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Performance of genetically improved farmed tilapia (GIFT) under mono and mixed culture with silver barb (*Barbodes gonionotus*) in south-west Bangladesh

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Abstract
A participatory on-farm trial was carried out to evaluate the production performance of GIFT (genetically improved farmed tilapia) strain of *Oreochromis* sp., either alone or with silver barb (*Barbodes gonionotus*), in six rain-fed freshwater ponds of coastal area. There were two treatments; (i) GIFT alone at a stocking density of 24,700/ha (T_1) and (ii) 1:1 combination of GIFT and silver barb (T_2). Each of the treatments had three replications. A significantly ($p<0.05$) higher production of 4306.14 kg/ha of GIFT was obtained in monoculture, compared to the total production of 3480.38 kg/ha of GIFT and silver barb. In the 1:1 combination treatment, the production of GIFT (2036.06 kg/ha) was also higher than that of silver barb (1444.32 kg/ha). The results reveal that GIFT monoculture can performe better in rain-fed seasonal freshwater ponds of south-west coastal areas.

Key words: GIFT, Silver barb, coastal freshwater ponds

Introduction

The inter-tidal flat plain areas of the south-west coastal regions (specially Satkhira and Khulna) of Bangladesh are usually used for shrimp, *Penaeus monodon* culture. The culture cycle continues from February to mid August when water salinity remains 6-17 ppt. Now, shrimp culture is severely threatened by a number of problems especially by mass mortalities due to various causes of disease. Besides tidally-fed shrimp culture areas, there are a large number of rain-fed seasonal freshwater ponds in the region, where water remains at least 1-1.5 meter for 4-6 months in a year and even more in some areas. People normally use these water bodies for their household activities. From the aquaculture perspective, these water bodies have a great potentiality.

Genetically improved farmed tilapia (GIFT) and silver barb (*Barbodes gonionotus*) are two important short cycle cultured fish species. Introducing the culture of GIFT and silver barb in coastal region may help the coastal people to their poverty alleviation. Considering the potentiality of small pond/ditches into aquaculture practice in coastal

region, the present study was designed to evaluate the performance of GIFT under mono and mixed culture with silver barb in the rain-fed seasonal ponds in coastal areas of Bangladesh.

Materials and methods

Pond preparation

Six rain-fed freshwater ponds of various sizes (155-410 m^2, average depth 1.5 m) were selected in Gopalpur, Saral and Bandikati villages of Paikgacha Upazilla, Khulna for this study for the duration of April to September. Ponds were prepared by application of lime to @ 250 kg/ha filling up with nearby freshwater sources and rain water. Three days after application of lime, ponds were fertilized with cattle manure @ 750 kg/ha. Inorganic fertilizers - urea @ 25 kg/ha and TSP @ 30 kg/ha were applied after five days of applying organic fertilizer.

Stocking & management

After three days of fertilization, when water became greenish, three ponds were stocked with only GIFT (24,700 nos./ha) (Treatment-1) and other three ponds were stoked with GIFT (12,350 nos./ha) + Silver barb (12,350 nos./ha) (Treatment-2). The average body weight of the stocked GIFT and silver barb was 0.37g and 3.79g, respectively. Fishes were fed with rice bran at the rate of 5~3% of the total biomass. After stocking, ponds were fertilized with urea and TSP @ half of the initial dose at fortnight interval.

Sampling

The ponds were sampled at fortnightly intervals to assess growth and condition of fish and feeding was adjusted on the estimated fish biomass in ponds. Physico-chemical parameters of water *viz.,* temperature, pH, dissolved oxygen and transparency were determined fortnightly according to the standard procedure and methods (APHA 1992). The quantitative abundance of plankton was estimated fortnightly, using a Sedgewick-Rafter counting cell, following the method of Stirling (1985). After six months of rearing, all fishes were harvested by draining out the pond water and growth, survival and production of fishes were estimated.

Statistical analysis

Data were analyzed for one-way ANOVA and any difference at 5% level of significance using the statistical package of STATGRAPHICS *Version 7.*

Results and discussion

Water quality parameters in all culture ponds throughout the experimental period are shown in Table 1. The water temperature of the culture ponds was recorded from 29

to 33 °C . pH of the ponds varied from 7.2-8.4 during the experiment. Water temperature in shallow and small fish ponds of Bangladesh has been found to range from 26-35°C, with the maximum in May to August, and to follow air temperature closely with a small variation (Rahman *et al.* 1982, Hossain *et al.* 1997).

Table 1. Mean (±SD) water quality parameters of ponds in different treatments

Parameters	Treatment 1	Treatment 2	Significance level
Water temperature (°C)	29.34 ± 0.27	29.21± 0.39	NS
pH	7.91 ±1.37	8.2 ± 0.88	NS
Dissolve oxygen (mg/l)	5.50 ± 0.13	5.92 ± 0.11	NS
Transparency (cm)	28.12 ± 1.16	28.76 ±1.07	NS
Phytoplankton ($\times 10^3$ cells/l)	53.65 ± 2.10	49.23 ± 1.75	NS
Zooplankton ($\times 10^3$ cells/l)	12.55 ± 1.52	9.94 ± 1.45	NS

NS= Not Significant at 5% level.

The dissolved oxygen of 3.5-8.5 mg/l and transparency of 25-35 cm were recorded throughout the culture period. A similar trend in fluctuation of 3.2-9.7 mg/l (Haq *et al.* 1994), 2.0-7.2 mg/l (Wahab *et al.* 1995), 3.2-8.5 mg/l (Grag and Bhatnagar 2000) of dissolved oxygen has been reported in fish ponds. Boyd (1982) suggested that a transparency between 15- 40 cm is suitable for fish culture which is very close to the observations of the present study. Values of all observed water quality variables were found congenial for fish culture. There was no significant difference ($p>0.05$) in physico-chemical characteristics of water among different treatment ponds.

In T1, the mean value of phytoplankton concentration was $53.65\pm2.10\times10^3$ cells/l, while in T2 the abundance was slightly lower at $49.23\pm1.75\times10^3$ cells/l. Shah *et al.* (2004) recorded a concentration of phytoplankton and zooplankton ranging from 29.03 to 31.81×10^3 cells/l and 6.32 to 7.09×10^3 cells/l, respectively in his experiment. Wahab *et al.* (1995) recorded the abundance of phytoplankton ranging from 2×10^5 to 8×10^5 cells/l and that of zooplankton from 2×10^4 to 2×10^5 cells/l in their study. Haque *et al.* (1998) recorded phytoplankton and zooplankton abundance of $3.78\pm0.15\times10^4$ cell/l to $50.64\pm1.29\times10^4$ cells/l and 4.91± 0.8 to $6.16\pm0.8\times10^4$ cells/l, respectively in their study. Compared to the observation, the plankton abundance was lower in the present study and this might be due to the lower quantity of fertilizer used.

Monthly growth performance of GIFT and silver barb under two treatments during the experiment is shown in Fig. 1. Throughout the study period, GIFT in monoculture showed higher growth than mixed culture with silver barb. GIFT reached an average final weight of 195.5 g in monoculture (T1) and 190 g in mixed culture (T2). There was no significant difference ($p>0.05$) between the treatments. The highest weight gain (195.13 g) of GIFT was attained in mono culture but when a one way ANOVA was run, the difference was not significant ($p>0.05$) statistically. In mixed culture system, the average final weight of silver barb was 144.5 g and the weight gain was 140.71 g (Table 2). Hossain *et al.* (1997) recorded average weight gain of *O. niloticus* 78.8 g in mixed culture system with mirror carp, silver carp and silver barb for 105 days.

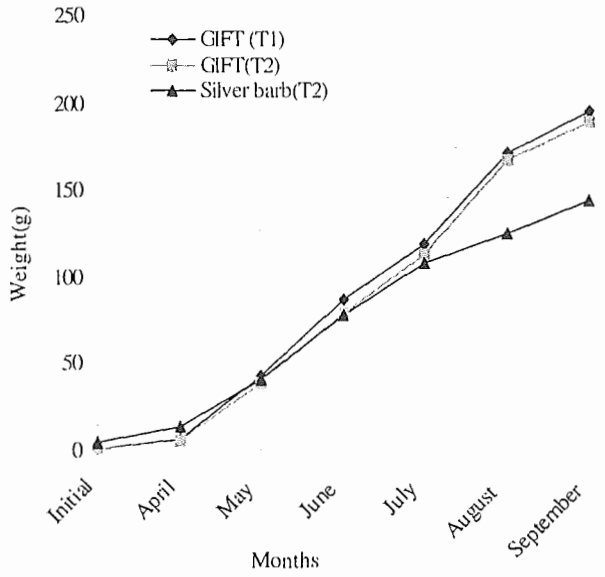

Fig. 1. Monthly growth (g) performances of fishes under two treatments.

Table 2. Growth and production of GIFT under mono and mixed culture system

Treat-ment	Fish species	Average initial weight (g)	Average final weight (g)	Average weight gain (g)	SGR (% day)	Survival (%)	Production (kg/ha)	
							Species wise	Total
T1 (Only GIFT)	GIFT	0.37±1.12	195.5± 3.13	195.13	2.37	89.17	4306.14	4306.14 ± 11.72[a]
T2 (GIFT + silver barb)	GIFT	0.37± 1.12	190± 2.18	189.63	2.36	86.77	2036.06	3480.38 ± 9.67[b]
	Silver barb	3.79± 2.32	144.5± 3.19	140.71	2.02	80.93	1444.32	

*Dissimilar superscript indicates significant difference at 5% level of probability.

In monoculture system, GIFT showed higher growth compared to the mixed culture with silver barb. The specific growth rate (SGR) of GIFT was 2.37 (%/day) and 2.36 (%/day) in mono and mixed culture, respectively. There was no significant difference ($p>0.05$) between the two treatments. In mixed culture system, SGR of silver barb was

comparatively lower (2.02 %/day) than the GIFT. Shah *et al.* (2004) recorded more or less similar SGR of 2.41 %/day of GIFT in mixed culture with silver barb.

The survival rate of GIFT was 89.17 % in monoculture (T1) and 86.77 % in mixed culture (T2). There was no significant difference ($p>0.05$) between survival rates of GIFT in two treatments. Hossain *et al.* (1997) observed 87.5-100% survival of GIFT when studied mixed culture with silver barb, mirror carp and silver carp in seasonal ponds. Shah *et al.* (2004) recorded survival rate of 93.52% and 87.57 % of GIFT and silver barb, respectively in mixed culture system.

Total yield of fish (4306.14 kg/ha) was significantly ($p<0.05$) higher in mono culture system (Table 2). Mazid (2002) reported the production of GIFT of 2,500-3,000 kg/ha in seasonal ponds within 5-6 months, which is lower than the present study. In mixed culture system, GIFT perform better position in the production (2036.06 kg/ha) and the total production was observed 3480.38 kg/ha. In mixed culture, the production of GIFT was higher than that of Shah *et al.* (2004), where production of GIFT was 1442.90 kg/ha in mixed culture with silver barb. The production of silver barb was 1606.53 kg/ha in mixed culture system (T2). Wahab *et al.* (1996) observed 5294 to 5670 kg/ha/yr production of silver barb in the polyculture with carps. Hossain *et al.* (1997) recorded total production of 2233 kg/ha/105 days in mixed culture of silver barb with nile tilapia, mirror carp and silver carp in seasonal ponds.

The cost-benefit from GIFT monoculture and mixed culture with silver barb is shown in Table 3. While estimating the cost of production, variable costs of only lime, feed, fertilizer and fingerlings were taken into consideration. Cost of production was Tk. 119,176.50/ha and Tk. 106,508.44/ha in monoculture and mixed culture, respectively. All the variable costs were remained same in both treatments except silver barb fingerling cost for T2. The gross benefit in monoculture amounted to Tk. 2, 58,368/ ha, leaving a net benefit of Tk 139,191.50/ha while gross benefit from mixed culture (T2) amounted to Tk. 179,936.40/ha with a net benefit of Tk. 73,427.96/ha showing a higher profit per hectare than that of mixed culture (T2).

Table 3. Cost and benefits per hectare from mono and mixed culture system of GIFT and silver barb

Input	Treatment 1 (Only GIFT)		Treatment 2 (GIFT + silver barb)	
	Quantity (kg)	Cost (Tk.)	Quantity (kg)	Cost (Tk.)
A. Cost				
Lime	250	1,750.00	250	1,750.00
Cattle manure	750	1,500.00	750	1,500.00
Inorganic fertilizer	357.50	4,697.50	357.50	4,697.50
Fingerlings-GIFT Silver barb	24,700	24,700.00	12,350 12,350	12,350.00 9,262.50
Rice bran	14,421.50	86,529.00	12,824.74	76,948.44
Total cost		119,176.50		1,06508.44
B. Benefits				

Marketable size fish GIFT (Tk.60/kg)	4,306.14	258,368.00	2,036.06	122,163.60
Silver barb Tk 40/kg			1,444.32	57,772.80
Gross benefit		258,368.00		179,936.40
Net benefit (B-A)		139,191.50		73,427.96

From the present results, it may be concluded that GIFT monoculture in freshwater ponds in coastal area is better than mixed culture with silver barb, due to their high growth performance. It is also suggested that GIFT can be a potential fish species to be commercially introduced into culture system to get higher production from the rain-fed seasonal freshwater ponds of coastal area.

References

APHA, 1992. Standard Methods for the Examination of water and wastewater. American Public Health Association, Washington.

Boyd, C.E., 1982. Water quality management for pond fish culture. Developments in Aquaculture and Fisheries Science, Vol. 9. 1st Edition. Elsevier Scientific Publishing Company, Amsterdam. Oxford, Newyork. 318 p.

Grag, S.K. and A. Bhatnagar, 2000. Effect of fertilization frequency on pond productivity and fish biomass in still water ponds stocked with *Cirrhinus mrigala* (Ham.). *Aquacult. Res.* 31: 409-414.

Haque, S.M., M.A. Wahab, M.I.Wahid and M.S. Haq, 1998. Impacts of Thai silver barb *(Puntius gonionotus* Bleeker) inclusion in the polyculture of carps. *Bangladesh J.Fish. Res.* 2(1): 15-22.

Hossain, M.A., S.M. Rahmatullah, M.S. Islam, A.K.M.A. Kabir, M.S. Islam and S. Dewan, 1997. Impact of chapila (*Gudusia chapra* Ham.) on growth of Carps in polyculture. *Bangladesh. J. Fish. Res.*, 1 (2): 19-23.

Haq M.S., M.A. Wahab, Z.F. Ahmed and M.I. Wahid, 1994. Effects of three fertilizer treatments on the water quality and fish production in semi- intensively managed fishponds. *BAU Res. Prog.* 8: 558-566.

Mazid, M.A., 2002. A Guide Book on Fish Production Technology. A special report on fish fortnight, Bangladesh Fisheries Research Institute, Mymensingh, Bangladesh.

Rahman, M.S., M.Y. Chowdhury, A.K.M.A. Haque and M.S. Haq, 1982. Limnological studies of four ponds. *Bangladesh J. Fish.* 2-5(1-2): 25-35.

Shah, M.M.R, M.Y. Mia and S. Rehman, 2004. Monoculture of silver barb (*B. gonionotus*) vs. mixed culture with GIFT (*O. niloticus*) in seasonal mini ponds under farming system in Bangladesh. *Pak. J. Sci. Ind. Res.* 47(4): 316-321.

Stirling, H.P., 1985. Chemical and biological methods of water analysis for aquaculture. Institute of Aquaculture, University of Stirling, Scotland, UK. 119 p.

Wahab, M.A., Z.F. Ahmed, M. Aminul Islam and S.M. Rahmatullah, 1995. Effect of introduction of common carp, *Cyprinus carpio* (L), on the pond ecology and growth of fish in polyculture . *Aquaculture Research.* 26: 619-628.

Wahab, M.A., M.E. Azim, M.M. Haque and Z.F. Ahmed, 1996. Effects of frequency of fertilization on water quality and fish yields. *Progress. Agric.* 7(2): 33-39.

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