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Evaluation of Fish Production in Fish-cum-Poultry Integrated Aquaculture System

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Abstract

A study was conducted to evaluate the growth performance of fish under integrated fish-cum-poultry system with three species polyculture in comparison with the non-integrated control in two 200 m^2 earthern ponds for one year. At the end of the culture period, the treatment pond recorded significantly different overall weight gain of 612.17±11.24 g for catla, 627.36±17.57 g for grass carp and 709.89±10.62 g for amur carp when compared to those of control . Overall survival percentage was higher (84%) in the treatment when compared to that of control (80.67%). Higher fish production of 25.78 kg / pond of catla, 25.83 kg / pond of grass carp and 30.53 kg / pond of amur carp was recorded in the treatment pond, while, the control pond pond recorded a lower fish production of 19.68 kg / pond of catla, 20.40 kg / pond of grass carp and 22.24 kg / pond of amur carp. A higher net fish production of 4,107.00 kg / ha for three species from integrated system was obtained when compared to the control (3,116.00 kg / ha). Also, an increase in fish production of 31.80 per cent was obtained in the integrated culture system when compared to the control.

Keywords : Evaluation, fish production, aquaculture

Integrated fish-cum-livestock systems aim at recycling the waste generated in the farm and its transformation into useful products in the form of various animal products like fish meat, milk, eggs and animal meat. These integrated systems play an important role in the eradication of protein malnutrition of the rural community in particular and human population in general (Gangawar *et al*., 2013). Integrated fish farming system provide an additional income to the farmers, ensure food security, provide employment and empower rural community (Zira *et al*., 2015). Fish-cum-poultry integration reduces the cost of production as bird droppings are excellent source of manure and the application of expensive supplementary feed and chemical fertilizers can be avoided. Thus, in fish –cum-poultry integration system, animal protein in the form of fish can be produced at very low production cost through waste recycling (Bhatnagar and Devi, 2013). Poultry dropping is preferred among all the regularly used manure because of its solubility and high level of phosphorus content (Safi *et al*., 2016). The poultry dropping is one of the best organic manures due to its adequate amount of major nutrients (N, P and K) and trace elements (Vohra *et al*., 2012). The present study was conducted using fish cum poultry integration using birds and fish in the polyculture. The bird droppings directly dropped in to the fish pond from poultry shed located over the pond. The objective of the present study was to evaluate the potential of integrated fish-cum-poultry culture system in enhancing fish production in polyculture combination of catla, grass carp and Amur carp.

Material and Methods

The study was conducted at Fisheries Research and Information Centre (Inland), Karnataka Veterinary, Animal and Fisheries Sciences University, Hesaraghatta, Bengaluru in two 200 m^3 earthern ponds for a period of 12 months. One of the earthern ponds was used as a treatment pond, which was used for the fish-cum-poultry integrated system while the other earthern pond was used as a non-integrated polyculture system as control.

Animal Husbandry component of the Integrated system

Housing: The poultry shed was constructed using iron frames, iron meshed walls and flooring. The top of the shed was covered with cement sheets with a

slope. The size of the poultry shed was 5 x 3 x 3 feet. The iron mesh which formed the floor of poultry house were big enough to allow the poultry droppings to fall directly into the fish pond.

*Feeding:*12 young chicks of Giriraja (Broiler-cum-layer) were stocked into the poultry shed. Care was taken to provide proper facilities for giving feed, water and also incandescent lamp facility to keep the birds warm. The birds were fed *ad libitum* daily with a specially formulated feed (Table I). The birds were harvested in batches upon reaching the minimum live weight of 3 to 3.5 kg.

TABLE I

Composition of specially formulated poultry feed

Ingredients	Percentage
Crushed wheat	50
Rice polish	14
GOC	15
Fish meal	19
Crushed Maize	1.5
Table salt	0.5
Vitamin and Mineral pre-mix	0.25
Total	100

Fisheries component of the Integrated culture system

Stocking: Polyculture system was followed and the fingerlings of catla *(Catla catla*), grass carp (*Ctenopharyngodon idella*) and amur carp (*Cyprinus carpio*) weighing between 2.13 and 2.41g were stocked into both treatment and control earthern ponds at the rate of 7,500 no.s/ha. in equal proportion.

Feeding: The fish of the treatment pond were fed on the natural food (plankton) produced because of the poultry droppings falling directly into the pond. Some percentage of poultry droppings were directly accepted by the fish. The grass carp fingerlings were fed daily with green grass grown on the pond dykes @ 5 per cent of body weight. The fish fingerlings of the control pond were fed with farm made fish feed made of ground nut oil cake (GOC) and rice bran (RB) in the ratio of 1:1 (w / w) @ 10 per cent biomass for the first 2 months, @ 5 per cent biomass for the next two months and from the 5th month onwards @ 2 per cent biomass till the harvest. Manuring was not done in the control pond.

Water quality and sampling: Liming was done for both the treatment and control pond @ 400 kg / ha. The water quality parameters like pH, temperature, dissolved Oxygen, total hardness, total alkalinity and total ammonia were measured on monthly basis using the water quality kit TRANSCHEM (AGRITECH LTD., Vadodara, Gujarat, India) and were maintained within the optimal ranges (Table II). The growth and survival of fish was recorded by monthly sampling.

Statistical analysis: One way analysis variance (ANOVA) was used for finding the significant difference between the growth performance of fish in the treatment and control pond.

RESULTS AND DISCUSSION

Fish growth and survival: Significant difference in the average weight gain of fish, both within the treatment and between the treatment and the control was observed in the present study ($p<0.05$). A significantly higher mean final weight of Amur (709.89±10.62 g) was recorded when compared to other species in the treatment as well as all the three species in the control. The average final weight of all the three species was significantly higher when compared to those of control (Table III). Singh *et al.*

TABLE II

Water quality parameters observed in the ponds during the study period

Ponds	pH	Temperature (°C)	DO_2 (mg/l)	Hardness (mg/L $CaCO_3$)	Alkalinity (mg/L $CaCO_3$)	Ammonia (mg/L)
Treatment (Fish –cum-Poultry culture)	8.0	27	7.0	160	250	0.2
Control	7.8	26	7.2	150	200	0.2

TABLE III

Details of growth, survival and production of fish both in integrated treatment pond and non-integrated control

Particulars	Poultry cum fish culture			Control		
	Catla	Grass carp	Amur carp	Catla	Grass carp	Amur carp
Weight gain (g) (Mean±SE)	612.17±11.24[c*]	627.36±17.57[b]	709.89±10.62[a]	477±14.89[f]	507±13.47[e]	554±10.47[d]
Species-wise survival (%)	84.00	82.00	86.00	82.00	80.00	80.00
Overall survival (%)		84.00			80.67	
Species-wise fish production (Kg / 200 m^3 pond)	25.78	25.83	30.53	19.68	20.40	22.24
Species-wise fish production (Kg / ha)	1289.00	1291.50	1526.50	984.00	1020.00	1112.00
Total fish production (Kg / 200 m^3 pond)		82.14			62.32	
Total fish production (Kg / ha)		4,107.00			3,116.00	
Increase in Fish Production (%)			31.80			

***** Values with the same superscripts are not significantly different

(2013) observed that the average final weight of grass carp (490.4 g) and common carp were (247.8g) cultured in the chicken-cum-fish integrated system were higher than their average final weights, 449.8g and 224.7 g, respectively in the control. In the present study, the overall survival percentage was higher (84%) in the treatment when compared to that of control (80.67%) (Table III). Singh *et al.* (2013) also reported that the survival rates of grass carp (62%) and common carp (73%) in the chicken-cum-fish culture system were higher when compared to the control which recorded lower survival rates of 58.7 and 66.3 per cent for grass carp and common carp, respectively.

Fish Production: In the present study, a high species-wise fish production of 1289.0 kg / ha of Catla, 1291.5 kg / ha of grass carp and 1526.5 kg / ha of amur carp for the integrated fish-cum-poultry system while a lower production of 984.0 kg / ha for catla,1020.0 kg / ha for grass carp and 1112.0 kg / ha for amur carp were observed for the non-integrated control for the three species polyculture system (Table III). Safi *et. al.* (2016) also reported a higher species wise fish production of 1,498.35 kg / ha for catla, 1,392.82 kg / ha for rohu and 962.02 kg / ha for mrigal when compared to lower 534.78 kg / h for catla, 391.13 kg / ha for rohu and 301.78 kg / ha for mrigal in the control. In the present study, a higher net fish production of 4,107.00 kg / ha for three species integrated system was obtained when compared to the control (3,116.00 kg / ha). Also, an increase in fish production of 31.80 per cent was obtained in the integrated culture system when compared to control in the present study. Singh *et al.* (2013) reported a higher net fish production of 6,870 kg / ha when compared to a mere 5,808 kg / ha in the control. Safi *et al.* (2016) reported a higher net fish production of 3,853.20 kg / ha for the polyculture with three species, catla, rohu and mrigal when compared to a mere 1,227.69 kg / ha in the control. In the present study, a higher net fish production of 82.14 kg / 200 m^3 was observed for the poultry-cum-fish integration and lower net fish production of 62.32 kg / 200 m^3 was observed for the control. The reasons for higher fish production from ponds fed with chicken manure as direct droppings might be due to the nutrients present in chicken excreta were fed directly by the fish to some extent and the remaining, induced the production of phytoplankton and zooplankton through detritus food chain (Oribhabor and Ansa, 2006). The fish fed on this naturally produced plankton *ad libitum* and hence, the increase in fish production when compared to that in the non-integrated fish culture system. Also, poultry manure is one of the best organic manure due to its adequate amount of major nutrients (N, P and K) and trace elements (Vohra *et al.*, 2012) contributing to higher natural productivity of the ponds.

From the results of the present study, it is clear that integrated fish-cum-poultry farming achieves higher species-wise production in the polyculture combination of catla, grass carp and amur carp as well as net fish production, provides additional income to the rural community and ensures food security. It also greatly reduces the cost of production as it eliminates the need for the application of expensive supplementary feed and chemical fertilizers.

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