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RESEARCH NOTE

An Economic Analysis of Semi-Intensive Pond Aquaculture in Southern Telangana Zone

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ABSTRACT

Telangana is newly formed landlocked state with third largest inland water resource territory in the country. The state government is promoting semi-intensive pond aquaculture at larger scale. In this context, the study has assessed the economics of semi-intensive pond aquaculture during the year 2019-20. Data from 60 fish farmers of southern Telangana zone was collected and analysed for the study. Cobb-Douglas production function was used to estimate the resource-use efficiency in fish production. The study found that the net returns per hectare of fish farming was Rs. 4,93,018.73 with benefit-cost ratio of 1.44. The results indicated that feed and fingerlings were the major inputs of fish farming of which feed was over-utilised and fingerlings were under-utilised. Hence study recommends for distribution of subsidised fingerlings to fish farmers and awareness creation on optimum utilisation of feed in fish production under semi-intensive pond aquaculture.

Key Words: Fish farming, cost of production, benefit-cost ratio, resource-use efficiency

JEL: Q21,Q22, Q26

I

INTRODUCTION

Fish farming is one of the fastest growing sectors in India and has the potential for large scale employment. India is the third largest producer of fish and second largest producer of inland fish in the world after China. The total fish production in 2017-18 was about 12.59 million metric tonnes, which constitute 8.90 million metric tonnes of inland production and 3.69 million metric tonnes of marine production. Aquaculture in India has now moved from a traditional activity to a well-developed industry Das *et al.* (2013). Telangana is the 29th state of India, formed in 2014. Though the state is landlocked with no coastal line, it is the third largest inland water resource territory in the country and occupied seventh place in fish production in the year 2018 with a quantity of 2,84,210 tonnes. The total water spread area of Telangana was 6,55,005 hectares. Though the fish production was increasing in the state, semi-intensive pond aquaculture has recently gained importance. Therefore, the present paper attempts to study the economics of semi-intensive pond aquaculture and examine resource use efficiency.

II

DATA SOURCE AND METHODOLOGY

2.1. *Data*

The study was carried out in Nalgonda, Suryapet and Yadadri Bhuvanagiri districts of Telangana state. Nalgonda district was purposively selected as it has highest area (29.89 per cent) under semi-intensive pond aquaculture in Telangana.

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Suryapet and Yadadri Bhuvanagiri districts were part of undivided Nalgonda district before formation of new districts in Telangana in 2016. Hence, they were also included in the study. Since the fish farmers are scattered over large area the total fish farmers list of study area was obtained from Department of Fisheries, Telangana. A sample of 60 fish farmers were selected using proportionate random sampling method. District wise distribution of sample fish farmers was presented in Table 1.

TABLE 1. DISTRICT WISE NUMBER OF SAMPLE FISH FARMERS INCLUDED IN THE STUDY

District (1)	Fish farmers (2)
Nalgonda	36
Suryapet	10
YadadriBhuvanagiri	14
TOTAL	60

2.2. *Methodology*

A pre-tested questionnaire was used to collect required information from the respondents. The cost of fish production, resource-use efficiency was estimated for the selected study area.

2.2.1. *Cost Concepts*

The cost of fish production was calculated by using various cost concepts. The following model was used [Nisar*et al.* (2017)]:

Cost A1: It includes –

1. Value of hired human labour
2. Value of hired and owned machine labour
3. Value of seed(fingerlings)
4. Value of manures (owned and purchased) and fertilizers
5. Value of feed
6. Value of protection chemicals
7. Depreciation on boats, fishing nets and other equipment
8. Land revenue
9. Interest on working capital

Cost A2: Cost A1 + rent paid for leased in land

Cost B1: Cost A2 + interest on fixed capital (excluding land)

Cost B2: Cost B1 + rental value of owned land

Cost C1: Cost B1 + imputed value of family labour

Cost C2: Cost B2 + imputed value of family labour

Cost C3: Cost C2 X 1.10 (10 per cent of cost C2 is added to cost C2 as management cost)

Here fish production was assumed as crop unit and cost concepts were applied.

$$Cost\ of\ fish\ production\ per\ Kg = \frac{Cost\ C3}{Yield}$$

2.2.2. *Farm Income Measures*

Net returns = Gross returns – Cost C3

Farm business income = Gross income – Cost A_1

Family labour income = Gross income – Cost B_2

Intensive income (or) Farm investment income = Farm business income – Imputed value of family labour

Return per rupee spent = Gross returns/Cost C3

Procedure for determining the value of the product:

The value of the product was computed at the actual prices received by the respondents during the study period.

2.2.3. *Resource Use efficiency*

Cobb-Douglas production function was used to estimate the resource-use efficiency in fish production.

The model as follows

$$Y = a\, X_1^{b_1} X_2^{b_2} X_3^{b_3} X_4^{b_4} X_5^{b_5} X_6^{b_6} X_7^{b_7} e^u \qquad \ldots.(1)$$

Where,

Y= Fish yield (kg/ha)

X_1 = Quantity of feed (kg/ha)

X_2 = Number of fingerlings (number/ha)

X_3 = Labour used (man-days/ha)

X_4 = Quantity of fertiliser used (kg/ha)

X_5 = Quantity of manure used (kg/ha)

X_6 = Quantity of lime (kg/ha)

X_7 = Experience of fish farmers (years)

a = Constant

b_1 to b_7 are elasticity coefficients of respective inputs. The equation (1) was converted into the log linear equation as follows.

$$\text{Log } Y = \log a + b_1 \log X_1 + b_2 \log X_2 + b_3 \log X_3 + b_4 \log X_4 + b_5 \log X_5 + b_6 \log X_6 + u$$

Where, u stands for error term.

2.2.4 *Allocative Efficiency of Resources*

Allocative marginal efficiency is determined for major inputs by calculating the ratio of marginal value product (MVP) to factor cost (MFC). The MVP is the product of the marginal product of each input and unit price of output.

$$MVP_i = MPP_i * P_y$$

Where, MVP_i= Marginal value product of i-th input

MPP_i = Marginal physical product of i-th input

P_y = Unit price of output

If allocative efficiency (MVP/MFC) is greater than 1, then that particular input was efficiently used and there is further scope for allocating one more unit of that particular input. If allocative efficiency is less than 1 then that particular resource was excessively used, so that the fixed resources are no longer responsive to the variable input applied. The criteria for determining optimality of resource use are:

MVP/MFC >1: Under-utilisation of resource

MVP/MFC = 1: Optimal use of resource

MVP/MFC <1: Over-utilisation of resource

III

RESULTS AND DISCUSSION

The farmers in the study area follow composite fish culture for rearing of fish in which Catla, Rohu, Grass carp and Common carp are stocked in a same pond. Six per cent of farmers grow other fish varieties like Murrel, Mrigal and Pangasius also. Fish attains marketable size within 8 to 10 months. In the study area most of fish produced was marketed to Hyderabad and Kolkata.

3.1.*Cost of Fish Production Under Semi-Intensive Pond Culture*

The cost of production of fish farming per hectare under semi-intensive pond culture is presented in the Table 2. The total cost of production (Cost C3) was about Rs. 3,43,454.25.

Considering variable cost, the cost of fingerlings was Rs. 45,165.13. The average stocking rate was 11,526.32 fingerlings per hectare with average price of

Rs. 3.92 per fingerling including transportation cost. The feed cost was Rs.1,61,793.19 with 9,841.43 kilograms of feed per hectare. Rice bran, groundnut oilcake, rice and other branded feed were different types of feed used by the fish farmers. The average price of the feed was Rs. 16.44 per kg. The manure and fertilizer were applied at the rate of 5,872.05 kg and 94.73 kg per hectare respectively. The average price per one kilogram of manure and fertiliser were found to be Rs.1.20 and Rs. 13.91respectively. A quantity of 342.50 kg lime @ Rs.10/kg costing Rs.3,424.96 was applied per hectare. The requirement of average hired labour was 45.07man-days with wage rate of Rs.425.90. The cost incurred on hired labour was Rs.19,196.96. The labour was mostly hired for operations like stocking, feeding and harvesting. The investment on protection chemicals was less (Rs.291.75) with application of 23.7 kg costing Rs. 12.32/Kg.

Table 2 at a glance indicates that feed cost accounts for 59.14 per cent of the total variable cost. Sharma *et.al* (2018) also found feed was the largest cost item while studying the economics of fish production in Chaitwan district, Nepal. Next to the feed, cost of fingerlings accounts for major share constituting 16.51 per cent of total variable cost. The cost incurred on manure, fertilisers and lime were found to be minimal as most of farmers give less preference to them. It also noticed that the cost of protection chemicals was negligible since farmers were using only salt and turmeric to control diseases in fishes rather than medicines. The value of hired labour and imputed value of family labour constitutes 7.02 per cent and 6.81per cent respectively to the total variable cost. Feeding was the main operation which requires most of the labour and performed generally by family labour. From the The total fixed cost under semi-intensive pond aquaculture worked out Rs..38,676.67 (Table 3).

TABLE 2. VARIABLE COST UNDER SEMI-INTENSIVE POND FISH CULTURE

Sl.No. (1)	Particulars (2)	Quantity/ha (3)	Price/Unit (Rs.) (4)	Cost (Rs.) (5)
1.	Fingerlings (No's)	11,526.32	3.92	45,165.13 (16.51)
2.	Feed (kg)	9,841.43	16.44	1,61,793.19 (59.14)
3.	Manure (kg)	5,872.05	1.20	7,046.46 (2.58)
4.	Fertiliser (kg)	94.73	13.91	1,317.41 (0.48)
5.	Lime (kg)	342.50	10.00	3,424.96 (1.25)
6.	Hired labour (Man-days)	45.07	425.90	19,196.96 (7.02)
7.	Family labour (man-days)	62.14	300.00	18,642.11 (6.81)
8.	Protection chemicals (kg)	23.67	12.32	291.75 (0.11)
9	Interest on working capital @ 7 per cent	-	-	16,676.51 (6.10)
	TOTAL	27,807.91	783.69	2,73,554.48 (100)

TABLE 3: FIXED COSTS UNDER SEMI-INTENSIVE POND AQUACULTURE

S.No. (1)	Particulars (2)	Cost (Rs.) (3)
1.	Interest on fixed capital @ 10per cent	3,553.94 (9.19)
2.	Cost of depreciation	10,539.40 (27.25)
3.	Rental value of owned land/ha	24,583.33 (63.56)
	TOTAL	38,676.67 (100)

The cost concepts for semi-intensive pond aquaculture were estimated and presented in the Table 4. Cost C_3 was estimated by adding 10 per cent of Cost C_2 to the Cost C_2. Thus, the cost C3 was Rs. 3,43,454.25.

TABLE 4. ESTIMATES OF COST CONCEPTS FOR SEMI-INTENSIVE POND AQUACULTURE

Sr. No. (1)	Particulars (2)	Value (Rs.) (3)
1	Cost A1	2,65,451.76
2	Cost A2	2,65,451.76
3	Cost B1	2,69,005.70
4	Cost B2	2,93,589.03
5	Cost C1	2,87,647.80
6	Cost C2	3,12,231.14
7	Cost C3	3,43,454.25

From the Table 5 it is observed that gross returns per hectare of pond fish farming was Rs. 4,93,018.73. Net returns per hectare of fish farming was observed as Rs.1,49,564.48. Further it was observed that Rs.72.50 cost is incurred to produce 1 kg of fish. The Benefit Cost Ratio (BCR) was 1.44. From the above findings, it could be identified that fish farming was profitable. This result was similar to Singh and Singh (2017) since they also revealed that B-C ratio for small fish farms in Punjab was 1.44. The farm income measures like farm business income, family labour income, farm investment income and returns per rupee spent were also worked out.

TABLE 5. GROSS RETURNS, NET RETURNS AND FARM INCOME MEASURES PER HECTARE OF FISH FARMING

Sl. No. (1)	Particulars (2)	Value (Rs.) (3)
1.	Yield (kg)	4737.18
2.	Average price(Rs./Kg)	104.07
3.	Gross returns	4,93,018.73
4.	Net Returns	1,49,564.48
5.	Cost of production (Per Kg)	72.50
6..	Benefit cost ratio (BC ratio)	1.44
7.	Farm business income	2,27,566.98
8.	Family labour income	1,99,429.70
9.	Intensive income (or) Farm investment income	2,08,924.87
10.	Returns per rupee spent	1.44

3.2. *Resource Use Efficiency of Pond Culture*

The Cobb Douglas production function was applied to examine the resource use efficiency in semi-intensive pond fish culture per hectare (Table 6). The factors quantity of feed, number of fingerlings stocked, man days of labour, quantity of fertilizer, manure, lime and experience of fish farmers were considered to evaluate the impact of these factors on yield. TheR^2 is 0.74 indicating that 74per cent of the variation in the yield was explained by the explanatory variables.

The elasticity co-efficient for quantity of feed, number of fingerlings stocked and experience of fish farmers were found significant at 1 per cent level of significance. It indicates that 1 per cent increase in feed quantity, keeping other variables constant would increase the yield by 0.09 per cent. With 1 per cent increase in the number of fingerlings stocked, keeping other variables constant would increase the yield by 0.47 per cent. The results are similar to findings of Singh *et.al* (2015) who also reported that fingerlings and feed were significant at 1 per cent significance level of significance. It also noticed that 1 per cent increase in the experience of fish farmers, keeping other variables constant the production increases by 0.11 per cent. Increased experience helps in the better management of inputs and acquiring technical knowledge which leads to the increased yield.

TABLE 6. RESOURCE USE EFFICIENCY OF FISH FARMING UNDER SEMI-INTENSIVE POND FISH CULTURE

Input Factors	Regression Co-efficients	Standard errors
Intercept	2.91	0.53
Feed	0.09***	0.03
Fingerling's	0.47***	0.06
Labour	0.03	0.03
Fertilizer	0.002	0.03
Manure	0.03	0.03
Lime	-0.03	0.03
Experience of fish farmer	0.11***	0.03
R^2	0.74	

***,** and * indicate significance level at 1, 5 and 10 per cent level, respectively.

From the above results one can derive that feed and fingerlings are the major inputs which influence the yield. It is necessary to create awareness on balanced use of feed according to the size of fish and optimum stocking of fingerlings through extension programmes. Quantity of lime was found to show negative effect on yield, but the regression co-efficients of the variable was in-significant, thus further studies are required to study the effect of these variables in fish production. Singh (2007) found that expenditure on feed, fingerlings, lime, manure, chemical fertilisers and hired labour and pond area were the important determinants of fish production while studying input output relationship in fish production in Tripura.

3.3. *Allocative Efficiency of Resources:*

The data provided in the Table 7 revealed that the MVP/MFC ratio was less than one (0.28) for feed and greater than one (5.12) for fingerlings. This implies that an additional one rupee invested in feed would increase the returns by only 0.28 rupees thus feed was over-utilised (in excess of recommended feed rate). While additional one rupee invested in fingerlings would increase the returns by 5.12 rupees indicating fingerlings are under-utilised (relative to recommended stocking density) and there is a scope to increase the fingerlings stocked. The results are similar to the findings of Abbas and Ahmed (2018) on allocative efficiency of fish production in Ondo state, Nigeria who reported that fingerlings are under-utilised (with respect to recommended stocking density) and feed was optimally utilised by the fish farmers. While Williams *et.al* (2012) found that fish seed was under-utilised and all other variables like feed cost, fertiliser, lime, labour and pond area were over-utilised by the fish farmers in Lagos state of Nigeria.

TABLE 7. RATIO OF MARGINAL VALUE PRODUCT TO MARGINAL FACTOR COST FOR MAJOR INPUTS IN FISH PRODUCTION

Sl. No. (1)	Inputs (2)	MVP/MFC ratio (3)	Resource use efficiency (4)	Significance level (5)
1.	Feed	0.28	Over-utilisation	1 per cent significance
2.	Fingerlings	5.12	Under-utilisation	1 per cent significance

IV

CONCLUSIONS

Semi-intensive pond aquaculture was found to be profitable with benefit-cost ratio of 1.44. The study found that feed and fingerlings are the major inputs of fish farming. Cost of feed was 59.14 per cent of variable cost and over-utilised (with respect to recommended feed rate). The cost of fingerlings constitutes 16.51 per cent of variable cost and under-utilised (relative to recommended stocking density). Thus, there is a need to create awareness among fish farmers about the optimum use of feed and distribution of subsidised fingerlings to fish farmers by department will increase the fish production in the state.

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