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STUDY ON COMPARISON OF PRODUCTION PERFORMANCE AND ECONOMICS OF DIFFERENT CARP POLYCULTURE SYSTEMS AT GANGNI UPAZILA IN MEHERPUR DISTRICT

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Abstract

The study was conducted to evaluate the comparison of production performance and economics of different carp polyculture systems in Gangni Upazila under Meherpur district from July to November 2015. PRA tools such as questionnaire based interview, cross check interview etc. were used for primary data collection and secondary information were used to assess the performances in aquaculture activities. Forty pond fish farmers were randomly selected, among them 7 (18.0 %), 17 (42.0 %), 3 (8.0 %), 7 (18.0 %) and 6 (15.0 %) farmers were engaged with carp-mola, carp-tilapia, carp-koi, carp-shing polyculture and carp fattening, respectively. Only 23 % farmers had small ponds (5dec -15 dec), 35 % medium (16 dec-25 dec) and 40 % had large ponds (above 25 dec). The minimum water depths of 23 % ponds were within 0. 5m -1.0 m, 53 % were 1.00m-1.5 m, 17 % were 1.6m -2.0 m and 7 % were up to 2.0 m. From the survey, it was found that 14 (35.0 %) of the farmers applied supplementary/homemade feed prepared with rice bran and mustard oil cake, 17 (43.0 %) farmers used commercial feed and 9(22.0 %) farmers were depended on natural feed. Average fish production of the farmers was 6274 kg ha^{-1} yr^{-1}. The calculated highest fish production 7,904 kg ha^{-1} yr^{-1} and net income was BDT 2,42,060 ha^{-1} yr^{-1}, respectively in carp-tilapia polyculture system. The lowest fish production was 5,187 kg ha^{-1} yr^{-1} and net income was BDT 1,66,478 came in carp-koi polyculture system. From the result of present study, it is clear that fish production and financial benefit in carp-tilapia polyculture were higher than others. The present findings reveal that carp-tilapia polyculture system is more suitable and profitable culture system than other polyculture systems existing in Gangni upazila of Meherpur district.

Keywords: Fish farmer, aquaculture, polyculture system, carp, pond

Introduction

Polyculture or composite fish culture is the system in which fast growing compatible species of different feeding habits are grown in the same pond. Polyculture technique is based on the relationship between fishes at different levels of the food chain and environment. The outcome of fish production from polyculture systems depends on the species combinations and their stocking densities.

Bangladesh is an agro-based country and is striving hard for rapid development of its economy. It is often argued that the future development of the country depends particularly on the agricultural sectors especially fisheries. Fisheries sector plays a vital role in the socio-economic development of rural area by fulfilling the animal protein demand, creating employment opportunity, alleviating poverty and earning foreign exchange for the country. About 17.80 million people, 11 % of the total population are employed (full time and part time) in fisheries sector to earn their livelihood involving activities related to fisheries (DoF, 2015). So, fish and fisheries are indispensable part in the life and livelihoods of the people of Bangladesh and it is also the part of our cultural heritage.

Freshwater fish farming or aquaculture plays an important role in the livelihoods of rural people in Bangladesh (Mazid, 2002). It creates diverse livelihood opportunities for a number of people, many of whom living below the poverty level, in the form of farmers, operators, employees, traders, intermediaries, day laborers and transporters (Ahmed and Rahman, 2004). Pond fish farming has been proved to be a profitable business than rice cultivation. So many farmers in rural areas are converting their rice field into aquaculture pond (Islam *et al*., 2002). Many pond fish

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farmers in rural areas have taken fish farming activities as their secondary occupation and most of the people involved in fish farming to improve their socio-economic condition through pond fish farming activities (Ara, 2005).

Bangladesh has got a large number of ponds scattered all over the country. Bangladesh Bureau of Statistics (BBS) (1997) reported that there are 52,77,572 ha water bodies of which 9,15,506 ha ponds are suitable for fish culture. So, the country has good potential for freshwater aquaculture, this potential cannot be fully utilized for various reasons (DoF, 2012). Fish resources play a very important role in the economy of Bangladesh accounting for about 3.65% of GDP. About 1.92% of annual export earning comes from the fisheries sector and it ranks 3rd among the export oriented industries (DoF, 2016).

In the recent year, fish farming activities are gradually increased in Gangni Upazila of Meherpur District. Fish culture in Gangni Upazila of Meherpur District is characterized by extensive (traditional), semi-intensive (improved traditional) and improved semi-intensive culture system. In traditional method of fish culture, fishermen did not stock any fry rather depended on natural fry to entry through the opening section of the embankment along with the rain waters. As a result, the average harvest from these types of ponds was very low. Meanwhile the fishermen improved the traditional culture system into semi-intensive culture system. In this system, all the ponds were repaired, stocked fry along with natural predator and non-predator stock, given some supplementary feeds (not regular), as well as in necessity water was changed from underground water. This approach has enhanced production than traditional culture system but some fishermen practices in improved semi-intensive culture system. In the study area, they cultivate fish in polyculture system. Most of the species cultured in polyculture system were rui, catla, mrigal, silver carp, mirror carp, grass carp, bata, tilapia, shing, koi and mola. These species are highly demandable fish species and have high market value. Small portion of fish farmer are practicing integrated vegetable fish farming in recent years. In GangniUpazila of Meherpur District, both small scale and large scale aquaculture are being practiced but small scale aquaculture has been getting more popularity day by day because of its low investment and high production rate. The success of such aquaculture largely depends on the extension activities provided by different NGOs and Government agencies. The present study was planned to know the present status of aquaculture practices in the Gangni Upazila and to compare production performance and economics among different carp polyculture systems.

Materials and Methods

The study was carried out for 5 months from July to November 2015. It was conducted in selected nine villages named Baneapukur, Jugirgofa, Sholotaka, Bathanpara, Sharbati, Hariadha, Bhobanipur, Harabhanga and Gangni under Gangni Upazila of Meherpur district (Fig. 1). Pond fish culture was heavily concentrated in the area because PKSF (Pally Karma Sohaok Foundation), PSKS (Palashipara Samaj Kallyan Samity), DBS (Daridra Bimochan Sangtha) and government have been working for many years with fish farmers to increase fish production and their economic development.

Forty fishermen each with at least one fishpond were randomly selected from the study area. Participatory Rural Appraisal (PRA) is a group of methods to collect information from pond fish farmers in participatory fashion (Chambers, 1992). PRA tools such as focus group discussion (FGD), questionnaire based interview, cross check interview etc. were used for primary data collection and secondary information were also used. In order to collect relevant information, a questionnaire was carefully designed keeping the objectives of the study in view. Before preparing the final questionnaire, it was pretested in the study area. Thus, some parts of the questionnaire were improved, rearranged, modified and added in the actual and practical experiences. Finally, a set of items were listed and grouped in the logical sequence, so that, the target group could answer easily.

The questionnaire interviews were conducted at the pond sites and home in the selected area. Before going to make an actual interview, a brief introduction about the objective of the study was informed to each of the farmers and assured them that all information would be used for their welfare. At the time of interview, the physical conditions of fish farmers' ponds and the fish cultivation methods like pond preparation, application of food and fertilizers, harvesting etc. were closely observed because there was a scope to well understanding the fish production technology in the study area.

After collecting data, it was verified by cross-checking to eliminate errors and inconsistencies. Collected data from various sources were coded and entered into a data base system using "Microsoft Excel Software" and "SPSS" (Statistical package for social science) computer package.

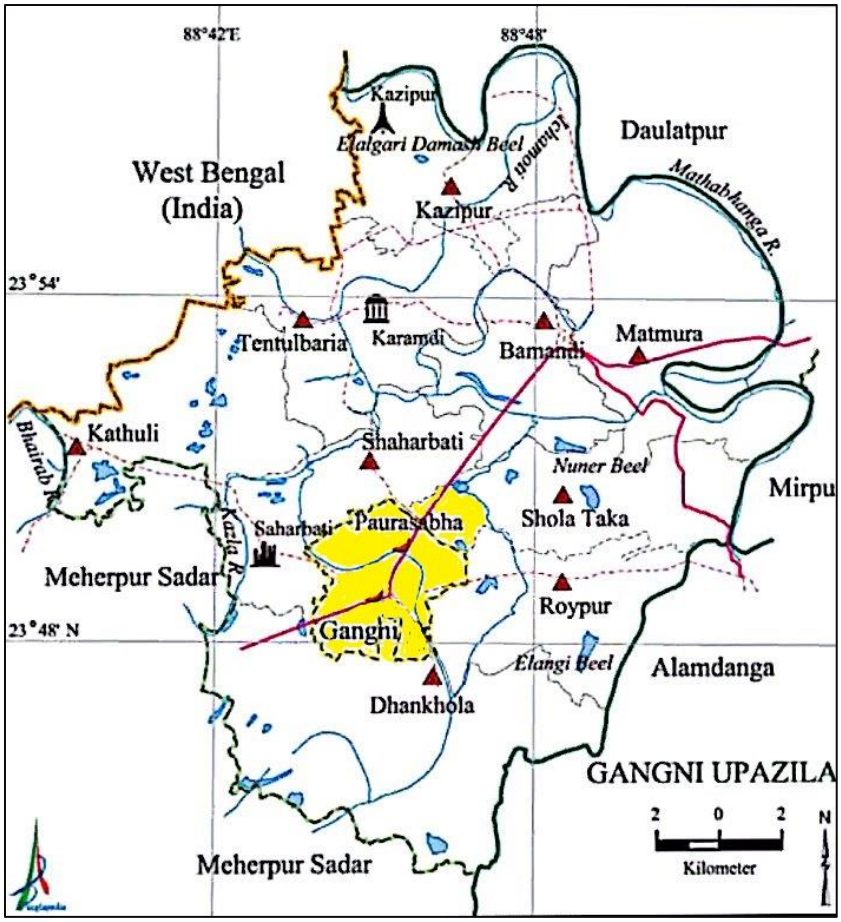

Fig. 1. Map of Gangni Upazila of Meherpur district showing the study area (Yellow colored).

Results and Discussion

This chapter describes results concerning comparison of production performance and economics of different carp polyculture systems in Gangni Upazila under Meherpur district.

Present status of aquaculture practices in the study area

Experience of fish farmers in aquaculture: On the basis of previous findings, it was found that aquaculture was not very traditional occupation in the study area. Most of the farmers (65.0 %) came to aquaculture within 5 years. Moreover, 15.0 % farmers came within 6years-10years, 10.0 % farmers came within 11years-15 years, 7.0 % farmers came within 16years -20 years and only 3.0 % farmers came to aquaculture more than 20 years ago(Fig.2). It was observed that most of the fish farmers in the area were not highly experienced in fish farming. Farmers mentioned that they started aquaculture because of getting inspiration and training from different NGOs.

Size of ponds in the study area: The sample ponds were grouped into three categories depending upon their different sizes in the surveyed area. Only 23 % ponds were small(5 dec -15 dec) whereas 35 % were medium (16 dec -25 dec) and 42 % ponds were large (more than 25 dec). From the study, it was found that most of the ponds were medium to large. Saha *et al*. (1995) found that the range of pond size were within 12.35 decimal to 37.05 decimal in Bangladesh.

Depth of water in the ponds: It was observed that the average water depth of 23 % ponds were within 0.5 m- 1.0 m, 53 % were within 1.0 m-1.5 m, 17 % were within 1.6 m - 2.0 m and 7 % farms were above 2.0 m. Ali and Basher (2008) stated that the minimum water depths of 35 % farms were within 0.75-1.5 m and 65 % farms were within 1.51-3.0 m in Rajshahi district, which supports the present findings.

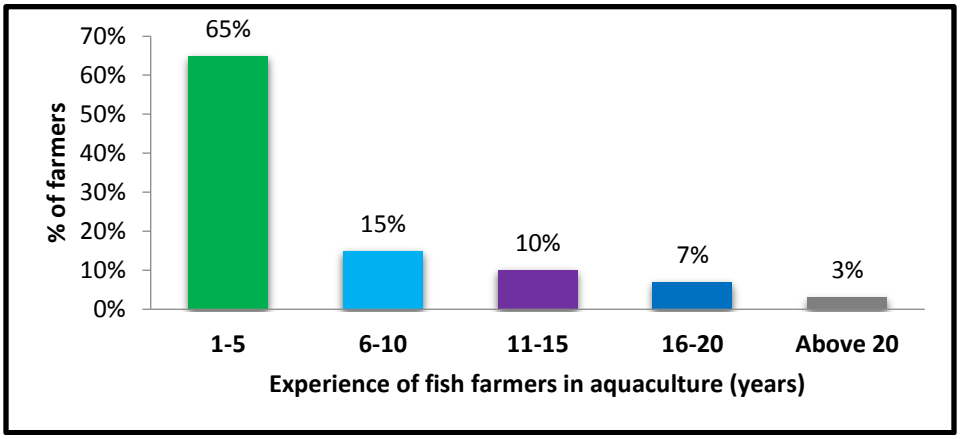

Fig. 2. Experience of fish farmers in aquaculture in the study area.

Pre-stocking management of ponds: Pre-stocking management of ponds in the study area was included dike repairing, removing aquatic weeds and undesirable branches of trees, watering, liming and fertilizing that were followed by all of the farmers. It was found that all farmers controlled aquatic weeds manually. Majority of the farmers used nearly same dose of the fertilizer and lime as recommended by NGO (Table 1). Sarker and Ali (2016) prepared ponds by using lime, cow - dung, urea and TSP at the rate of 1.01, 1.01, 0.16 and 0.08 kg dec^{-1}, respectively.

Table 1. Application rate of lime, cow-dung and fertilizers recommended by NGO used during pond preparation.

Materials used	Application rate kg dec^{-1}
Lime	1
Fresh cow dung	15
Urea	0.2
TSP	0.1

Culture systems practiced

Among 40 fish farmers, 7 (18.0 %),17 (42.0 %, 3 (8.0 %), 6 (15.0 %) and 7 (18.0 %) farmers followed carp-mola, carp-tilapia, carp-koi, carp-shing, carp fattening polyculture respectively (Fig. 3). Here it is notable that nearly half of the fish farmers practiced carp-tilapia polyculture.

Stocking density under five culture systems

After one week of pond preparation, all the farmers had received fish from NGO with their own investment. Fishes were stocked to 40 ponds according to the culture systems and pond size. Five species of carps viz. rui (*Labeo rohita*), catla (*Catla catla*), mrigal (*Cirrhinus cirrhosus*), silver carp (*Hypophthalmichthys molitrix*), common carp (*Cyprinus carpio*) and grass carp (*Ctenopharyngodon idella*) with mola (*Amblypharyngodon mola*) or tilapia (*Oreochromis mossambica*) or shing (*Heteronewstes fossilis*) or koi (*Anabas testudineas*) were stocked in the farmer's ponds. In stocking density of carp-mola, carp-tilapia, carp-shing, carp-koi and carp fattening polyculture was 166, 145, 140, 185 and 76 fry dec^{-1} respectively (Table 2). Saha (2004) reported that average stocking density of polyculture system was found 70fry dec^{-1} in Tangail Sadar upazila which is lower than present study.

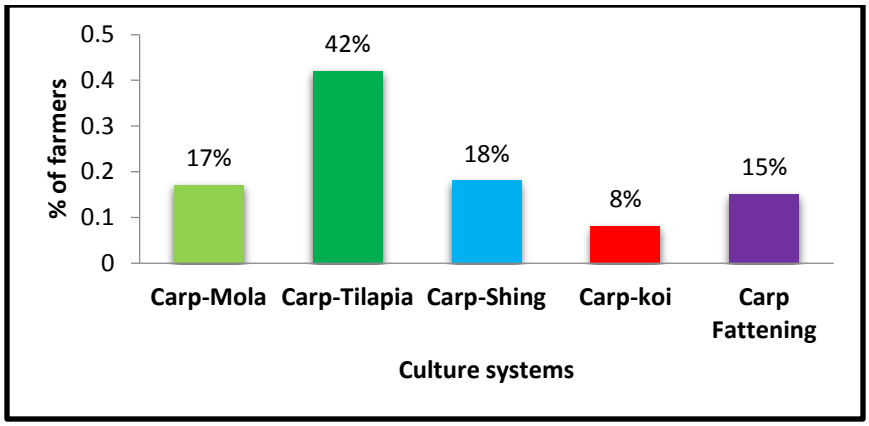

Fig. 3. Culture systems followed by fish farmers in the study area.

Table 2. Average stocking density fry dec^{-1} of five polyculture systems in the study area.

Fish species	Culture systems				
	Carp-mola	Carp-tilapia	Carp-shing	Carp-koi	Carp fattening
Carps (Rui, Catla, Mrigal, Silver carp, Common carp, Grass carp)	58	14	72	75	76
Mola	108	-	-	-	-
Tilapia	-	131	-	-	-
Shing	-	-	68	-	-
Koi	-	-	-	110	-
Total	166	145	140	185	76

Comparison of production performances among different carp polyculture systems: Among five polyculture systems, the highest average fish production was found 7904 kg ha^{-1} yr^{-1} in carp-tilapia polyculture system followed by carp fattening (6669 kg ha^{-1} yr^{-1}, carp-shing (6175 kg ha^{-1} yr^{-1}), carp-mola(5434 kg ha^{-1} yr) and carp-koi(5187 kg ha^{-1} yr^{-1}). The average production was 6274 kg ha^{-1} yr^{-1} year in the study area (Fig. 4).Rahman (1995) stated that the average annual fish yield was 4923 kg ha^{-1} yr^{-1} and it ranged from 4505 kg ha^{-1} to 5413 kg ha^{-1} yr^{-1} in Gouripur thana under Mymensingh district, that is more or less similar to the present study. Biswas (2003) stated that the average productions were 4199, 4446, 3705, 4693 and 4816 kg ha^{-1} yr^{-1} in 1996-97, 1997-98, 1998-99, 1999-2000 and 2000-2001, respectively of the surveyed farms in Mymensingh district. According to DoF (2016), average fish production in ponds of Bangladesh was 4261.93 kg ha^{-1} yr^{-1}. This production is lower than present production. The possible reason for this difference is that they collected data from productive, less productive and unproductive ponds around the country. On the other hand, present data were collected from only carp polyculture farmers pond. Due to higher production, maximum fish farmers preferred carp-tilapia polyculture system in their ponds.

Income and expenditure under five culture systems in the study area: Among the five culture systems, it was found that average size of carp-mola, carp-tilapia, carp-shing, carp-koi and carp fattening ponds were 17, 27, 23.4, 11, 40 dec respectively and the average profit ha^{-1} were BDT 1,70,924yr^{-1}, 2,42,060yr^{-1}, 1,66,478yr^{-1}, 1,75,123yr^{-1} and 2,11,432yr^{-1} respectively. The highest average net profit was come from carp-tilapia polyculture system and the lowest average net profit was come from carp-koi polyculture system (Fig. 5). From the above analysis it can be said that the culture of tilapia with carp polyculture was the most suitable culture system among five aquaculture practiced. Tanjina (2011) stated that the total fish production in last five years were the highest in 2006 (9,672 kg) and the lowest in 2010 (8,556 kg). The average gross returns were BDT 1,11,910 ha^{-1} and BDT 1,22,652 ha^{-1}, respectively in Shing Horkhali *beel* in Dinajpur district, which is more or less similar to the present study. Sarker et *al.* (2015) studied on fish feed manufacture with its nutritional quality and impacts on fish production and found net profit BDT 1,79,776/ha^{-1}/yr^{-1} in Mymensingh district. This study supports the present study.

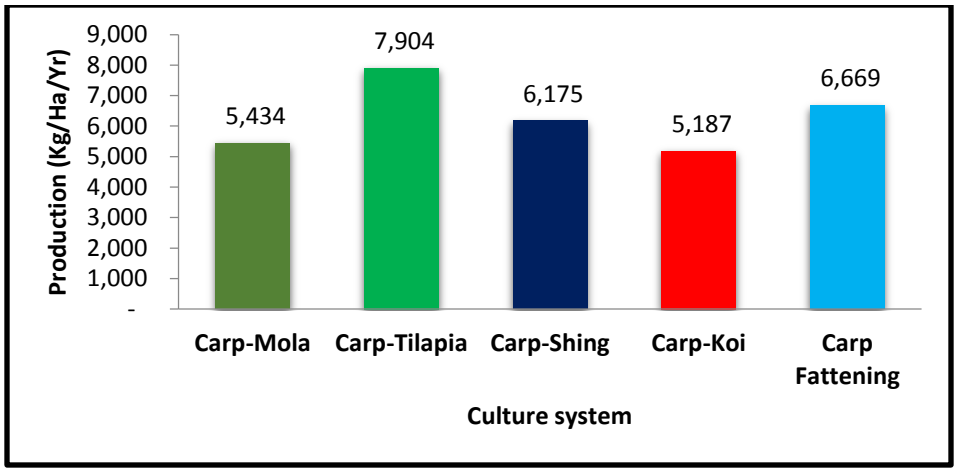

Fig. 4. Average fish production under five polyculture systems in the study area.

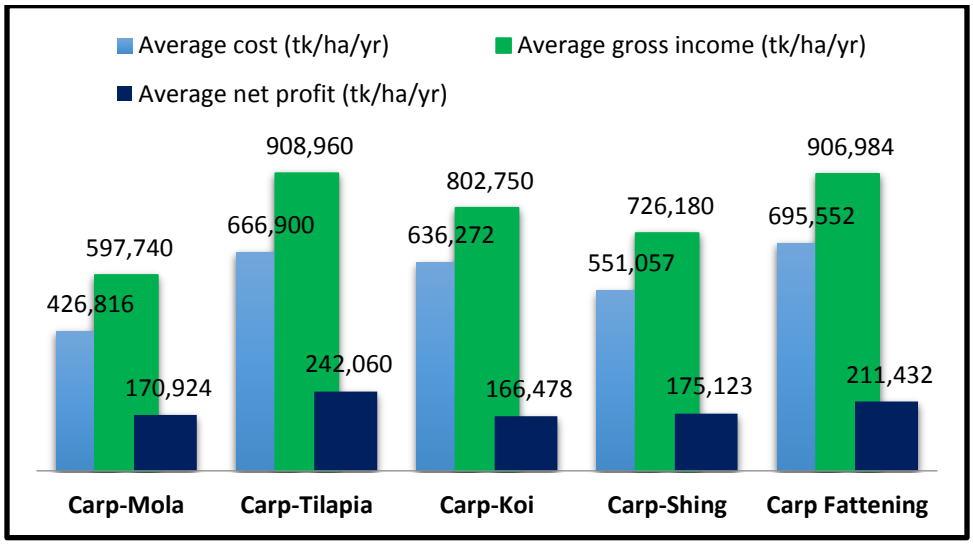

Fig. 5. Income and expenditure under five culture systems.

It is noted that proper management and stocking density can improve the production performance of carp polyculture system and also contribute to overall economic improvement of fishermen. Among five culture systems, average production and net profit from carp-tilapia polyculture were found higher during present survey. For this reason, this culture technique was widely accepted by the local fish farmers (17 out of 40). From the present findings, it reveals that carp-tilapia polyculture system is possibly more suitable and profitable culture system than other polyculture systems existing in Gangni upazila of Meherpur district.

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