

## A Study on Silver Barb (*Puntius gonionotus*) Monoculture Vs. Mixed Culture with Carp (*Cyprinus carpio*) in the Yard Ditches of Bangladesh

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**Abstract:** A comparative study on monoculture of *Puntius gonionotus* and mixed culture of *Puntius gonionotus* and *Cyprinus carpio* was conducted in 6 ditches of 400 m<sup>2</sup> for five months. There were two treatments and each ditch was stocked with a 15000 nos. ha<sup>-1</sup> of fish. A significantly higher ( $p < 0.05$ ) total production (2002.45 kg ha<sup>-1</sup>/5 months) was obtained in the mixed culture system (T<sub>2</sub>) than that of the production (1556.86 kg ha<sup>-1</sup>/5 months) of monoculture system (T<sub>1</sub>). The net benefit of monoculture and mixed culture system was Tk. 49,943.00 and Tk. 56,514.00 respectively.

**Key words:** Silver barb (*P. gonionotus*), carpio (*C. carpio*), monoculture, mixed culture, ditch

### Introduction

Most of the farmers in Bangladesh have many of utilized or unutilized water bodies like ditches, canals, mini ponds etc. which retains water for 5-6 months. Therefore, farmers can effectively utilize these water bodies for fish culture. The production potentiality of *P. gonionotus* for culture in seasonal ponds, ditches and canals has already been proven in Bangladesh. Synergistic interactions among fish species are manifested by higher growth and yielding mixed culture than monoculture (Yashouv, 1971). The basis for these interactions are two interrelated processes namely the increase of available food resources and the improvement of environmental conditions (Milstein, 1992). The silver barb, *P. gonionotus* is creating a significant profitability in Bangladesh. It was introduced into Bangladesh from Thailand in 1977. It has been introduced in many Asian countries including Bangladesh not only for its palatability and market ability but also for high yield potential (Hussain et al., 1987). Fish selection is a key factor in the optimal management of mixed culture. It is an important phenomenon to know silver barb mono and mixed culture with carpio that fed on different natural resources may play an significant management technique to efficiently utilize the production potential of the ditches. Considering the above facts, this study was undertaken to observe the comparison of production potential and determine the feasibility of culturing silver barb in monoculture and mixed culture yard ditches with carp.

### Materials and Methods

The experiment was conducted in Bangladesh Jute Research Institute under farming system research sites, Dhaka, for a period of five months May to October, 1999 in 6 ditches of 400 m<sup>2</sup> each with an average depth of 1.4 m. Seven days before of stocking the ditches were prepared with liming @ 250 kg ha<sup>-1</sup> and then fertilized with urea and triple super phosphate (TSP) @ 50 kg ha<sup>-1</sup> respectively.

After seven days of fertilization 3 ditches under the treatment I (T<sub>1</sub>) were stocked with only silver barb at a density of 15000 ha<sup>-1</sup> and rest 3 ditches under the treatment II (T<sub>2</sub>) were stocked with silver barb and carpio (50 : 50) with same stocking density. Fish were fed with rice bran. Blind feeding was continued seven days after stocking, considering 10% mortality. Feeding frequency varied between 2-4 times/day depending on the mean weight of the fish. All the ditches were organic fertilized with the cowdung at monthly intervals @ 1,000 kg ha<sup>-1</sup>. The water quality parameters such as water temperature (°C), secchi disc depth (cm), pH, dissolved oxygen (mg l<sup>-1</sup>) and total alkalinity (mg l<sup>-1</sup>) were monitored fortnightly using HACH kit (HACH FF-2).

For sampling purpose, fish in each replicate of all the treatments were weighed and recorded at every 15<sup>th</sup> day by cast netting. Fish were harvested at the end of the experiment by dewatering the ditches. One way analysis of variance (ANOVA) was used for

statistical analysis this was followed by Duncan's new multiple range test (Duncan, 1955) to identify the level of significance of variation among the treatment means.

### Results and Discussion

The ranges of water quality parameters viz. water temperature, secchi disc depth, pH, dissolved oxygen and total alkalinity in different ditches during the study period (5 months) were found 28-32 °C, 24.8-38.9 cm, 7.1-8.9, 3.5-7 and 45-78 mg l<sup>-1</sup> respectively (Table 1).

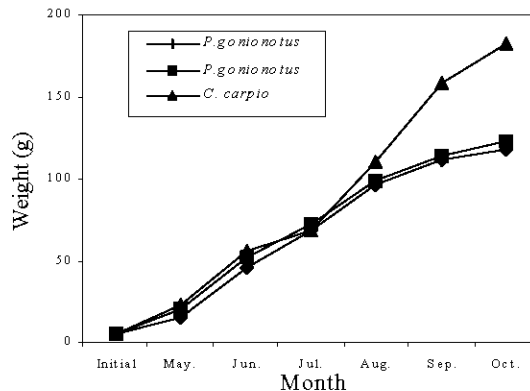


Fig. 1: Growth performance of fishes under two treatments

In this study, the monitored water quality parameters were within optimum range of fish farming. Azad Shah et al. (1998) observed the temperature range of 29.2-30.7 °C, pH from 6.46-7.04, Total alkalinity 43.38-78.63 mg l<sup>-1</sup> and dissolved oxygen ranges were 4.21-7.47 mg l<sup>-1</sup>. The ranges of temperature recorded in this study were more or less similar to that reported by Azad Shah et al. (1998). pH plays an important role in pond fish culture system. Swingle (1967) considered a pH of 6.5-9 as satisfactory for fish culture. Boyd (1982) suggested a transparency between 15-45 cm to be good for fish culture. In this study, the ranges of transparency (secchi disc depth) was within the optimal limit. The level of dissolved oxygen (DO) was within acceptable range in all the experimental ditches, which is more or less to that reported by Azad Shah et al. (1998). Dissolved oxygen content of 5-7 mg l<sup>-1</sup> is good for pond fish culture (Boyd, 1982). The ranges of total alkalinity values in this study was in the suitable condition. Moyle (1946) reported that ponds and lakes with range of total alkalinity of 40-90 mg l<sup>-1</sup> are of medium to high productivity.

In Fig. 1 showed monthly growth performance of silver barb and carpio under two treatments during the experimental period. In monoculture system (T<sub>1</sub>) average final weight of silver barb was 117.5g whereas in mixed culture system (T<sub>2</sub>) silver barb reached

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Table 1: Ranges of water quality parameters in different ditches during the study period

Parameters	May	June	July	August	September	October
Water temp. (°C)	29.7-31.0	30.9-31.5	31.5-32.0	29.8-31.8	28.3-30.1	28.0-30.2
Secchi disc depth (cm)	27.8-29.08	27.1-30.0	24.8-35.7	28.0-33.8	28.8-35.0	26.5-38.9
pH	7.85-8.71	7.17-8.7	7.4-8.9	7.57-8.2	7.1-8.5	7.2-8.0
Dissolved oxygen (mg l <sup>-1</sup> )	5.5-7.0	4.8-5.6	5.5-6.0	5.4-6.3	4.9-6.2	3.5-6.0
Total Alkalinity (mg l <sup>-1</sup> )	45.0-56.8	58.2-65.0	55.8-78.0	64.1-68.2	59.0-70.0	60.5-75.0

Table 2: Growth parameters of silver barb and carp in mono (T<sub>1</sub>) and mixed culture system (T<sub>2</sub>)

Treatments	T <sub>1</sub>	T <sub>2</sub>	
Species	<i>P. gonionotus</i>	<i>P. gonionotus</i>	<i>C. carpio</i>
Stocking (No. ha <sup>-1</sup> )	15,000	7,500	7,500
Mean No. of fish at harvest	13,840	6,835	6,741
Survival (%)	92.27	91.13	89.88
Avg. initial wt (g)	5.01	5.01	5.5
Avg. final wt (g)	117.5	123.02	182.9
Avg. wt. gain (g)	112.49	118.01	177.4
Net production (kg ha <sup>-1</sup> )	1556.86	806.60	1195.85
Total production (kg ha <sup>-1</sup> )	1556.86 <sup>a</sup>	2002.45 <sup>b</sup>	

at 5% level of significance.

Table 3: Cost and benefit per hectare from monoculture of silver barb (T<sub>1</sub>) and mixed culture (T<sub>2</sub>) with carp

Inputs	Treatments			
	T <sub>1</sub>		T <sub>2</sub>	
	Amount	Price (Tk.)	Amount	Price (Tk.)
<b>Cost</b>				
Fingerlings (Nos.)	15,000	4,500	15,000	8,250
Lime (Kg)	250	1,000	250	1,000
Cowdung (Kg)	5,000	2,500	5,000	2,500
Urea (Kg)	50	300	50	300
TSP (Kg)	50	600	50	600
Rice bran (Kg)	9,000	18,000	9,000	18,000
Netting (Tk.)	----	1,000	----	1,000
Total (Tk.)	----	27,900	----	31,650
<b>Benefit</b>				
Silver barb (Tk.50/kg)	1,556.86	77,843	806.60	40,330
Carpio (Tk.40/Kg)	----	----	1,195.85	47,834
Gross benefit (Tk.)	----	77,843	----	88,164
Net benefit (Tk.)	----	49,943	----	56,514

an average final weight 123.02g (Table 2). There was no significant difference ( $p > 0.05$ ) between the two treatments. In mixed culture system (T<sub>2</sub>) the average final weight of carp was 182.9g. The maximum weight gain was observed in mixed culture system (T<sub>2</sub>) for both the fishes viz. carp (177.4g) and silver barb (118.01g). On the contrary, in monoculture system of silver barb showed lowest gain 112.49 g. This may be due to the fact that proper utilization of waterbody in mixed culture system. The mean survival rate of two different species in the two treatments varied between 92.27-89.88% which are similar to that reported by Haque *et al.* (1998) for silver barb in polyculture. Kohinoor *et al.* (1993) obtained survival rate of 86-94% in the monoculture of silver barb. Wahab *et al.* (1995) found that the survival rate of fish including silver barb was higher than 80% in polyculture of native carps. Between the two treatments in mixed culture system carp ranked 1<sup>st</sup> position in the net production (1,195.85 kg ha<sup>-1</sup>). The highest total production was found 2002.45kg ha<sup>-1</sup> in mixed culture system due to increase yield of carp and additional yield of silver barb. The lowest production was obtained 1,556.86 kg ha<sup>-1</sup> in silver barb monoculture (T<sub>1</sub>) system. The total production performance was significantly different ( $p < 0.05$ ) between the two treatments. Hussain *et al.* (1989) reported a silver barb production of 1,952 kg ha<sup>-1</sup>/5 months. Wahab *et al.* (1995) also observed 5,294-5,670 kg ha<sup>-1</sup>/yr production in the polyculture of carps with silver barb. The overall increase of fish production in mixed culture system may have due to the synergistic interaction from fecal input of

silver barb. The excreta has enriched the bottom of the ditches which helped to increase the growth and production of carp. On the contrary, by stirring up the mud, the carp recirculates the nutrients into the water which helped to increase the phytoplankton population and ultimate growth of silver barb as well. Shahabuddin *et al.* (1994) found positive effect of silver barb on the growth of common carp. The excreta of silver barb reported to influence the growth of common carp (Dev, 1994). The cost benefit feature from silver barb monoculture and silver barb mixed culture with carp are shown in Table 3. Cost of production in silver barb monoculture (T<sub>1</sub>) and silver barb mixed culture with carp (T<sub>2</sub>) was 27,900 and 31,650. All variable costs were remaining same in the both treatments except carpio fingerling costs for T<sub>2</sub>. The gross revenue in T<sub>1</sub> amounted to Tk. 77,843 ha<sup>-1</sup>, having with a net benefit of Tk.49,943 ha<sup>-1</sup>, whereas gross revenue from T<sub>2</sub>, amounted to Tk. 88,164 ha<sup>-1</sup> having with a net benefit of Tk. 56,514 ha<sup>-1</sup>, showing a higher profit per hectare than that of T<sub>1</sub>.

It is concluded that silver barb mixed culture with carp is far better than that of silver barb monoculture in the yard ditches of Bangladesh. Silver barb is one of the most acceptable candidates for mixed culture anywhere in Bangladesh.

References

Azad Shaha, A. K. M., M. A. Hossain and K. Afsana, 1998. Effect of different rice bran on the growth of Thai silver barb (*Puntius gonionotus*, Bleeker) in seasonal ponds. Bangladesh J. Fish. Res., 2: 159-169.

Boyd, C. E., 1982. Water quality management for pond fish culture. Elsevier Science Publishers, Amsterdam. The Netherlands, pp: 318.

Dev, B. C., 1994. Food selection and electivity in ditches of the Thai barb *Puntius (=Barbados) gonionotus* in extensively managed, rain fed pond in Bangladesh. M. Sc. Thesis. Dept. of Aquaculture and Management, Bangladesh Agricultural University, Mymensingh.

Duncan, D. B., 1955. Multiple Range and Multiple F Test. Biometrics, 11: 1-42.

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

Hussain, M. G., M. Akteruzzaman, A. H. M. Kohinoor, K. A. T. Karim and M. S. Shah, 1989. Semi intensive culture of silver barb. Bangladesh J. Fish, 12: 32-38.

Hussain, M. G., M. M. Akhteruzzaman and P. Perchabacker, 1987. Horme induced evaluation and spawnin<sup>-1</sup> g of *Puntius gonionotus* (Bleeker). Bangladesh J. Fish., 10: 1-4.

Kohinoor, A. H. M., M. Akhteruzzaman and M.S. Shah, 1993. Production of *Puntius gonionotus* (Bleeker) in ponds. Bangladesh J. Zool., 21: 77-83.

Milstein, A., 1992. Ecological aspect of fish species interactions in polyculture ponds. Hydrologia, 231: 177-186.

Moyle, J. B., 1946. Some indices of lake productivity. Trans. Am. Fish. Soc., 76: 322-334.

Shahabuddin, M., M. S. Miah and M. S. Alam, 1994. Study on production optimization through polyculture of indigenous and exotic carps. Bangladesh J. Train. Dev., 7: 67-72.

Swingle, H. S., 1967. Standardization of chemical analysis of waters and pond muds. FAO Fish Rep., 4: 397-421.

Wahab, M. A., Z. F. Ahmed, M. A. Islam, M. S. Haq and S. M. Rahmatullah, 1995. Effect of Introduction of common carp, *Cyprinus carpio* (L.) on pond ecology and growth of fish in polyculture. Aquacult. Res., 26: 619-628.

Yashouv, A., 1971. Interaction between the common carp (*Cyprinus carpio*) and the silver carp (*Hypophthalmichthys molitrix*) in fish ponds. Mamidges, 23: 85-92.