Bangladesh J. Fish. Res., 3(2), 1999: 157-164

Production of Thai sharpunti (*Puntius gonionotus* Bleeker) in polyculture with carps using low-cost feed

A.H.M. Kohinoor*, M.S. Islam, N. Begum and M.G. Hussain
Bangladesh Fisheries Research Institute, Freshwater Station, Mymensingh 2201, Bangladesh
**Corresponding author*

Abstract
The effectiveness of duckweed and rice bran as a low cost supplementary feed was compared through a six months production trial of rajpunti (*Barbodes gonionotus*) with carps. Six earthen ponds of 360 m^2 each were used for the trial. Three ponds received duckweed, while the other three received rice bran as supplementary feed. Fish biomass after six months of rearing increased to an average of 2,056 kg/ha in ponds which received duck weed and 2,056 kg/ha in rice bran treated ponds. The net profit with duckweed and rice bran worked out to Tk. 69,752 and Tk. 73,480 kg/ha, respectively. This study revealed that duckweed is a low cost supplementary feed, particularly for farmers with limited income.

Key words : *P. gonionotus*, Silver carp, Common carp, Polyculture, Duck weed

Introduction

Rajpunti, *Puntius gonionotus*, was introduced into Bangladesh from Thailand in 1977. The species has high potentiality for culture in seasonal ponds, ditches and road-side canals where the major carps do not perform well. It is a herbivore, feeding mainly on aquatic plants, grasses and algae (Phaohorm 1970 and Srisuwantach 1981). Hussain *et al.* (1989) studied the production potential of this species in earthen ponds, while Kohinoor *et al.* (1993) reported on optimizing its production by using a mixture of rice bran (60%) and mustard oil cake (40%) as supplementary feed. The species is suitable for low input culture system in small seasonal ponds and ditches because of its quick growth. This investigation was undertaken to evaluate the efficacy of duck-weeds (*Lemna* spp.) as a low cost supplementary feed.

Materials and methods

The experiment was carried out from October'93 through March'94 in six ponds of 360 m^2 each, with an average water depth of 90 cm. Fingerlings of rajpunti (*Barbodes gonionotus*), silver carp (*Hypophthalmichthys molitrix*) and mirror carp (*Cyprinus carpio* var *specularis*) were uniformly stocked in ponds at a stocking density of 20,000, 1,000 and 1,000/ha, respectively. Duckweed was given as supplementary feed in three ponds (T-1) while rice bran was used in the second treatment (T-II). In both the treatments, fertilization was done with cow dung at fortnightly intervals at a rate of 1,000 kg/ha.

The ponds were prepared by draining and application of lime to the pond bottom at the rate of 250 kg/ha. Three days after the application of lime, ponds were filled with ground water and fertilized with cattle manure at the rate of 750 kg/ha. Five days after the application of cattle manure, inorganic fertilizers- urea and TSP were applied 8 and 17 kg/ha, respectively. Five days after the application of fertilizers, fish were stocked in all the ponds. Feeding began immediately after stocking. Rice bran and duckweed were fed at 4-6 and 8-10 % of body weight of fish biomass, respectively. Ten percent of the stock was sampled fortnightly, to estimate the growth and standing crop, based on which feeding was adjusted.

The important physico-chemical parameters of water *viz.*, temperature (°C), secchi disc transparency (cm), pH and dissolved oxygen (mg/L) were analyzed every seven days, following standard methods (APHA 1989). The samples of water were collected between 09.00 to 10.00 AM. Plankton samples were collected fortnightly from each of the experimental ponds. Ten liters of water, collected from different locations and depths of each pond, were passed through a plankton net of 25µm mesh size. Filtered samples were transferred into a measuring cylinder and carefully made up to a standard volume of 50 ml. Plankton samples were then preserved in 5% formalin in small plastic vials for subsequent studies. One ml sub-sample was examined under a binocular microscope using a Sedgewick-rafter cell (S-R cell). Plankton cells in 10 randomly chosen squares were counted and used for quantitative estimation using the following formula (Stirling 1985):

$$N = \frac{A \times 100 \times C}{V \times F \times L}$$

Where, N= No. of plankton cells, A = Total no. of plankton counted, C = Volume of final concentrate of the sample in ml, V = Volume of a field in cubic mm, F = Number of fields counted and L = Volume of original water in litre

After six months of rearing, the fish were harvested by dewatering the ponds. During harvest, they were counted and individually weighed to assess survival, growth and production. Statistical analysis of all the data was performed using the Student's t-test (Zaman1982). One way analysis of variance (ANOVA) was applied whenever necessary, following Sokal and Rohlf (1991).

Results and discussion

The physico-chemical properties of water in the experimental ponds were: water temperature 17-32°C, Secchi disc transparency 16-50 cm, pH 7.1-8.9 and dissolved oxygen 2.0-7.4 mg/L (Table 1). ANOVA of the mean values of each water quality parameter did not show any significant difference between the two treatments.

Table 1. Physico-chemical characteristics of pond water during the study period

Parameter	October	November	December	January	February	March
Water temperature(^{0}C) 0	23-32	25-27	17-23	15-23	15.5-27.0	20.5-28.0
Secchi disc transparency (cm)	24-40	22-32	18-50	16-24	20-30	18-30
Dissolved oxygen (mg/L)	2.5-5.9	2.7-5.0	2.0-6.0	2.0-6.3	2.0-5.6	2.4-7.4
pH	7.31-8.4	7.6-8.5	7.4-8.9	7.1-8.0	7.5-8.7	7.46-8.71

The temperature recorded in this experiment was found to be comparatively low for the optimum growth of carp as the experiment was conducted during the winter months. Dewan *et al.*(1991) reported a temperature range from 30.2 to 34.0°C (June-August) while Wahab *et al.* (1996) recorded a temperature range 28.5 to 31.3°C (August-November) in their experiment with carps. pH is one of the most important factors in pond fish culture system. Swingle (1967) considered a pH of 6.5 to 9.0 as satisfactory for fish culture. Ali *et al.* (1982) observed a pH range of 7.5 to 9.5 in a freshwater pond at the BAU campus. In this experiment, pH ranged from 7.1 to 8.9 which indicates that the ponds were conducive for fish culture. Transparency of ponds was high in January and low in December. The higher values of transperancy were probably due to decreased concentration of plankton. Mollah and Haque (1978) recorded a transparency of 91.5- 127cm in ponds of Bangladesh Agricultural university Campus. Boyd (1982) suggested a transparency between 15 to 45 cm to be good for fish culture. Kohinoor *et al.* (1998) recorded higher values in August-September due to higher rainfall. The level of dissolved oxygen (DO) was within the acceptable range in all the experimental ponds. Generally oxygen content was higher in winter and lower in summer, probably because of the inverse relationship between dissolved oxygen content and temperature. Boyd (1982) stated that dissolved oxygen content of 5 to 7 ppm is good for pond fish culture.

The group-wise mean abundance of plankton observed in two treatments is shown in Table 2. Phytoplanktonic population mainly comprised of Bacillariophyceae, Chlorophyceae, Cyanophyceae and Euglenophyceae. In T-I, the mean value of phytoplankton was 24.46±5.79 cells/L, while in T-II, the abundance was marginally higher at 26.29±7.64 cells/L. Chlorophyceae was the dominant phytoplanktonic group in terms of number in both treatments throughout the experiment. Euglenophyceae abundance was the lowest in the two treatments. There was no significant variation between treatments with regard to phytoplankton population.

Table 2. Mean (±sd) plankton numbers ($x10^3/L_{x1BN}$) recorded in the two treatments

Treatment	T-I	T-II	Significance level
Phytoplankton			
• Bacillariophyceae	4.71±2.02	4.20±2.76	NS
• Chlorophyceae	10.11±4.61	11.91±6.24	NS
• Cyanophyceae	6.64±3.12	6.39±2.98	NS
• Euglenophyceae	3.0±1.96	3.79±1.59	NS
Total	24.46±5.79	26.29±7.64	NS

Zooplankton	2.10±1.19	2.0±1.09	NS
• Crustacea			
• Rotifera	3.41±2.20	3.05±1.95	NS
Total	5.51±1.67	5.05±1.99	NS

• *NS= Not Significant at 5% level*

The zooplankton population was represented by only two groups *viz.*, Crustacea and Rotifera. The mean values of zooplankton in T-I and II were 5.51±1.67 and 5.05±1.91 unit/L, respectively and the difference was not significant (P>0.05). Rotifera was the dominant group in terms of abundance in both the treatments.

Phytoplankton population showed an inverse relationship with zooplankton population. Similar results were also recorded by Islam and Saha (1975). Wahab and Ahmed (1991) estimated mean phytoplankton population of 17.72 x 10^4 /L, 9.36x 10^4/L and 13.87 x 10^4 /L from three sets of ponds, respectively. In another study, Wahab *et al.* (1994) recorded phytoplankton numbers ranging from 2.0 x 10^5 to 8x 10^5 cell/L and zooplankton between 2.0x 10^4/L to 2x 10^5 unit/L in three ponds. Haque *et al.*(1998) observed phytoplankton and zooplankton abundance of 3.78±0.15 to 50.64±1.29 cells/L and 4.91±0.8 to 6.16±0.8, respectively in their study. Compared to these observations, the plankton abundance was lower in the present study and this might be due to the lower quantity (about 50%) of fertilizers used.

The month-wise growth performance of rajpunti, silver carp and mirror carp is shown in Figure 1. Throughout the study period, fish fed with rice bran showed higher growth than those receiving duck weed.

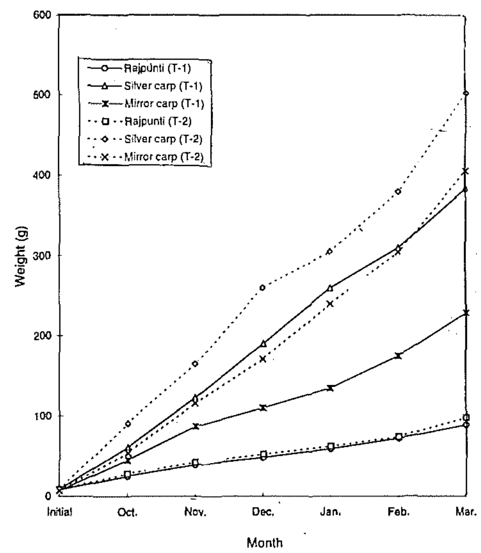

Fig.1. Monthly growth (g) of fishes under two treatments.

Details of stocking density, initial weight (g), harvesting weight, specific growth rate (SGR), survival rate and total production are shown in Table 3. Rajpunti reached an average final weight 89.0±12.25 and 98.0±14.63 in T-I and II, respectively. There was no significant difference (P>0.05) between the two treatments.

Table 3. Stocking density, gross production, specific growth rate (SGR), survival and FCR of rajpunti and other carps using duckweed and rice bran

Treat-ments	Species	Stocking density (k/ha)	Av. initial Wt.(g)	Av. Final Wt. (g)	SGR (%)	Production (kg/ha) Species wise	Total	Survival (%) Species wise	Total	AFCR
T-I	Rajpunti	20,000	8.03±3.45	89.0±12.25	1.33	1,575.89		88.53	80.94	10.09
(Duck- weed)	Silver carp	1000	8.54±2.46	384±18.67	2.11	3,14.26	2,056.08	81.83		
	Mirror carp	1000	7.07±3.42	229±24.69	1.93	165.93		72.46		
T-II	Rajpunti	20,000	8.5±3.69	98.0±14.63	1.35	1,807.69		92.23	86.22	5.2
(Rice bran)	Silver carp	1000	8.21±2.15	503±20.95*	2.34	427.55	2,565.87	85.00		
	Mirror carp	1000	6.83±3.65	406±30.25*	2.27	330.63		81.44		

**Significant at 5% level*

On harvest silver carp weighed 384.00±18.67 in T-I and 503.00±20.95g in T-II. The specific growth rate was higher in T-II (2.34%). Significant difference ($P<0.05$) in its harvesting weight between the two treatments was observed. Mirror carp grew to an average weight of 229.00±24.69 and 406.00±30.25g in T-I and II, respectively. The specific growth rate was also higher in T-II (2.27%). The harvesting weight of mirror carp also showed significant difference ($P<0.05$).

The mean survival rate of the different species in the two treatments varied between 82-86% in the present study which was higher than the survival rate reported by Wahab *et al.* (1991) for Indian major carps in polyculture, where supplementary feed was given. Lakshmanan *et al.*(1971) observed a carp survival rate of 80% in polyculture, where ponds were fertilized with both organic and inorganic fertilizers and fishes were fed with a mixture of rice bran and mustard oil cake. In another study, Kohinoor *et al.*(1993) obtained a survival rate of 86 to 94% in the monoculture of Thai sharpunti. Wahab *et al.*(1995) found that the survival of fish including sharpunti was higher than 80% in polyculture of native carps. Haque *et al.* (1998) recorded 88.89 to 93.93% survival of rohu, catla and mirror carp in their experiment.

The gross production from ponds provided with duckweed (T-I) was 1,923 to 2,128 kg/ha, with an average of 2,056 kg/ha/6 months. In the case of ponds fed with rice bran (T-II), gross production ranged from 2,407 to 2,655 kg/ha with an average of 2,565 kg/ha/6 months. Gross production from rice bran fed ponds was significantly higher ($P<0.05$) than those provided with duckweed.

The cost of production and return from culture of rajpunti with silver carp and mirror carp are presented in Table 4. While estimating the cost of production, variable costs of only lime, feed, fertilizer and fingerlings were taken into consideration. Cost of production amounted to Tk.16,397.60/ha and Tk. 32,263.79/ha in T-I and T-II, respectively, it being higher in T-II due to the higher cost of rice bran. The gross revenue in T-I amounted to Tk. 86,150.40/ha, leaving a net benefit of Tk. 69,752.80, while gross revenue from T-II, amounted to Tk. 1,05,744.60, with a net benefit of Tk. 73,480.81/ha, showing a higher profit per hectare from ponds fed with rice bran. Economic analysis indicates that an additional cost of Tk.15,866.19 is required for getting the additional net benefit of Tk. 3,728.01 using rice bran which works out to a return of 23.6% on investment, but would be difficult for a small farmer.

Table 4. Cost and benefits per hectare from culture of rajpunti with carps using duckweed (T-I) and rice bran (T-II) as supplementary feed

Inputs	T-I Quantity (kg)	T-I Cost (Tk.)	T-II Quantity (kg)	T-II Cost (Tk.)
A. Cost				
- Lime	250	750.00	250	750.00
- Cattle manure	11,000	4400.00	11,000	4,400.00
- Fingerlings	22000 nos.	7100.00	22,000 nos.	7,100.00
- Rice bran	-	-	13,342.52	20,013.79
- Duckweed	20,738	4147.60	-	-
		16,397.60		32,263.79
B. Benefits				
- Rajpunti (Tk.45.00/kg)	1,575.89	70,915.05	1,807.69	81,346.05
- Silver carp (Tk.30.00/kg)	314.26	9,427.80	427.55	12,826.50
- Mirror carp (Tk.35.00/kg)	165.93	5807.55	380.63	11,572.05
Gross benefit		86,150.40		1,05744.60
Net benefit (B-A)		69,752.80		73,480.81

Baily and Bhuiyan (1982) obtained high production of fish using supplementary feed along with inorganic and organic fertilization. Davis *et al.* (1983) harvested yields of carps ranging from 1,890 to 3,820 kg/ha/yr., while Ameen *et al.*(1983) obtained 3,100 kg/ha/yr from carps ponds. Hussain *et al.* (1989) reported a rajpunti production of 1,952 kg/ha/5 months in monoculture with rice bran feeding. Kohinoor *et al.* (1993) obtained an yield of 2,384 kg/ha/6 months when rajpunti was fed on rice bran and mustard oil cake and the ponds were also fertilized with organic and inorganic fertilizers. In trials with farmers' participation, Gupta (1991) reported an yield of 1.6 tons/ha/6 months when rajpunti was fed on rice bran.

The present study indicates that the use of duckweed in lieu of rice bran as a supplementary feed can give economically satisfactory results, though the net benefit and production per hectare are lower with duckweed. However, it appears to be a viable alternative to rice bran as a supplementary feed for polyculture of rajpunti and carps particularly for farmers who do not have easy access to rice bran.

References

Ali, S., A.K.A. Rahman, A.R. Patwary and K.H.R. Islam, 1982. Studies on diurnal variations in physico-chemical factors and zooplankton in freshwater pond. *Bangladesh J. Fish.*, **2-5**(1-2):15-23.

American Public Health Association (APHA), 1982. Standard Methods for the Examination of Water and Wastewater. American Public Health Association, Washington DC.

Ameen, M., S. Ali, Z. Begum. F.M.A. Munyem, M. Rahman, T. K. Roy, N. Ahmed, A. R. Bhuiyan and C.W. Davis, 1983. Traditional versus semi-intensive fish culture in ponds:

remarkable difference in fish production. Proceedings of 4th Seminar on Maximum Livestock Production from Minimum Land. Bangladesh Agri. Uni. Mymensingh, Bangladesh. pp. 106-110.

Baily, W.M and L. Bhuiyan, 1982. Experimental aquaculture in demonstration ponds in Chandpur Irrigation Project Area. *In*: Fifth Annual Reports, Irrigation Fishery Development Project for Chandpur, Muhuri and Karnafuli, Bangladesh. Directorate of Fisheries Environmental Group.

Boyd, C.E., 1982. Water Quality Management for Pond Fish Culture. Elsevier Science Publishers, Amsterdam. The Netherlands. 318pp

Davis, C.H., A.R. Bhuiyan and M. Ameen, 1983. Fish production in managed farmers' with different feeding and stocking regimes-Raipur, Noakhali district. *ADAB News*, **10**(2): 2-26.

Dewan, S., M.A. Wahab, M.C.M. Beveridge, M.H. Rahman and B.K. Sarkar, 1991. Food selection, electivity and dietary overlap among planktivorous Chinese and Indian major carps fry and fingerlings grown in extensively managed, rain-fed ponds in Bangladesh. *Aquaculture and Fisheries Management*, **22**: 277-294.

Gupta, M.V., 1991. Low-input technologies for rural aquaculture development in Bangladesh. Paper Presented at BOSTID-ICLARM Aquaculture Workshop for PSTC/CRD Scientists, 6-10 August, Manila, Philippines.

Hussain, M.G., M. Akhteruzzaman, A.H.M. Kohinoor, K.A.T. Karim and M.S. Shah, 1989. Semi-intensive culture of *Puntius gonionotus* (Bleeker). *Bangladesh J. Fish.*,**12**(2):32-38.

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.

Kohinoor, A.H.M., M. Akhteruzzaman and M. S. Shah, 1993. Production of *Puntius gonionotus* (Bleeker) in ponds. *Bangladesh J. Zool.*, **21**(2): 77-83.

Kohinoor, A.H.M., M.L. Islam, M.A. Wahab and S.H. Thilsted, 1998. Effect of mola (*Amblypharyngodon mola* Ham.) on the growth and production of carps in polyculture. *Bangladesh J. Fish. Res.*, **2**(2):119-126.

Lakshmanan, M.A.V., K.K. Sukumaran, D.S. Murty, D.P. Chakraborty and M.T. Philiposoer, 1971. Preliminary observations on intensive fish farming in freshwater ponds by the composite culture of Indian and exotic species. *J. Inland Fish. Soc. India.*, **2**: 1-21.

Mollah, M.F.A., and A.K.M. Aminul Haque, 1978. Studies on monthly variations of plankton in relation to the physico-chemical conditions of water and bottom soil of two ponds. *Bangladesh J. Fish.*, **1**(1): 29-39.

Phaohorm, S., 1970. The study of biology, feeding and growth of *Puntius gonionotus* (Bleeker). Annual Report, Deptt. of Fish., Bangkok, Thailand. pp.19-33.

Srisuwantach, V., 1981. Induced breeding of Thai Silver barb (*P. gonionotus*, Bleeker). SAFIS manual No. 10. Eng. Transl. The secretariat, South- East Asian Fish. Dev. Center, Thailand.

Stirling, H.P., 1985. Chemical and Biological Methods of Water Analysis for Aquaculturist. Institute of Aquaculture, University of Stirling, Scotland, FK9 4LA. 119pp.

Swingle, H.S., 1967. Standardization of chemical analysis for waters and pond muds. *FAO Fish. Rep.*, **4**(44): 397-421.

Wahab, M. A., M. Begum and Z.F. Ahmed, 1991. The effects of silver carp introduction in the polyculture of major Indian carps. *Proc. BAU Res. Prog.*, **5**: 429-437.

Wahab, M. A. and Z.F. Ahmed, 1991. Effects of planktivorous carp species combination on food organism and electivity indices in fish ponds. *Progress. Agric.*, **5**(2): 21-30.

Wahab, M.A., Z.F. Ahmed, M.S. Haq and M. Begum, 1994. Computability of silver carp in the polyculture of cyprinid fishes. *Progress. Agric.,* **2**(2): 221-228.

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

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

(Manuscript received 16 March 1998)