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Effect of Varying Stocking Density on Growth and Survival of *Catla catla* Fry in Nursery Cisterns

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Nursery rearing of carps is one of the important management practices for successful fish culture. Better health, growth and survival of the fish seed can be achieved by appropriate rearing methods. This study was undertaken to determine the optimum stocking density of *Catla catla* fry in nursery ponds. Catla spawn were stocked at the rate of 2.5, 3.0, 3.5 and 4.0 million. ha^{-1} in triplicate cisterns and designated as S_1, S_2, S_3, and S_4, respectively. They were fed with a diet containing 38.5% protein (soya flour and fish meal based). The best growth and survival of catla fry were recorded in S_1 followed by S_2, S_3, and S_4. However, S_4 (4.0 million. ha^{-1}) was found to be cost effective with higher net return.

Key words: ***Catla catla*, nursery, stocking density, survival**

Culture of Indian major carps in polyculture is very popular in India. Major constraint in the expansion of carp culture in the country is lack of availability of sufficient seeds. Contribution of seed from riverine collection has decreased substantially over the years. Presently, maximum contribution of carp seed (almost 99%) comes from induced breeding/ hyphophysation technique. Average survival in traditional carp nurseries is poor (25-30%) due to improper pond preparation, management and stocking densities employed and other reasons. Ideal stocking density in carp nurseries plays a vital role in the sustainable seed production.

Several studies have been conducted to standardize the stocking density. With a stocking density of 12.3-13.3 million. ha^{-1} of catla fry and 11.3-23.3 million. ha^{-1} of rohu fry, a maximum survival of 78% and 84.9%, respectively has been obtained in cement nurseries (Venugopal *et al.*, 1986). On the other hand *Labeo rohita* reared in traditional nursery ponds in Andhra Pradesh at a stocking density of 10-11.25 million ha^{-1} recorded a survival rate ranging from 64.72 to 93.75% (Saha, 1991).

Information on nutritional requirements of carp fry is important for formulation of suitable pellet diets for their rearing in nurseries. Sen *et al.* (1978) and Mohanty *et al.* (1990) observed that protein requirements of young ones of Indian major carps lie between 40 and 45%. Das *et al.* (1991) showed the possibility of lowering the protein level to 38% by increasing the dietary energy to 400 kcal. $100g^{-1}$ in carp feed without affecting the growth performance. Swamy *et al.* (1988) reported that mrigal grow better with 40% protein. A protein level of 38.5% was maintained in the feed in the present study and four stocking densities of *Catla catla* fry namely, 2.5, 3.0, 3.5 and 4.0 million. ha^{-1} were tested in cement nurseries to determine optimum stocking density in catla nursery rearing.

Materials and Methods

The present study was conducted in 12 cement cisterns measuring 25 m^2 each. Diet was formulated to a crude protein content of 38.5% using soya flour, fish meal and groundnut oil cake as protein sources. The feed ingredients were mixed, cooked and pelletised through a 2 mm die. Ingredient

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proportion and proximate composition of the feed are presented in Table 1. Standard methods (AOAC, 1995) were followed to analyse the proximate composition.

Table 1. Percentage composition of the ingredients and proximate composition of the experimental diet

Ingredients	%	Proximate composition of the diet %	
Fish meal	20	Moisture	9.63±2.12
Soya flour	36	Crude protein	38.5±1.98
Ground nut oil cake	24	Crude fat	9.31±3.32
Rice bran	5	Crude fibre	4.87±0.17
Ragi flour	5	Ash	9.8±1.57
Tapioca flour	8	NFE	27.89
Vitamin and mineral mixture	2	Gross energy, (k J.g^{-1})	16.23

Spawn of *C. catla* were brought from Bhadra Reservoir Fish Seed Farm. The treatments were designated as S_1, S_2, S_3 and S_4 with corresponding stocking densities of 2.5, 3.0, 3.5 and 4 million. ha^{-1} respectively. Each stocking density was tested in triplicate cisterns.

The experiment was carried out for a period of 15 days, which is the usual duration in traditional carp nursery rearing. Feed was offered to catla fry by broadcasting four times daily. Feeding rate was adjusted in such a way that fry were fed four times the initial biomass for the first seven days and eight times the initial biomass for the rest of the period.

Weekly water sampling was done to analyse the water quality parameters such as temperature, pH, dissolved oxygen, free carbon dioxide and total alkalinity. After 15 days of rearing, weight, length, specific growth rate and survival rate of catla fry were recorded. Analysis of variance technique was employed to find out the significant difference among different stocking densities.

Results and Discussion

Water quality was found suitable for carp seed rearing throughout the experiment. The ranges of various parameters were as follows: temperature 23.8 to 26.7°C, pH 7.49 to 7.91, dissolved oxygen 7.6 to 8.37 ppm, free carbon dioxide 0.35 to 2.52 ppm and total alkalinity 38.42 to 48.51 ppm.

The initial average weight and length of individual spawn were 1.3 mg and 6.5 mm, respectively. The final weight and length, specific growth rate and survival rate attained by catla fry in the four stocking densities are given in Table 2. Maximum weight, length, specific growth rate and survival were achieved in S_1 followed by S_2, S_3 and S_4. Two - way analysis of variance employed for the growth data indicated the significant difference in the final average growth of fish due to different stocking densities. A stocking density of 2.5 million. ha^{-1} in stagnant cement nurseries has given best growth and survival. Horvath *et al.* (1992) proposed a stocking density ranging from 1 to 4 million. ha^{-1} for carp seed rearing in nursery ponds under semi intensive management. The growth and survival of catla fry was found better in the present study than in such studies conducted earlier (Mohanty *et al.*, 1990, Das *et al.*, 1991, Mukhopadhyay *et al.*, 1991).

However, when economics of nursery rearing of catla were worked out, a stocking density of 4.0 million. ha^{-1} was found to give maximum returns to the farmer and was cost-effective with moderate size and survival rate of fry. The gross profit will be the highest with the stocking density of 4.0 million ha^{-1} (Rs. 17,932) followed by 3.5

Table 2. Mean and Standard deviation of weight, length, specific growth rate and survival of *Catla catla* fry recorded at the end of 15 days.

Stocking density million ha^{-1}	Weight (mg)	Length (mm)	SGR (%)	Survival (%)
2.5	153.70±1.47	38.40±1.2	7.99±0.12	93.76±0.09
3.0	145.03±5.25	36.43±2.84	8.35±0.25	91.20±1.12
3.5	134.73±4.20	32.50±0.95	12.37±0.17	89.25±2.16
4.0	125.40±0.95	22.17±1.55	16.26±0.45	82.60±4.49

and least in this case of 2.5 million. ha^{-1} (Rs. 12,640).

It may therefore be concluded that even though growth and survival of catla fry will be better with lower stocking density, a higher stocking density will be optimum from the point of view of economic returns.

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