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GROWTH AND PRODUCTION PERFORMANCE OF TILAPIA (*Oreochromis niloticus*) POLYCULTURE WITH CARPS IN HOMESTEAD POND

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ABSTRACT

Sarker MR, Ali MM, Monir MS, Paul M, Barman AC (2014) Growth and production performance of tilapia (*Oreochromis niloticus*) polyculture with carps in homestead pond. *Marine Res. Aqua.* 2(1), 1-6.

An experiment was conducted in six homestead ponds (20 decimal) to assess growth and production of fishes with different species compositions in polyculture using tilapia (*Oreochromis niloticus*), silver carp (*Hypophthalmichthys molitrix*), catla (*Catla catla*), rohu (*Labeo rohita*), mrigal (*Cirrhinus cirrhosus*) and mirror carp (*Cyprinus carpio* var. specularis) for the period of 121 days from March 16 to June 16, 2012 at Gouripur upazila under Mymensingh district. There were three treatments each with two replicates *viz.* stocking densities: tilapia 250, silver carp 5, catla 3, ruhu 3, mrigal 3 and mirror carp 3 fish per decimal inT_1 (267 fish/dec); tilapia 330, silver carps 3, catla 3, rohu 2, mrigal 5 and mirror carps 2 fish per decimal in T_2 (365 fish/dec); and tilapia 130, silver carps 2, catla 2, rohu 3, mrigal 2 and mirror carp 3 fish per decimal in T_3 (142 fish/dec);. The physico-chemical parameters of water temperature (31.61-32°C), transparency (30.69-34.11 cm), dissolved oxygen (5.33-7.56 mg/l) and pH (7.48-7.76) during the study period was found within optimum range. The mean final weight attained of tilapia under T_1, T_2 and T_3 were 199.9, 88.1 and 185 g, respectively. The mean final weight gain (g) of tilapia, silver carp, catla, ruhu, mrigal and mirror carp were 154.8, 258.8, 119.7, 119.7, 124.7 and 193.8 g in T_3 that was the highest among the treatments. However, it was found that the highest total production was in T_3 (1151 kg/20dec/121days) and the lowest in T_2 (588.7 kg/20dec/121days). However, the lowest species wise production of tilapia 425, silver carp 40.5, catla 16.0, rohu 36.0, mrigal 34.5, mirror carp 36.7 kg/20dec/121 days was in T_2 and the highest in T_3 that was tilapia 960, silver carp 68, catla 28, rohu 31, mrigal 28 and mirror carp 36 kg/20 dec/121days.

Key words: *polyculture, tilapia, carps, homestead ponds, production*

INTRODUCTION

Over the last century, aquaculture has proved to be the fastest growing food producer in the world and total production has recorded an upward trend over the last decades (Khondker *et al*. 2010). Two leading producers of freshwater aquaculture species; India and Bangladesh produced 45% of the world's total freshwater aquaculture production (FAO 2008). In Bangladesh, aquaculture is mainly a rural activity where an estimated 73% of rural households are involved in some form of freshwater aquaculture (Mazid 1999). The majority of this production is earthen ponds based under semi-intensive polyculture systems consisting of fast growing fish species.

To optimize the utilization of available resources, polyculture is the best and pond culture has presented this opportunity to tilapia polyculture with carps. The productivity of the aquatic system is thus increased by more efficiently utilizing ecological resources within the environment. Stocking two or more complimentary fish species can increase the maximum standing crop of a pond by allowing a wide range of available food items and the pond volume to be utilized (Lutz 2003).

Tilapia (*Oreochromis niloticus*) is one of the first growing fish species that is cultured in the world (Bardach *et al*. 1972, and Pompa and Masser, 1999). In recent years, tilapia has become one of the most popular commercial culturable species due to they have good resistance to poor water quality and disease, tolerance of a wide range of environmental conditions, ability to convert efficiently the organic and domestic waste into high quality protein, rapid growth rate and tasty flavour (Ballarin and Hallar, 1982). They are currently having important impacts on poor people in developing countries, both as cultured species in household-management systems and through access to fish production in informal and formal fisheries (Edwards 2003 and Little 2003).

In Bangladesh, culture of tilapia has been promoted in small, seasonal roadside ditches for poor marginal farmers (Gupta *et al*. 1992 and Rahman 1992). Most farmers maintain tilapia in their homestead ponds in addition to carp, tilapia are sold to the market for cash income as well as carps also helps to gain an extra fish production. The sale of surplus production also provides additional income to the subsistence farmers. It proves an important source of food and nutrition to the farmer's family and there is often a surplus for selling to others. Though polyculture techniques of carps with other species are developing in Bangladesh, there are very few literatures available on tilapia polyculture with carps in homestead pond. Therefore, the present study was undertaken to compare the growth and production performances of tilapia, silver carp, catla, rohu, mrigal and mirror carp under different stocking densities in homestead pond.

MATERIALS AND METHODS

Experimental site and pond facilities

The present study was conducted in farmer's ponds under semi intensive rearing system during the period of 16 March 2012 to 16 June 2012. Six ponds were selected for the study at Gouripur upazila under Mymensingh

district. The average size of the experimental ponds was 20 decimal having a depth of 1.66±0.5 m. The experiment was conducted in six homestead ponds under three treatments each with two replicates.

Experimental fish species

The experiment was conducted by using tilapia (*Orecohromis niloticus*), silver carp (*Hypophthalmichthys molitrix*), catla (*Catla catla*), rohu (*Labeo rohita*), mrigal (*Cirrhinus cirrhosus)* and mirror carp (*Cyprinus carpio* var. specularis). The experimental fish were collected from local fish fry traders at Gouripur Bazar in Mymensingh and average initial weight of each species was recorded.

Pond preparation

The ponds were drained out completely and left exposed to sunlight for about 15 days. All ponds were treated with lime at the rate of 1 kg/dec for 14 days before stocking of fish fingerlings.

Stocking of fish

After two weeks of pond preparation, the ponds were stocked with the fingerlings of tilapia, silver carp, catla, rohu, mrigal and mirror carp. The combination of tilapia 250, silver carp 5, catla 3, rohu 3, mrigal 3 and mirror carp 3 fish per decimal in T_1 (267 fish/dec), tilapia 330, silver carp 3, catla 3, rohu 2, mrigal 5 and mirror carp 2 per decimal in T_2 (365 fish/dec) and tilapia 130, silver carps 2, catla 2, rohu 3, mrigal 2 and mirror carp 3 per decimal in T_3 (142 fish/dec).

Feeding of stocking fish

After stocking the fish in all of the treatments, a 28% protein containing Quality commercial pelleted fish feed were applied at the rate of 5-3% of estimated fish biomass twice daily at 9.30 in the morning and at 17.00 in the evening. The feed was supplied at the rate of 5% (1st month), 4% (2nd month) and 3% (up to harvesting) of their body weight. During the culture trial, in every month all the ponds were limed at the rate of 0.5 kg/dec to maintain pH and water qualities.

Water quality parameters

The pond environment parameters such as water temperature, transparency, dissolved oxygen and pH were measured fortnightly using a Celsius thermometer, a Secchi-disk a portable dissolved oxygen meter (HI 9142, Hanna Instruments, Portugal) and a portable pH meter (HI 8424, Hanna Instruments, Portugal).

Growth measurement

The growth of fishes of all ponds was monitored fortnightly by using random sampling method. At least 20 fishes were sampled with the help of a cast net to measure the growth to assess the health status and for feed adjustment.

Harvesting of fish

After five months of rearing, the fish were harvested by dewatering the ponds. During harvest, they were counted and weighted individually to assess survival, growth and production. Specific growth rate was estimated as**:**

SGR (% bw/d) = [In (final weight)-In (initial weight)]/culture period (days) x 100

Data analysis

Simple statistical analysis was done to observe the growth and production performance of fishes in different species combination by Zar1998.

RESULTS

Water quality parameters

The physico-chemical parameters of water *viz.* temperature, transparency, dissolved oxygen and pH during the study period was found within optimum range. The mean values of water quality parameters in three treatments are presented in Table 1. The mean values of temperature were observed 32.00±3.43, 31.61±2.76 and 31.94±3.82^{o}C in T_1, T_2 and T_3, respectively. The mean transparency recorded during the study period was 30.69±4.21 to 34.11±5.45 cm in T_3 and T_2. The dissolved oxygen content of the water varied from 5.33±1.43 to 7.56±2.21 mg/l. The maximum dissolved oxygen was found in T_3 and minimum was in T_2. Again, the range of pH values varied from 7.48±0.76 to 7.76±1.14 in the experimental ponds.

Table 1. The water quality parameters (Mean ±SD) observed in different treatments during the experimental period

Treatments	Parameters			
	Temperature (°C)	Transparency (cm)	Dissolved oxygen (mg/l)	pH
T_1	32.00±3.43	32.61±4.32	6.75±1.98	7.76±1.14
T_2	31.61±2.76	34.11±5.45	5.33±1.43	7.48±0.76
T_3	31.94±3.82	30.69±4.21	7.56±2.21	7.64±0.83

Growth and production performance

Growth and production performance of different species of fish among the treatment *viz*, tilapia, silver carp, catla, rohu, mrigal and mirror carp in terms of final weight, weight gain, specific growth rate and total production are shown in Table 2. On the basis of mean final weight attained of tilapia under T_1, T_2 and T_3 were 199.9, 88.1 and 185 g, respectively. The mean final weights were obtained of silver carp 185 g, catla 163 g, rohu 254.1 g, mrigal 218.1 g and mirror carp 220 g in T_1, silver carp 253.2 g, catla 173 g, rohu 160.1 g, mrigal 169 g, and mirror carp 173 g in T_2 and in T_3 silver carp 358.8 g, catla 244.7 g, rohu 219.8 g, mrigal 224.9 g, and mirror carp 234.8 g in the experimental ponds. The average weight gain of tilapia at the end of the experiment was followed by 154.8 g, 129.9 g and 62.9 g in T_3, T_1 and T_2, respectively. The survival rate (%) of different fish species in different treatments was fairly high. Survival of tilapia ranging was from 93.08% to 99.19% of the experimental ponds. The highest survival rate was found in T_3 among the treatments. The highest specific growth rate (1.49%) of tilapia was found in T_3 and lowest was 0.86% in T_1. However, it was found that all of the fish species showed the highest total production in T_3 (1151) than others T_2 (588.7) and T_1 (589.5 kg/20dec/121days), respectively (Fig. 1). The species wise production of tilapia 506, silver carp 21.78, catla 14.3, rohu 17.5, mrigal 14 and mirror carp 16 Kg/20dec/121days in T_1 and tilapia 425, silver carp 40.5, catla 16.0, rohu 36.0, mrigal 34.5, mirror 36.7 kg/20dec/121 days in T_2 and tilapia 960, silver carp 68, catla 28, rohu 31, mrigal 28, mirror carp 36 kg/20 dec/121days in T_3, respectively (Fig. 1). The highest production of silver carp was in T_3 (68) where as T_1 (21.78) and T_2 (40.5 kg/20dec/121days).

The production of tilapia was also the highest in T_3 (960) followed by T_1 (506) and T_2 (425 kg/20dec/121days). The production of rohu 36 kg/20dec/121days in T_2 which was the highest among the treatments. The production of mrigal was also highest in T_2 (34.5) where as T_1 (14) and T_3 (28 kg/20dec/121days). The production of mirror carp was highest in T_2 (36.7) where as T_1 (16) and T_3 (36 kg/20dec/121days). However, the total production was highest in T_1 (1151 kg/20dec/121days) and the lowest was in T_2 (588.7 kg/20dec/121days) at the end of the experiment.

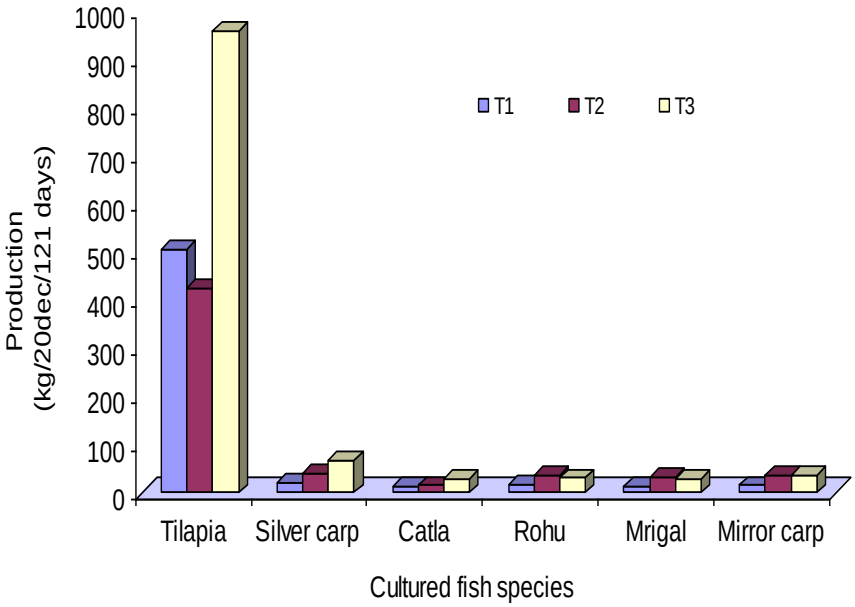

Fig. 1. Species wise production (kg/20 dec/121 days) of Tilapia-carp polyculture at homestead ponds in different treatments.

Table 2. Growth and production of fish in different treatments during the study period

Treatments	Species	Initial weight (g)	Final weight (g)	Weight gain (g)	SGR (% per day)	Production (Kg/20 dec/121 days)	
						Species wise	Total production
T_1	Tilapia	70	199.9	129.9	0.86	506	589.58
	Silver carp	100.2	185	184.8	0.51	21.78	
	Catla	74.5	163	88.5	0.64	14.3	
	Rohu	95.1	254.1	159	0.81	17.5	
	Mrrigal	100	218.1	118.1	0.64	14	
	Mirror carp	75.1	220	124.9	0.88	16	
T_2	Tilapia	25.2	88.1	62.9	1.03	425	588.7
	Silver carp	100.2	253.2	153	0.76	40.5	
	Catla	125	173	48	0.26	16.0	
	Rohu	100.1	160.1	60	0.38	36	
	Mrrigal	100	169	69	0.43	34.5	
	Mirror carp	50	173	123	1.02	36.7	
T_3	Tilapia	30.2	185	154.8	1.49	960	1151
	Silver carp	100	358.8	258.8	1.05	68	
	Catla	125	244.7	119.7	0.55	28	
	Rohu	100.1	219.8	119.7	0.65	31	
	Mrrigal	100.2	224.9	124.7	0.67	28	
	Mirror carp	50	234.8	193.8	1.27	36	

DISCUSSION

This study was conducted to know the growth and production performance of tilapia polyculture with carps in different stocking densities in homestead ponds. The water quality parameters measured in three treatments were found more or less similar and all of those were within the suitable range for fish culture. The range of temperature recorded in T_3 and T_1 were varied from 31.61 to 32.00^{0}C. Rahman (1996) recorded water temperature from 19.04 to 28.88^{0}C in two experimental ponds, which is lower than the result of present experiment. Uddin (2002) found water temperature varied from 25.60 to 33.00^{0}C in farmers carp polyculture ponds, which is more or less similar with the value of the present experiment. The mean transparency recorded during the study period was 30.69 to 34.11 cm in T_3 and T_2. According to Boyed (1982) transparency values of about 15 to 40 cm are appropriate for fish culture, which are strongly supported in this result.

The mean dissolved oxygen (DO) concentrations in the morning hours were higher in T_3 (7.56 mg/l) than those obtained in T_1 (6.75 mg/l) and T_2 (5.33 mg/l). Hoq *et al.* (1996) measured dissolved oxygen from 5.00 to 6.90 mg/L in polyculture of Thai pangus with seven and half months culture period, which is more or less similar with the values of present experiment. Ahmed *et al.* (2009) also recorded dissolved oxygen value range from 3.00 to 5.45 mg/L in four beels (Shidlong, Gangni, Buka, Kailla) of Mymensingh during April 2006 to March 2007, which are lower values of dissolved oxygen than our present experiment. Rahman *et al.* (1992) reported that dissolved oxygen content of a productive pond should be 5.00 mg/l or more. The values in present experiment were around 6 to 7. The mean values of pH were 7.76 in T_1, 7.48 in T_2 and 7.64 in T_3 which indicated good productive condition. The pH values of pond water under different treatments were found to be slightly alkaline. Akter *et al.* (2009) recorded pH 7.15 to 7.60 in Kailla oxbow Lake of Mymensingh from summer to winter season and Hoq *et al.* (1996) measured pH from 7.50 to 8.00 in five prawn ponds, which are almost similar with the findings of the present experiment. The mean pH values were slightly alkaline in three treatments, which indicated good productive condition of the ponds and suitable for fish culture. According to Swingle (1969) pH 6.5 to 9.0 is suitable for pond culture which agreed to the present study.

The average weight gain of tilapia was highest in T_3 (154.8 g) and lowest in T_2 (62.9 g). Again in case of silver carp, catla, mrigal and mirror carp in T_3 were also higher weight gain except for rohu. The better weight gain attained in T_3 might be due to proper utilization of both natural and supplementary feed by the fishes and also better combination of different carps species with tilapia in the treatment. The weight gains of silver carp, cata and mrigal obtained in the present study were more or less similar with the findings of Azad *et al.* (2004). The mean survival rate of tilapia, silver carp, catla, rui, mrigal and mirror carp in different treatments varied between 95.2 to 96.8 % which is more or less similar with the findings of Ali *et al.* (2005) but higher than that reported by Azad *et al.* (2004). The higher survival rate of the fish might be due to the relatively larger size of fingerlings stocked. In this study, all species showed the highest total production in T_3 (1151) than others T_1 (589.58) and T_1 (588.7 kg/20dec/121days), respectively. However, this production was higher than those reported by Jose *et al.* (1992), Islam *et al.* (1999) and Hossain *et al.* (2003). Jose *et al.* (1992) reported a gross production of 106-

254 kg/ha for a 160 days period. In T_3, the higher production than the others treatments that might be due to good combination carps species with tilapia as well as appropriate stocking density.

CONCLUSION

Tilapia (*Oreochromis niloticus*) is an attractive and popular species to the people of Bangladesh due to its delicious and nutritious food value. But now, most of the marginal tilapia farmers are not getting more benefit due to high price of fish feed as well as not to get aspect production. There are many factors that affect the production of tilapia. Stocking density and culture system are the most important factors for the production of tilapia. So, the proper stocking densities and best carps species combination with tilapia polyculture may get good production in the homestead ponds.

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