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Economic evaluation of Composite carp culture in Odisha

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Abstract

The present study was conducted in Dhenkanal district of Odisha to analyze the cost and returns of composite carp culture. Data were collected from 71 fish farmers through personal interviews. Farmers had an average pond area of 0.4 ha and mean fish yield was found to be 2.1 t/ha/y. Rate of return on total investment (ROI) and Benefit-Cost ratio (B:C ratio) for adopters and non-adopters were worked out as 72.83%; 1.73 and 38.62%; 1.39 respectively. Feed constituted the maximum share (37%) in cost of production of fish followed by lease value of pond (15%). Lack of knowledge about scientific fish farming, high cost of supplementary feeding, lack of financial support and non-availability of bigger sized fingerlings were identified as the major constraints to adoption of composite carp culture technology. The economic appraisal clearly established carp culture as a profitable venture.

Keywords: Composite carp culture, economics, benefit-cost ratio, constraints

Introduction

Fisheries and aquaculture remain important sources of food, nutrition, income and livelihoods for hundreds of millions of people around the world (FAO, 2016). Presently, India is the second largest fish producing and second largest aquaculture nation in the world after China. The export earnings from the sector registered at Rs. 45,106.89 crores in 2017-18 with the quantity of 1377244 tonnes (DADF, 2019). The sector contributed about 0.96% to the National Gross Value Added (GVA) and 5.37% to the agricultural GVA (2016-17). So far, about 0.89 million ha of water area have been brought under fish farming covering 1.1 million beneficiaries. At the same time training has been imparted to about 0.94 million fishers on various aspects of fish and fisheries. Currently the average annual yield is around 3.0 tonnes ha^{-1}. Foreseeing high potential, "Blue Revolution" has been initiated in the fisheries sector in order to focus mainly on increasing fisheries production and productivity from aquaculture and fisheries resources, both inland and marine with the objectives of ensuring food and nutritional security, generating employment and export earnings, ensuring inclusive development and empowering fishers and aquaculture farmers (DADF, 2019). The Union Government has also recently launched Pradhan Mantri Matsya Sampada Yojana to turn India into a hot spot for fisheries and aquaculture through appropriate policy, marketing and infrastructure support. Government of India has also set a target of 20 MT fish production by the year 2022-23 (Anon, 2020).

Inland fisheries and aquaculture constitute the main components of the fisheries sector in India from production point of view. The inland fishery has grown in absolute terms, but the development in terms of its potential is yet to be realized as the sector is extremely diverse and dynamic. The freshwater aquaculture has emerged as a major contributor overtaking the other sub-sectors in fish production. The state of Odisha is a rich state in Indian aquaculture sector having 1.32 lakh ha of water area in the form of ponds and tanks. Among the state resources, Dhenkanal covers a water area of 1749.22 ha as ponds and tanks. Freshwater fish production in Dhenkanal district was 10232.46 MT in 2017-18, contributing 2.2% towards total freshwater fish production of Odisha (Anon, 2019a). The state occupies fifth position in inland fish production among various states of India. Inland fish production of Odisha has almost doubled *i.e.* from 2.68 lakh MT in 2011-12 to 5.34 lakh MT in 2017-18 (Anon, 2019b). However, there is a gap between

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the total production potentiality and present productivity level. In the case of culture fisheries, the present productivity stands at 3.31 lakh MT against the total production potentiality of 3.9 lakh MT indicating a gap of 60,000 MT (Anon, 2018). The country has 429 Fish Farmers Development Agencies (FFDAs) and 39 Brackishwater Fish Farmers Development Agencies (BFDAs) for promoting freshwater and coastal aquaculture.

Composite carp culture is one of the proven technologies with higher rate of returns on investment. It has the potential to attract rural youth and stop migration. It creates self-employment besides generating employment opportunities for others. Right from seed production to harvest, freshwater fish farming offers number of enterprises for farmers in Odisha in general and Dhenkanal in particular. Hence, this study was conducted with the aim to estimate cost structure and returns of composite carp culture in Dhenkanal district and to identify the constraints encountered by the fish farmers.

Materials and Methods

For the present study, Dhenkanal district of Odisha was selected randomly. From the district three blocks namely Sadar block, Odapada block and Gondia block were selected purposively because of the presence of more fish farmers. Selection of village and respondents was done through multistage random sampling. From each block three villages were selected *i.e.,* total 9 villages were selected to get a representative sample and to reduce sampling error. From each village, 8 fish farmers were selected, hence a total of 71 data were collected (One schedule was discarded due to insufficient data). Secondary data was collected from Directorate of Fisheries, Odisha and District Fishery Office, Dhenkanal.

The schedule contained information on the socio-economic factors, which were likely to influence the adoption of recommended technology of composite carp culture. Variables included were age, education level, pond area, extension contact, exposure to mass media and knowledge level on recommended technology. For measurement of variables *viz.,* exposure to mass media and knowledge level, the total score of an individual was computed. The responses for the variable exposure to mass media were recorded in a three point continuum i.e. never, need based and daily with score-1, 2 and 3 for their exposure towards newspaper, radio, television, facebook, youtube, whatsapp, text message, internet, E-mail, magazine, leaflet/bulletin etc. For knowledge level, a knowledge scale was developed following Jethi et al. (2019) with step by step procedures which included preliminary screening of the items based on Likert's method through calculation of t-statistics and mean score with reliability and validity test. The knowledge test was then administered to the respondents for their knowledge with regard to different aspects of composite carp culture technology. Then based on the total score of both the variables, the respondents were categorized into 3 groups by computing the mean and standard deviation (SD).

The three groups are-low (<Mean–SD), medium (Between Mean±SD) and high (>Mean+SD).

A total number of 13 practices that constitute composite carp culture technology were selected. The 13 practices selected were i) Predatory and weed fishes removed ii) Pond preparation done for every crop cycle iii) Water pH was adjusted through lime or alum iv) Water inlet and outlet were provided with filters v) Seeds were stocked after proper acclimatization vi) Seeds were disinfected before stocking vii) Fertilization and manuring done as per recommendation viii) Plankton crash was observed during crop cycle ix) Supplementary feeding is given based on biomass calculation x) Water exchange and aeration adopted for maintaining water quality xi) Fortnightly sampling to check the health status of the fish xii) Careful disposal of dead animals and xiii) Supplementary feeding with pellet feed. The farmers were asked to respond whether they adopt or do not adopt the practices. Score of 1 and 0 were assigned to adoption and non-adoption of the technology respectively. Therefore, maximum possible score was 13 for each respondent. The respondents who scored 6 and above (i.e., farmers who adopted at least 50% of scientific practices), are considered as adopters and those who scored below 6 are marked as non-adopters of the technology. Among 71 responses 48 fish farmers were adopters and the rest 23 were non-adopters.

This study employed Gross Margin Analysis (GMA) tool to measure the profitability in composite carp culture. GMA is a vital tool in measuring the level of farm profitability. A Gross margin (GM) is the difference between Gross income (Total Revenue) earned by the fish farm and the total variable costs required to produce the output (Firth, 2002). The

total revenue is the total output multiplied by price per unit of fish. The variable costs are those costs that vary in direct proportion to the level of production. The total variable cost includes costs on inputs such as: fertilizers, transportation, labour input, feeding cost and cost of other inputs like fingerlings etc.

The above discussion can be represented in the following equation as follows:

Gross Margin = Total Revenue – Total Variable Cost

Let us suppose, GM = Gross Margin;

TR = Total Revenue;

TVC = Total Variable Cost; TFC = Total Fixed Cost;

S = Selling Price per unit; Q = Quantity Produced & Sold; V = Variable cost/unit

The rate of return on total investment can also be calculated to know the profitability of the proposed scheme as follows:

ROI = (Net Margin/ Total Cost)* 100

Where Net Margin = Gross Margin – Non-operating Expenses

In the above formula net margin is determined after paying non-operating expenses like interest on loan etc.

A list of possible constraints in composite carp culture were selected from literatures and past survey in consultation with block-level Fishery Extension Officer, subject matter specialist of Krishi Vigyan Kendra and District Fisheries Officer, Dhenkanal. The respondents were asked to give their opinion about the problems they encounter. Responses from the farmers were recorded in a 3 point continuum *i.e.,* most severe, severe and not severe for which a numerical score of 3, 2 and 1 were assigned respectively. Total score for each constraint was calculated based on the scores given by the respondents. Mean score for each constraint was computed by dividing the total score with the total no of respondents. After computing the mean score the constraints were given a rank order. Constraints were finally listed according to their degree of severity.

Results and Discussion

Majority of the respondents (59.15%) were from the age group of 35-50 years while 32.40 percent in the category of >50 years and only 8.45% of them were in 20-35 years age group. With regard to education level, 22.53% of the respondents had higher secondary level of education followed by middle level (21.12%), primary level (16.94%), matriculation (14.08%), no formal schooling (9.85%), graduation (7.04%) and 3% of them were in the category of illiterate and post-graduation level each. Majority (54.94%) of the respondents had a pond area of 1-2 ac. Whereas, 29.57% of the respondents had a pond area of less than 0.40 ha and only 15.49% of the respondents had more than 0.80 ha of pond area. Majority (61.97%) of the respondents were having medium level of extension contact followed by high level (22.54%) and low level (15.49%). Most (50.71%) of the respondents had medium level of exposure to mass media followed by low level (25.35%) and high level (23.94%) of exposure to mass media. Most (66.20%) of the farmers possessed a medium level of knowledge while 21.13% of them a high knowledge level and only 12.67% of them possessed a low knowledge level. Yield ranged from 1.25 to 3.00 t/ha/y averaging at 2.1 t/ha/y. The yield gap in composite carp culture is partly contributed low levels of contact with extension personnel, less exposure towards mass media and low level of knowledge.

Economic appraisal of composite carp culture technology is important to assess the profitability. It will enable the extension functionaries to encourage and attract more fish farmers and rural youth for adoption of technology. A comparison study of input use and net profit was carried out between adopters and non-adopters. Cost of composite carp culture includes both operational as well as fixed cost. Here the operational cost includes the fish seed cost, cost of labour, maintenance, manures and fertilizers, lime, supplementary feed. Fixed cost includes the lease value of ponds and interest on fixed capital. The costs, returns and profit in composite carp culture were computed on per hectare basis and presented in Table 1.

It emerges from comparative economics presented in Table 1 that average area, lease value of pond and seed cost were almost equal both for adopters and non-adopters. A difference of Rs.1415.61 was observed in application of inorganic fertilizer between the adopters and non-adopters. Maximum difference *i.e.,* Rs 22,836.41 was observed in feed cost between the two categories of farmers. In the case of adopters, the cost of production per ha.was Rs

Table 1. Economics of composite carp culture for 1 ha of pond area

Particulars		Non-Adopters	Adopters
No. of respondents		48	23
Total Area (ha)		21.44	9.92
Avg. area (ha)		0.45	0.43
Lease (Rs)		26865.67	27520.16
Pond prep (Rs)		23087.69	28629.03
Seed cost (Rs)		18045.71	18528.23
Lime (Rs)		8815.30	10655.24
Inorganic fertilizers	DAP (Rs)	4976.87	5771.98
	Urea (Rs)	1355.15	1975.65
Organic manure	Cow dung (Rs)	7509.33	9822.18
	Pelleted feed (Rs)	28031.72	40927.42
Feed	Rice bran + oil cake (Rs)	31203.36	41129.03
	Others (Rs)	1749.07	1764.11
Cost of Harvesting* (Rs)		Nil	Nil
Cost of Labour, maintenance & misc. (Rs)		17933.77	22620.97
Total variable cost (Rs)		142707.95	181723.03
Cost of production (Rs)		169573.62	209243.19
Total production (Kg/ha)		1679.01	2583.17
Total revenue (Rs)		235061.57	361643.15
Gross Margin (Rs)		92353.62	179920.12
Net Margin (Rs)		65487.95	152399.96
Rate of return on total investment (ROI)		38.62%	72.83%
B:C ratio		1.39	1.73

*Retailer or his agents usually do the harvesting employing his men and net. This is why producer farmer does not incur any expenditure for harvesting.

169573.62 whereas in the case of non-adopters it was Rs 209243.19 indicating a difference of around Rs 39,669.57. The adopters are getting an average production of 2.5 t/ha/y. against 1.6 t/ha/y. that of non-adopters. The net margin of the adopters from 1 ha. of pond was around 2.3 times higher than that of non-adopters. The ROI for adopters and non-adopters were found 72.83% and 38.62% respectively. The B: C ratio was worked out and found 1.73 and 1.39 for adopters and non-adopters respectively. It indicates that the farmers adopting most of the recommended practices are getting more than twice the returns of non-adopters. Hussain et al. (2013) in their study observed that production of fishes and profitability is more than double in CFC (composite fish culture) over the local practice which is because of adoption of good management practices.

The share of various inputs in the variable cost was estimated and is given in Fig. 1. It is observed that feed (37%) constituted the maximum share towards the cost of production of fish.

The marketing channel prevalent for fish marketing in study area include the following *i.e.,*

Producer ⟶ Retailer ⟶ Consumer

The farmers sell the fish on the pond dyke directly to the retailer and the price of fish at the farm gate level is Rs 140 kg^{-1}. The retailers sell the fish in the

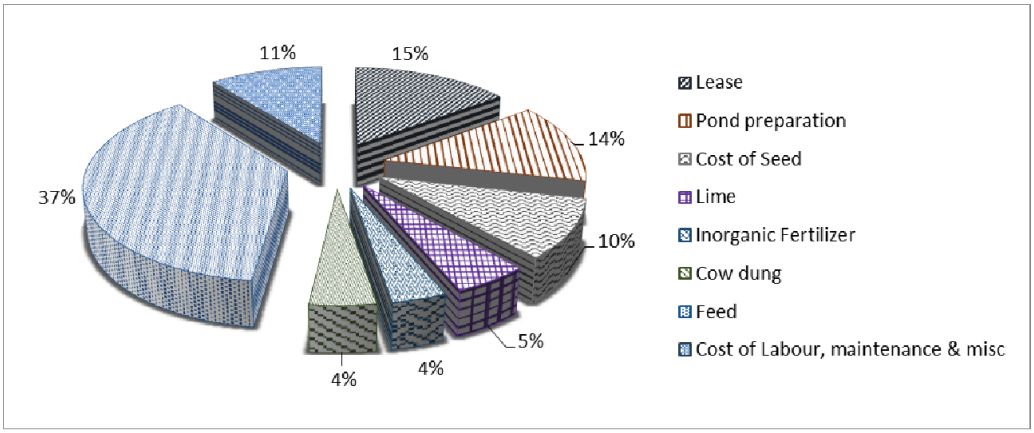

Fig. 1. Percentage share in cost of production

Table 2. Frequency distribution of respondents according to constraints identified (n=71)

Sl. No	Constraints	Most Severe (F)	Severe (F)	Not Severe (F)	Total weighted score	Mean Score	Rank Order
1	Non-availability of bigger size fingerling	15	18	38	119	1.67	V
2	High cost of supplementary feeding	20	30	21	141	1.98	III
3	High lease value of ponds	5	21	45	102	1.43	VI
4	Lack of knowledge about scientific Fish farming	39	20	12	169	2.38	I
5	Lack of Training	35	19	17	154	2.16	II
6	Lack of financial support in terms of Loan	15	25	31	126	1.77	IV
7	Problems in fish marketing	0	11	34	56	0.78	VII

market at a price of Rs 200 kg^{-1} to the consumers thus, indicating a price spread of Rs 60 kg^{-1}. It may be noted that retailer adds value by means of dressing, fillet making and render it ready to cook for the consumers. The fish distribution channel thus keeps the difference of price paid by a consumer and the price realized by the fish farmer is reasonable (Phukan & Barman, 2013).

It is depicted in Table 2 that lack of knowledge about scientific fish farming was the major constraint encountered by the fish farmers. The farmers are not fully aware about all the practices of the recommended technology as a consequence their adoption level is low. The second most severe constraint was lack of training with a mean score of 2.16. Other constraints include high cost of supplementary feed followed by lack of financial support in terms of loan, non-availability of bigger size fingerling and high lease value of ponds. The farmers encountered the least problems in marketing of fish. As the demand for fish remained higher than the supply And the fish were marketed immediately after harvesting and consumed locally. Pandey & Dewan (2006); Nisar et al. (2017); Chidambaram et al. (2016) found that lack of institutional support, seed related problems, high cost of inputs, unfavourable price of fish, involvement of middlemen, lack of infrastructure facilities, inactive cooperative societies and pond related problems were some of the important problems farmers were facing. Goswami et al. (2013) in their study mentioned that lack of technical know-how, plurality of ownership, and lack of credit were rated as the most important constraints affecting growth of fish farming practices in Gondia district of Maharashtra. Feed, lack of financial support, poor retention of water in ponds, disease outbreak, high lease value of ponds, period of lease, difficulty in eradicating weeds in ponds, infestation of aquatic weeds and high cost of net hiring charges

were the important constraints in freshwater aquaculture reported by Radheysham (2001); Sahoo et al. (2016); Bhuyan et al. (2017).

Composite carp culture is economically feasible with impressive benefit-cost ratio. There is a need to make it popular among the rural populace by way of removing the hindrances. It would lead to increase in fish production with efficient exploitation of existing production potential and better economic returns to the fish farmers. Adequate emphasis is also needed in areas beyond production especially in marketing, input supply, advisory service, cold chain etc. Organised marketing system can draw the attention of a higher number of fish farmers as well as rural youth towards composite carp culture.

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