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Effects of colour on growth of *Oreochromis niloticus* (linnaeus 1757) fingerlings

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ABSTRACT

Understanding *Oreochromis niloticus* behaviour and performance in aquaculture is important to optimize the design, management of tanks, and other culture conditions. The objective of this study is to evaluate how different combinations of tank colours affect the feed intake and growth in *O. niloticus* fingerlings. A feeding trial was conducted for 75 days to determine the effects of tank colours (black, blue, pink, green and white) on growth and nutrient utilization in *O. niloticus* (10.0 g) fingerling. Result indicated that *O. niloticus* fed and raised in black and green tanks had better growth performance of 26 ± 0.19 g and 25 ± 0.19 g and specific growth rate of 1.71 ± 0.33 g and 1.67 ± 0.33 g than the others. While the least growth performance were recorded in the white and pink tanks correspondingly (18.0 ± 0.15 g and 17.5 ± 0.15 g). In conclusion, tank colour is an important factor to consider when planning enhancing the performance of *O. niloticus* in an intensive culture condition.

Keywords: Coloured tanks, *Oreochromis niloticus*, nutrient utilization.

INTRODUCTION

Tilapias have been an important source of food since recorded history (Liem, 1989). It is one of the most productive and internationally traded food fish in the world (Modadugu and Belen, 2004). Tilapia culture became popular only after the introduction of Nile tilapia (*Oreochromis niloticus)* in the 1970's. One thing that is apparent on tilapias that has relevant to aquaculture is that the most commonly studied species at present is *Oreochromis niloticus*. *O. niloticus* is not only the second most important farmed fish globally (next to carp spp.) but also described as the most important aquaculture species of the 21st century (Shelton, 2002). It accounts for 64% of the world production by weight (Fagbenro, 2002). FAO (1998) reported that Nile tilapia (*Oreochromis niloticus*) is amongst the top ten most cultured fish species in the world, with total production of 201,933 metric tones(FAO, 2002), amounting 83% of the global tilapia aquaculture production. In spite of remarkable achievement reported on tilapia aquaculture, early experiences in culture of this species was met with failure due to its undesirable characteristics and production of small, low value fish at harvest, which could likely be attributed to poor rearing methods in the indoor hatchery by the hatchery operators using different rearing culture vessels without taking into consideration the colour of the culture tanks. Numerous authors have established the effects

of tank colour on larval survival and growth of in some species that are of commercial importance (Strand et al., 2007; Yasharian et al., 2005; Abed Golam and Chaoshu, 2005). A study by Strad et al. (2007) on the effect of tank and light intensity on feed intake, growth rate and energy expenditure of juvenile Eurasian perch(*Perca fluviatilis*) and reported that tank colour and light intensity has positive influence on growth and development of Eurasian perch. In view of the insufficient information on the importance of tank colour on the growth performance of fish in an indoor hatchery, the objective of this study therefore, is to evaluate how different combinations of coloured tanks affects feed intake and growth of *Oreochromis niloticus* fingerlings.

MATERIALS AND METHODS

Diet formulation and preparation

Feedstuffs were purchased from a feedstuff market in Ado Ekiti, Ekiti State, Nigeria and were separately milled to small particle size (< 250 µm) using grinding machine (Model BCC2516). A diet (isonitrogenous and isocalorific) was formulated (Table 1) at 35% crude protein. The feedstuffs were thoroughly mixed in a Hobart A-200T pelleting and mixing machine. Hot water was added at intervals to gelatinize starch. The diet was pelletized using a die of 0.8 mm diameter. The diet was air-dried at ambient temperature for 72 hours; broken, sieved into small pellet sizes, packed in air-tight plastic containers, labelled and stored. Proximate analysis of the diet was also determined (Table 2).

Experimental system and animals

A feeding trial was conducted to determine the effects of tank colour on growth and nutrient utilization of *O. niloticus* fingerlings. *O. niloticus* fingerlings were obtained from Ekiti State Agricultural Development Project (ADP) and acclimated for 14 days in concrete tanks during which they were fed with a commercial diet (30% crude protein). After acclimation, 10 *O. niloticus* (mean weight, 10.0 $\pm$ 0.01 g) were stocked in each of 15 coloured laboratory tanks (75 x 40 x 40 cm) {pink, green, black, blue and white} supplied with 60 litres of fresh water (water temperature, 27 ^{o}C, pH, 7.3, alkalinity, 50 ppm dissolved oxygen, 7.6-7.9 mg/L), continuous aeration was provided using a blower and air stones (Tecas air pump AP-3000; two ways). The treatments were replicated thrice. Feeding commenced a day after stocking and lasted 75 days. The fish were fed at 4% body wt/day in two instalments at 0900-0930 h and 1700-1730 h. All fish were removed from each cultured tanks every 14 days, batch weighed and the amount of feed was adjusted accordingly. Growth performance of fish used in the experiment were measured in terms of final individual fish weight (g), survival (%), specific growth rate (SGR, % day-1) and average daily growth rate (ADG).

Growth respond parameters were calculated:

- SGR (% day-1) = 100{(loge final body weight – loge initial body weight)/time(day)}
- ADG = final body weight – initial body weight)/ no of days.

Statistical analysis

The data obtained from the experiment were subjected to One-Way Analysis of Variance (ANOVA) test using the SPSS Version 11. Fisher's pairwise comparison was used in comparing differences among individual means.

RESULTS AND DISCUSSION

The results emanating from this study (Table 4) indicated that *O. niloticus* fingerlings raised in black tank recorded the highest mean weight gain (26 ± 0.19 g) when compared with other coloured tanks (blue, 19.0 $\pm$ 0.17 g, green, 25.0 $\pm$ 0.19 g, pink, 17.5 $\pm$ 0.15 g and white, 18.0 $\pm$ 0.15 g), even though there was no significant difference ($P<0.05$) between fingerlings raised in black tank and that raised in green.

Table 1: Ingredient composition of experimental diet (35% crude protein).

Ingredient	g/kg Diet
Menhaden fish meal	280
Soybean meal	370
Yellow maize	250
Cod liver oil	30
Vegetable oil	20
Vitamin-mineral mix	30

Table 2: Proximate analysis of the experimental diet.

Nutrient	%
Ash	12.98
Moisture content	5.7
Crude protein	37.50
Crude lipid	10.22
Crude Fiber	1.78
NFE	31.82

Table 3: Water quality parameters over 75-days treatment period.

Parameters	*Oreochromis niloticus*
Temperature (°C)	27 ±0.03
pH	7.3 ±0.01
DO_2 (mg/L)	7.6 – 7.9 ±0.02
Alkalinity	50 ±0.02 ppm

Table 4: Growth performance and protein utilization of *Oreochromis niloticus* fingerlings reared in five different coloured tanks.

Treatment (Enclosure)	Initial Wt. (g)	Final Wt. (g)	Wt. gain (g/day)	ADG (% day-1)	SGR (% day-1)
Pink	10.00a	27.5±0.19c	17.5±0.15c	0.23±0.10 c	1.35±0.22 c
Green	10.00a	35.0±0.13a	25.0±0.19a	0.33±0.15 a	1.67±0.33 a
Black	10.00a	36.0±0.10a	26.0±0.19a	0.35±0.15 a	1.71±0.31 a
Blue	10.00a	29.0±0.15b	19.0±0.17b	0.25±0.20 b	1.42±0.28 b
White	10.00a	28.0±0.19c	18.0±0.15c	0.24±0.10 c	1.40±0.22 c

Values in each row having the same superscripts are not significantly different (P<0.05).
Standard error calculated from residual mean square (ANOVA).

The best specific growth rate (1.71± 0.31 g) was obtained in black coloured tank (P>0.05), while the least was recorded in pink coloured tank (1.40±0.22 g). The average daily growth rate of fingerlings in both black and green coloured tanks were not significant different (P<0.05) from each other, even though both are significantly different from blue, pink and white. Fish survival was actually not affected by the tank colour, as survival was over 96% in all treatment tanks (P<0.05).

In a similar study by Abel Golam and Chaoshu (2005), it was reported that the background colour of culture tanks affected the success of mud crab larval. Also, Hecht

and Appelbaum (1987) reported that growth cannot only be attributed to the quality of the feed but also the hatchery condition. This corroborates the present study, where the best growth performance was recorded in the dark coloured tanks (black and green) and the least growth was recorded in the light coloured tanks (white and pink). It is obvious from this study that *Oreochromis niloticus* fingerlings reared in dark coloured tanks (black and green) have the best growth performance and this may be attributed to the habit of this fish species which prefers darken environment to where there is high light intensity.

Also, the water quality parameters obtained in this study (Table 3) corroborated the recommended water quality requirement for *Oreochromis niloticus* (Balarin and Hatton, 1982; Boyd, 1981).

This study has indicated that background colour is an important factor which can facilitate the growth of *Oreochromis niloticus* fingerlings under intensive indoor hatchery management.

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