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Nursery Rearing of Catla (*Catla catla*) Under Different Dietary Protein and Fertilization Levels

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Catla (*Catla catla*) spawn were stocked at 5 million/ha in a commercial fish seed farm. Cow dung at the rate of 13,000 (T1), 15,000 (T2) and 18,500 kg/ha (T3) were applied in split doses during the experimental period of 21 days. Finely powdered groundnut cake-rice bran mixture (1:1) served as control diet (A). Experimental diets were formulated by incorporating fish meal at 10 (B), 24 (C) and 38% (D) level in the control diet. All the diets were tested at each level of fertilization and fed at equivalent, 3 times and 4 times the initial body weight for the first 5, next 10 and rest of the days respectively. Irrespective of the diet given, increased growth and survival of catla and increased weight of plankton were recorded with increase in fertilization rate. The highest average length and weight gain were observed in fish fed diet C with 35% protein. The overall survival was the highest in T3 and lowest in T1. Fish meal based diet with 35% protein was found to be ideal for the nursery rearing of catla in fertilized ponds to obtain higher growth and survival.

Key words: ***Catla catla*, dietary protein, growth rate, survival rate, pond fertilization**

The use of fertilizer is widely recommended for small scale fish farms in tropical Asia. Although pond fertilization is an ancient and much investigated aspect, it is still difficult to recommend the amount and type of fertilizer to be added to a system, the frequency of application and the expected returns from such additions (De Silva & Anderson, 1995). Investigations have shown that split dose application of manure at weekly or fortnightly intervals helps to enhance production (James, 1987). Even though there are a number of reports on the use of formulated feeds (Chakraborty *et al.*, 1973; Sen *et al.*, 1978; Mohanty *et al.*, 1990), majority of the farms engaged in production of carp seeds use a mixture of powdered rice bran and groundnut cake as supplementary feed. It is reported that major carps require about 40-45% protein under laboratory conditions (Sen *et al.*, 1978; Singh & Bhanot, 1988; Khan & Jafri, 1991). Lakshmanan *et al.* (1967) reported higher survival rate of carp fry when fed protein rich supplementary feed. Jena *et al.*, (1996) have reported enhanced growth of catla in nurseries when fed formulated diet with 45% protein, compared to spawn fed rice bran-groundnut cake mixture. However, reports of experimental studies on diets with varying levels of protein on growth and survival of catla in nursery ponds with different rates of fertilization under field conditions are scanty. Hence an experiment on these lines was conducted in the fish seed farm of B.R. Project, Shimoga, Karnataka, India.

Materials and Methods

The experiment was conducted in 4 cement cisterns of 0.01 ha (T1), 4 cement cisterns of 0.016 ha (T2) and 4 earthern ponds of 0.03 ha (T3). Cow dung at the rate of 13,000 kg (T1), 15,000 kg (T2) and 18,500 kg/ha (T3) were used as manure. 50% of the above quantity was applied 5 days prior to stocking and the rest was applied on alternate days in equal instalments during

the experimental period of 21 days. Catla spawn, produced by induced breeding, with 1.89 mg (T1) and 2.02 mg (T2 and T3) average weight were stocked at the rate of 5 million/ha. Finely powdered rice bran and groundnut cake served as control diet (diet A). The experimental diets were prepared by incorporating fish meal at 10% (diet B), 24% (diet C) and 38% (diet D) level to the control diet. All the diets were tested at each level of fertilization. The details of the ingredients of each diet are summarised in Table 1. The ingredients were mixed thoroughly and broadcast once daily in the morning. The fish were fed at the rate equivalent to its initial body weight for the first five days, at 3 times the body weight for the next 10 days and 4 times the body weight for the remaining period (Alikunhi, 1957; Hora & Pillay, 1962). The feed samples were analysed for proximate composition following the methods of AOAC (1980). The nitrogen-free extract content (NFE) was calculated following the difference method of Hastings (1976). Calorific value of different feeds was obtained by multiplying protein, lipid and NFE contents by energy values, 5 (Smith, 1975), 9 and 4 (Hastings, 1975) respectively. The calorific value was multiplied by the factor 4.184 to obtain the energy content in joules. Water was analysed for dissolved oxygen, free carbon dioxide, total alkalinity, pH, temperature and plankton production (dry weight) at weekly intervals following standard methods (APHA, 1992). The data on survival and growth were analysed by ANOVA (Snedecor & Cochran, 1968) followed by multiple range test (Duncan, 1955).

Results and Discussion

The water quality parameters recorded in different treatments were within the optimum range for fish culture (Table 2). Alkalinity was comparatively higher in treatment 3. Among the different fertilization rates followed, the highest dry weight of plankton was obtained in T3 (Table 2) followed by T2 and T1 corresponding to the decrease in fertilization rates.

The growth, food conversion efficiency (FCE) and survival of *C. catla* recorded in different treatments and fed different diets are summarised in Table 3. Fish fed on diets C and D recorded significantly higher weight gain and specific growth rate compared to diets A and B in T1. The survival rate

Table 1. Ingredients used and the proximate composition (±S.D.) of different diets

	Diets			
	A	B	C	D
Ingredients (%)				
Rice bran	50	45	38	31
Groundnut cake	50	45	38	31
Fish meal	-	10	24	38
Proximate composition %				
Dry matter	92.28±1.06	92.10±1.23	91.86±0.74	91.60±0.86
Crude protein	24.74±0.37	29.41±0.47	34.94±1.04	41.48±1.25
Lipid	4.75±0.34	4.46±0.17	4.05±0.10	3.64±0.03
Ash	13.05±0.16	13.10±0.32	13.19±0.09	13.28±0.18
Crude fibre	15.51±0.52	13.96±0.32	11.79±0.47	9.62±0.09
NFE	34.23	31.17	27.89	23.58
Energy (kJ/g)	10.81	13.04	13.50	13.99

Table 2. Water quality parameters and dry weight of plankton (range and average) recorded in different treatments

Treatment/Fertilization rate (kg/ha)	Diet	Dissolved oxygen (ppm)	Free carbon dioxide (ppm)	Total alkalinity (ppm)	pH	Dry wt. of plankton (mg/100 l)
T1	A	4.99-8.01	0-6.40	45.00-72.50	6.8-7.2	15.0-75.0
13,000		7.12	3.42	52.50	6.84	42.00
	B	4.58-8.45	0-7.20	51.00-75.50	6.8-7.2	20.0-85.0
		6.26	2.92	59.46	7.08	40.50
	C	3.30-6.89	0-5.20	55.00-80.50	6.8-7.4	20.0-95.0
		5.34	1.92	59.34	6.84	49.50
	D	3.33-7.34	0-4.00	51.50-65.50	6.8-7.2	17.5-115.0
		5.98	1.68	55.71	7.08	51.75
T2	A	4.18-6.35	0-8.00	51.25-65.42	6.8-7.0	22.5-75.0
15,000		6.12	2.96	55.71	6.84	47.00
	B	3.48-8.45	0-6.40	52.00-67.50	6.8-7.0	30.0-72.5
		5.86	3.52	59.56	6.84	48.00
	C	3.94-8.01	0-4.40	55.50-70.00	6.8-7.4	27.5-87.5
		7.21	1.88	59.64	7.08	50.50
	D	3.71-7.94	0-2.4	51.25-61.25	6.8-7.4	22.5-105.0
		5.64	1.44	57.77	7.08	52.25
T3	A	3.71-7.94	0-7.2	90.0-131.07	7.6-8.6	35.0-115.0
18,500		6.18	1.42	118.0	7.96	66.25
	B	3.94-6.75	0-6.4	110.0-162.8	7.9-8.0	50.0-130.0
		6.42	2.04	126.0	7.98	66.80
	C	3.02-6.75	0-6.4	102.0-177.94	7.8-8.6	37.5-130.0
		6.57	2.16	139.0	8.24	73.12
	D	3.48-7.94	0-4.8	104.0-181.51	7.8-8.6	45.0-135.0
		6.91	1.96	141.0	8.16	78.75

Table 3. Fertilization rate, growth and survival of *C. catla* in different treatments

Treatment	Diet	Av. initial wt. (mg)	Av. initial length (mm)	Av. final wt. (mg)	Av. wt. gain (mg)	SGR	FCE	Survival (%)
T1	A	1.89	5.89	39.26	37.37^{a}	6.27^{a}	33.51^{a}	19.21^{b}
	B	1.89	5.89	42.96	41.07^{a}	6.46^{a}	36.83^{a}	24.68^{d}
	C	1.89	5.89	59.74	57.85^{c}	7.14^{c}	51.88^{b}	26.31^{e}
	D	1.89	5.89	56.06	54.17^{c}	7.01^{c}	48.58^{b}	13.41^{a}
T2	A	2.02	6.25	41.46	39.44^{a}	6.25^{a}	34.79^{a}	25.71^{de}
	B	2.02	6.25	48.65	46.63^{b}	6.58^{b}	40.82^{a}	25.14^{de}
	C	2.02	6.25	121.79	119.77^{f}	8.48^{f}	102.19^{c}	21.31^{c}
	D	2.02	6.25	59.68	57.66^{c}	7.00^{c}	50.07^{b}	20.71^{c}
T3	A	2.02	6.25	92.77	90.75^{d}	7.91^{d}	77.84^{c}	21.53^{c}
	B	2.02	6.25	106.84	104.82^{c}	8.21^{e}	89.85^{b}	25.75^{de}
	C	2.02	6.25	146.85	144.83^{g}	8.86^{g}	122.50^{f}	33.22^{f}
	D	2.02	6.25	123.28	121.26^{f}	8.50^{f}	101.74^{e}	24.91^{d}

Figures in the same column with same superscript are not significantly different ($p>0.05$)

recorded was significantly different with different diets, the highest being with diet C and the lowest with diet D. In treatments 2 and 3, the average weight gain recorded was significantly ($p < 0.05$) different between different diets, the highest being in diet C and the lowest in diet A. The survival rates were not significantly different from each other in T2 while in T3, diet C recorded significantly higher survival.

The average weight gain for fish fed diets B and C in T2 were significantly ($p < 0.05$) higher than that for fish fed the same diet in T1 and T3. The growth and survival of fish fed diet C with 35% protein was the maximum in all the treatments except for the survival rate in T2.

FCE increases with dietary protein content (Jauncey, 1982; Gangadhar *et al.*, 1997) and in the present investigations, the FCE increased with increase in dietary protein level and the highest value was recorded with diet C in all the treatments.

It is generally known that the protein content of the diet has significant effect on growth and survival of carp spawn and fry. As growth and protein turnover (anabolism and catabolism) rates as well as energy requirements are higher during early stages in the life history of fish (Kaushik, 1986), the protein requirement during this stage is comparatively high. Singh & Bhanot (1988) and Khan & Jafri (1991) recorded a dietary protein requirement of 47 and 40% respectively for catla fry fed casein based purified diets. Mohanty *et al.* (1990) fed catla fry with fish meal based diets of varying levels of protein and obtained best growth at 45% level under laboratory conditions. Jena *et al.* (1996) reported the optimum level of protein for catla and rohu fry as 45% in ponds receiving split doses of groundnut cake, cow dung and single super phosphate as fertilizers. The growth and survival of catla recorded in the present study in treatment 3 with a 35% protein diet is almost comparable to that reported by Jena *et al.* (1996). The good growth of catla in this case reveals that planktonic contribution supplements the dietary protein. The higher growth of fish observed in treatment 3 compared to treatments 1 and 2 can be attributed to the increased production of plankton due to higher dose of manuring. High fish productivity in manured systems is primarily due to phytoplankton, which provides protein-rich natural food for fish, and dissolved oxygen to support respiration of all aerobic organisms in the pond (Knud - Hansen *et al.*, 1991). Alikunhi (1957) considered cow dung, the most commonly used organic manure, to be one of the best manures for carp nurseries. It was observed that phased manuring of cow dung enhanced the plankton production and maintained it at a high level for a longer duration while the same quantity of manure applied in a single dose did not give similar results (Anon, 1975).

It may be concluded that a supplementary feed with 35% protein sufficient for the nursery rearing of catla in fertilized ponds. Since organic manures are relatively cheaper, it is economical to take advantage of this by its judicious application, so that the cost of supplementary feeds could be reduced.

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