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EFFECT OF STOCKING DENSITY ON GROWTH AND SURVIVAL RATE OF *LABEO ROHITA* (HAMILTON) FED WITH FORMULATED FEED

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Abstract

To study the effect of stocking density on growth and survival rate of *Labeo rohita*, a three month experiment was conducted during July to September 2009. Three different stocking densities 10, 15 and 20 Fish/ aquaria were assigned as treatment I, II and III respectively. The experimental fish were fed with formulated feed 35% (gross protein). The result of the density experiment showed significantly ($p<0.05$) highest growth and survival rate in treatment II (15 fish/ aquaria). While significantly lowest growth and survival was recorded in treatment III. The water quality parameters and their monthly fluctuations recorded throughout the study period were found with in the suitable ranges for the fish culture.

Keywords: Stocking density, *Labeo rohita*, Growth and Survival rate, Formulated feed.

1. Introduction

Stocking density is an important parameter in fish culture operations, since it has direct effect on the growth and survival and hence production (Backiel and LeCren 1978). For the development and rearing techniques of any fish species, stocking density might play a very important role. A number of research publications are available on the effect of stocking density on growth and survival rate of different fish species like Hassan *et al*., (1982) reported *Sarotherodon niloticus* in floating ponds, Sarder and Mollah (1991) published information on *Pangasius pangasius* in net cages, Sarder *et al*., (1991) studied the effect of density in *Clarias gariepinus*, Alam *et al*., (1995) conducted experiment on *Clarias batrachus*, Kohinoor *et al*., (1999) studied effect of stocking density of *Amblypharyngodon mola* in seasonal ponds, Azimuddin *et al*. (1999) calculated the effect of stocking density of *Pangasius sutchi* in net cages fed with formulated diet, Narejo *et al*., (2002) reported in *Monopterus cuchia* from cemented cisterns and Narejo *et al*., (2005) studied the effect of stocking of *Heteropneustes fossilis* in cemented cisterns fed with formulated feed. Only one paper is available Ahmed *et al*., (1983) related to effect of stocking density of *Labeo rohita* in floating ponds. The present study was initiated to study the effect of stocking density on growth and survival rate of *Labeo rohita*, one of the major carps of commercial value for the pond culture in this region, reared in glass aquaria fed with formulated feed.

2. Materials and Methods

a) Collection and stocking of experimental fish

The experiment was conducted for three months during July to September 2009.Three different densities 10, 15 and 20 fish/aquaria (size 90 × 60 cm) were assigned as treatments I, II and III respectively with two replications each. The experimental fish of almost same size (52 ± 0.28 mm and 9. 4 ± 0.58 g in length and weight respectively) were collected from Carp Fish Hatchery, District Badin. Water of aquaria was replaced with freshwater on every alternate day to prevent the accumulation of the growth inhibitory ammonia.

b) Preparation of pellet feed

To prepare formulated feed for feeding the experimental fish, rice protein, rice bran, rice milling, wheat flour and vitamin premix were ground thoroughly and sieved to pass through 0.5 mm mesh size. An experimental diet was formulated contain 35% protein. All ingredients were mixed together according to the formulae, and then put into the manually operated pellet machine for the preparation of pellet feed of size 1mm. The composition of pellet feed is shown in **(Table-1).**

Table.1. Ingredients and composition of the experimental diet.

Ingredients	Protein Content (%)	Amount (g/kg)
Rice protein	50	350
Rice bran	35	100
Rice milling	10	500
Wheat flour	04	48
Salt+ Vitamin premix	1	2
Total	100	1000

c) Feeding and Sampling

Feeds were supplied to fish twice daily at 9.00 AM and at 5.00 PM at a rate of 8% of the wet body weight. Sampling was done at an interval of one month to adjust the feeding rate, by measuring the weight of fish and to observe the health condition of fish. The length of experimental fish was measured to the nearest mm with an ordinary scale graduated with tenth of centimeters. Weight was measured to the nearest g by a sensitive portable electronic balance (Model AK- 3000H AFD), with the help of small plastic bucket, while an ordinary wooden fish measuring board was used for length measurement in mm.

d) Water Quality Parameters

The water quality parameters like temperature, dissolved oxygen, pH, alkalinity, ammonia and nitrite was recorded monthly throughout the study period with the help of digital portable water quality kit (JENCO Model No. 2631N).

(e) Statistical Analysis

One way analysis of variance (ANOVA) was used to determine the effects of stocking density on the growth and survival rate of *L. rohita*. This was followed by Duncan's New Multiple Range Test (DNMRT), (Duncan 1995) at 5% level of significance to study any difference among treatment means.

3. Results

The growth parameters of *L. rohita* in different treatments in terms of mean weight gain, mean length gain, % weight gain, % length gain, SGR %/ day, FCR, survival (%) and production (kg/m/90 days) were calculated and are shown in Table 2. Growth of rahu, *L. rohita* in glass aquaria indicated that the growth rate varied in different stocking densities. Treatment II (15 fish/aquaria) showed significantly ($p<0.05$) highest growth and survival rate among the treatments. The net length and weight gain of individual fish in treatment II was higher (128 mm and 16.4 g) than those of Treatment I (108 mm and 11.7 g) and (88 mm and 8.8 g) in treatment III respectively. The survival and specific growth rates were also found highest in treatment II (100% and 0.48 respectively) followed by treatment I (90% and 0.36). While significantly ($p<0.05$) lowest survival rate and SGR was recorded (80% and 0.31) in treatment III **(Table 2).**

Table 2. Growth parameters of rahu, *Labeo rohita* with different stocking densities reared in glass aquaria fed with formulated feed.

Parameters	Treatment I	Treatment II	Treatment III
Mean initial length (mm)	$52^{a1} \pm 0.56^{2}$	$52^{a1} \pm 0.28^{2}$	$52^{a1} \pm 0.14^{2}$
Mean final length (mm)	$160^{b} \pm 0.28$	$180^{a} \pm 0.70$	$140^{c} \pm 0.65$
Mean length gain (mm)	$108^{b} \pm 0.34$	$128^{a} \pm 0.56$	$88^{c} \pm 0.23$
% length gain	$207.96^{b} \pm 2.39$	$246.15^{a} \pm 2.39$	$169.23^{c} \pm 2.39$
Mean initial weight (g)	$9.4^{a1} \pm 0.33^{2}$	$9.4^{a1} \pm 0.58^{2}$	$9.4^{a1} \pm 0.14^{2}$
Mean final weight (g)	$20.1^{b} \pm 0.28$	$25.8^{a} \pm 0.84$	$18.20^{c} \pm 0.42$
Mean weight gain (g)	$11.7^{b} \pm 0.35$	$16.4^{a} \pm 0.53$	$8.8^{c} \pm 0.28$
% weight gain	$113.82^{b} \pm 2.57$	$174.46^{a} \pm 2.06$	$82.97^{c} \pm 1.75$
SGR % per day	$0.36^{b} \pm 0.014$	$0.48^{a} \pm 0.014$	$0.31^{c} \pm 0.013$
FCR	$3.61^{b} \pm 0.19$	$2.57^{c} \pm 0.23$	$4.08^{a} \pm 0.13$
Survival rate (%)	$90.0^{b} \pm 1.0$	$100.0^{a} \pm 0.0$	$80.0^{c} \pm 2.0$
Production (kg/m^3/90 days	$0.308^{b} \pm 0.0012$	$0.206^{c} \pm 0.001$	$0.406^{a} \pm 0.001$

1. Fig. in the same row having same superscripts are not significantly different ($p>0.05$).

2. Standard deviation

The water quality parameters and their monthly fluctuations recorded throughout the study period were found with in the suitable ranges for the fish culture as shown in **(Table 3).**

Table 3. Showed month-wise variation in water quality parameters in glass aquaria throughout the study period

Months	Parameters					
	Temperature (ºC)	pH	D.O mg/L	Alkalinity mg/L	Ammonia mg/L	Nitrite mg/L
July	29.1	7.30	4.7	160	0.38	0.169
Aug.	30.6	7.45	4.0	170	0.44	0.172
Sept.	30.3	7.55	4.1	159	0.50	0.170

4. Discussions

The effect of stocking density on growth and survival of rahu, *L. rohita* was conducted and observed that the growth rate of rahu in glass aquaria varied in different stocking densities. Treatment II (15 fish/aquaria) showed significantly ($P<0.05$) highest in growth among the treatments. The net weight gain of an individual fish in treatment II was higher (16.4 g) than those of treatment I (11.7 g) and (8.8 g) in treatment III. The present results coincide with the findings of Alikunhi (1957), Kawamoto *et al*., (1957) and Haque *et al.*, (1984) who achieved best growth at lower stocking densities.

The lowest stocking densities provide more space, food and less competition, which were reported by various authors like Ahmed (1982); Hassan *et al*., (1982); Haque *et al*., (1984) and Narejo *et al*., (2005). This phenomenon indicated that there might be lower community feelings among the fishes, which influence them to consume feed properly, and it might be absent in the treatments with higher stocking densities. The percentage of survival as recorded in the present study was 100, 90 and 80% for treatment II, I and III respectively. Survival was found to be negatively influenced by stocking densities. It might be due to the high competition and space among the fishes. Mollah (1985) reported that the lower density gave larger size and higher survival rate in *Clarias macrocephalus*. Ita *et al*., (1989) studied that the lower stocking density showed higher survival of *Clarias angullaris* Barua (1990) calculated that the survival rates were higher in the larvae of *Clarias batrachus* raised at the stocking densities of 2, 4 and 8 fish per liter as compared to those obtained 16 fish/liter. Narejo *et al*., (2005) reported that highest weight gain and survival rate of *Heteropneustes fossilis* in lower stocking density. The above findings support the results of the present study. Significantly ($P<0.05$) higher net production was obtained from the treatment III (0.406 kg/m^3/90 days) in the present study. It might be due to higher number of fish stocked (20 fish/aquaria). The present result agrees with the findings of Dimitrov (1976); Mollah (1985); Ita et *al*., (1989); Barua (1990); and Narejo *et al*., (2005) they obtained higher production from higher density. The water quality parameters were recorded throughout the study period and were found with in the suitable ranges as reported by (Barua 1990; Rahman 1992; Narejo *et al*. 2002; Narejo *et al*, 2003; Narejo *et al*., 2005). The results of the present study indicated that a stocking density of (15 fish/aquaria) might be suitable for the culture of rahu, *Labeo rohita* in glass aquaria.

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