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DETERMINANTS OF TRAINING NEEDS OF THE TILAPIA (OREOCHROMIS SP.) FISH FARMERS: AN EMPIRICAL STUDY FROM A SELECTED AREA IN BANGLADESH

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ABSTRACT

Capacity building of fish farmers is inevitable for profitable fish farming. This research was undertaken primarily to identify the factors influencing the training requirements of tilapia fish farmers and to assess the level of training required for optimal farm management. Thus, the research was conducted in Phulpur Upazila (sub-district) under the Mymensingh district of Bangladesh. Face-to-face interviews were conducted with 100 randomly selected tilapia fish farmers using a pre-tested questionnaire. The training needs of tilapia fish farmers were measured using a four-point rating scale. The overwhelming majority (99%) of the respondents reported high training needs. Determination of mono-sex tilapia, a non-probiotic and probiotic fish production, and production techniques of mono-sex tilapia were identified as significant areas of training needs. Linear multiple regressions confirmed that level of education, experience in fish farming, training received, extension media contact and social mobility were the statistically significant determinants ($P<0.05$) of the training needs for the tilapia fish farmers. The high cost of fish feed, unavailability of extension service, and high fertilizer costs were identified as the major problems faced by the respondents. Respective authorities, especially the Department of Fisheries (DoF), should emphasize initiating capacity-building programs for the farmers, considering the identified training needs and problems. In addition, providing training, ensuring the availability of credits at low-interest rate, supply inputs for tilapia culture for improving tilapia fish farming could facilitate the farmers.

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INTRODUCTION

Globally, fish production has increased dramatically in the last 50 years (FAO, 2014). While the livelihoods of millions are dependent on fish farming; thus, it is recognized as a vital sector of the world economy (Ike and Roseline, 2007). In Asia, the fish trade accounts for roughly 60 percent of worldwide fish output. The region's coastal fisheries play a crucial role in providing food security and enhancing livelihoods, especially for economically disadvantaged population segments (Stobutzki *et al.*, 2006). Moreover, a vast number of populations (about 880 million) get their income on aquaculture (Allison *et al.*, 2013), whereas over 18 million (11% of the total population) Bangladeshis are involved in the fisheries industry (Shamsuzzaman *et al.*, 2017).

Bangladesh is endowed with the richest and most diversified inland aquatic environment in the world, with a vast range of aquatic living resources dispersed across the nation in the form of tiny ponds, beels, lakes,

canals, small and big rivers, and estuaries. However, the fish production rate is lower than that of the population boom. Nationwide, just 7.71 percent of ponds are utilized for business purposes, while the remainder is utilized for non-commercial purposes (Hossain and Das, 2013). To assure the intake of the necessary protein and minerals, increasing fish production is one of the most important initiatives in Bangladesh. To fulfil the demand of the increasing population, it is vital to practice fast-growing fish culture like Tilapia. The future of tilapia aquaculture looks very promising and will remain a lucrative business with good demand and stable prices (Mohamad et al., 2021). Thus, Tilapia culture is becoming popular all over the country, especially in the southwestern part (Saha, 2004).

Tilapia is one of the most important fish species and is produced extensively in Bangladesh to meet the increased need for protein. Initially, in 1970, UNICEF imported *Oriocromis niloticus* from Thailand. The Bangladesh Fisheries Research Institute (BFRI) acquired *Oriocromis niloticus* from Thailand in 1987, secondly. In 1988, the Red Tilapia Hybrid species was imported from the Asian Institute of Technology (AIT) in Bangkok, Thailand. Through a 1994 World Fish Center project, the BFRI imported Gift Tilapia for genetic enhancement. BFRI imported a second type of Red Tilapia in June 2005 (Hossian, 2005). Today, Tilapia farming in Bangladesh's watershed region is prevalent (Rahman et al., 2012). Approximately 201,000 farmers are engaged in Tilapia farming (DOF, 2017). Historically, river spawn was the principal source of Tilapia fish seed in Bangladesh. A limited amount was generated in government and private hatcheries, and hatcheries supplied a negligible portion of fish seed. As fish seed is the key input for fish farming, there is an increasing need for high-quality fish seed. Tilapia fish producers have to rely on wild seeds obtained from natural breeding grounds (rivers) for more than 85 percent of their seed needs (DOF, 2017). During 2017-18, the annual production of Tilapia in Bangladesh was about 381,215 metric tonnes, contributing to about 8.91% of the total fish production (DOF, 2018). The majority of the Tilapia was cultivated in ponds (about 316,283 metric tonnes) and secondly in the seasonal cultured water bodies (about 21,986 metric tonnes) (DOF, 2018). In species composition of annual fish production of ponds (2017-18), after pangas (23.24%), Tilapia was the second highest (16.64%) (DoF, 2018). Cultivation of Tilapia in Bangladesh is increasing every year (in 2013-14, the annual production was about 298,062 metric tonnes; while in 2015-16, it was about 377,346 metric tonnes, and in 2017-18, it was about 381,215 metric tonnes) (DOF, 2018). However, fish production has been facing plenty of problems like poor knowledge, poor skills, high cost of inputs, increased feed cost, improper management practices, poor communication facilities, high labor cost etc. that may create obstacles to maximizing productivity (Ahmed, 2005; Yeasmin *et al.*, 2014; Hossen, 2016). On the other hand, technology in fish and seeds production culture has been upgrading daily. Therefore, fish farmers need many skills to practice these technologies to increase production. So, fish farmers' skills need to be developed through imparting training. For this reason, identifying and analyzing the fish farmers' training needs is crucial before organizing a training program. Farmers who get proper training in tilapia culture can make themselves fit for it, resulting in increased production.

Few research studies were conducted on training needs in fish culture, while Sumon (2014) performed research on the training requirements of catfish producers. Besides, Hossen (2016) studied on training needs of fish farmers in semi-intensive fish culture, Yeasmin *et al.* (2014) investigated the training requirements of fish farmers for integrated fish farming, and Siddique (2017) investigated the training needs of commercial fish producers for disease control. However, no available study found the training needs of the farmers in tilapia culture, though this area has been gaining popularity recently. Therefore, the paper tries to fulfill the following objectives: i) to investigate the individual features of fish producers, ii) determine the level of training requirements for tilapia production among fish producers; iii) to determine the factors influencing the training requirements of tilapia fish farmers, and iv) to identify the challenges fish producers confront in tilapia farming.

METHODOLOGY

The study was conducted at five villages (Tilatia, Nimtola and Partola, Matichapur, Arjunkhila) under the Rahimganj and Rupasi unions of Phulpur sub-district in the Mymensingh district. These villages were purposively selected because; tilapia fish culture was higher in these areas than in other areas of the Phulpur sub-district. The selection was based on suggestions

made by the Upazila Fisheries Officer (UFO) and other relevant officials of the Phulpur sub-district. A map of the Phulpur sub-district indicates the study area in Figure 1.

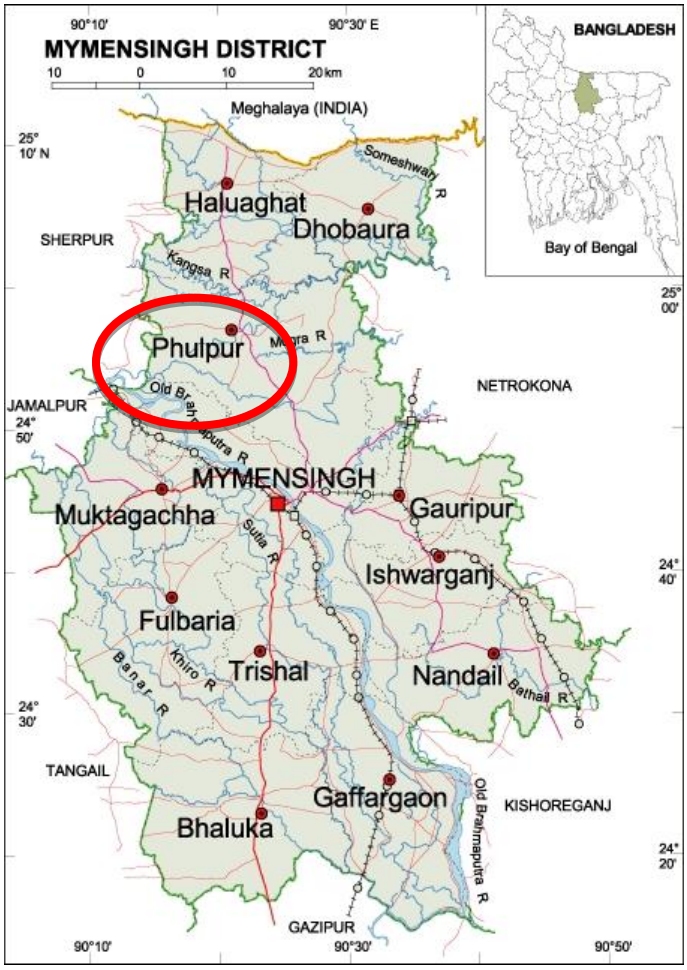

Figure 1. Map of Phulpur Upazila (sub-district) showing the location of the study.

Upazila (sub-district) Fisheries Office provided a list of the total number of fish farmers 18,250 in Phulpur Upazila (sub-district). A sampling frame of Tilapia fish farmers was prepared by using a snowball sampling strategy. There were 502 Tilapia fish growers in the five chosen villages, constituting the study's target population. After that, 20% of the population was randomly selected as a sample from the target population (502). Therefore, 100 Tilapia fish farmers were selected as a study sample. Choosing a particular sample number was arbitrary as the actual population size was high (Cochran, 1977). The research budget, time, and quality were also considered in drawing the sample size (Lynn, 2016). A hundred sampled farmers were questioned utilizing a pre-tested interview schedule in October 2019 to collect data.

Farmers' Tilapia-cultivation training requirements were the dependent variable that was measured on a 4-point scale. The ratings of 3, 2, 1, and 0 represent "great training demand," "medium training need," "low training need," and "not at all" accordingly. In addition, a respondent's score on training needs (based on 18 aspects of training needs) was computed based on his total score. Thus, the scores of a respondent's Tilapia culture's training needs could range from "0" to "54", where 0 indicates no training need and 54 indicates a high training need.

The rank order of the training needs was prepared using formula 1. A similar formula was used by Halder *et al.* (2019).

$TSTN = T_h \times 3 + T_m \times 2 + T_l \times 1 + T_n \times 0$ ……(1)

Where,

TSTN = Total score of training needed

T_h = Number of farmers stating a strong need for training

T_m = Number of farmers stating a moderate need for training

T_l = Number of farmers citing a low need for training

T_n= Number of farmers claiming they require no training whatsoever.

On the other way, independent variables of the Tilapia fish farmers were measured using the appropriate techniques and scales.

Various statistical measures, including range, mean, percentage, and standard deviations, were employed to characterize the selected characteristics of the study's respondents. Version 20 of the statistical package for social science (SPSS) was used to cleanse, code, and analyze the data for the analysis.

Liner multiple regression model was employed to identify the determinants of training needs of the Tilapia fish farmers. Following is the equation for multiple regression analysis (Eq. 2):

$$y_i = \beta_0 + \beta_1 X_1 + \beta_2 X_2 + \beta_3 X_3 + \beta_4 X_4 + \beta_5 X_5 + \beta_6 X_6 + \beta_7 X_7 + \beta_8 X_8 + \beta_9 X_9 + \beta_{10} X_{10} + \beta_{11} X_{11} + \in i \quad \ldots\ldots (2)$$

Where,

y_i = training need of fish farmers, β_0 = constant, X_1 = age, X_2 = level of education, X_3 = household size, X_4 = farm size, X_5 = annual family income, X_6 = experience in fish farming, X_7 = extension media contact, X_8 = social mobility, X_9 = credit received, X_{10} = training experience, X_{11} = knowledge of tilapia culture, $\in_i$ = Error term

The problems' rank order was prepared using the following (3), a total problem score (TPS). In previous research by Shajahan et al., (2019) a similar formula was employed.

$$TPS = P_h \times 3 + P_m \times 2 + P_l \times 1 + P_n \times 0 \ldots\ldots\ldots\ldots\ldots\ldots (3)$$

Where,

TPS = Total Problem Score, P_h = Number of farmers reporting a serious issue, P_m = Number of farmers reporting a moderate difficulty, P_l = Number of farmers reporting little issues, P_n = Number of farmers that report no problems whatsoever.

RESULTS AND DISCUSSION

Characteristics of the Tilapia Fish Farmers

Table 2 illustrates the characteristics of the responders. According to the data, the majority of respondents (47%) were young, compared to 41% middle-aged and 12% elderly. A little more than half (53 %) of the Tilapia fish farmers were middle to old aged category.

Usually, farmer experience is positively related to technology adoption. However, a few studies reveal that less experienced farmers (young and middle-aged) are more open to new ideas, technology, and, hence, are more likely to embrace new techniques and practices (Li *et al.*, 2019; Das *et al.*, 2018).

The majority (36%) belong to the primary category in terms of education, and 33% were illiterate. Similar findings were reported in the study conducted by Uddin *et al.* (2017) and Hasibuan *et al.* (2020). Table 2 also indicates that 19 % of the respondents were from small families, while 79 % and 2 % had medium and large families, respectively. Similar categorizations were followed by Wossen *et al.* (2017).

Data indicated that only 3% of the fish farmers belonged to the marginal farm size; 79% had a small farm size category compared to 18% had a medium-sized farm. The average farm size of the farmers surveyed was 0.620 hectares. It was more than the average farm size of the nation, which was 0.6 hectares Uddin *et al.* (2017). The farmers' yearly household income varied from 90 to 800, with a mean of 197.6 and a standard deviation of 147.52. Among the 100 fish farmers, 19 % were reported in the low-income category, 66 % medium, and 15 % high-income category.

The average experience of the fish farmers was 6.39 years, and the standard deviation was 3.85. Regarding farming experience, the highest proportion (51%) of fish farmers were found with low experience, 41 % medium, and 10 % with high experience. The farmers' interaction with extension media varied from 3 to 13, with an average of 8.7 and a standard deviation of 1.78. Less than three-fifths (59%) of fish farmers had medium media interaction, while 41% had low media contact and only 1% had high media contact.

More than half (57%) had low social mobility, while 42 % had a medium level of mobility. The farmers' credit varied from 0 to 200 thousand BDT, with an average of 32.65 and a standard deviation of 46.33. The highest proportion (57%) of the fish farmers were found with no credit receiving category, while 17% received credit ranging from 1,000-500,000 BDT. On the other hand, only 18% received credit with 51,000-100,000 BDT, while 8% of the farmers were credit receivers of more than 100,000 BDT. Training received by the farmers ranged from 0 to 7 days, the average was 1.18 days, and

the standard deviation was 2.017. Among the fish farmers investigated, 68% had no training experience, while 10% had low, 13 % had medium, and only 9% had high training experience. Knowledge of Tilapia fish culture Tilapia of the fish farmers ranged from 12 to 26, the average was 16.90, and the standard deviation was 2.47. The majority (96%) of the fish farmers were reported with the medium knowledge category, followed by the low (3%) category. Only 1% was found with the knowledge of high category regarding Tilapia culture.

Table 2. The salient feature of the selected characteristics of the respondents (N=100).

Characteristics (Measuring unit)	Score Range		Respondents		Mean	SD
	Possible	Observed	Category	%		
Age (Year)	Unknown	20-70	Young (18-35)	47	39.95	12.19
			Middle-aged (36-55)	41		
			Old (above 55)	12		
Level of education (Year)	Unknown	0-12	Illiterate (0)	33	4.04	4.61
			Primary (1-5)	36		
			Secondary (6-10)	20		
			Higher Secondary (above 10)	11		
Family size (No. of members)	Unknown	2-15	Small (up to 4)	19	5.89	1.76
			Medium (5-8)	79		
			Large (above 9)	2		
Farm size (Hectare)	Unknown	0.16-2.43	Marginal farmer (0.001-0.19)	3	0.619	0.497
			Small farmer (0.2-0.99)	79		
			Medium farmer (1-2.99)	18		
			Large farmer (3 and above)	0		
Annual family income ('000' taka)	Unknown	90-800	Low income (up to 100)	19	197.6	147.5
			Medium income (101-300)	66		
			High income (above 300)	15		
Experience in fish farming	Unknown	2-25	Low experience (up to5)	51	6.39	3.85
			Medium experience (6-10)	41		
			High experience (above 10)	8		
Extension media contact (Score)	0-24	3-13	Low (1- 8)	41	8.7	1.78
			Medium (9-16)	59		
			High (above 16)	0		
Social mobility (Score)	0-18	4-14	Low (up to 6)	57	6.27	1.55
			Medium (7-12)	42		
			High (above 12)	1		
Credit received ('000' Taka)	Unknown	0-200	No credit (0)	57	32.65	46.33
			Low (1-50)	17		
			Medium (51-100)	18		
			High (above 100)	8		
Training experience (Days)	Unknown	0-7	No training (0)	68	1.18	2.017
			Low (up to 2)	10		
			Medium (3-4)	13		
			High (above 4)	9		
Knowledge of tilapia fish culture (Score)	0-36	12-26	Low (0-12)	3	16.90	2.47
			Medium (13-24)	96		
			High (above 24)	1		

Extent of Tilapia Fish Farmers' Training Needs

According to the data reported in Table 3, an overwhelming majority (84 percent) of respondents had significant training requirements. 14% belonged to the category of having medium training needs. Nevertheless, only 2% of the respondents reported the low training needs category. Similar results were noticed by Yeasmin *et al.* (2014) and Sumon (2014). The respondents in the research region remained interested in tilapia cultivation best practices. However, they were unable to execute effectively owing to a lack of tilapia culture-related knowledge, expertise, and information. Consequently, it is natural that the respondents perceived a substantial need for training in this area.

Table 3. Classification of respondents according to their overall tilapia cultivation training requirements.

Category of the respondents	Score Range		Respondents	Mean	Standard Deviation
	Possible	Observed	%		
Low training need (up to18)	0-54	35-46	2	40.02	2.17
Medium training need (19-36)			14		
High training need (above 36)			84		
Total			100		

Source: Analysis of field survey, 2020

Table 4. The extent of training needed on tilapia culture (n = 100)

Statements	The Extent of Training Needs				Total Score	Rank Order
	H (3)	M (2)	L (1)	N (0)		
Determination of mono-sex Tilapia	98	2	0	0	298	1
Non-probiotic and probiotic fish production	96	4	0	0	296	2
Production techniques of mono-sex Tilapia	76	24	0	0	276	3
Weed management	8	49	43	0	165	16
Lime and fertilizer management	6	72	22	0	184	15
Systems of water depth measurement	7	43	50	0	157	17
Techniques for checking phytoplankton and zooplankton	75	24	1	0	274	4
Selection of fry species	14	85	1	0	213	14
Selection of disease-free fry species	21	79	0	0	221	11
Identification of fish species that are suitable for Tilapia culture	22	76	2	0	220	12
Stocking density of fish species	35	65	0	0	235	9
pH and Oxygen level management	48	51	1	0	247	6
Measurement of optimum level of water temperature	43	56	1	0	242	8
Way of feed application	18	81	1	0	217	13
Doses of fertilizer application	28	72	0	0	228	10
Identification of diseases, their management, and ways of disease control	64	35	1	0	263	5
Utilization strategies for insecticides/pesticides and aqua drugs	44	56	0	0	244	7
Time and Methods of Harvesting	1	1	96	2	98	18

Notes: H = High, M = Medium, L = Low, N = Not at all

Source: Analysis of field survey, 2020

Data in Table 4 reveals that out of eighteen aspects, thirteen aspects belong to high training needs based on computed total score. These were determination of mono-sex tilapia, non-probiotic and probiotic fish production, production techniques of mono-sex Tilapia, techniques for checking phytoplankton and zooplankton, identification of disease and their management and ways of disease control, pH and oxygen level management, ways of using insecticides/pesticides and aqua-drugs, measurement of optimum level of water temperature, the stocking density of fish species, doses of fertilizer application, selection of disease-free fry species, identification of fish species which are suitable for tilapia culture, way of feed application. On the other hand, the remaining five aspects were reported with medium training needs, and these were: selection of fry species, lime and fertilizer management, weed management, systems of water depth measurement, time, and methods of harvesting. Nevertheless, none of the aspects of training needs was found in the low category. Anani *et al.* (2017) and Ebo Onumah *et al.* (2010) reported more or less similar findings in their respective studies on catfish culture and integrated fish farming issues.

Besides, according to the computed total score, the aspects, namely 'determination of mono-sex tilapia' got ranked first. In contrast, 'time and methods of harvesting' got last as an aspect of training needs. A close look at the findings showed that the respondents prioritized issues related to tilapia culture and identified training needs on their existing available practices. Deficiencies in resource management expertise, education, social mobility, and communication exposure may have contributed to these outcomes.

Factors affecting training needs of Tilapia Farmers

A multiple linear regression analysis was conducted to determine the determinants and their significance in predicting the dependent variable, i.e., the farmers' training requirements in tilapia farming. Table 5 summarizes the results of the multiple linear regression study. The Variance Inflation Factor was used to assess the multicollinearity of the model's variables. Multicollinearity was not an issue, since the highest VIF value was 6.84, and the tolerance values of the variables were likewise high. The F-test result for the model was 7.83, with statistical significance at $p<0.01$ and an adjusted R-squared value of 0.495. This shows that the predicted model matches the data well and that none of the parameters have statistically significant zero significance. Regression analysis show that among the eleven explanatory variables, five variables, such as level of education, experience in fish farming, extension media contact, social mobility, and training, have showed significant influences in predicting the training needs of the farmers in tilapia culture. The variable-wise effect is explained below:

Level of education

Farmers' level of education had a significant negative impact in predicting the training needs of the farmers, indicating that if the level of education increases by one unit (one year of schooling), the training needs of the farmers will decrease by 0.109. Education is considered an essential factor in reducing the training of the farmers in tilapia culture. These results are consistent with those of previous investigations (Pandit and Basak, 2014; Mohamed *et al.*, 2020; Goli *et al.*, 2022), which revealed that farmers with lower education need more training.

Table 5. Summary of multiple linear regression elucidating the variable of interest (n = 100).

Model	Unstandardized Coefficients		t	Sig.	Collinearity Statistics	
	B	Std. Error			Tolerance	VIF
(Constant)	47.441	2.032	23.347	0.000		
Age	0.005	0.021	0.264	0.792	0.641	1.561
Level of education	-0.109	0.050	-2.167	0.033	0.732	1.366
Family size	-0.079	0.149	-0.528	0.599	0.565	1.770
Farm size	0.968	1.032	0.938	0.351	0.146	6.842
Annual family income	0.001	0.004	0.285	0.777	0.190	5.268
Experience in fish farming	-0.170	0.069	-2.445	0.016	0.597	1.675
Extension media contact	-0.313	0.119	-2.622	0.010	0.784	1.275
Social Mobility	-0.299	0.126	-2.378	0.020	0.667	1.500

Credit received	0.005	0.005	0.871	0.386	0.653	1.531
Training received	-0.467	0.117	-3.976	0.000	0.529	1.889
Knowledge of tilapia culture	-0.018	0.104	-0.174	0.862	0.580	1.725

Experience in fish farming

Experience in fish farming of the farmer had a significant negative impact on training need, indicating that if experience in fish farming of the farmer increases by one unit (one year), the amount of training need of a farmer decreases by 0.170 units. It is often argued that farmers' knowledge, experiences, and insights are considered as an important resource for the sustainable development farming system. Thus, farmers tend to generate knowledge from practical experiences, and not from formal experiments and research (Stuiver *et al.*, 2004). Mulinya (2017) and Karim *et al.* (2016) similarly argue that farmers having long experience in farming activities, would be able to even predict their production, understand certain scenarios involved in farming and gain more information and knowledge of farming activities. In addition, farming experience may contribute to problem solving, which may reduce the training need of the fish farmers. Following this study, the results from Danso-Abbeam *et al.* (2018) and Rahman *et al.* (2021) are consistent.

Extension media contact

Extension media contact of farmers had a negative and significant effect on training needs, indicating that if extension media contact of the farmer increases by one unit (one day), the training need of the farmer decreases by 0.313 units. This might imply that farmers' exposure to extension media contact provides an opportunity to get new techniques and knowledge of farming, which can significantly affect their training needs on tilapia fish culture. Extension media concept in terms of inter-personal and face to face forms of communication renders good sources of information for managing diversified farm activities effectively (Odini, 2014; Hoque *et al.*, 2021). The finding is consistent with the results found by Sarker (2004) and Hossen (2016) in their study.

Social mobility

Social mobility of the farmers had a significant negative impact on the training need of the Tilapia Farmers, indicating that with a one unit increase in social mobility, farmers' training needs decreased by 0.299. This is due to the fact that the mobility of fish farmers may alter their attitude toward the adoption of better farming techniques (Yeasmin *et al.*, 2014).

Training

Training received by farmers also had a significant negative impact on the training need of the Tilapia farmers, indicating that with one unit increase in training of Tilapia fish farmers, farmers' training needs will be reduced by 0.467 units. Empirical evidence shows that training is considered as an effective tool to improve knowledge, especially in reducing subjective uncertainty about the technology (Jackline *et al.*, 2016; Nejadrezaei *et al.*, 2018; Caffaro *et al.*, 2020).

Problems encountered by fish producers in tilapia farming

Table 6 depicts the problems faced by the respondents concerning tilapia culture. The findings indicate that majority (86%) had a high level of problem, followed by 14 % had a medium level, and none was found to be in the low problem category. Thus, the findings suggest that the respondents are experiencing different sorts of problems to a greater extent. High cost of feed, lack of knowledge on fish culture, inadequate training facility, poor extension service etc., could be the possible reasons behind such a greater extent of problems. The findings are in line with Islam and Sarker (2018).

Based on the Total Problem Score (TPS), problems were ranked out and placed in Table 7. Results indicated that the respondents identified the high cost of fish feed as the most significant problem, with a total problem score (TPS) of 276. Bakİ and Yücel (2017) and Das *et al.* (2018) had similar findings. The respondents ' second critical problem was the unavailability of extension service, with a TPS score of 275. Of course, there are still problems like an inadequate number of extension workers, a tendency to communicate with wealthy farmers, and a lack of need-based services, making the extension service unavailable for the farmers. Nevertheless, the finding aligns with Ganpat *et al.* (2014) and Ahmed (2005). The high fertilizer cost was the third-ranked problem, with a TPS score of 260. The fish farmers must use different fertilizers to maintain the

water quality and keep the pond environment disease-free. The high fertilizer cost makes it difficult for them to produce tilapia fish commercially. The findings are in line with the study of Mondal (1970).

Table 6. Distribution of fish producers based on their respective problems (n = 100).

Category of the respondents	Score Range		Respondents (%)	Mean	Standard Deviation
	Possible	Observed			
Low problem (Up to 13)	0-39	24-36	0.0	29.16	2.52
Medium problem (14-26)			14.0		
High problem (Above 26)			86.0		
Total			100		

Table 7. Problems faced by the fish farmers on tilapia culture (n = 100).

Problems	Extend of problem				Total Score	Rank Order
	H (3)	M (2)	L (1)	N (0)		
Problem of site selection	20	53	25	2	191	11
Unavailability of quality seed and species	3	70	25	2	174	12
Lack of knowledge on fish feed application	32	66	2	0	230	7
Lack of knowledge on fertilizer application	59	36	3	2	252	5
High cost of fish feed	78	21	0	1	276	1
High cost of fertilizer	63	35	1	1	260	3
Lack of knowledge on fish processing	28	67	4	1	222	8
Lack of knowledge on fish preservation	29	64	6	1	221	9
Unavailability of extension service	76	23	1	0	275	2
Lack of financial support	53	43	4	0	249	6
Natural calamities (like flood)	0	7	88	5	102	13
Lack of marketing facilities	26	60	14	0	212	10
Lack of training facilities	60	39	1	0	259	4

Notes: H = High, M = Medium, L = Low, N = Not at all

There were also various problems associated with tilapia culture, such as lack of training facilities, lack of knowledge regarding application of fertilizer, lack of financial support, lack of knowledge of the application of fish feed, lack of knowledge of fish processing, lack of knowledge on fish preservation, lack of marketing facilities, the problem of site selection, unavailability of quality seed and species, natural calamities. During the informal conversation with the respondents, it was proposed that tilapia culture might be enlarged if extension operations in the study region were expanded as well, and tilapia culture training facilities were improved.

CONCLUSION AND RECOMMENDATIONS

The study identified that the fish farmers of the study area are still facing problems due to insufficient training. Issues like the determination and production technique of mono-sex tilapia and non-probiotic and probiotic fish production were identified as major training needs. On the other hand, education, farming experience, extension media contact, training received, and social mobility were the determining factors in explaining the training need of the respondents. These influential factors might be helpful while taking the policy measures\in this regard. In addition, the high cost of fish feed, unavailability of extension service, and high cost of fertilizer was identified as the major problems faced by the farmers. Therefore, it can be said these above-mentioned problems may be the reasons for having low tilapia production. Thus; the current study opens a window of opportunity for the concerned authority to take initiatives on the identified issues. In connection to these issues, the Department of Fisheries (DoF) and related NGOs should emphasize need-based training for the fish farmers rather than traditional training. In

addition, the extension workers must ensure that all the fish farmers get the desired extension service, i.e., making extension service available for all farmers. Moreover, the Government should confirm the availability as well as accessibility of quality fish feed and fertilizer subsidies at local level. Finally, regular monitoring of the feed and fertilizer market by the concerned authority is crucial.

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