Fishery Technology 57 (2020) : 206 - 212

Influence of Socioeconomic Factors on Adoption of Aquaculture Practices

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Abstract

The present study was conducted in West Champaran and East Champaran districts of Bihar with the objective to assess the socio-economic profile and the adoption level of scientific aquaculture practices among fish farmers. Improving aquaculture production by adopting scientific aquaculture practices into the existing farming system is essential for the food and nutritional security of the farmers and their income. The study also attempted to identify factors that influence the adoption of scientific aquaculture practices. Data from 144 fish farmers were analysed and it was found that the majority (70.1%) of the fish farmers were middle aged with 56% having high school to graduate level education which is an important factor influencing adoption of new technology. Results also indicate that sex, age, extension participation, land size, income and family size are the other factors that influence the adoption of scientific aquaculture practices.

Keywords: Fish farmer, socio-economics, adoption, scientific aquaculture practices

Introduction

Freshwater fish farming plays an important role in ensuring livelihoods of rural people in the state of Bihar. Fish farming is one of the technologies that were introduced elsewhere also to meet that end (Wetengere et al., 1998). Fish contains 17-20% protein on dry weight basis and is a good source of minerals, vitamins and polyunsaturated fat and is available at a cheaper rate than terrestrial animal meat (Hague, 1992). Fish farming is recognised as an important component of rural development strategy with the aim to improve the food and nutritional security and to enhance the income of poor rural households (Miller, 2009). Pond based fish farming has been proven to be a profitable business. Many paddy farmers in rural areas in Southern Asia have taken fish farming activity as their secondary occupation and it has been indicated that fish farming helped improve their socioeconomic condition (Pandey & Chaturvedi, 1994; Gurung et al., 2016). Consequently, central and state governments have been attempting to encourage the wider adoption of fish farming by introducing various programs in terms of input support and financial subsidies. East and West Champaran districts of Bihar are the two major districts where pond-based aquaculture has progressed rapidly with pond area of about 9153 hectares and 4003 hectares respectively. Kumar et al., 2018 reviewed the factors influencing the adoption of scientific/ technical knowledge by aquaculture farmers and categorised them into five broad areas such as method of information transfer, characteristics of technology, farm characteristics, economic factors, and sociodemographic and institutional factors. Earlier studies have indicated that adoption of good aquaculture practices help to enhance the fish farm profitability (Dickson et al., 2016). In this context, the present study was carried out to assess the influence of socioeconomic profile of fish farmers on the adoption level of scientific aquaculture practices in West Champaran and East Champaran districts of Bihar.

Materials and Methods

The study was undertaken in four blocks (Motihari, Chhauradano, Pakadi Dayal and Patahi) in East Champaran and four blocks (Bettiah, Nautan, Chanpatia and Bairiya) in West Champaran districts of Bihar. These districts were purposively selected as they have the vast inland fishery resources ideally suited for taking up scientific fish culture. A

Received 28 October 2014; Revised 24 May 2020; Accepted 13 July 2020

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combination of purposive and simple random sampling procedures was employed. A list of fish farmers was prepared in the selected block with the help of the Department of Fisheries (DoF). Eighteen numbers of fish farmers from each block were selected by using proportionate stratified random sampling technique. Thus, a total of 144 fish farmers were selected for the study. Based on a thorough review of relevant literature and discussion with the experts in the subjects, variables having some bearing on the socio-economic profile and adoption were identified for the study. FAO (1989) has reported that a number of aquaculture practices are used world-wide in three types of environment (freshwater, brackish water and marine) for a great variety of culture organisms. Out of these 28 practices were selected as per expert opinion and relevance to the locale of study.

In the present study adoption referred to the practice of some or all the recommended scientific aquaculture practices in fish farming by the respondents. Adoption behavior refers to the extent of adoption of scientific aquaculture practices in fish farming, by the fish farmers. The methodology followed by Singha (1995) was adopted in this study. An adoption score of 2, 1 and 0 was allotted for full adoption, partial adoption and non-adoption of recommended aquaculture practice. A farmer was considered to be fully adopting a practice when he/she has adopted the recommendations for that practice in totality, partial adoption refers to any deviation from the normal recommendation, and when the respondent did not adopt the recommendation, he/she was put in the "no adoption" category for that practice. Adoption index and extent of adoption for different scientific aquaculture practices were calculated as per the formulae given below

$$\text{Adoption index} = \frac{\text{Total score obtained by the respondent for each practice}}{\text{Maximum score that could be obtained}} \times 100$$

$$\text{Extent of adoption} = \frac{\text{No of respondents who had adopted the practice}}{\text{Total no of respondents}} \times 100$$

Accordingly, the total score for respondent was obtained by summing up the score obtained on each individual practice. The maximum score that one could get was 56 and minimum was 0. The respondents were categorized into three adoption categories, low (<Mean - SD), medium (Mean ± SD) and high (>Mean + SD). The data were collected with the help of structured and pre tested interview schedule developed for the purpose from the fish farmers through personal interview.

Results and Discussion

Various scientific aquaculture practices recommended for fish farming were categorised into three categories- pre-stocking management, stocking management and post-stocking management.

Table 1, provides a brief description about the adoption indices of fish farming practices in the study area. Many of the extension programs and government schemes are aimed to increase the level of adoption of scientific aquaculture practices among fish farmers. It was found that fish farmers had shown higher adoption for the practices such as discontinuation of feeding 24 h prior to harvesting (79.15%), ensuring selection of seed of proper size and weight for stocking (73.95%), filling of water to maintain a minimum water depth of 1 m (72.9%) and repair of bund prior to stocking (59.4%). Among the practices that were adopted by the fish farmers at medium level was, time of seed release (52.75%), feeding method (52.25%), application of feed (52.05%), maintenance of water quality parameters like pH and alkalinity (51.4%) and stocking of seeds at recommended density (50%). Majority of the farmers had stocked the ponds at a density higher than recommended and had little awareness about the use of feed and feeding methods. The adoption index was found to be very low for practices, like sludge removal (18.8%), maintaining hardness of water (19.5%), ploughing of the pond (20.8%), maintaining dissolved oxygen in water (22.9%), drying of pond (22.9%) and complete draining of the culture water after harvest (22.9%). Low adoption for management practices related to maintenance of water quality parameters may be attributed to lack of knowledge among farmers of use of field test kits and unavailability of labs for water quality testing in the study area. Study also indicates that farmers in the area were practising aquaculture mostly in the perennial ponds and hence practices like dewatering, ploughing, desilting and drying of the pond bottom had very low level of adoption.

The categorization of respondents was made on their level of adoption, namely, low, medium and high that was further based on mean and standard deviation as suggested by Talukdar & Solanki

Table 1. Adoption indices of fish farming practices (n=144)

Sl. No.	Scientific aquaculture practices (as per recommendation)	Adoption Index	Rank
1	Discontinuation of feeding 24 h prior to harvesting	79.15	I
2	Size and weight of seed	73.95	II
3	Water filling to maintain water level	72.9	III
4	Bund repairing	59.4	IV
5	Seed releasing time	52.75	V
6	Feeding method	52.25	VI
7	Application of artificial feed	52.05	VII
8	Maintenance of pH level and alkalinity of water	51.4	VIII
9	Stocking density and mode of harvesting	50	IX
10	Quality evaluation of seed	48.25	X
11	Fertilization	44.1	XI
12	Stabilizing plankton bloom	44.1	XII
13	Transparency of water	39.5	XIII
14	Acclimatization of seed	37.85	XIV
15	Application of drugs and probiotics	36.8	XV
16	Liming of the pond	31.6	XVI
17	Regular monitoring of fish health	30.25	XVII
18	Cleaning and packing of harvested fish	27.75	XVIII
19	Purchase of oxygen packed fish seed	27.4	XIX
20	Application of tranquilizer for seed transportation	26.05	XX
21	Complete draining of the culture water after harvesting, drying the pond bottom and maintaining dissolved oxygen	22.9	XXI
22	Ploughing after drying	20.8	XXII
23	Maintaining the hardness of pond water	19.5	XXIII
24	Removal of sludge after draining of pond	18.8	XXIV

(2005). Majority (70.83%) of the respondents had medium level of adoption followed by high (15.97%) and low (13.20%) level of adoption (Table 2). Therefore, efforts are still required to promote large scale adoption of scientific aquaculture practices as suggested by Goswami et al. (2010).

The fish farmers were grouped into different categories based on their chronological age. Majority (70.1%) of the fish farmers belonged to middle age revealing that fish farming as a profession demand a good deal of managerial experience with physical fitness. Young and middle-aged farmers are innovative, aggressive and energetic people who are more willing to adopt new technology than older farmers. Older farmers are conservative, risk-averse and unlikely to try new ideas (Wetengere, 2009). The findings of age group of fish farmers were supported by the findings of Sujathkumar (1988) and Gautam et al. (2007). While assessing the education level, it was found that a sizable number of fish farmers had primary education (29.9%) followed by higher secondary (22.2%), high school education (20.8%), and middle school (11.1%). Graduate fishers were observed to be 13.2%. An educated farmer is more likely to adopt new technology than an uneducated one (Meena et al., 2002). The results obtained corroborate with the findings of Yhome et al. (2011). About 64% of the farmers had nuclear family and 36.1% of farmers had joint family. Majority (84%) of the farmers had a family size of more than five members and 16%

of them had a family size of less than five members. The findings on family type are supported by the report of Ali et al. (2008) where the majority of the fish farmers (72%) had nuclear family.

As observed in Table 3, 46.5% of the fish farmers were members in co-operatives. They became members in order to avail the facilities given by government, like, acquiring leasing rights in the government water bodies. About 4.9% of them were also serving as the elected members of the Panchayat. However, 36.1% of them were not members in any of the organization. The findings on social participation are in accordance with the findings of Swathilekshmi et al. (2005) where the majority (56.67%) of the fish farmers had low levels of social participation.

It was found that the majority (74.3%) of the fish farmers occasionally contacted the Department of Fisheries (DoF) to seek information about various types of schemes, training programmes and information about fish farming. Majority (66.7%) of the fish farmers had never visited Krishi Vigyan Kendra (KVK), which is nearby followed by 33.3% contacting the KVK occasionally to know about new technology for fish farming. All fish farmers contacted the input suppliers occasionally for getting farm inputs and occasionally contacted the progressive farmers to know about fish culture practices and marketing. This finding is supported by the findings of Swathilekshmi et al (2005).

As presented in Table 4, 46.5% of the fish farmers had occasionally participated in training programmes. However, majority of them occasionally participated in exhibitions (88.2%), demonstrations (81.3%), field visits (72.2%), group meetings (56.9%) and KVK visits (13.9%) organized by the fisheries department.

All the fish farmers had their own houses. Majority (59.7%) of the fish farmers had semi-pucca house, whereas 37.5% had Pucca house and only 2.8% fish farmers were found to live in Kuchcha houses. Most of the fish farmers (57.6%) had own pumping-sets and 50.7% had owned cast nets. Only 19.4% and 16.7% fish farmers had own mahajal (large drag net) and a boat. Most of the fishermen community fish farmers, who were dependent on community ponds, had own cast-net, mahajal and boats, whereas, most of the farmers belonging to non-fishermen categories, mostly owned ponds and pump-set. Majority (55.6%) of the fish farmers had a motorcycle (bike), followed by a bicycle (29.2%), and four wheelers (15.3%).

Most of the fish farmers reported that labourers who were hired to do farm activities were unskilled and had poor labour productivity. It was difficult to get skilled labours and they managed their farming operations with unskilled labour. It was found that

Table 2. Distribution of fish farmers with respect to level of adoption of scientific aquaculture practices (n=144)

Sl. No.	Categories	Score index	Frequency	Percentage
1	Low adopter <(Mean-SD)	Up to 24	19	13.20
2	Medium adopter (Mean±SD)	25-58	102	70.83
3	High adopter >(Mean+SD)	59 and above	23	15.97

Mean=41.59 and standard deviation (SD) =17.27

Table 3. Social participation (n=144)

Organisation	Membership (%)	Importance of participation (%)		
		Indirectly important	Important	Very important
Co-op society	46.5	0	0	46.5
PACS	12.5	11.1	1.4	0
Gram Panchayat	4.9	4.9	0	0
No membership	36.1	-	-	-

Table 4. Extension participation (n=144)

Activities	Extent of participation per year (%)		
	Regularly	Occasionally	Never
Training	0	46.5	53.5
Demonstration	6.9	81.3	11.8
Field visit	2.1	72.2	25.7
Group meeting	0	56.9	43.1
Exhibition	4.2	88.2	7.6
KVK visit	0	13.9	86.1

(68.9%) of the fish farmers used their own money for fish farming. Others had taken credit from banks, money lenders, Kisan Credit Card (KCC), relatives and friends.

Majority (74.3%) of the fish farmers had to sell the produce at farm itself and 25.7% fish farmers sold in market place. Those who sold fish in market belonged to the fishermen caste.

The economic profile of the farmers is depicted in Table 5. It was found that, 44.4% of the fish farmer had marginal land holdings (up to 1 ha) followed by 26.66% with small land holdings (1 to 2 ha), and 16% and 8.3% were under medium (2 to 4 ha) and big (>4 ha) land holdings categories respectively. There is a need to organize and empower the small and marginal fish farmers to increase the farm holding size or to from clusters in order to promote sharing of resources and also to improve their capacity of negotiation for the prices of input material with the input suppliers. More than half of the respondents (56.3%) had their own ponds while 43.8% had ponds on lease obtained either through cooperative societies or private owners. Majority (34.03%) of the farmers had 5 to 10 years' of experience in fish farming followed by 28.47% of farmers who had more than 15 years' experience and 22.2% of farmers had 10 to 15 years' experience. Only 15.3% of farmers had less than 5 years' experience. Majority of farmers (43.8%) were able to generate an annual income of Rs. 5 to 10 lakh through fish sale followed by 32.6% who had income of more than Rs. 10 lakh, and only 34% of the fish farmers had income of Rs.1 to 5 lakhs. The high gross income as evident from the data may be attributed to the high sales price (sales price up to Rs. 160/kg) of carps realised by the farmers in the study area. Majority (53.5%) of the fish farmers had

Table 5. Economic profile of fish farmers (n=144)

Characteristics	Category	Percentage
Land holding (in ha)	Up to 1	44.4
	1 to 2	31.3
	2 to 3	12.5
	3 to 4	3.5
	> 4	8.3
Pond Ownership	Owned	56.3
	Leased	43.8
Pond number	1	53.5
	2	34.7
	3	8.3
	4	3.5
Pond area (in ha)	Up to 1	19.5
	1 to 2	77.1
	> 2	3.5
Farming experience	Up to 5	15.3
(in years)	5 to 10	34.03
	10 to 15	22.2
	> 15	28.47
Gross income/ha water	1 to 5 lakh	15.3
of bodies (in Rs.)	5 to 10 lakh	84.7
Gross income from	1 to 5 lakh	23.4
fish culture (in Rs.)	5 to 10 lakh	43.8
	> 10 lakh	32.6

fish farming as their secondary occupation and 46.5% had it as a primary occupation.

Results presented in Table 6 show the variable that had significant relationship with adoption level of fish farmers. The variable 'membership in a cooperative society' has shown a negative correlation with adoption (-0.174*). Fish farmers' cooperative societies are only for traditional fisher caste. The traditional fisher caste mostly culture fish in the government ponds leased out to them. The adoption level in the traditional community can be increased by developing compatible extension literatures and selecting more opinion leaders from this community in the form of Fish Farmers Friend and Field Schools to communicate the technology to them. Significant relationship existed between education and adoption (0.222**). From it is inferred that, the fish farmers with higher level of education might have inquired to update their knowledge in fish farming

Table 6. Correlation between profile characteristics of farmers and their adoption level

Sl. No.	Independent variables	'r'
1.	Gross income/ha of water body	0.902**
2.	Gross income from fisheries	0.578**
3.	Pumping-set	0.322**
4.	House area	0.275**
5.	Training centre (CIFE, Kakinada)	0.265**
6.	Pond number	0.248**
7.	Pond Area	0.232**
8.	Education	0.222**
9.	House Type	0.222**
10.	Conveyance	0.215**
11.	Stocking of spawn	0.210*
12.	Participation in extension activity	0.209*
13.	Land holdings	0.207*
14.	Mahajal	0.187*
15.	Farm get selling	0.187*
16.	Contractual labour	0.186*
17.	Caste	0.183*
18.	Coop society	-0.174*
19.	Stocking of fry	0.169*

**-Significant at 1% level, *- Significant at 5% level

and hence they would have adopted more number of scientific aquaculture practices. Physical capital like house type, house area, land area, mahajal, pond number and area, conveyance and pumping-set are also positively correlated with adoption level of scientific aquaculture practices. The extensive participation, training (CIFE, Kakinada) and KVK visit showed a positive relationship with adoption. More participation in extension programmes like training, field visits and demonstration will help the farmers to get more exposure to fish farming technologies and these extension programs are used by these fish farmers in a positive way. Some other variables like, contractual labour, stocking of fry, stocking of spawn and farm gate selling also show the positive relationship with adoption level. The gross income (0.902**) was strongly correlated with adoption level of cultural practices and this might be due to the fact that if the farmer's income was more, they might adopt the more scientific technology or they might try new innovations.

This study was taken up to identify factors which influence the adoption of scientific aquaculture practices in Bihar. The study shows that fish farming were more likely to be middle age and educated farmers.

Based on the findings of the study, it was concluded that adequate trainings and seminars should be arranged at regular interval to update fish farmers' knowledge on fish farming practices and procedures as well as to fill the gap created by poor contact with extension agents. Fish farmers should come together to form co-operative unions to facilitate their access to credit and other input. Government must provide access to credit by fish farmers in the study area by review of the stringent lending policies of the formal lending institutions. Necessary effort should be made to bring down the cost of feeds by exploring alternative sources offered for fish, through well-funded researches.

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