

## Production performance of Pabda (*Ompok pabda*) and Gulsha (*Mystus cavasius*) with Rohu (*Labeo rohita*) in polyculture management

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**Abstract.** The study was carried out in on-farm condition during May to October 2017 in Kapashia Upazila, Gazipur. Three stocking densities of Pabda (*Ompok pabda*) and Gulsha (*Mystus cavasius*) were tested keeping the Rohu (*Labeo rohita*) stocking density the same. The stocking densities of Pabda and Gulsha fingerlings in Treatments-1, 2 and 3 were 125,000 and 50,000; 187,500 and 75,000; 250,000 and 100,000/ha, respectively. In all the treatments, the stocking density of Rohu was the same (1250/ha). Supplemental feed having 30% crude protein was applied at the rate 2-10% of the body weight in all the ponds. After five months of rearing, highest production ( $8690 \pm 249$  kg/ha) was obtained from Treatment-3, where Pabda and Gulsha were stocked at highest stocking density whereas; lowest production was obtained in Treatment-1 ( $5875 \pm 458$ ). The production levels showed significant difference ( $p < 0.05$ ) between Treatment-1 with Treatment-2 and Treatment-3. However, no significant difference was observed between Treatment-2 and Treatment-3 ( $p > 0.05$ ). The study concludes that Pabda and gulsha if stocked with rohu at a density of 250,000 and 100,000/ha respectively will give higher production.

**Keyword:** Pabda (*Ompok pabda*), Gulsha (*Mystus cavasius*), Polyculture

### Introduction

Bangladesh is blessed with vast water resources which include inland waters and marine water resources. Inland water resources of Bangladesh are considered to be one of the richest in the world both in area and potential for fisheries development. But at present the situation has changed due to environmental degradation, pollution, extensive fishing pressure on natural water bodies and use of banned fishing gear. For this reason to meet up the growing demand of aquaculture has the greatest potential in Bangladesh. Pond aquaculture in Bangladesh is expanding very fast. Currently aquaculture production accounts for about one third of the total fish production in Bangladesh. To increase the production of fish, species selection is very important. Pond aquaculture in Bangladesh is expanding very fast presently. According to FAO report, Bangladesh ranked 3<sup>rd</sup> in inland open water capture production and 5<sup>th</sup> in world aquaculture production (DoF 2019). To increase the suitable indigenous fish species production, species selection is very important.

Pabda (*Ompok pabda*) and Gulsha (*Mystus cavasius*) is an integral component of subsistence fisheries for thousands of years but has gained popularity in recent years. Pabda and Gulsha are better performing species in the pond aquaculture system of Bangladesh. These two fishes are great favorite to consumers because of its mouth-watering taste and therefore have a great demand and high price in the fish market. Though these two species have been reported quite favourable under standard conditions of carp farming (Kohinoor *et al.* 1997), their culture technique with carps in polyculture system is still under developed. This trial was designed to

evaluate the production performances of Rui (*Labeo rohita*) with Pabda (*Ompok pabda*) and Gulsha (*Mystus cavasius*) in polyculture management at on farm condition.

### Material and Methods

Nine ponds of 3 farmers at Kapashia Upazila under Gazipur district of Bangladesh were used in this field for five month rearing period from 15 May to 15 October 2017. The average of pond area was 0.10 ha.

**Preparation of pond:** Selected ponds were free from predatory animals, unwanted fishes and aquatic higher vegetation. Flexible plastic pipes were used for water supply from the deep tube-well. The embankment was well protected and covered with grass. Prior to commencing the experiment, rotenone (12.50 kg/ha) was applied to eradicate predators and small fish. Then ponds were treated with lime at the rate of 250 kg/ha.

**Experimental design:** Three stocking densities of Pabda (*Ompok pabda*) and Gulsha (*Mystus cavasius*) were tested keeping the Rui (*Labeo rohita*) stocking density similar. Fingerlings of Pabda and Gulsha were stocked in Treatments-1, 2 and 3 were 125,000 and 50,000; 187,500 and 75,000; 250,000 and 100,000/ha, respectively. In all the treatments, the stocking density of Rui was same and it was 1,250/ha.

**Feed and feeding management and sampling of fish:** The fingerlings of Pabda, Gulsha and Rui were stocked on 15 May 2017. All treatments were subjected to the same regime of feed and fertilizer application. After stocking, in all treatments, a 30% protein containing pelleted feed were applied at the rate of 12-3% of estimated fish biomass twice daily at 7.0 pm and 6.0 am. The fingerlings were fed at the rate of 12% of their body weight for the first two weeks and it was reduced to 3% on the subsequent months. During the culture trail, lime and salt were applied in all the ponds fortnightly interval at the rate of 50 and 100 kg/ha, respectively. Twenty fish of each species from each pond were caught at each monthly sampling day using a seine net. After weighted, all fishes were returned into the ponds after sampling.

**Determination of water quality parameters:** Different types of water quality parameters were estimated and recorded fortnightly throughout the experimental period. Water quality measurement and sample collection were made between 9.00-10.00 am. Water quality parameters such as temperature (°C), transparency (cm), pH, dissolved oxygen (mg/L) were measured by thermometer, secchi disk, digital pH meter and DO meter, respectively. Total alkalinity (mg/L) was determined in the water quality Laboratory of the Freshwater station, BFRI. Water samples were collected from the ponds and transported in black plastic bottles having a volume of 250 ml each marked with pond number to the laboratory for analysis.

**Harvesting and data analysis:** After five months of culture period, fish were harvested by repeated seine netting. After seine netting, the pond water was pumped out and all fishes were harvested. Total bulk weight and number of fish from each pond was recorded. Data were analyzed using the statistical package, Stat Graphics Version 7. ANOVA was performed on all the dependent variables to find out whether treatments had any significant difference on growth. Duncan's New Multiple Range Test (DNMRT) was performed to identify any significant difference among treatment means.

## Results and Discussion

**Water quality parameters:** Mean values of five months data of each parameter are presented in Table I. The water temperature recorded during the study period was more or less similar in different ponds under three treatments. Temperature varied from 27.26 to 31.90°C with mean values of  $29.15 \pm 2.59$ ,  $29.40 \pm 1.44$  and  $29.34 \pm 1.46$ °C in Treatments-1, 2 and 3, respectively (Table I). There were no significant differences among the treatments when ANOVA was performed ( $p > 0.05$ ). Paul (1998) reported temperature ranged from 25 to 35°C was suitable for fish culture. Water temperature in shallow and small fish ponds in Bangladesh conditions has been found to range from 26-35°C, with the maximum in May to August and follows air temperature closely with a small variation (Mollah and Haque 1978, Rahman *et al.* 1982 and Hossain *et al.* 1997). In the present experiment water temperature was favorable for fish culture.

**Table I. Water quality parameters of the ponds in different treatments**

Parameter	Treatment-1	Treatment-2	Treatment-3
Temperature (°C)	$29.15 \pm 2.59$	$29.40 \pm 1.44$	$29.34 \pm 1.76$
Transparency (cm)	$33.60 \pm 3.19^a$	$36.11 \pm 4.55^a$	$42.44 \pm 5.90^b$
Dissolved oxygen (mg/L)	$4.44 \pm 2.57^a$	$4.07 \pm 1.03^b$	$3.93 \pm 3.15^b$
pH	7.13-7.81	7.10-7.63	7.20-7.71
Total Alkalinity (mg/L)	$193.27 \pm 24.13^a$	$170.31 \pm 19.67^b$	$174.5 \pm 33.28^b$

\*Figures in the same row having the different superscripts are significantly different ( $p < 0.05$ )

Water transparency values of different ponds under the three treatments showed variations on different sampling dates. The transparency values ranged from 30 to 42, from 28 to 39 and from 28 to 44 cm in Treatments-1, 2 and 3, respectively. The mean values of transparency were found to be  $33.60 \pm 3.19$ ,  $36.11 \pm 4.55$  and  $42.44 \pm 3.90$  cm in Treatments-1, 2 and 3, respectively (Table I). Significant differences among the treatments were observed when ANOVA was performed ( $p < 0.05$ ). Transparency values increased with increasing stocking density of Pabda due to lower abundance of phytoplankton, indicating that Pabda grazed more on plankton. Rahman (1992) stated that the transparency of productive water bodies should be 40cm or less (turbidity resulting from plankton). Majumder *et al.* (2107) recorded transparency values ranging from 31 to 38 cm in tilapia monoculture. The water transparency values of the ponds under Treatment-1, treatment-2 and treatment-3 were within productive range in the present experiment.

The values of dissolved oxygen were found to range from 3.40 to 6.20 mg/l in Treatment-1, 3.22 to 6.11 mg/l in Treatment-2 and 3.14 to 5.96 mg/l in Treatment-3. The mean values of Treatments-1, 2 and 3 were  $4.44 \pm 2.57$ ,  $4.07 \pm 1.03$  and  $3.93 \pm 3.15$  mg/L, respectively (Table I). The value of treatment-1 was significantly ( $p < 0.05$ ) higher than those of Treatments-2 and 3, while Treatment-2 was not significantly different from Treatment-3. The dissolved oxygen concentrations in ponds showed variations among treatments which might be due to variation in the rate of dissolved oxygen consumption by fish and other animals through respiration. The significantly lower concentration of dissolved oxygen was observed in Treatments-2 and 3 where stocking density of fish was higher than Treatment-1. However, the fluctuations in dissolved oxygen concentrations in all treatments pond waters within the productive range throughout the experimental period (Boyd 1982). Majumder (2017), Mazid (2009), Sarker (2007), found more or less similar results. In the present experiment the mean dissolved oxygen values were within suitable range.

During the study period, the pH values of pond water under different treatments were found to be alkaline. The levels of pH varied from 7.13-7.81, 7.10-7.63 and from 7.20-7.71 in Treatments-1, 2 and 3, respectively. Different authors have reported a wide variations in pH from 6.7 to 7.2 (Ahmed 1993); 6.7 to 8.3 (Hossain *et al.* 1997); 6.5 to 9.0 (Swingle 1967) and 7.18 to 7.24 (Kohinoor *et al.* 1998) in fertilized fish ponds and found to be productive. The values of pH recoded in the present experiment are well within above reported ranges, indicating the productive nature of the ponds.

The total alkalinity values of the pond water under different treatments were found to be within productive level. The values of total alkalinity as recorded from water of the ponds under Treatments-1, 2 and 3 were found to vary from 175 to 212, 148 to 192 and 114 to 181 mg/l, respectively. The mean values of total alkalinity in Treatments-1, 2 and 3 were found to be  $193.27 \pm 24.13$ ,  $170.31 \pm 19.67$  and  $174.5 \pm 33.28$  mg/L, respectively. Significant variations ( $P > 0.05$ ) were observed among the treatments. Majumder *et al.* (2007) recorded total alkalinity values ranging from 164 to 167 mg/L.

**Growth and production performances:** Details of stocking, growth and production performances in different treatments are presented in Table II. The average final weights of Pabda were  $42 \pm 7.80$ ,  $38 \pm 6.90$  and  $33 \pm 7.30$ g, in Treatment-1, Treatment-2 and Treatment-3, respectively. The poor harvesting weight was observed in Treatment-3 whereas, comparatively higher harvesting mean weight was observed in Treatment-1. The weight of Pabda showed significant difference ( $p < 0.05$ ) among the treatments. In case of Gulsha, the average final weights were  $32 \pm 5.30$ ,  $29 \pm 5.99$  and  $26 \pm 4.70$ g, in Treatment-1, Treatment-2 and Treatment-3, respectively. The poor harvesting weight was observed in Treatment-3 whereas, comparatively higher harvesting mean weight was observed in Treatment-1. The weight of Gulsha showed significant difference ( $p < 0.05$ ) among the treatments. The average weight attained by Rohu was  $709 \pm 110$ ,  $660 \pm 920$  and  $630 \pm 126$ g in Treatments-1, 2 and 3, respectively at the end of the experimental period. However, it was observed that Treatment-1 was significantly better ( $p < 0.05$ ) than Treatments-2 and 3.

**Table II. Growth and productions of rohu, pabda and gulsha after six months rearing under three different treatments**

Treatments	Fish sp.	At stocking		Harvesting wt. (g)	Survival (%)	Species wise production (kg/pond)	Total production (kg/pond)	Total production (kg/ha)
		Initial wt. (g)	Stocking density/ha					
1	Pabda	3.3±0.26	1,25,000	42±7.80	75±6.11	3938±304	926±67	5875±458 <sup>a</sup>
	Gulsha	2.30±0.28	50000	32±5.30	69±7.21	1104±113		
	Rohu	34±2.1	1250	709±110	94±2.64	833±107		
2	Pabda	3.6±0.26	1,87,500	38±6.90	79±6.24	5629±196	774±51	7786±550 <sup>b</sup>
	Gulsha	2.60±0.28	750000	29±5.99	65±4.72	1414±106		
	Rohu	35±2.1	1250	660±92	90±4.72	743±75		
3	Pabda	3.8±0.26	2,50,000	33±7.30	77±6.24	6353±265	739±72	8690±249 <sup>c</sup>
	Gulsha	2.10±0.28	100000	26±4.70	62±6.55	1612±75		
	Rohu	30±2.1	1250	630±126	92±3.51	725±54		

After five months rearing, the total calculated fish production obtained were 5875±458, 7786±550 and 8690±249 kg/ha in Treatments-1, 2 and 3, respectively (Table II). The highest production was obtained from Treatment-3, where Pabda and Gulsha were stocked at the stocking density 250000 and 100000/ha respectively. The lowest production was obtained in Treatment-1 where Pabda and Gulsha were stocked at 125000 and 50000/ha respectively. The production levels showed significant differences ( $p < 0.05$ ) among the treatments. Sultan (1997) obtained survival rates 93.75%, 91.88%, 86.88% under treatment-1, treatment-2, and under treatment-3 in polyculture of tilapia, rohu, catla and mrigal. In the present study average survival rate was comparatively lower in Treatment-3 than other treatments. Kohinoor *et al.* (1997) recorded an average production from semi-intensive culture of Pabda (*O. pabda*) with Rajpunti (*Barbodes gonionotus*) and Mirror carp (*Cyprinus carpio*) in six months culture period as 2,932 kg/ha/6 months where the contribution of pabda was only 15.27%, while, Hossain *et al.* (1998) obtained a production of 3,125 kg/ha from polyculture of gulsha (*M. cavasius*) with rajpunti (*Barbodes gonionotus*) and silver carp (*Hypophthalmichthys molitrix*) in earthen ponds. From the present study it can be concluded that the total production of fish in a poly culture of pabda and gulsha with rohu can be increased when the stocking density of pabda and gulsha will be increased up to 250000/ha and 100000/ha respectively.

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