1	13.75	50.0	13.33	40.0	13.33
Silver Carp	183.3	13.94	246.4	14.69	229.2	14.67	212.0	14.36
Grass Carp	106.7	16.96	91.4	19.64	75.0	19.11	94.8	18.20
Total population	1179.6	14.50	1202.1	15.31	1120.8	15.82	1171.8	15.06
Mortality rate (%age)	9.89		9.51		10.41		9.90	

Grass Carp, Thalla and Ghulfam were the other species raised by the fish farmers in the area. Overall price paid by the fish farmers was Rs. 15.06 per seed. The seed price paid by the farmers was relatively higher for Grass Carp as compared with other species. Size of seed may be the reason for higher price. Overall, mortality rate was 9.9 percent in the area.

Cost of fish feed

Fish farmers were using 5.59 trolleys of farm yard manure per acre with relatively lower use among medium farmers. Farmers were also using 0.44 trolley

of poultry feed with relatively higher number among large farmers (Table 4). This may be due to more resources available with large farmers. Fish farmers were also using 30.74 maunds of rice powder on overall basis with higher quantity among large farmers (Table 4). As far as fertilizer use is concerned farmers were applying 6.54 bags of DAP and 6.92 bags of Urea on per acre basis. The fertilizer use was relatively more at medium farms. Overall, 46.83 maunds of green fodder was used as feed on per acre basis with relatively more quantity at large farms. Overall, Rs. 14551.02 were spent on water expenses on per acre basis.

Table 4. Feed cost by farm size

Feed Items	Unit	Farm size categories			Overall
		Small	Medium	Large	
Farmyard manure quantity	Trolley	5.96	4.81	5.78	5.59
Farmyard manure price	Rs/trolley	2958.33	3142.86	3563.64	3146.94
Poultry feed quantity	Trolley	0.26	0.37	0.88	0.44
Poultry feed price	Rs/trolley	6857.14	7000.00	6666.67	6842.11
Rice powder quantity	Maunds	25.00	33.45	39.06	30.74
Rice powder price	Rs/maund	667.86	673.21	679.17	672.34
DAP quantity	Bags	6.51	7.67	5.28	6.54
DAP price	Rs/bag	3658.33	3685.71	3708.33	3678.00
Urea quantity	Bags	6.30	7.35	7.64	6.92
Urea price	Rs/bag	1863.04	1842.86	1866.67	1858.16
Green fodder quantity	Maunds	27.99	56.76	72.92	46.83
Green fodder price	Rs/maund	200.00	200.00	200.00	200.00
Water expenses	Rs/acre	14608.70	14357.14	14666.67	14551.020

Labor and marketing cost

Overall 0.11 workers were employed on per acre basis for feeding and watching throughout the season. The harvesting cost paid by the fish farmers was Rs. 300 per maund (Table 5). The transportation cost was Rs. 66.10 per maund with higher cost among large farmers. The higher cost among large farmers is due to marketing of fish in Rawalpindi/Islamabad market whereas small and medium farmers sold fish in the local market. The commission agents charged three percent on the total sale.

Table 5. Labor and marketing cost by farm size.

Characteristics	Farm size categories			Overall
	Small	Medium	Large	
Labour number	0.16	0.12	0.08	0.11
Wages per month	8250.00	7857.14	8250.00	8130.43
Harvesting cost (Rs/maund)	300.00	300.0	300.0	300.00
Transportation cost (Rs/maund)	54.88	67.29	87.17	66.10
Commission agent fee (Rs.)	2.00	3.00	4.00	3.00

Production and sale price

Overall fish production was 34.90 maunds per acre in the area. In case of large farmers it was little bit higher i.e. 37.50 maunds per acre (Table 6). Sale price was

Table 6. Production and sale price by farm size.

Characteristics	Farm size categories			Overall
	Small	Medium	Large	
Production (Maund/acre)	33.13	35.71	37.50	34.90
Sale Price (Rs/maund)	7156.25	7232.14	8125.00	7410.00

Rs. 7410.00 per maund in the area. The price received by the large farmers was comparatively higher as compared with medium and small farmers.

Partial budgeting analysis

On overall basis, total cost of fish production on per acre basis was estimated at Rs. 199310.70 (Table 7). Feed was the major cost in fish farming followed by pond rent. The inter farm size comparison shows that total cost of fish production was comparatively more on large farms as compared with medium and small farms. As far as seed cost is concerned, fish farmers were spending Rs. 17534.80 with slightly higher cost among medium farmers (Table 7). The average feed cost was estimated at Rs. 84801.20 on overall basis with relatively lower cost among small farmers. The labour cost was comparatively higher at small farms i.e. Rs.11880.0. Harvesting and marketing cost was relatively higher at large farms because of higher fish

Table 7. Partial budgeting of fish farming by farm size

Production cost	Small farms		Medium farms		Large farms		Overall	
	Cost	Share (%)	Cost	Share (%)	Cost	Share (%)	Cost	Share (%)
Seed cost	17249.6	9.0	18151.6	9.1	17310.1	7.9	17534.8	8.8
Feed cost	75700.7	39.6	86408.0	43.1	101418.2	46.1	84801.2	42.5
Water expenses	14608.7	7.6	14357.1	7.2	14666.7	6.7	14551.0	7.3
Labour cost	11880.0	6.2	8485.7	4.2	5940.0	2.7	8049.1	4.0
Harvesting	9939.0	5.2	9963.0	5.0	11250.0	5.1	10260.0	5.1
Marketing	6559.9	3.4	9440.1	4.7	15456.4	7.0	9863.3	4.9
Annual repair of pond	12333.3	6.5	10357.1	5.2	10100.0	4.6	11051.3	5.5
Pond rent	42916.7	22.4	43214.3	21.6	43750.0	19.9	43200.0	21.7
Total cost	191187.9	100.0	200377.0	100.0	219891.4	100.0	199310.7	100.0
Total revenue	237086.6		258259.7		304687.5		258609.0	
Net profit	45898.7		57882.7		84796.1		59298.3	
Net profit without pond rent	88815.4		101097.0		128546.1		102498.3	
Benefit cost ratio	1.2		1.3		1.4		1.3	
Benefit cost ratio without pond rent	1.6		1.6		1.7		1.7	

production. On an average farmers were earning Rs. 258609.0 per acre from fish farming. Total revenue earned by the large farmers was relatively more as compared with medium and small farmers. The fish farming in saline soils in the area was profitable enterprise as they were getting net profit of Rs. 59298.3 per acre. The net profit of fish farming was higher among large farmers as compared with medium and small farmers. Benefit cost ratio of fish farming in saline area of Hafizabad was 1.0:1.3 showing earning of Rs. 1.3 on every rupee spent in the fish farming. If we exclude pond rent from the total cost, owner farmers were earning Rs. 1.70 on every rupee spent in fish farming. The results are in accordance with Qasim *et al.*, (2004) who found fish farming a profitable activity in saline area of central Punjab. Chughtai and Mahmood (2004) also found benefit cost ratio 1.0:1.47 in fish farming in saline area of district Jhang.

Problems faced by fish farmers

The technical and marketing problems faced by the fish farmers are listed below:-

1. Fungus diseases attack on skin and lungs of the fish and cause heavy losses in fish production.
2. Lices also attack on fish and cause loss.
3. One very common and major problem that is faced by farmers, is lack of oxygen in the water during July - August when rainy season starts and oxygen level becomes low in the water. Fish can't take proper oxygen and die at the depth of water. This causes huge loss of production every year.
4. Turbidity is also a problem faced by the farmer in which water becomes so clay that fish can't feed and breathe properly.

5. Siberian crane is also a problem as they eat the small fishes and cause heavy losses in production.
6. Monopoly of the market agents in price fixing is very major issue in the fishery sector. Overall 94 percent of the farmers said that they face price fixation problem as there is no check and balance on pricing.

RECOMMENDATIONS

- Fish farming is still an infant enterprise in Punjab and has yet to be adopted by the farmers at a large scale as a profitable enterprise especially in saline soils where crop production is not profitable. Although, Fisheries Department is already conducting some research yet there is need for strengthening research activities to develop fish production technology suitable for various environmental conditions. Further, more research for development of fast growing and high yielding hybrid breeds is the need of time.
- Supply of good quality seed in adequate amount at low prices and at the right time is an important requirement of fish farming. As it is difficult especially for small farmers to produce their own seed, supply of standardized length and genetically improved and high valued desirable seed needs to be ensured through increasing production of seed at public hatcheries.
- Well equipped extension service programme is needed for technical guidance of already existing fish farms for better production and control of fish diseases. Moreover, efforts are also needed for motivating more farmers towards fish farming especially in saline/water logged soils where crop production is not suitable.

- Monopolistic attitude of market agents in price fixing results in low returns to the farmers. It is proposed that price fixing mechanism be developed by the government authorities in favour of fish producers.

CONCLUSION

Fish farming on saline soil not only plays an important role in human nutrition but also in the rural economy of the country. The fish farming culture is flourishing in saline area of rice-wheat cropping system of Punjab. The fish farming in saline soil of district Hafizabad is a profitable enterprise as farmers are earning net profit of Rs.59298.3 per acre. However, some problems/ constraints hinder more production as per potential like fungus diseases attack on skin and lungs of the fish, lack of oxygen in the water during July - August (rainy season) and turbidity causing major losses in fish production. The findings of the study reveal better prospects of fish farming in the area which not only can raise income of the farming from saline soil but also increase the employment opportunities for the local population.

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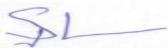
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CONTRIBUTION OF AUTHORS

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2.	Shahira Ambren	Collected data and reviewed literature	
3.	Irfan Mahmood	Analysed data and wrote conclusion	
4.	Sultan Ali Tariq	Helped in review and data collection	