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The Growth Performance and Survival of *Clarias gariepinus* Fry Raised in Homestead Concrete Tanks

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ABSTRACT

Fertilizer application in earthen ponds has been used as a low-cost method of sustainable aquaculture production. This study was carried out to investigate the growth response of African catfish fry, *Clarias gariepinus* in three different culture media in homestead concrete tanks. The water in the control (T_1) was not treated while T_2 and T_3 were treated with poultry droppings and soy bean milk filtrate, respectively. Nine hundred catfish fry weighing averagely 0.67-0.69 g were randomly allocated to the 3 treatments in equal number. In each tank (2×3×1.5 m) were suspended, 3 net cages each of dimension, 1×1×1 m containing 100 fry. The fish in tank 1 (control treatment) were fed fish meal from the start at 5% of their body weight and four times daily. The other treatments were not fed at all for the first 7 days. Feeding with fishmeal commenced for treatments T_2 and T_3 on the next 8-14 day. The weights of the feed were adjusted after weekly weighing of the culture media for phytoplankton composition. The best weight increase was recorded in T_1 (2.33 g). The highest survival rate was in T_3 (98%). Treatment T_3 ($11.56\pm1.14\times10^3$) generated higher concentrations of most of identified zooplanktons than treatments T_1 ($5.39\pm0.73\times10^3$) and T_2 ($12.78\pm0.98\times10^3$). These zooplanktons were absent in treatments T_1 and T_2. The result indicates that fertilizing the culture medium using soybean milk filtrate or poultry droppings improved the growth and of *C. gariepinus*.

Key words: Non-conventional, culture media, growth, survival, *Clarias gariepinus*, concrete tanks

INTRODUCTION

The use of fertilizer is considered a viable low cost method of sustainable aquaculture production. The success of any aquaculture enterprise will depend greatly on the quality of the medium in which the fish is raised, e.g., the concentration of natural and life micro-organisms which constitute the first feed for the fry. Hence, the culture of natural food organisms in the medium which fish is raised becomes important if the goal of the farmer is to produce viable and quantity fingerlings at minimum cost (Anetekha *et al.*, 2005).

In tropical Africa and in Nigeria in particular the use of *Artemia* increases the cost of fingerling production (Omitoyin, 1999). Natural live food organisms occupy aquatic and semi-aquatic media habitats. They range from minute zoo and phytoplankton to insect larvae (Adeniji, 1987; Ovie, 1986). They have the advantages of assured freshness, supply of high quality proteins and provision of vitamins. They can be produced in large quantities with predictable quality using manures, which are relatively cheap.

C. gariepinus is widely cultivated in Nigeria (Olukunle, 1996; Omitoyin, 2007). The fish is omnivorous and can thus feed on both zoo and phytoplanktons (Moses, 1983). The manures used to fertilize the water (medium) in order to generate plankton are relatively cheap except for transportation cost. Poultry waste can be obtained free while soybean is cheaper than fishmeal. It is readily available in the local market. The use of homestead concrete tanks is fast becoming well known and should be encouraged for home bred fish in Nigeria (Olukunle, 1996).

Hence, it is therefore relevant to investigate the growth performance and survival of *C. gariepinus* fry raised in different culture media, with the aim of recommending the best to our local fish farmers reducing cost and boosting fingerling production.

MATERIALS AND METHODS

Rearing tanks: Three concrete tanks with dimension 3.0×2.0×1.5 m each were used. The tanks were impounded with water. Three net cages of 1.0×1.0×1.0 m^3 were suspended in each of the tanks. The net cages were anchored to the sides of the tanks and weighted down with heavy stones inserted in the pockets made at the lower corners of the net cages. This is to prevent drifting. Zippers were sewn at the top edges of the net cages to facilitate feeding and protection of the fingerlings from predation.

Each rearing tank was impounded with 6.0 m^3 of water. Tanks 2 and 3 were fertilized with poultry waste and soybean milk filtrate respectively to enhance plankton production. Tank 1 was not fertilized and it served as the control.

Media preparation: The poultry waste was collected from the University Teaching and Research Farm while the soybean was purchased from the local market both in Ibadan, Nigeria.

Four hundred and twenty gram of poultry waste was weighed, stuffed in a jute bag and dropped into tank 2. The recommended application followed the dosage of 60 kg soybean per 10,000 m^2 was weighed, soaked in water for 6 h and ground to a paste using 15 L of water. The resulting milk was filtered and the filtrate distributed evenly into the water in tank 3.

Tank 1 (control) was impounded with water from the mains and no fertilizer was added.

Experimental fish: Nine hundred hatchery-bred advanced fry (3 weeks) old of *Clarias gariepinus*, mean weight 0.67-0.97 g were randomly distributed into the net cages (Table 1). Three hundred fry per treatment with 100 fry/net cage. Each cage served as replicate. The experiment lasted 3 weeks.

Experimental feeding trials: Feeding of the experimental fish started the following day after stocking. Fish in tank 1 were fed 5% body weight of fish meal (72% CP). Fish in tanks 2 and 3 were allowed to graze on the generated natural micro-organisms for one week. No fishmeal was given.

Feeding of fry in tanks (2 and 3) with fishmeal commenced in the 2nd week till the end of the experiment. The fish were fed 4 times per day. The initial and final weight of the fish per cage were taken using an electronic digital scale, SK 1000 to determine the weight gained over the experimental period (Table 1).

Water was allowed to flow freely in and out of the system at a minimum of 1 L min^{-1}. Water samples were collected from the control and from each of the treatments at the end of the experiment. Table 4 shows the water quality parameters monitored which include dissolved oxygen, temperature, pH. Plankton abundance was estimated from 0.1 mL sub-sample using the electronic microscope and the plankton composition is as shown in Table 3. The survival rate of the fish in each unit was counted manually and subtracted from the number of fish stocked (Table 2).

Statistical analysis: The Analysis of Variance (ANOVA) was used to test for significant differences between the treatment means (Sokal and Rohlf, 1995).

RESULTS AND DISCUSSION

Fertilizer treatments used in this study increased plankton abundance. This agrees with the findings of Tidwell *et al*. (2000), Azim *et al*. (2001), Keshavanath *et al*. (2001) and Dharmarag *et al*. (2002). Treatment 1 had the highest wait (Table 1) while treatment 3 recorded the highest survival rate (Table 2). The quantity and quality of the planktons in treatment 3 (Table 3) encouraged the observed parameters. Treatment 2 (T_2), though had the highest plankton

Table 1: Mean weight gain (g) of *C. gariepinus* fry raised in experimental media

Treatments	Initial total weight (g)	Final total weight (g)	Initial average weight (g)	Final average weight (g)	Weight gain (%)
1a	68.87	206.07	0.69	2.24	308.0
1b	68.36	250.29	0.68	2.55	266.7
1c	69.18	216.60	0.69	2.28	302.6
2a	67.95	181.05	0.68	1.85	369.6
2b	67.42	176.68	0.67	1.84	364.1
2c	66.90	167.46	0.67	1.73	289.3
3a	67.84	191.97	0.68	1.98	343.4
3b	68.33	179.94	0.68	1.82	393.6
3c	66.66	183.59	0.67	1.89	354.9

Table 2: Survival of *C. gariepinus* fry per week (Nos.)

Weeks	T_1	T_2	T_3
0	300	300	300
1	296	296	298
2	291	293	296
3	285	291	293

Table 3: Plankton composition and abundance ($\times 10^3$) in individual treatment tanks

Plankton component	Affiliation	Control (T_1)	Poultry droppings (T_2)	Soy bean milk filtrate (T_3)
Chaetoceros decipiens	Phytoplankton	2.25±0.34	2.50±0.20	3.39±0.47
Anabaena sp.	Phytoplankton	-	-	0.55±0.14
Scenedesmus accuminatus	Phytoplankton	1.17±0.19	2.56±0.01	0.20±0.02
Cyclotella sp.	Phytoplankton	-	-	0.22±0.01
Microcystis sp.	Phytoplankton	-	2.21±0.04	-
Euglena viridis	Phytoplankton	0.56±0.14	2.15±0.10	0.52±0.01
Oedogonium sp.	Phytoplankton	-	0.22±0.04	1.02±0.01
Melosira sp.	Phytoplankton	1.10±0.01	-	-
Cosmarium sp.	Phytoplankton	0.18±0.01	0.15±0.03	0.24±0.02
Oscillatoria sp.	Phytoplankton	0.13±0.04	1.25±0.32	1.87±0.11
Pandorina sp.	Phytoplankton	-	0.51±0.10	0.62±0.12
Brachionus sp.	Zooplankton	-	0.15±0.02	0.21±0.01
Thermocyclops sp.	Zooplankton	-	0.12±0.01	0.49±0.03
Lecane sp.	Zooplankton	-	0.11±0.01	0.21±0.02
Trichocerca obtusidens	Zooplankton	-	0.75±0.10	0.68±0.11
Rotifer	Zooplankton	-	-	0.62±0.04
Daphnia	Zooplankton	-	-	0.52±0.02
Total		5.39±0.73	12.78±0.98	11.56±1.14

Table 4: Water quality parameters measured in treatment tanks

Treatments	Temperature (°C)	Dissolved oxygen (mg L^{-1})	pH
1	25.5±1.0^a	7.5±1.3^a	7.5±0.78^a
2	25.5±1.2^a	5.5±0.8^a	7.9±0.87^a
3	25.5±1.1^a	6.5±0.8^a	7.2±0.81^a

Values (Mean±SD) along the same row with different superscripts differ significantly from their respective mean values at $p<0.05$

abundance (12.78×10^3), recorded a lower species diversity (4 zooplankters and 8 phytoplankters while treatment 3 (T_3) had 6 zooplankters and 9 phytoplankters. The zooplankton count for T_2 (1.13×10^3) was equally lower than T_3 (2.73×10^3). Specifically, Table 3 shows that treatment 3 induced higher production of zooplanktons of rotifers (0.62×10^3) and *Daphnia* spp. (0.52×10^3) which are absent in treatments 1 and 2, respectively. These zooplanktons are among the most preferred food for fry (Heisig, 1979; Hirata, 1979; Bamimore, 1989). Hence, the observed higher survival of fry in the T_3 (98%) as against T_2 (87%) and T_1 (97%). All the three treatments had high survival levels but the significantly lower survival of fry in treatment T_2 can probably be ascribed to the significantly lower concentration of dissolved oxygen (5.5±0.8 mg L^{-1}) compared to that in T_1 (7.5×1.3 mg L^{-1}) and T_3 (6.4±0.8 mg L^{-1}) 9.50. The mean temperature range of 25.1±1.1 to 25.5±1.2°C and pH range of 6.5-9 in all the treatments are within environmental parameters recommended and reported by Viveen *et al.* (1985) and Boyd (1979) for tropical fish optimum growth and nutrient utilization. Table 4 shows the water quality parameters of the treatments.

CONCLUSION

This study shows that the uses of organic fertilizers in enriching the media in which fry/fingerlings are raised are not only economical means of producing fish but also ensures higher survival rates. Soybean milk filtrate a non-convectional medium competed favourably with poultry droppings as well as the use of fishmeal as food for early stages of fish. A closer look at the three treatments of plankton composition showed that a composite combination of the two or the three treatments will probably generate 100% composition of both phyto and zooplanktons to meet the nutrient utilization needs of the fry, there is need to confirm this suggestion through experimentation. But for economic consideration, a combination of T_2 (poultry droppings) and T_3 (soy bean milk filtrate) will suffice. However, the addition of fishmeal (T_1) can be done when financial consideration is not limiting after the third week. By this time some cost would have been saved and the fish farmer can be sure of a higher survival rate of fry/fingerlings. Hence, fish farmers should be encouraged to raise fry/fingerling in medium fertilized using soybean milk filtrate.

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