Research Article
ISSN 1011-3916
Volume 32, No. 1, 2020

BANGLADESH JOURNAL OF EXTENSION EDUCATION
Journal of the Bangladesh Agricultural Extension Society (BAES)

Adoption of Thai Koi by the Fish Farmers in a Selected Area of Mymensingh District

Sunjida Begum[1], M Asaduzzaman Sarker[2] and M Zannatun Nahar Mukta[3]

[1, 2 & 3]Department of Agricultural Extension Education, Bangladesh Agricultural University, Mymensingh

ABSTRACT

The study assessed the Thai Koi adoption rate by the fish farmers of two villages from Muktagacha upazila under Mymensingh district. The rate of adoption of Thai Koi was measured on the basis of percentage of the value of the pond area under Thai Koi culture by a fish farmer out of his total pond area. Based on the rate of adoption of Thai Koi, the fish farmers were classified into low, medium and high adoption categories. Pearson's product moment correlation coefficient was used to determine the relationship between the Thai Koi adoption rate and 13 selected characteristics of the farmers: age, education, household size, farm size, annual family income, distance of farm from growth centre, fish farming experience, knowledge on Thai Koi cultivation, availability of inputs, training exposure, credit received, extension media contact, and benefit cost ratio. Data were collected randomly from 75 Thai Koi farmers using a pre-tested structured interview schedule. Informal discussions and pre-test interviews with Thai Koi farmers contributed to identify 17 problems of Thai Koi cultivation for further analysis. The findings revealed that 54.5 percent of the Thai Koi farmers had medium rate of adoption, 28.3 percent had low and only 18.2 percent had higher rate of adoption. Correlation analysis revealed that economically associated variables such as farm size, annual family income, availability of inputs and credit received by the farmers had significant positive relationships with their rate of adoption of Thai Koi while distance of fish farm from growth centre had significant negative relationship with their rate of adoption of Thai Koi. Based on the problem facing score, majority of the farmers fell into the category of high to medium problems in Thai Koi culture while higher cost of production was ranked first among the 17 identified problems. The other top ranked problems were lack of capital, higher expenses for labour, feed, and drugs, and high sensitivity to diseases of Thai Koi. The study recommends appropriate intervention mechanism by relevant authorities that must include credit facilities and subsidized inputs to increase Thai Koi adoption rate by the fish farmers of the area investigated.

ARTICLE INFO

Article History

Received
30 July 2020

Received in revised form
9 September 2020

Accepted
18 September 2020

Available online
22 September 2020

KEYWORDS

Adoption, fish farmers, Thai Koi, problems

Corresponding author: M Asaduzzaman Sarker, Department of Agricultural Extension Education, Bangladesh Agricultural University, Mymensingh, **Email:** masarker@bau.edu.bd

Introduction

Over the past two decades, the world's aquaculture production has been dominated by Asia with an 89 percent of the total share of farmed aquatic production (FAO, 2020). Among Asian countries, Bangladesh has started to obtain global recognition as one of the biggest fish producers after China and India (FAO, 2018; The Daily Star, 19th July, 2018). In the economy of Bangladesh, rapid growing aquaculture sector contributes 3.57 percent to GDP and 25.30 percent to agricultural GDP (DoF, 2018). In the Fiscal Year 2017-18, the estimated total annual fish production was 42.77 lakh MT, of which a vast majority of the production (56.24%) was obtained from inland aquaculture (DoF, 2018). Bangladesh became self-sufficient in fish production for the first time in 2018, with a per capita fish consumption of 62.58 g/day against set target of 60 g/day (DoF, 2018). However, fulfilment of daily dietary requirement of animal protein for the growing population of Bangladesh will still be a challenge in future because fish alone supplements 60 percent of the per capita animal protein intake (Sarker *et al*., 2014). Keeping this in view, the government has projected a production target of 45.52 lakh MT fishes by 2021. To reach this target and sustain the promising growth in aquaculture production, it is important to increase the rate of adoption of high yielding, nutrient rich fish species by the fish farmers of Bangladesh. The present study undertook the case of Thai Koi (*Anabas testudineus*) adoption scenario from a selected area of Bangladesh.

The Thai Koi is an exotic fish species in Bangladesh which had been introduced in 2002 from Thailand after drastic reduction of popular native koi fish has recognized in the late 1980s (Ahmed *et al*., 2014). The Thai Koi opens up a new horizon in pond fish culture which was first introduced in Mymensingh region of the country (Sarker *et al*., 2014). The fish is getting popularity over time because of good taste and special nutritive qualities (Akter *et al.*, 2010; Ahmed *et al.*, 2017). The Thai Koi contains very high amount of physiologically available iron, copper, easily digestible fat, and many good essential amino acids (Saha, 1971 as quoted in Sarker *et al*., 2014). Therefore, the fish is considered as a valuable item of diet for sick and convalescent (BFRI, 2006). Now, the Thai koi became a commercially valuable fish in Bangladesh because of availability of fry and fingerling, higher growth rate and easy marketing (Kulsum, 2005). In response to growing demand of the fish, many hatcheries have been established across the country with a view of producing Thai Koi fry, especially in greater Mymensingh, Bogra and Gazipur (Mahmood *et al*., 2004). We assume that the higher adoption of Thai Koi culture and expansion of the fish could be a potential option to contribute to fulfill nutritional requirement and generate livelihood opportunities for the poor people of Bangladesh. But existing literature has little or no information about the existing adoption rate of the Thai fish culture. A study conducted by Ahmed *et al.* (2017) revealed that most of the fish farmers of selected area of Mymensingh district had highly favorable attitude towards Thai Koi farming. However, the actual rate of adoption of Thai koi by the fishers in this region remained unexplored.

It is also important to note that the intensive pond culture of Thai Koi is comparatively new to the fish farming community of Mymensingh and other regions of Bangladesh. Although the fish species showed impressive growth performance with an annual growth rate of 54 percent in 2011-12 (DoF, 2012), it showed wide fluctuations from one to another year. For instance, the fish showed 72 percent annual growth rate in 2008-9 and 132 percent in

2011-12 (without a consistent growth rate in between the year 2008 to 2012) (Sarker *et al*., 2014). This fluctuation in growth rate of the cultured fish may be due to a variety of technical reasons and socio-economic problems of the farmers which should be explored from fish farmers' local contexts where Thai Koi culture is common. However, only a few studies explored the problems of Thai Koi cultivation from a few fish farming villages of Mymensingh district (Ahmed *et al*., 2017; Sarker *et al.,* 2014) while some other studies were conducted to see the growth performance of Thai Koi fry with controlled pond management in the Bangladesh Agricultural University at Mymensingh (Hasan *et al.*, 2010; Ahmed *et al*., 2014). In this backdrop, we found it important to assess the rate of adoption of Thai Koi culture in some selected area of Mymensingh district and explore the farmers' problems in Thai Koi cultivation from the farmers' local contexts. Therefore, this study intends to shed light on following specific objectives:

- To describe fish farmers' socio-economic characteristics;
- To asses rate of adoption of Thai Koi by the fish farmers;
- To explore the relationship between fish farmers' selected characteristics and the rate of adoption of Thai Koi; and
- To identify and analyze fish farmers' problems associated with Thai Koi adoption.

Methodology

In Bangladesh, greater Mymensingh region has obtained significant advancement in commercial fish production (Monir *et al*., 2011). This study was conducted in Muktagacha upazila of Mymensingh district which is one of the leading areas for the production and culture of indigenous and exotic fishes because of easy to adopt culture system, availability of fry, feed, good profit and high demand (Salam *et al.*, 2018). Two villages namely: Dhoro and Parolitola villages of Ghoga union under Muktagacha upazila were purposively selected as study area because Thai Koi culture is a common practice in these villages but the adoption rate and farmers' problems were not studied before.

At the onset of the study, a list of total 400 fish farmers of the two study villages were collected from the Upazila Fisheries Office. Among the 400 fish farmers, 120 fish farmers were engaged in Thai Koi culture that constituted the population of the study. Afterwards, 75 Thai Koi farmers were selected randomly as the sample of the study (around 63 percent of the population). An interview schedule was prepared and pre-tested with 10 farmers of the study area to correct, improve, and finalize a structured interview schedule before final data collection. During pre-test, informal discussion was done with the fish farmers to know and list their problems of Thai Koi adoption. Thus, 17 problems were identified and listed in the final interview schedule to know the extent of each problem from the original respondents. Thus, primary data were collected through informal discussion and personal interviewing from the Thai Koi farmers during 1st April to 20th April, 2017. Secondary data were also collected from Upazila Fisheries Officers and relevant office documents.

The dependent variable of the study was 'rate of adoption of Thai Koi culture' by the fish farmers of the study villages. The adoption rate was measured by the following formula which was given by Kashem (2004). Similar formula was used by Sakib and Afrad (2014) to assess rate of fisheries technology adoption in Bangladesh.

$$\text{Rate of adoption} = \frac{\text{Pond area under Thai Koi}}{\text{Total pond area}} \times 100$$

As the study aimed to explore the relationship between adoption rate of Thai Koi and fish farmers' socio-economic characteristics, 13 special characteristics of the fish farmers were selected as explanatory (independent) variables of the study those are: age; education; household size; farm size; annual family income; distance of farm from growth center; fish farming experience; knowledge on Thai Koi culture; availability of input; training exposure; credit received; extension media contact; and benefit cost ratio. The age of respondent was measured in terms of actual years from the respondent's birth to the time of interview. A score of one (1) was assigned for each year of respondent's age. The education of a respondent was measured in terms of year of schooling he had completed from a formal educational institute. A score of one (1) was assigned for passing each schooling year. The household size of a respondent was measured in terms of actual number of members in the respondent's family who jointly live and eat together. Farm size of a respondent was measured in terms of hectares which included all types of land of the respondents such as, household; own land under own cultivation; land taken as lease from others; land taken as borga from others; and total pond area. Annual family income of a respondent was measured on the basis of the respondent's total yearly earning from agriculture (including crop, livestock, fish culture etc.) and other off-farm sources. It was measured in thousand '000' TK. Distance of farm from growth center was measured in kilometers. Fish farming experience of the farmers was calculated in complete years. The respondents were asked to answer 17 open questions on Thai Koi culture to measure their 'Knowledge on Thai Koi cultivation'. The questions were prepared in consultation with the Upazila Fisheries Officer and the researcher which were further refined after pre-test interviews. A total of 48 marks were assigned to score the respondents' knowledge while they obtained full marks for correct answer and zero (0) for a wrong answer. Thus, the total knowledge score of a respondent could range from 0-48, indicating no knowledge to highest level of knowledge. Availability of inputs was measured on the basis of respondent's purchasing ability of fingerlings, feeds, drugs, fertilizer and facilities of water supply, pond area and capital. The input availability of each respondent was scored. Training exposure was measured in total days of training received by the respondent from different organizations. Credit received by a respondent was measured in terms of amount of money (thousand '000' TK) received as loan from different sources. Extension media contact was measured on the basis of respondent's extent of visit to 11 selected media using four point rating scale: frequently, occasionally, rarely and not at all. Benefit-cost ratio was calculated using the formula, B= TC-TV (A×B) Where, B = Benefit; TC = Total cost; TV = Total value; A = Production/hectare (ton); and B = Price of product/ton (taka).

The extent of 17 problems of Thai Koi farmers were measured using a four point rating scale such as high, medium, low and not at all and weights were assigned to these responses as 3, 2, 1 and 0, respectively. Thus, the total problem facing score of one respondent could range from 0 to 51, where 0 indicates no problem and 51 indicates severe problems regarding Thai Koi adoption. Based on the observed score, the respondents were grouped into 3 categories: high, medium, and low problem in Thai Koi culture. Problem Facing Score (PFS) (Pandit and Basak, 2013, Rahman, 2014) of each problem was calculated to make rank order of the 17 problems. The following formula was used to calculate the PFS. Similar formula was used by Ahmed *et al.* (2017) to explore fish farmers' problem.

$$PFS = (Ph \times 3) + (Pm \times 2) + (Pl \times 1) + (Pn \times 0)$$

Here,

Ph = Number of farmers with high problems

Pm = Number of farmers with medium problems

Pl = Number of farmers with low problems

Pn = Number of farmers with no problem

Data were systematically gathered in master sheet, then compiled, tabulated and analyzed in accordance with the objectives of the study. The analysis of the data was performed using SPSS (Statistical Package for Social Science) computer programme. Descriptive statistics like range, mean, percentage distribution and standard deviation were used to describe the concerned variables. Pearson's Product Moment Correlation coefficient (r) (Pearson, 1895) was used for testing the relationship between the fish farmers' characteristics and their rate of adoption of Thai Koi.

Results & Discussion

Socio-economic characteristics of the Thai Koi farmers

This section documented the findings on fish-farmers' socio-economic characteristics in Table 1. The result indicated that around half (47.9 percent) of the respondents were middle aged compared to 38.7 percent young and 13.4 percent old farmers. Young and middle aged respondents are generally more inclined to know and practice new ideas and take risk of adopting new technologies. Almost similar findings were found by Rahman (2014) and Hossain (2013) in their study.

Table 1 Socio-economic characteristics of the fish farmers (N=75)

Characteristics (Measuring unit)	Observed range	Respondents		Mean	SD*
		Categories	Percentage		
Age (years)	22 –59	Young (18- 35)	38.7	40.96	9.99
		Middle aged (36-55)	47.9		
		Old (>55)	13.4		
Education (Year of schooling)	0–12	Illiterate (0)	1.0	6.59	3.16
		Primary (1-5)	44.4		
		Secondary (6-10)	42.6		
		Above secondary (>10)	12.0		
Household size (Number of members)	4–12	Small (up to 4)	12.0	7.13	2.11
		Medium (5-6)	58.7		
		Large (>6)	29.3		
Farm size (Hectares)	0.39-3.78	Marginal (0.02-0.20)	0.0	1.44	0.86
		Small (0.20-0.99)	40.7		
		Medium (1.00-3.00)	48.9		
		Large (>3.00)	10.4		
Annual family income (‘000’ TK)	90–2240	Low (up to 100)	19.5	137.28	107.92
		Medium (100.1-300)	57.8		
		High (>300)	22.7		
Distance of farm from growth centre (Kilometers)	0.5-2.5	Short (up to 1.00)	30.7	1.64	0.67
		Medium (1.01-2.00)	46.6		
		Long (>2.00)	22.7		
Fish Farming experience (Years)	4–21	Low (up to 7)	6.7	12.76	3.55
		Medium (8-14)	24.0		
		High (>14)	69.3		
Knowledge on Thai Koi cultivation (Score)	10-43	Low (up to 18)	14.6	29.07	9.24
		Medium (19-36)	58.6		
		High (>36)	26.7		
Availability of input (Score)	5-18	Low (up to 6)	2.7	12.63	2.8
		Medium (7-12)	52.0		
		High (>12)	45.3		
Training exposure (Number of days)	1-21	Short duration (1-7)	46.8	34.95	40.14
		Medium duration (8-15)	10.6		
		Long duration (>15)	42.6		
Credit received (‘000’ TK)	0–500	No credit (0)	21.3	119.67	132.77
		Low (up to 100)	46.9		
		Medium (101-250)	14.6		
		High (>250)	17.2		
Extension media contact	8-29	Low (up to 11)	20.0	18.55	6.17
		Medium (12-22)	52.0		

(Score)		High (>22)	28.0		
Benefit cost ratio (‘000’ TK)	71-1290	Low (up to 100)	32.2	86.25	7.71
		Medium (100.1-300)	49.6		
		High (>300)	18.2		

SD*= Standard Deviation

Findings revealed that a great majority of the respondents had primary to secondary level education (87 percent) while only 1 percent of the respondents were illiterate. Majority of the respondents (58.7 percent) had medium sized family and 29.3 percent had large family. Similar result was found by Ahmed (2013) in his study. Findings in Table 1 revealed that the majority of the fish farmers had small to medium sized farm. Dhar (2015) found that 72% of the fish farmers had medium farm size that is similar to the present study. However, we did not find any marginal fish farmer as a respondent of the present study. It implies that the poor marginal farmers have fewer resources to start Thai Koi culture. The highest proportion of the respondents had medium to high annual family income while only around one-fifth (19.5 percent) of the farmers managed to engage in Thai koi farming with low family income. Results revealed that the majority of the fish farmers’ farm was located at a short to medium distance from the growth centre. The respondents’ fish farming experience ranged from 4 to 21 years while the highest proportion (69.3 percent) of the farmers had high farming experience (more than 14 years). Table 1 indicated that a great majority of the farmers had medium to high knowledge (85.3 percent) on Thai Koi culture based on their knowledge score. Findings indicated that only 2.7 percent of the fish farmers had low input capacity while all other Thai Koi farmers had medium to high input capacity based on their input availability score. Findings revealed that nearly half (46.8 percent) of the fish farmers obtained short duration training while a significant percentage (42.6 percent) of them received long duration training. Nearly half of the respondents (46.9 percent) received low credit while 21.3 percent of them did not receive any credit. However, rest of the farmers (31.8 percent) received medium to high credit for fish farming. The highest proportions (52 percent) of the farmers had medium extension contact, 28 percent had high and 20 percent had low extension contact. The highest proportions (49.6percent) of the farmers fell into the category of medium benefit cost ratio, 32.2 percent had low and only 18.2 percent had high benefit cost ratio.

Rate of adoption of Thai Koi by the fish farmers

Findings revealed that the rate of adoption of Thai Koi fish was ranged from 11.43 to 69.70 against a possible range of 0-100. Based on the observed range of Thai Koi adoption rate, the fish farmers were distributed into low, medium and high adoption rate categories (Table 2).

Table 2 Distribution of the Thai koi farmers according to their rate of adoption of Thai Koi

Observed range rate of adoption of Thai Koi	Categories	Respondents (N=75)		Mean	Standard Deviation
		Number	Percentage		
11.43-69.70	Low (up to 33)	21	28.3	39.48	15.66
	Medium (34-66)	40	54.5		
	High (>66)	14	18.2		

The highest proportions (54.5 percent) of the fish farmers had medium rate of adoption while 28.3 percent had low rate of adoption. The findings indicated that the majority of the fish farmers (82.8 percent) had medium to low adoption of Thai Koi. This means that although the respondents cultivate Thai koi species, their actual pond area under Thai Koi culture remained considerably lower than their total pond area under fish cultivation. Thus, majority of them had medium to low adoption of Thai Koi cultivation. However, only 18.2 percent of the respondents had high rate of Thai Koi adoption in the study villages. A study conducted by Sakib and Afrad (2014) found low adoption rate of pond culture of Thai koi in selected area of Bogra district of Bangladesh which have similarity with the findings of the present research.

It seems important to make note that a study on attitude towards Thai Koi farming was conducted in Shaiod and Ahmedpur villages in Muktagachha Upazila of Mamensingh district during 2015. The study (Ahmed *et al.*, 2017) found highly favorable attitude towards Thai koi farming by majority of the respondents. However, the present study was conducted in 2017 in the same upazila but two different villages which found a medium to low adoption rate of Thai Koi by majority of the respondents. There is no direct link between the two studies conducted in different time and contexts, but it could be said that highly favorable attitude towards Thai Koi culture did not show any positive impact on actual adoption rate of Thai Koi by neighboring fish farmers of same upazila.

Relationship between rate of adoption of Thai Koi and selected characteristics of the fish farmers

In this section, Pearson's product moment correlation co-efficient 'r' value is used to determine the strength of relationships between the selected characteristics of the fish farmers and their rate of adoption of Thai Koi (Table 3). Results revealed that out of 13 independent variables, only 5 variables had significant relationship with the adoption rate of Thai Koi. The farm size; annual family income; availability of inputs; and 'credits received' by the farmers are important variables which showed significant positive relationship with the Thai Koi adoption rate. This result implies that farmers who have large fish farm are more enthusiastic to adopt Thai Koi than the farmers who have small fish farm. Several other studies found that farm size have significant positive relationship with the rate of adoption of various technologies in the field of agriculture (Das, 2013; Rahman, 2014; Uddin, 2010). The findings also suggest that the Thai Koi adoption rate increases with the increase of farmers' 'annual family income' and 'input availability'. Based on the findings, it can be said that the

economically solvent farmers can afford to buy necessary inputs to start practicing a new technology and such farmers are capable of taking risk of adopting a new technology like Thai koi farming. Other studies conducted in Bangladesh showed similar findings where annual family income showed positive and significant relationship with the technology adoption rate of farmers (Hossain, 2004; Rahman, 2014). The positive significant relationship between 'credit received' and Thai Koi adoption rate suggests that when farmers receive credit support or facilities, their Thai Koi adoption also increases. Similar findings were found in other studies by Haque (2002) and Mondal (2009) which were conducted on the farmers' adoption behaviour on Hybrid rice and homestead agricultural practices.

Table 3 Co-efficient of correlation of the selected characteristics of the fish farmers and their rate of adoption of Thai Koi (N=75)

Focus variable	Characteristics of fish farmers (Independent variables)	Correlation co-efficient (r) value with 73 degrees of freedom
Rate of adoption of Thai Koi	Age	.121
	Education	.157
	Household size	.217
	Farm size	.507**
	Annual family income	.341**
	Distance of farm from growth centre	-.401**
	Fish farming experience	-.111
	Knowledge on Thai Koi cultivation	-.051
	Availability of inputs	.240*
	Training exposure	-.035
	Credit received	.520**
	Extension media contact	.135
	Benefit cost ratio	.165

*=Correlation is significant at the 0.05 level of probability (2-tailed)

**= Correlation is significant at the 0.01 level of probability (2-tailed)

Results in Table 3 also showed that 'distance of fish farm from the growth centre' had a significant negative relationship with the Thai Koi adoption rate. This finding may be explained in such a way that the higher the distance between fish farm and growth center, there will be lower adoption rate of Thai Koi cultivation by the farmers. We found it technologically important variable which suggest that the fish farm and the growth center should be closer to enhance farmer motivation towards Thai Koi adoption. Respondents' age, education, household size, extension media contact and benefit cost ratio also showed positive but insignificant relationship with farmers' Thai Koi adoption rate. However, fish farmers' knowledge, training exposure and farming experience showed a little bit negative trend but these did not show significant relationship with farmers' Thai Koi adoption rate. The overall expression of the findings indicated that, some farmers might have knowledge, training and experience in Thai koi farming but their Thai Koi adoption rate might remain lower or medium due to having less annual family income, small farm size, poor input availability and lack of credit support. Thus, the correlation co-efficient analysis showed

clear evidence that the fish farmers' financial situation plays a vital role in Thai Koi adoption decision than the other social and personal characteristics of them. Similar result was found in another study by Hasan *et al*. (2010) which highlighted the limitation of resource poor farmers in adopting Thai koi in larger extent due to higher expense in feed management.

Problems of Thai Koi farmers

Findings revealed that the Thai koi farmers' score on 17 identified problems ranged from 11 to 46 against a possible range of 0-51. Based on the observed score range, the Thai Koi farmers were distributed into three categories such as low, medium and high problems (Table 4).

Table 4 Distribution of the farmers according to their scores on problems in Thai koi culture

Range		Fish Farmers (N=75)			Mean	Standard Deviation
Possible	Observed	Categories	No.	%		
0-51	11-46	Low problem (up to 17)	5	6.6	28.91	8.79
		Medium problem (18-34)	31	41.4		
		High problem (>34)	39	52		

The findings indicated that a vast majority of the Thai Koi farmers (93.4 percent) had high to medium problems in Thai Koi cultivation and rest of the farmers had low problem in Thai Koi cultivation. Therefore, we esteemed it important to provide a ranked order of each of the 17 problems which are shown in Table 5. Findings showed that higher production cost was the top ranked problem followed by other 5 major problems: lack of capital, higher expenses for labour, feed, and drugs, and higher sensitivity to diseases. Majority of the top ranked problems are also associated with expenses and affordability of the farmers which are congruent with the correlation co-efficient analysis result of the present study.

Similar finding was reported in the study conducted by Ahmed *et al*. (2017) where higher sensitivity to diseases, higher price of feed, drugs and labour were ranked at higher position in selected villages of Muktagacha upazila. The study conducted by Sakib and Afrad (2014) and Sarker *et al.* (2006) also found that cost of production was a major problem in Thai koi adoption by the farmers of selected areas in Bogra district. The studies by Mahamud *et al.* (2018) and Ahmed *et al.* (2017) noted that the sensitivity of Thai Koi to different diseases, particularly at juvenile stage, is a big problem in the culture of the fish. 'Higher sensitivity to diseases' was also identified as a big problem in the area of investigation of the present research (ranked as 6th problem out of 17 in the Table 5). Findings also revealed that the farmers have some technological problems regarding pond management, lack of knowledge and quality fish fry availability in the study area (ranked from 7 to 13 in Table 5). However, the physical facilities, marketing, security concerns and socio-political pressure were minor problems in the study area (ranked from 14 to 17 in the Table 5).

Table 5 Ranked order of the problems faced by the farmers in adopting Thai Koi (N=75)

Problems of Thai Koi farmers	Extent of problems in Thai Koi culture				Problem Facing Score (PFS)	Rank Order
	High problem (3)*	Moderate problem (2)*	Slight problem (1)*	No problem (0)*		
Lack of capital	45	20	7	3	182	2
Unavailability of quality of Thai Koi seeds	17	11	22	25	95	7
Higher price of Thai Koi feed	43	17	8	7	171	4
Lack of knowledge about Thai Koi culture	22	10	20	23	106	9
High sensitivity to disease of Thai Koi	35	12	13	15	142	6
Cost of labour	41	18	11	5	170	3
High price of drugs	37	12	15	11	150	5
Lack of water exchange facilities	7	10	15	43	56	13
Nitrogen gases present on the pond bottom	28	10	18	19	122	8
Algal blooms on the pond	15	8	14	38	75	12
Higher production cost	55	13	7	0	198	1
Lack of marketing facilities	9	9	6	51	51	15
Less security of fish pond	0	12	16	47	40	16
Social or political pressure	0	5	15	55	25	17
Lack of oxygen concentration	25	6	9	35	96	10
Lack of good roads and transportation facilities	10	8	8	49	54	14
Turbidity occurs on fish pond	17	7	23	28	88	11

PFS = Problem Facing Score

*=Figures in the parentheses indicate weightage of scale item.

Conclusion

Advancement in aquaculture is already evident in Muktagacha upazila of Mymensingh district but Thai Koi adoption rate was yet to satisfactory. This study revealed that majority of the fish farmers had medium to low rate of Thai Koi adoption which indicates a further scope of increasing its adoption in Muktagacha upazila. The present study revealed a number

of problems in Thai Koi cultivation which mainly includes higher expenses and lack of capital along with some technological problems in pond management. This study specifically identified that most of the economically associated problems and variables play big roles in Thai Koi adoption decision by the farmers than their age, education, knowledge, training, and experience. Hence, Department of Fisheries (DoF) and other extension service providing organizations should design specific intervention mechanism which must include credit support and subsidized inputs for the young and educated fish farmers so that they can start Thai Koi cultivation in their small fish farm. The DoF and BFRI should jointly focus on improved Thai Koi cultivation oriented technology development to engage resource poor fish farmers. In addition, training facilities and regular visits by the local level fisheries extension workers should be strengthened to provide technological knowledge to the fish farmers to address pond management related problems.

References

Ahmed, F., M.Z. Rahman, S. Sheheli and D.S. Dev. 2017. Attitude of Farmers towards Thai Koi Farming in Selected Upazila of Bangladesh. *Turkish Journal of Agriculture-Food Science and Technology*, 5(2): 113-117.

Ahmed, G.U., S.R. Upala, M.T. Hasan and N.A. Hasan. 2014. Comparative study on growth performance between Vietnam koi and Thai koi in mini ponds. *Journal of Bangladesh Agricultural University*, 12(2): 405–409.

Ahmed, F. 2013. Attitude of Farmers Towards Thai Koi Farming. *MS Thesis.* Department of Agricultural Extension Education, Bangladesh Agricultural University, Mymensingh.

Akter, N. 2010. An Economic Analysis of Pond Pangas Fish Production in a Selected Area of Trishal Upazilla in Mymensingh district. *MS Thesis*. Department of Agriculture Economics BAU, Mymensingh.

BFRI. 2006. *Research on Benchmark Survey of Aquaculture Practices; Potentials and Constraints in Bangladesh*. Fisheries Research Institute, Mymensingh, Bangladesh.

Das, A.K. 2013. Adoption of Conservation Agriculture Practices in Bangladesh. *MS Thesis.* Department of Agricultural Extension Education, Bangladesh Agricultural University, Mymensingh.

Dhar, M.C.S. 2015. Use of Aquaculture Practices by the Fish Farmers in Selected Areas of Melandah Upazila. *MS Thesis.* Department of Agricultural Extension Education, Bangladesh Agricultural University, Mymensingh.

DoF. 2018. Fisheries Statistical Year Book of Bangladesh, 2017-18. Department of Fisheries, Ministry of Fisheries and Livestock, Government of the People's Republic of Bangladesh, Dhaka.

DoF. 2012. Fisheries Statistical Year Book of Bangladesh. Department of Fisheries, Ministry of Fisheries and Livestock, Government of the People's Republic of Bangladesh, Dhaka.

FAO. 2020. *The State of World Fisheries and Aquaculture*. Food and Agriculture Organization of the United Nations. Retrieved at: http://www.fao.org/state-of-fisheries-aquaculture

FAO. 2018. *The State of World Fisheries and Aquaculture: Meeting the Sustainable Development Goals.* Food and Agriculture Organization of the United Nations. Retrieved at: http://www.fao.org/3/i9540en/i9540en.pdf

Hasan, M., A.K.S. Ahammad and M.M.R. Khan. 2010. A Preliminary Investigation into the Production of Thai Koi (Anabas testudineus) Rared in Nylon Hapas in Bangladesh. *Bangladesh Research Publications Journal*, 4(1):15-23.

Haque, M.M. 2003. Farmers' Adoption of Modern Maize Cultivation Technologies. *MS Thesis.* Department of Agricultural Extension Education, Bangladesh Agricultural University, Mymensingh.

Hossain, M.A. 2004. Adoption of Selected Modern Boro Rice Cultivation Technologies by the Farmers of Homna Upazila in Comilla District. *MS Thesis.* Department of Agricultural Extension Education, Bangladesh Agricultural University, Mymensingh.

Hossain, M.I. 2013. Problems Faced by the Fish Farmers in Practicing Aquaculture Management. *MS Thesis.* Department of Agricultural Extension Education, Bangladesh Agricultural University, Mymensingh.

Kulsum, U. 2005. Culture Status and Disease Investigation of Thai Koi (Anabus testudineus) in Some Selected Upazillas of Mymensingh District. *MS Thesis.* Department of Aquaculture, Bangladesh Agricultural University, Mymensingh.

Mahamud, M.A.A., M.S. Kamruzzaman, M.A. Hossen, H. Islam and G.U. Ahmed. 2018. Diseases of Cultured Thai Koi in Mymensingh region. International Journal of Applied Research Journal, 4: 62-68.

Mahmood, S.U., M.S. Ali and M. Anwar-ul-Haque. 2004. Effect of Different Feed on Larval / Fry Rearing of Climbing Perch, Anabas testudineus (Bloch), in Bangladesh: II. Growth and Survival. *Pakistan Journal of Zoology*, 36 (1): 13-19.

Mondal, S. 2009. Adoption Behaviour of Farmers Regarding Hybrid Rice Cultivation in Mymensingh District. *MS Thesis.* Department of Agricultural Extension Education, Bangladesh Agricultural University, Mymensingh.

Monir, M.S., M. Haque and S. Rahman. 2011. Study on technical aspects of Pangusius (Pangasianodon hypophthalmus) farming in Mymensingh region. International *Journal of Sustainable Crop Production*, 6(1): 36-42.

Pandit, J. C. and N.C. Basak. 2013. Constraints Faced by the Farmers in Commercial Cultivation of Vegetables. *Journal of Bangladesh Agricultural University*, 11(2): 193–198.

Pearson, K. 1895. Notes on Regression and Inheritance in the Case of Two Parents. Proceedings of the Royal Society of London, 58, 240-242.

Rahman, M.B. 2014. Adoption of Modern Sesame Production Technologies in Some Selected Areas. *MS Thesis.* Department of Agricultural Extension Education, Bangladesh Agricultural University, Mymensingh.

Rahman, W. 2014. Problems Faced by the Fish Farmer's in Pangus Culture. *MS Thesis.* Department of Agricultural Extension Education, Bangladesh Agricultural University, Mymensingh, Bangladesh.

Saha, K.C. 1971. *Fisheries of West Bengal*. West Bengal Government Press, Alipore, West Bengal, India.

Sarker, M.A., A.H. Chowdhury and Y. Itohara. 2006.F Entrepreneurships Barriers of Pond Fish Culture in Bangladesh-A Case Study from Mymensingh District. *Journal of Social Sciences*, 2(3): 68-73.

Sarker, M.A.A, F.M. Arshad, M.F. Alam, Z.A. Mohamed and M.A. Khan. 2014. Economics of Thai Koi (Climbing Perch, Anabas Testudineus) Farming in Pond in Bangladesh. *Trends in Agricultural Economics*, 7(1): 26-40.

Sakib, M.H. and M.S.I. Afrad. 2014. Adoption of Modern Aquaculture Technologies by the Fish Farmers in Bogra District of Bangladesh. *International Journal of Agriculture Innovations and Research,* 3(2): 2319-1473.

Salam, S., K.M.S. Rana and M.A. Salam. 2018. Comparative performances of exotic and indigenous fish species with commercial culture systems of Mymensingh district in Bangladesh. *Progressive Agriculture*, 29 (4): 371-379.

The Daily Star, 19 July, 2018. Bangladesh now world's 3rd inland fish producerhttps://www.thedailystar.net/city/bangladesh-now-worlds-3rd-inland-fish-producer-1607770

Uddin, M.S. 2010. Adoption Technologies by the Farmers for Climate Change Adaptation. *MS Thesis.* Department of Agricultural Extension Education, Bangladesh Agricultural University, Mymensingh.