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Technical Note 09

Trial ponds of Fish FFS, 2015

March, 2016

BETS

Socioconsult Ltd.
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(These are the views and expressions of Dr. Shamsul Huda, and do not necessarily represent the view of the Netherlands Embassy in Dhaka or the Blue Gold program')

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Issue and revision record

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List of Abbreviations

BWDB	Bangladesh Water Development Board
DAE	Department of Agricultural Extension
DoF	Department of Fisheries
EKN	Embassy of the Kingdom of the Netherlands
FFS	Farmer Field School
FO	FFS Organizer
GIFT	Genetically Improved Farm Tilapia

Abstract

The fish farming systems on trial ponds in the polder area of Patuakhali zone was conducted from April, 2015 to November, 2015. A total of 48 trial ponds for 48 FFS were established among in 48 WMGs using "learning by doing process". An average pond size both in mixed and mono culture was 12 decimal, and with 98% of the farmers having ponds of single ownership and 2% having ponds of multiple-ownership. Indian major carps, exotic carps and tilapia have been practiced by most of the farmers in mixed culture, and mainly tilapia was practiced in mono culture system. In the study areas, 14% of the ponds were seasonal and 86% are perennial. Fish fingerlings were stocked from May to June, 2015 and an average stocking density was 50 /decimal (12350/ha) in mixed culture and 120/decimal (29640/ha) in monoculture, Genetically Improved Farm Tilapia (GIFT).The annual fish production was 4652 kg/ha in mixed culture and 4910 kg/ha in mono culture. Fish production cost in mixed culture was Tk.184,595 / ha, of which 26% was spent for fingerlings and 52% for supplementary fish feed purpose. In case of monoculture system, a total of Tk.225,868/ha was invested: 28% for fingerlings and 54% for supplementary fish feed.

The gross income and net income in mixed culture were Tk.629,246/ha and Tk.444,650/ha respectively but in case of monoculture, gross income and net profit were Tk.611,412/ha and Tk.385,543/ha respectively.

Out of the 48 trial ponds, 33 (69%) pond were operated by female, the highest was recorded from polder 43/1A, followed by Polder 43//2D, 43/2F and the lowest in 43/2A. Mostly they were involved in cleaning the aquatic weeds, application of lime, fertilizers and supplementary feed. But very few women were involved in purchasing & selling activities (such as lime, inorganic fertilizer, fingerlings, supplementary feed purchase and harvesting & selling of fishes).

The constraints for sustainable pond fish farming in the areas were lack of acceptance of technical knowledge of the farmers, insufficient water in dry season, higher production cost (mainly fingerlings and feed), in-sufficient supply of fry and fingerlings, lack of money and credit facilities and inadequate extension services. The households have broadly improved their food consumption, increased protein intake from fish, gradually increasing the standard of living by selling fish, and also increased choice level and economic ability through fish farming.

1. Background

Bangladesh, though rich in having around 1.5 million of ponds of different sizes covering an area of about 146,955 hectares of land, only about 52% of the ponds are, at present (source DoF report), being utilized for fish production through semi extensive method. Production of fish per unit area is about 3800 kg/ha/yr (statistical year book of Fisheries-2013) which is very poor compared to that of other adjoining countries having similar climatic conditions. Inadequate extension service coupled with improper management and production techniques viz. high or low stocking, imbalanced stocking ratio of fingerlings, inadequate manuring and feeding etc. have been considered responsible factors for low production of fish.

As most of the farmers are poor and living in rural area, it is not possible for them to follow the intensive technology of fish production which needs proper water quality and higher inputs supply. An appropriate intermediate technology for the farmers thus should be the semi-intensive culture technique which requires moderate inputs and production management based mainly on proper stocking rate and ratio and adequate manuring on a regular basis with proper supplementary feeding.

Production of fish through integrated fish farming by using animal or agricultural by-products in fish pond as manure and feed has appeared to be the most appropriate technique for rural farmers.

Scope of using cow dung in fish pond is limited because of increased use of cow dung as fuel and manure in crop land. Chicken manure which is rich in nutrients presently, not being properly utilized in the country and in polder areas, could be utilized in fish production.

Traditionally, typical farmers of polder grow food grains, fruits and vegetables in their land. The farmers also keep cattle and poultry birds and raise fish in their ponds. But all these are scattered, there is no inter-linkage between the farming components. The only thing to do now is to integrate the possible agricultural activities of FFS together in a mutually supportive manner. In this regards, BG has conducted FFS activities in a one bundle (fish, poultry and nutrition) through 20 sessions.

There are two types of ponds in the project area namely perennial pond and seasonal pond. In perennial pond, water are available round the year with an average depth of 4-6 ft which is appropriate for mix culture like Rui, Catla, Silver carp, Mrigel, Grass carp, Tilapia and Golda species. In seasonal ponds, water is available about 3-4 ft depth for 5-6 months which is appropriate for single species (mono culture) of fish culture. Rajputi, Sing, Koi and Magur fish is also better for culture in seasonal ponds and some pond are also appropriate for fry/fingerling culture. .

Whether mono-culture or mix culture, it is dependent on pond condition, depth of water, pond size, and also opinion of the pond owner.

Considering the physical condition of ponds, 2 types of managements (mixed and mono culture) are conducted on trial ponds during fish FFS activities.

In this regards, a technical note has been prepared for mono culture and mixed culture in pond for semi intensive management system to conduct the fish FFS activities.

1.1 Objectives

- To teach the farmer through “learning by doing process” from first to last event through field trial activities in selected trial ponds and farmer’s ponds
- To increase the fish production by extension activities through FFS approach
- To adapt the improved technology in the polder area

- To make some suggestions for development and management of pond fish production.

1.2 Methodology

To boost up the fish production as well as adapt the technology in polder area, a lot of methodologies have been initiated like establishing the trial ponds and conducting hands-on training related to field activities (learning by doing process). In this regards, the learning sessions were split into 8 sessions considering the field situation and culture technologies. *Two types of trial pond were selected; one on Carp- Tilapia mixed culture and another one Tilapia culture* depending on the pond size as well as depth of the pond, and side by side also considered the farmer's opinion. A total of 48 trial ponds were conducted this year with 48 FFS groups. One trial pond was established for each FFS in different location of different polders.

Table 1
Polder wise fisheries trial ponds in Farmer Field School (FFS)

Name of the polder	43/2A	43/2B	43/2D	43/2F	43/1A	Total
Mixed culture	3	7	4	5	5	24
Mono culture	1	4	6	4	9	24
Total	**4**	**11**	**10**	**9**	**14**	**48**

Trial ponds were selected considering the opinion of WMG's president, secretary and members, and side by side considered the location of ponds, opinion of trial pond owners, and also considered, an appropriate condition like pond dyke, depth, duration of water retention etc. Farmer's ponds were also selected for FFS activities considering the opinion of WMG representatives and farmer's interest as well as the considered potential of the ponds.

Figure 1: Trial pond with dyke vegetables

Selection procedure started from March 2015 through community meeting with direct involvement of WMG representatives and pond owners. After that pond preparation activities were started from April, 2015 and completed the preparation within this month. Then fish fingerlings stocking activities were started from first week of May, 2015 and completed in the mid June of 2015.
Respective FOs and consultant supervised and monitored the culture activities of the trial ponds. FFS activities have been finished in November 2015, as it was not time for total harvesting of fishes. At the end of November 2015, fish sampling was conducted to estimate the present production. To calculate the total production, 15% - 20% of fish is deducted as a mortality rate. For this purpose, a structural questionnaire was supplied to respective FFS. Organizers (FO) collected the information and entered into computer for analysis.

2. Result and Discussion of Trial ponds

2.1 Pond size

Pond size is an important factor for fish culture because all management measures are planned considering the size of ponds. The management of small size pond is easier than large size pond. Ponds size ranged from 5 decimal to 35 decimal in the WMG areas. In case of mixed culture trial ponds, the average pond size was 13 decimal with a range from 8 decimal to 23 decimal and in mono culture trial ponds , an average size was 10 decimal with a range from 7 decimal to 15 decimal.

Figure 2: Trial pond at Purbo Kewabunia

2.2 Types of pond

From the record, it was found that 84% ponds were perennial and the remaining 14% ponds were seasonal. But the water level of some perennial ponds are declined during dry season and become unsuitable for fish culture. due to scarcity of water in prolonged drought. Some farmers pump water to their ponds during dry season. The average depth of the perennial ponds was 4-6 ft. Seasonal ponds become unsuitable for fish culture during dry season.

2.3 Culture season and method

In the study area, the season of fish farming is from April / May to next year March each year. Fish fries are stocked when the water become available in May to June, and the cultured fishes are started as a partial harvesting during end of October and generally final harvesting are happened in the month of March. Most of the farmers practice mixed culture activities in the polder areas. In this regards, Silver carp, Catla, Rui, Mrigel, Raj puti, Grass carp and Tilapia were stocked in the mixed culture trial ponds. Genetically Improved Farm Tilapia (GIFT) was stocked in mono culture trial ponds, and side by side Silver carp and Rajputi were also stocked to utilize the pond water properly. Besides this, some ponds were stocked by Mono sex tilapia. Here noted that a few numbers of trial owners released the additional fingerlings without our concern, and they tried to hide this from us. This types of activities, indirectly helps to reduce the fish production as well as enhance the probabilities of fish diseases. Such types of activities are also found all over the Bangladesh. This is one of the main barriers in aquaculture sector in Bangladesh.

Table 2
Schedule of fish culture in trial ponds

Selection and farming activities	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Mar. 2016
Community meeting with respective WMG area													
Pond resources survey with WMG members													
Selection & list of pond with WMG members													
Pond preparation													
Stocking of fingerlings													
Rearing period													
Partial harvesting													
Final Harvesting													

2.4 Pre-stocking management

Pre-stocking management of ponds in the polder area comprises dike repairing, aquatic weed control and undesirable species (predator and trash fish) control etc. About 98% of the farmers control aquatic weeds manually and for controlling undesirable species, most of them used netting method and few ponds were dried up. Some farmers used rotenone powder. Then farmers used lime at the rate of 240-250 kg/ha during pond preparation to increase the productivity as well as control the harmful particle of pond soil and pond water. Organic fertilizer mainly cow dung were used at the rate of 1000-1250 kg/ha and side by side also used inorganic fertilizer (urea and TSP) at the rate of 48-50 kg/ha during pond preparation to produce the natural fish feed, phytoplankton and zooplankton. Farmers also followed the related pre-stocking management procedures like natural feed test, quality of fingerlings with size and fingerling releasing techniques etc.

Figure 3: Farmers receiving standard size of fingerlings from nursery pond

2.5 Stocking density

Majority of farmer stocked hatchery produced fingerlings mostly collected from surrounding nurseries of the BG trained farmers of the polder. The average stocking density in mixed culture pond was 12,350 fingerlings / ha with an average size of 4-5 inch. But in case of Mono culture system (Tilapia), an average stocking number was 29,640 fingerlings / ha and an average stocking size of Tilapia was 2 inch.

Figure 4: Farmer releasing fingerlings in trial pond

2.6 Fertilization

It was recorded that majority of the trial farmers used cow dung, and side by side also used urea and TSP as an inorganic fertilizers to produce and maintain the natural feed in pond. In the study area, pond fish farmers were using cow dung in their ponds at the rate of 8500-9000 kg/ ha /year, mostly four times in a month (1 kg/ decimal/ week) during culture period. The average dose of urea and TSP was 580-592 kg/ha/yr and 450-494 kg/ha/year respectively.

Figure 5: Application of lime in trial pond

2.7 Use of lime and its application rate

Lime was used for pond preparation time and also after 2 months interval to increase the productivity as well as maintain the P^H balance. All the farmers used the lime regularly in variable doses. The average dose of liming during pond preparation was 240-250 kg /ha/year. But after 2 months interval, 50 kg/ha was applied to maintain the production capacity of pond and save from diseases.

2.8 Feed and feeding practices

It was found that 65% of the farmers applied supplementary feed like rice-bran and sun flower oil-cake from their own fund with a less quantity and irregularity. A few solvent farmers of trial pond owners tried to supply the sufficient feed for their fish culture. First months of stocking of fingerlings, supplementary feed was supplied to equivalent amount of 5% of the total body of fish, and gradually decrease the rate of percentage of supplementary feed amount from the next month. Here note that BG supplied 70 kg of sunflower oil cake and 10 kg of industrial

Figure 6: Feed supplied techniques in pond

feed to each all of trial pond owners to motivate farmers as practice of supplementary feed. Only few farmers supplied leaf of banana tree and duck weed for the Grass carp and Rajputi fish.

2.9 Fish growth performance

After ensuring the natural feed availability in trial ponds, proper size (4-5 inch) of fingerlings were stocked in pond maintaining the proper releasing techniques of fingerling, and most of the fingerlings were collected from the surrounding nursery owners, mostly BG trained nursery owners. Initial average weight of stocked major carp and exotic carp were from 25 gm to 35 gm, Rajputi was 18 gm and Tilapia was 8 gm. After 7 months culturing of fingerlings, the following wt. was gained by fishes - Silver carp - 590 gm, Catla-480 gm, Rui-390 gm and Grass carp-520 gm. Highest growth performance was found in Titkata trial pond (Catla-1050 gm, Rui-800 gm, silver carp-1100 gm due to release the large size fingerling (60-90 gm) as well as farmer supplied the proper amount of supplementary feed and maintain the proper fish culture technology. Here note that growth of Rajputi is very good in all trial ponds and the average size of Rajputi is 430 gm by 7 months but some of the trial ponds growth rate is above 500 gm. An average growth rate of Tilapia is 170 gm but data indicated that growth rate of Tilapia is better (above 220- 280 gm) where industrial feed was supplied in sufficient way.

Figure 7: Harvesting of fish for sampling

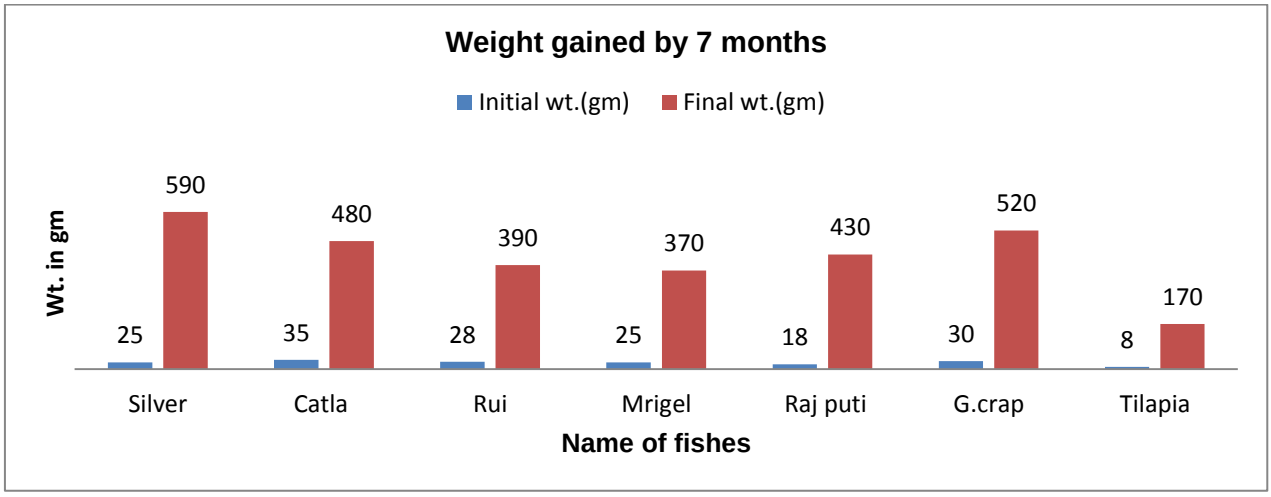


Figure 8: Growth performance of different species of fish by 7 months

2.10 Fish production

From the recorded data, it is revealed that the average annual yield of fish was 4652 kg/ha by 7 months in mixed culture, and 4910 kg/ha in monoculture by 7 months. The average fish production per hectare in trial pond was higher in mono culture system than mixed culture due to supply the industrial feed which was more expensive.

Table 3
Culture types and production in kg/ ha

Culture types	Production in kg/ha	Production in kg/decimal	Remarks
Mixed culture	4,652	19	Stocked Silver carp, Catla, Ruhi, Mrigel, Rajputi, Grass carp & Tilapia
Mono culture	4,911	20	Mainly Tilapia & partially Rajputi & Silver carp
Average	4,782	19	

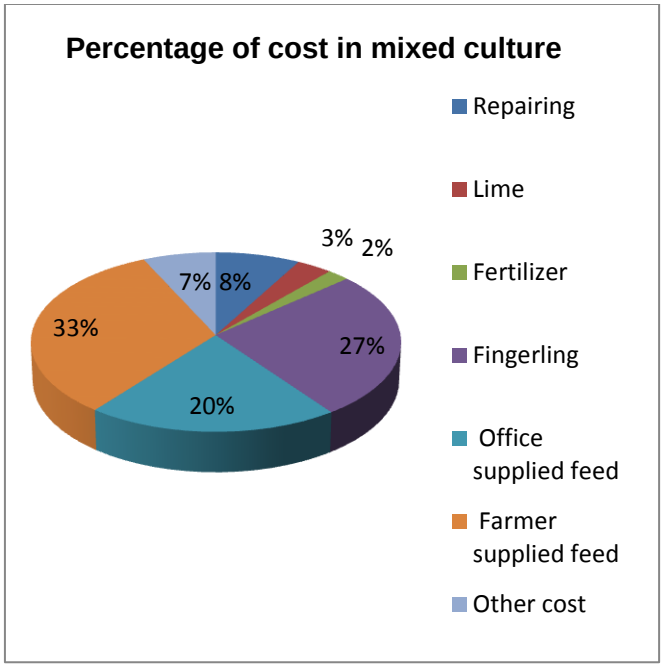
2.11 Production cost

From the survey, it is found that the average cost / ha for mixed and mono culture system was Tk. 184,595 and Tk. 225,868 respectively (table 04. The average cost of fish production was little bit higher

(Tk.42,091/ha) in monoculture activities (table 04) due to supplied the more industrial feed which is expensive as well as more protein content. Data indicated that the highest cost was observed in supplementary feed, 53%, (office supplied and farmer supplied feed), followed by fingerlings cost (27%) and repairing cost (8%) in mixed culture activities. But in case of mono culture, the highest cost was found in feeding purpose (54%), followed by 28% in fingerling and 7% in other.

Table 4
Production cost per hectare in the trial ponds (mixed and mono culture)

Cost items	Cost of mixed culture/ha (Tk.)	Percentage of cost of mixed culture (%)	Cost of mono culture/ha, Tilapia	Percentage of cost of mono culture	Production of mixed culture (MT)/ ha	Production of monoculture (MT)/ha	Average production (MT)/ha
Repairing	14742	8	14100	6	**5**	**5**	**5**
Lime	6175	3	6501	3			
Fertilizer	3889	2	3788	2			
Fingerling	49065	27	63734	28			
Feed (office supplied)	37873	21	49011	22			
Feed (farmer supplied)	60154	33	72972	32			
Other(netting, labour)	12697	7	15763	7			
Total	**184595**	**101**	**225869**	**100**			



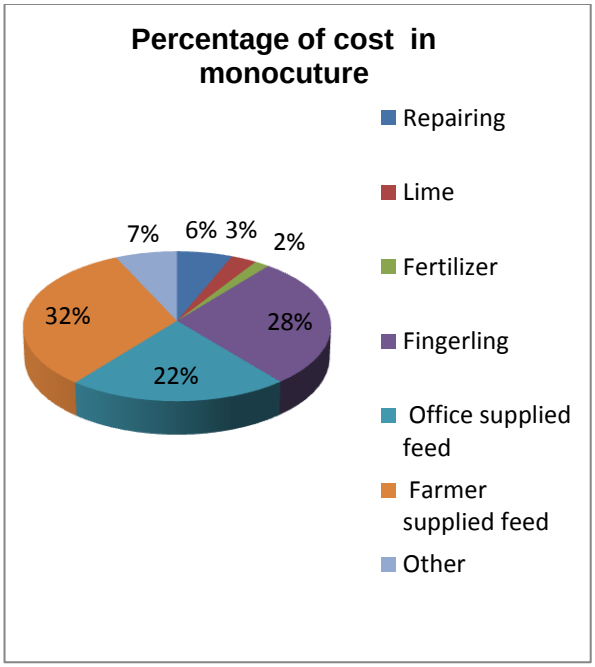


Figure 9: Cost percentage of different items of mono

Figure 10: Cost percentage of different items of mixed culture

2.12 Gross income and net return from fish production

Data indicated that the average gross income from fish production of mixed culture and mono culture are Tk.629,246 /ha/7 months and Tk.611,412/ha/7 months respectively. Data also indicated the average net income per hectare from fish production is Tk.415,097 but higher in mixed culture, Tk.444,651.

Table 5

Culture types, production cost /ha, gross income / ha and net income / ha

Culture types	Production cost/ha (Tk)	Goss income/ ha (Tk)	Net income/ ha (Tk)	Net income /decimal (Tk)
Mixed culture	184,595	629,246	444,651	1,800
Mono culture	225,869	611,413	385,544	1,561
Average	205,232	620,329	415,097	1,681

* Considered an average market price of rui/catla is tk.140 / kg and tilapia is tk.120 /kg

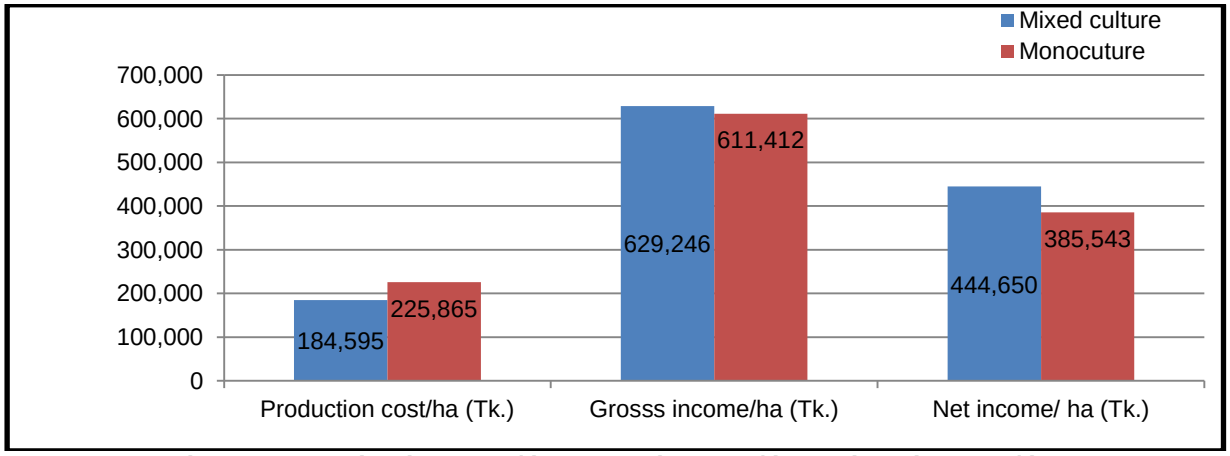


Figure 11: Production cost / ha, gross income / ha and net income / ha

2.13 Harvesting and marketing

Farmers harvested their fish using cast net and seine net locally known as ber jal. Harvested fish were kept in aluminium containers or plastic drum. From the survey it is found that around 78% of the fishes will be sold by the farmers to local *paikers* and the rest of 22% will be consumed by the households and give to the relatives.

In marketing systems, there found to be a number of middlemen such as local agents, whole sellers, local fish traders and retailers. Market communication is normally being made through middlemen. Data indicated that a few pond fish farmer directly will sell their fish to local *paikers* or local agents at the bank of the ponds. Majority of the farmers will take their fish in local markets and sell directly to local *paikers* or consumers. Only few women were involved in harvesting of fish for their family consumption but they are fully depend on male members for harvesting of fish, and selling of fish due to social barrier.

2.14 Observation

- Avoid the practices for more and small size fingerlings stocking in pond for better production.
- Ensure the natural feed (phytoplankton and zooplankton) production in pond to reduce the cost of fish production as well as for good production.
- Motivation is very important for supplying the supplementary feed in the pond for more production.
- Supplementary feed should be made from farmer's own resources to minimize the cost.
- Above 10 decimal area of perennial pond with proper sun lighted is better for mixed culture.
- For GIFT culture, commercial farming is important to grow more fish (2-3 crops / year).through sufficient amount of industrial feed.
- Seasonal pond is suitable (where water will be available up to end of October), for GIFT and Rajputi culture for having marketable size of fishes.
- Mixed culture is possible with low production cost by providing home-made feed side by side creating a natural feed through using organic and inorganic fertilizer in pond.
- Growth rate of mono sex Tilapia is little bit higher but when we collected the fingerlings, all the fingerlings could not treated 100% by hormone. So, some of the fingerlings remained untreated which were release the eggs in the ponds.
- Still female are not interest to purchase the inputs from market due to social norms and values, they are dependable on male members.
- High protein feed (industrial) has much impacts on growing more GIFT
- Apparently it is observed that mixed culture had higher return (Tk.1800/decimal) than the mono culture (Tk.1560/decimal)
- Early stocking (in April/ May) is better for good production.

3. Conclusion

- Proper pond preparation and management is very important for more production.
- Quality fingerling is major concern to grow more fish. Program should have a plan to minimize this issue.
- Large size fingerling (above 5 inch) is essential for better production as well as help to increase the survival rate of fish. FOs should carry these messages to the FFS farmers properly.
- Industrial floating feed is very important especially for increasing GIFT production and side by side natural feed is also essential in pond water.
- Though production of mono sex Tilapia is little bit higher but at farmer's level, 100% of mono sex Tilapia fingerlings are not available. So, to avoid complexity in mono sex Tilapia production, we can suggest farmers to grow GIFT in their ponds.
- Moderate (5-6 mton/ha/year) carp fish production is possible through the home made supplementary feed (rice bran, wheat bran and sunflower oil cake) and through creating natural feed in pond.
- Only 3-4 trial farmers released more fingerlings in their pond without consulting the BG authority and tried to hide because they were mostly convinced by local fingerling suppliers. Same case is found in all over Bangladesh. FOs are trying in FFS session to aware farmers on the negative impact of over stocking and we hope by the time, farmers will be conscious on this issue.