Journal of Entomology and Zoology Studies

Available online at www.entomoljournal.com

E-ISSN: 2320-7078
P-ISSN: 2349-6800
JEZS 2017; 5(6): 1514-1518

Received: 18-09-2017
Accepted: 20-10-2017

A Rajeshkumar
Ph.D., Scholar, Department of Agronomy, TNAU, Coimbatore, Tamil Nadu, India

M Balusamy
Dean, Vanavarayar Institute of Agriculture, Pollachi, TNAU, Coimbatore, Tamil Nadu, India

Correspondence
A Rajeshkumar
Ph.D., Scholar, Department of Agronomy, TNAU, Coimbatore, Tamil Nadu, India

The effect of different fish feeding methods on growth performance and fish yield in composite fish culture system

A Rajeshkumar and M Balusamy

Abstract
The composite fish culture experiment was planned to study the influence of different fish feeding methods on growth rate and yield performance of catla, rohu, mrigal and common carp in polyculture system and its impact on pond ecosystem during January to October 2016. A total of 800 fishes belonging to four species viz. *Catla catla*, *Labeo rohita*, *Cirrhinus mrigala* and *Cyprinus carpio* were stocked in three earthen ponds. The dimensions of each pond were 31 × 13 × 1.7 meter length, breadth and depth. Three experimental fish pond was selected namely; the fish pond manured with desi poultry droppings (T_1), fish pond manured with duck droppings (T_2) and fish pond manured with turkey droppings (T_3) was evaluated. Along with birds droppings all the fish were fed with a concentrated feed contains rice bran 40%, maize flour 40% and dried azolla 20% at 2% body weight of individual fish. *Catla catla* and *C. carpio* showed maximum growth which was followed by *C. mrigala* and *L. rohita* in all the three ponds. Maximum growth was observed in T_2 followed by T_1 and T_3. Among fish species *Catla catla* and *C. carpio* showed higher growth rates than the rest of fish species. Total fish yield of 696.9, 671 and 637.1 kg was obtained from the fish pond manured with duck dropping (T_2), desi poultry dropping (T_1) and turkey dropping (T_3) respectively.

Keywords: Composite fish culture, poultry droppings, fish feeding, growth rate, fish yield

Introduction
Fish is an inexpensive source of protein and an important cash crop in many regions of world and water is the physical support in which they carry out their life functions such as feeding, swimming, breeding, digestion and excretion. Water quality is determined by various physico-chemical and biological factors, as they may directly or indirectly affect its quality and consequently its suitability for the distribution and production of fish and other aquatic animals. So, good water quality is very essential for survival and growth of fish. As we know fish is an important protein rich food resource and there has been sharp increase in demand of fish products due to increasing population pressure in this century. Thus to meet the demand of present food supply, water quality management in fish ponds is a necessary step that is required to be taken up. With the increase in fish demand trend, measures have developed to culture fish more intensively to enhance the present level of fish production. 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 (Hussein, 2012) [1].

Aquaculture is working as economic stimulant and has a great potential to be a major income generating component, poverty alleviation and employment generation ultimately leading to sustainable rural pond fish farming. Aquaculture provides almost 50% of the total inland fish production. During the last two decades, inland freshwater aquaculture production grew more than 10% annually, relaying mainly on polyculture of native and exotic carp species in ponds (DOF, 2005) [2].

In Asia, carp culture grew on 12% annually during the last two decades. Carp contribute more than 70% of the inland aquaculture production in Asia and the world and considered as the major provider of fish protein through aquaculture. *Cyprinus carpio* is extensively cultured all over the world due to its fast growth, omnivorous feeding nature and tolerance to wide water quality and temperature ranges.

It can feed in any part of fish pond. *C. carpio* enhanced aerobic decomposition of organic matter at the pond bottom and suspended bottom nutrients into the water column, there by stimulating natural food production. However, not only increased food availability but also changes in behaviour of rohu when common carp is introduced in the pond might have affected rohu feeding behaviour and food intake (Acosta and Gupta, 2005) [3].

Polyculture of compatible fish species is the most favoured fish culture practice because this facilitates efficient utilization of all ecological zones within pond environment enhancing the maximum standing crop (Lutz, 2003) [4]. In some cases, one species enhances the food availability for other species and thus increases the total fish yield per unit area. Selection of species plays an important role for any culture practices. For efficient utilization of different strata and zones of a pond, three or more species need to be stocked. In current fish culture set up three Indian carps *Catla catla, Labeo rohita, Cirrhinus mrigala* and two Chinese carps, silver and grass carp are considered the best combination (Rahman *et al.*, 2006) [5].

Currently farming depends mainly on the application of organic fertilizers and to some extent on inorganic fertilizers. Fertilization increases the productivity of phytoplankton in breeding and storage ponds. The composite diets are not available and the farmers often use fertilizers (compost or animal droppings) or inorganic fertilizers with cheap feed. Current farming practices depending on regular input of organic and inorganic fertilizers. The recycling of these organic wastes and proper exposure to light for their inclusion phytoplankton is very important for their legitimate use (Bhakta *et al.*, 2006)[6]. Time and dosage of organic manuring significantly affect the ecological processes of pond ecosystem. It encourages the organic loading and anaerobic conditions, which reduces the heterotrophic activities. Nitrogen microbial destabilization declines gradually with the passage of time and increases with the manuring rate. Common carp is more responsive to feed supplied as it is a bottom feeder. Naturally pond primary productivity (zooplankton) in earthen pond enhances the fish production with increase the growth rate of carp species by using the fertilizer. Utilization of homestead organic waste, in polyculture carp proves to be the harmless for physico-chemical properties of water. *Cirrhinus mrigala* and *C. carpio* responded best in manured ponds with homestead organic wastes (Jha *et al.*, 2006) [7].

Materials and Methods

The experiment was conducted in earthen fish ponds of wetland farm at Department of Farm Management, Tamil Nadu Agricultural University, Coimbatore. Three earthen ponds were chosen for the experiment that were drained, dried, disinfected by liming and well prepared before the start of research trial. The dimensions of each pond were 31 × 13 × 1.7 meter length, breadth and depth. A total of 45 days old 800 fingerlings belonging to four fish species were stocked in the stocking ratio of 40:20:30:10 with the population of 320, 160, 240 and 80 numbers in catla, rohu, mrigal and common carp respectively, to utilize the food material available in the entire water column. All three ponds were considered as three treatments and were labelled as T_1, T_2 and T_3. After filling water, ponds were manured with raw cowdung 4000 kg per acre for stimulating the growth of zoo and phytoplankton in the pond water for accelerating the growth of fingerlings. To supplement the feed requirement of fingerlings, fish pond was manured with desi poultry dropping (T_1), duck dropping (T_2) and turkey dropping (T_3) with twenty numbers of desi birds, 20 numbers of duck and 15 numbers of turkey were sheltered in a shed having a plinth area of 2.2 m^2 and the bottom provided with wire mesh (5 mm x 5 mm) to facilitate free falling of dropping to the pond and placed over the fish pond at one corner. Fish were fed once a day at same time and same place with a diet of concentrated feed contains rice bran 40%, maize flour 40% and 20% dried azolla at 2% body weight. The fish samples were weighed and measured at the time of stocking; and thereafter every month ten fish samples of each species were captured through sample fish netting. They were weighed and measured and released back in their respective ponds. Phytoplankton population was taken at monthly intervals and water quality parameters viz., pH, dissolved oxygen, biological oxygen demand and chemical oxygen demand were analysed at monthly intervals using standard procedure (APHA, 1995) [8].

Results and Discussion

Monthly increase in body weight and length of fish in all the three treatment ponds is given in Table 1 & 2. *Catla catla, Labeo rohita, C. mrigala* and *C. carpio* attained significantly higher body weight and fish length in treatment T_2 ponds while the same was minimum for all the fish species in T_3 which clearly indicates that turkey dropping is has not effective in growth and development of all cultured fish species in polyculture system. Among the fish species *Catla catla* recorded maximum weight of 972.3 g in fish pond manured with duck dropping (T_1) with regard to fish length, *Cirrhinus mrigala* recorded the maximum length of 34.8 cm in same pond.

Among bottom feeders, *C. carpio* grows better than *C. mrigala* probably due to their superior feed utilizing capability. Moreover, faster growth rate of bottom dwellers is attributed to effective utilization of ecological niches and rich detritus food web that is maintained through periodic manuring, liming and fertilization. Milstein *et al.* (2002)[9] reported that farmers prefer to stock *C. carpio* as a bottom feeder instead of *C. mrigala* because *C. carpio* grows faster than *C. mrigala* and the overall production is higher when combined with *L. rohita* and *C. catla* in polyculture ponds.

In the present study, surface feeder *C. catla* showed maximum weight gain in duck dropping fed pond (T_2) followed by desi poultry dropping fed pond (T_1) *C. carpio* showed maximum weight gain in duck dropping fed pond (T_2) followed by desi poultry dropping fed pond (T_1). Likewise *L. rohita* and *C. mrigala* showed maximum weight gain in duck dropping (T_2) followed by desi poultry dropping (T_1), but among all the fish species *C. catla* showed maximum weight gain.

Many abiotic and biotic components of aquatic ecosystem directly and indirectly influence water quality. Measurements of these components also reflect the dynamics of the living organisms such as metabolic and physiological behaviour of aquatic ecosystems. pH, temperature and dissolved oxygen have great influence on fish growth (Noor *et al.*, 2010)[10].

During the experiment, major water quality parameters like pH, DO, BOD and COD remained in the favourable range for fish culture in all the three ponds. Fish pond manured with desi poultry dropping (T_1) average value of pH remained in the range of 7.8 to 8.7, DO 4.5 to 7.7 mg/L, BOD 3.7 to 7.7 mg/L and COD 6.7 to 42.4 mg/L were observed within the optimum range throughout the experiment. In fish pond manured with duck dropping (T_2) the value of pH 7.6 to 8.3, DO 4.2 to 6.2 mg/L, BOD 3.3 to 6.2 mg/L and COD 7.6 to 31.3 mg/L were observed while the value of pH 7.9 to 8.9, DO 4.7 to 8.7 mg/L, BOD 5.1 to 9.2 mg/L and COD 11.8 to 49.7 mg/L was observed in pond manured with turkey dropping (T_3) (Table 3). Ghazala *et al.* (2011) [11] observed variations in water temperatures from 29.66 to 30.0 °C, pH from 8.32 to 8.55, dissolved oxygen 6.31 to 6.60 mg/L which are close to the values recorded during the experiment. Chandra *et al.* (2005) [12] observed in their studies that variations in fish growth depended on electrical conductivity, pH, and total alkalinity and phosphorus contents of rearing water. Growth performance of fish was not limited by any of water quality parameters during present study. The values of physico-chemical characteristics of water ponds during the experimental period were within the acceptable limits for carps.

According to Hussain *et al.* (2011) [13] decrease in water temperature also reduces fish growth and phosphorus is a key metabolic nutrient in fish ponds which promotes planktonic production. However, decline in dissolved oxygen can be expected during night due to eutrophication and consumption of oxygen by phytoplankton in the absence of light if excessive doses of organic manure are used.

Phytoplankton population in the all fish pond manured with different poultry bird dropping has recorded within the optimum range for fish growth and development (Table 4). In pond water the most important natural food materials are phytoplankton, zooplankton, benthic macro-invertebrates and detritus. Zooplanktons are the first link in food chain within pond water and are the indicators of production level in ponds. Fish ponds with a high Plankton abundance characterized as highly eutrophic systems, primary productivity and promote the growth of fish in polyculture system. Fertilization increases primary productivity with careful management and a continuous and controlled addition of inorganic and organic fertilizers to produce autotrophic organisms. Organic fertilizers act as an energy source for bacterial growth, but the aerobic decomposition of organic matter by bacteria was an important drain of oxygen supplies in ponds (Veronica *et al.*, 2014) [14]. During present study Chlorophytes were the dominant phytoplankton group followed by the Cianophytes and Bacillariophytes. In polyculture system fish species combinations, fish stocking density ratio and nutrient input quality and quantity are the management factors that predisposed the amounts of these natural foods in ponds. The feeding behaviour of fish has a significant influence on natural food quantity.

Artificial feed has two main functions in aquaculture especially in semi-intensive systems first it is directly eaten by fish and second it supplies nutrients to the ambient environment enhancing primary productivity and natural food availability. The major portion of artificial feed is lost as uneaten feed and feces. Benthivorous fishes enhance oxygen availability in the sediment and cause re-suspension of bottom particles by digging and sieving of sediments which has a large impact on the abiotic and biotic properties of the overlying water column of the pond (Hussain *et al.*, 2011) [13].

Fish yield

Fish pond manured with duck dropping registered maximum fish yield of 696.9 kg which was followed by fish pond manured with desi poultry dropping 671 kg. Among the fish species *catla catla* recorded higher yield of 295.6, 287.4 and 276.6 kg which was followed by *C. mrigala* 196.7, 190.6 and 181.3 kg in fish pond manured with duck dropping, desi poultry dropping and turkey dropping respectively (Table 5).

Table 1: Monthly increase in fish body length (cm) and body weight (g) of catla and rohu in different treatment ponds during 2016.

Period (Months)	Catla						Rohu					
	Desi poultry dropping (T_1)		Duck dropping (T_2)		Turkey dropping (T_3)		Desi poultry dropping (T_1)		Duck dropping (T_2)		Turkey dropping (T_3)	
	Length (cm)	weight (g)	Length (cm)	weight (g)	length (cm)	weight (g)	length (cm)	Weight (g)	Length (cm)	Weight (g)	length (cm)	weight (g)
Jan 2016	6.2	7.8	6.2	7.8	6.2	7.8	5.4	5.9	5.4	5.9	5.4	5.9
Feb	11.4	64.6	12.2	76.8	11.1	59.8	11.9	47.3	12.2	51.6	11.1	43.2
March	15.5	145.2	16.1	159.4	15.0	131.2	17.4	119.8	18.3	128.6	17.2	112.4
April	18.3	239.5	18.9	267.1	17.9	198.9	20.0	217.6	20.8	219.3	19.9	208.6
May	20.2	361.3	21.7	389.8	19.6	337.5	22.7	287.4	23.4	294.6	22.4	274.3
June	23.1	466.4	23.9	497.6	22.4	418.6	24.8	368.1	25.9	379.2	24.1	347.9
July	25.4	592.3	25.8	628.3	24.9	539.1	26.6	446.6	27.8	468.5	26.3	429.7
Aug	27.3	742.8	27.8	787.5	27.0	693.7	28.9	567.6	29.6	572.5	28.0	548.6
Sep	29.2	816.1	29.7	847.2	28.6	781.9	30.3	632.9	31.8	658.4	29.2	608.8
Oct	30.4	931.7	31.0	972.3	29.2	909.3	32.2	729.2	33.9	744.2	31.1	710.5

Table 2: Monthly increase in fish body length (cm) and body weight (g) of Mrigal and Common carp in different treatment ponds during 2016.

Period (Months)	Mrigal						Common carp					
	Desi poultry dropping (T_1)		Duck dropping (T_2)		Turkey dropping (T_3)		Desi poultry dropping (T_1)		Duck dropping (T_2)		Turkey dropping (T_3)	
	length (cm)	weight (g)	Length (cm)	Weight (g)	length (cm)	weight (g)	length (cm)	Weight (g)	length (cm)	weight (g)	length (cm)	Weight (g)
Jan, 2016	6.0	8.2	6.0	8.2	6.0	8.2	5.1	6.3	5.1	6.3	5.1	6.3
Feb	12.1	58.2	12.9	61.3	11.8	51.5	11.8	66.1	12.7	69.4	11.9	61.8
March	17.7	139.6	18.7	145.8	17.2	137.4	17.1	158.2	17.4	167.8	16.7	147.2
April	21.6	227.4	22.7	234.6	20.9	219.6	19.2	247.8	20.4	294.5	19.1	239.5
May	25.0	306.7	26.8	314.7	24.8	296.1	21.7	349.7	22.3	383.4	21.2	347.4
June	27.6	397.2	28.3	412.4	27.1	374.8	23.6	449.4	24.1	498.7	22.9	435.3
July	29.2	518.6	30.4	529.8	28.4	503.6	25.1	553.6	25.3	587.5	24.7	532.8
Aug	31.3	606.7	31.2	617.5	30.7	597.1	27.0	649.8	27.7	674.3	26.3	634.7
Sep	32.7	679.9	32.9	698.3	32.1	652.9	28.1	718.2	28.9	756.4	27.9	698.9
Oct	34.2	764.5	34.8	786.8	33.9	747.7	29.3	822.5	30.5	861.1	29.1	809.6

Table 3: Monthly fish pond water quality parameters of different treatment ponds during 2016.

Period (Months)	Fish pond manured with desi poultry dropping (T_1)				Fish pond manured with duck dropping (T_2)				Fish pond manured with turkey dropping (T_3)			
	pH	DO mg/L	BOD mg/L	COD mg/L	Ph	DO mg/L	BOD mg/L	COD mg/L	pH	DO mg/L	BOD mg/L	COD mg/L
January	8.1	4.5	3.7	6.7	8	4.4	3.3	7.6	8.3	4.7	5.1	11.8
February	7.8	4.8	4.4	15.6	8.1	4.9	3.9	10	8.5	5.4	5.7	20
March	8.6	5.9	5.8	21	7.8	4.2	4.2	17.6	7.9	7.1	6.8	18.7
April	7.9	5.4	4.6	24	8	5.6	3.6	24.3	8.4	6.8	6.3	26.4
May	8.7	6.5	7.1	29.4	8.1	4.7	3.8	16.7	8.9	7.4	7.2	31
June	8.4	6	6.6	36.4	8.3	5.4	4.3	19.5	8.2	7.3	7.9	39
July	8.7	6.8	5.3	23.1	7.6	5.7	4.8	25.9	8	7.9	7.4	33
August	8.2	7.3	6.7	32.7	7.9	6.2	5.6	31.3	8.6	8.4	8.4	44.8
September	8	7.7	7.2	38.8	8.2	5.6	5.4	18.4	8.7	8.1	8.4	49.7
October	7.8	7.6	7.7	42.4	8.3	6.1	6.2	23	8.6	8.7	9.2	37.2

Table 4 Monthly phytoplankton population (No. L^{-1}) of different fish ponds during 2016.

Period (Months)	Desi poultry dropping (T_1)	Duck dropping (T_2)	Turkey dropping (T_3)
Jan	1463	1634	2078
Feb	1736	2149	2599
Mar	2122	2452	2792
April	2485	2763	3246
May	2876	3267	3618
June	3043	2877	3824
July	2717	3164	3385
Aug	2852	3625	2938
Sept	2528	2872	3346
Oct	2233	2638	3635

Table 5: stocking preposition (%), stocking density (No, s) and fish yield (Kg) of catla, rohu, mrigal and common carp in 0.04 ha of treatment pond during 2016.

Fish species	Stocking preposition (%)	Stocking density (No's)	Fish yield (kg)		
			Desi poultry dropping (T_1)	Duck dropping (T_2)	Turkey dropping (T_3)
Catla catla	40	320	287.4	295.6	276.8
Labeo rohita	20	160	121.8	128.4	115.9
Cirrhinus mrigala	30	240	190.6	196.7	181.3
Cyprinus carpio	10	80	71.2	76.2	63.1
Total	100	800	671	696.9	637.1

References

1. Hussein MS. Effect of feed, manure and their combination on the growth of *Cyprinus carpio* fry and fingerlings Egypt. J Aquat. Biol. Fish. 2012; 16(2):153-168.
2. DOF. Fishery Statistical Year book of Bangladesh. Fisheries Resources Survey System, Department of Fisheries, Ministry of Fisheries and Livestock, Matshya Bhaban, Dhaka, Bangladesh, 2005, 43-46.
3. Acosta BO, Gupta MV. The status of introduced carp species in Asia. In, Carp genetic resources for aquaculture in Asia. The World Fish Center, Penang. Malaysia. 2005, 121-128.
4. Lutz CC. Polyculture: principles, practices, problems and promise. Aquaculture Magazine. 2003; 29(2):34-39.
5. Rahman MM, Verdegem MCJ, Nagelkerke LAJ, Wahab MA, Milstein A, Verreth JAJ. Growth, production and food preference of rohu Labeo rohita (H.) in monoculture and in polyculture with common carp *Cyprinus carpio* (L.) under fed and non-fed ponds. Aquaculture research. 2006; 257:359-372.
6. Bhakta JN, Bandyopadhyay PK, Jana BB. Effect of different doses of mixed fertilizer on some biogeochemical cycling bacterial population in carp culture pond. Turk. J Fish. Aqua. Sci. 2006, 165-171.
7. Jha P, Barat S, Nayak CR. A comparison of growth, survival rate and number of marketable koi carp produced under different management regimes in earthen ponds and concrete tanks. Aquac. Int. 2006; 14:615-626.
8. APHA. Standard methods for the examination of water and sewage. American Public Health Association, American water works Association and American water pollution control federation (Pub.), Broadway, New York, 1995.
9. Milstein A, Wahab MA, Rahman MM. Environmental effects of common carp *Cyprinus carpio* and *Cirrhinus mrigala* as bottom feeders in major Indian carp polycultures. Aquacult. Res. 2002; 33:1103-1107.
10. Noor EL, Deen AIE, Mona SZ. Impact of climatic changes (oxygen and temperature) on growth and survival rate of Nile tilapia (*Oreochromis niloticus*). Rep. Opin. 2010; 2:192-195.
11. Ghazala R, Tabinda AB, Yasar A. Growth response of juvenile grass carp (*ctenopharyngodon idella*) fed isocaloric diets with variable protein levels. Journal Anim. Plant Sci. 2011; 21(4):850-856.
12. Chandra DP, Ayyappan S, Jena J. Comparative changes in water quality and role of pond soil after application of different levels of organic and inorganic inputs. Aquac. Res. 2005; 36:143-155.

13. Hussain O, Altaf, Farhanullah K, Jahanzeb F. The effect of various stock densities of bottom feeder fish *Cirrhinus mrigala* and *Cyprinus carpio* on growth performance and fish yield in polyculture system. African Journal of Fisheries Science. 2011; 2(9):155-161.
14. Veronica E, Leksono AS, Soemarno, Arfiati D. Effect of water quality on phytoplankton abundance in hampalam river and fish pond of batanjung village. Journal of Environmental Science, Toxicology and Food Technology. 2014; 8(1):15-21