Comparison of Growth of Carps Fed on Salvinia based Feed and Conventional Feed*

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Utility of floating aquatic weed *Salvinia* in the feed for grass carp and common carp fingerlings has been studied. Both *Salvinia* based feed (SF) and control feed (CF) was fed at the rate of 5% of the body weight of fish in an experiment conducted for 112 days in 20 m^2 cement cisterns with triplicates for each treatment. Statistical analysis of results indicated that there was no significance at 5% level between the fishes fed by *Salvinia* based feed, and control feed on their growth.

Major share of expense in intensive fish culture is accounted for supplementary feeds. Commonly used conventional feed in India is the mixture of rice bran and oil cake in equal proportions. Varghese *et al.*, (1976) have reported that this conventional feed is nutritionally imbalanced to achieve fast growth of fish. Further, considerable increase in the cost of ingredients of conventional feed in these days have necessitated to look for alternative protein sources. Several unconventional sources of plant proteins like grasses and weeds of terrestrial origin have been studied for their supplementation in fish feeds. Utility of aquatic weeds in fish feed is of recent development. *Nymphoides* and *Spirodella* (Patnaik & Das, 1979), *Colocasia esculenta* (Venugopal, 1980) and *Eichhornia* (Anil, 1981) weeds were used to replace the major ingredients partially in supplementary feedss. Mohanty & Swamy (1986) enriched the conventional feed with *Salvinia* leaf powder and fed to Indian major carps. Shivananda Murthy (1989) has studied the utility of *Eichhornia* and *Pistia* as major ingredients in the supplementary feeds for grass carp and common carp.

In the present study feed formulated by using *Salvinia molesta* as a major ingredient was tested on the growth of grass carp, *Ctenopharyngodon idella* (Val.) and common carp, *Cyprinus carpio* (Linn.) and compared with the conventional feed.

Materials and Methods

The experiment was conducted in six uniform sized cement cisterns (20 m^2 each), located at the Fisheries Research Station, Hesaraghatta, University of Agricultural Sciences, Bangalore for a period of 112 days.

The composition of ingredients used in the *Salvinia* based feed (SF) is given in Table 1. Prior to formulation of feeds all the ingredients were dried, powdered and analysed for their proximate composition. Moisture content was determined by heating the samples at 105°C for 30 min and then at 65°C till a constant weight was obtained (Boyd, 1979). Total nitrogen content was estimated by using Tecator Kjeltec apparatus and the crude protein was obtained by multiplying the value by the factor 6.25. Crude fat was estimated by using Tecator Soxtec apparatus using petroleum ether (40

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- 60°C) and expressed in percentage. Total ash content was determined by ashing the sample in a muffle furnace at 550 ± 10°C for 6 h. Crude fibre was analysed as per Pearson (1976). Carbohydrate content was obtained as nitrogen free extract (NFE) by the difference method (Hastings, 1976).

Two iso-nitrogenous and isocaloric diets were prepared separately by using weighed amounts of various feed ingredients. The conventional feed (CF) was prepared by using ground nut cake and rice bran in the ratio of 1:1 by weight. Ingredients were mixed with just sufficient quantity of water to get the required soft consistency and hand-kneaded. It was then cooked in a pressure cooker for 30 min at 15 PSI. The cooked feed was cooled by spreading under the fan. Then vitamin-mineral premix (Suplevit-M by M/s Sarabhai Chemicals, Baroda) was added and mixed uniformly. Then the feed was sun dried till the moisture was less than 10 percent and stored in plastic bags. Caloric values of feeds were calculated. The feeds were analysed for their proximate composition following the procedures mentioned earlier.

Before stocking, all the cisterns were drained, cleaned and then exposed to sun for a day. A soil bed of 15 cm was provided, then filled with water upto a level of one metre and the same level and maintained throughout the experiment. Initial manuring was done with cowdung at the rate of 15 kg per cistern. There was no subsequent manuring. Fingerlings of grass carp and common carp were acclimatised to respective feeds for about two weeks and then they were stocked in combination at a density of 7,500/ha in cisterns maintaining triplicates for each feed treatment. Each cistern was stocked with 7 fingerlings of grass carp and 8 fingerlings of common carp having an average weight of 6.53 and 3.13 g respectively. Feeding was done daily once in the morning at the rate of 5 per cent of the body weight of fingerlings on dry weight basis. Feed was presented in the form of a ball in aluminium trays suspended in the water by hanging. Quantity to be fed daily was adjusted once in a fortnight based on the average weight gain of fish.

Water samples were collected on sampling days and analysed for the physico-chemical parameters like pH, total alkalinity, dissolved oxygen and free carbon dioxide by following standard procedure (Jhingran *et al*, 1969). Quantitative estimation of plankton in terms of numbers per litre was made by using sedgewickrafter plankton counting cell following direct census method. Volume of plankton per litre of water on wet weight basis was determined as per Jhingran *et al.* (1969).

At the end of the experiment average weights and lengths of fish were recorded and growth response of each species tested statistically by analysis of variance (ANOVA). The relative conversion rate, food conversion efficiency and specific growth rate indicating percentage increase in body weight per day were calculated following standard procedures.

Results and Discussion

Table 1 gives the composition of feed and the proximate composition of feed ingredients. Dried *Salvinia* leaf power has a protein content of 16.26%. Table 2 gives the proximate composition of Salvinia based feed and control feed.

During the course of study water temperature ranged from 24 to 28°C. Average pH values varied from 7.4 to 8.3 in cisterns under Salvinia based feed (SF) treatment and from 7.8 to 8.5 in control feed treatment (CF) cisterns. While average total alkalinity values fluctuated from 142.0 to 184.7 ppm in SF treatment and 108.7 to 180.0

Table 1. *Composition of feed and chemical composition of feed ingredients (% on dry weight basis)*

Ingredients	Composition %	Dry matter %	Crude protein %	Crude fat %	Crude fibre %	Nitrogen free extract %	Ash %
Salvinia leaf powder	50	97.33	16.26	1.07	18.52	39.58	21.90
Groundnut cake	24	92.67	50.10	5.33	3.58	28.55	4.91
Rice bran	11	94.73	5.95	1.63	35.14	30.68	21.33
Fish meal	11	95.33	60.33	2.68	0.09	13.83	18.21
Vit-mineral premix	1	-	-	-	-	-	-
Edible oil	3	-	-	-	-	-	-

Table 2. *Chemical composition of formulated feeds (% on dry weight basis)*

Feed	Dry matter %	Crude protein %	Crude fat %	Crude fibre %	Nitrogen free extract %	Ash %	Caloric value (k cal/g)
SF	93.32	27.47	5.99	19.22	26.40	14.24	2.97
CF	96.34	28.02	4.33	17.02	33.30	13.62	3.13

ppm in CF treatment cisterns. Average dissolved oxygen content of water ranged from 5.07 to 11.07 ppm in SF treatment and 6.87 to 15.6 ppm in CF treatment. Higher value of oxygen was associated with the fresh water pumped into the cisterns. Average free carbon dioxide values varied from 1.33 to 3.33 ppm in SF and from 0 to 1.66 in CF treatment. Mean values of plankton volume fluctuated from 0.012 to 0.04 ml/1 in SF treatment and from 0.018 to 0.04 ml/1 in CF treatment. Initial manuring enhanced the plankton production in the beginning, while manurial effect of faecal matter of fish and unconsumed food could probably be responsible for the continued plankton production.

Growth trend of grass carp and common carp is depicted in Fig.1, by taking the average weight gains during different

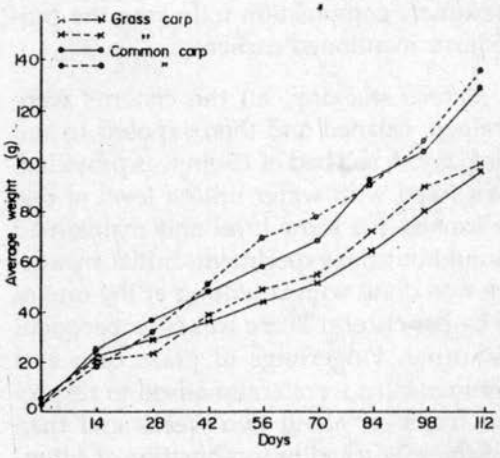

Fig. 1. Average weight (g) attained by grass carp and common carp in the two treatments

fortnights. Growth of grass carp was almost similar in both the treatments, while common carp grew slightly better in CF treatment (Table 3).

Table 3. *Details of growth performance, survival and fish production*

Feeds	SF		CF	
Species	Grass carp	Common carp	Grass carp	Common carp
No. of fish stocked/3 cisterns (@ 7,500/ha)	21.00	24.00	21.00	24
Initial average individual weight, g	6.53	3.13	6.53	3.13
Minimum individual weight at harvest, g	81.25	108.75	90.00	101.87
Maximum individual weight at harvest, g	99.50	152.14	95.71	167.50
Average individual weight at harvest, g	91.36	124.88	92.90	130.27
Average daily growth increment, g	0.76	1.09	0.77	1.14
Total weight at harvest, kg	1.83	2.92	1.77	3.12
Survival, %	95.24	100.00	90.48	100.00
Average specific growth rate	2.35	3.29	2.37	2.98

Further, growth of common carp was better than grass carp in both the treatments, probably due to its voracious feeding habits. Cent percent survival of common carp was observed in both the treatments.

Statistical analysis (ANOVA) of results indicated that there was no significant difference at 5% level of growth between replications and between two species with respect to final average weight. The food conversion efficiency was 47.34% in SF treatment and 47.04% in CF treatment (Table 4).

Table 4. *Percentage food conversion efficiency of two feeds*

Particulars	Feeds	
	SF	CF
Relative conversion rate	2.11	2.13
Food conversion efficiency %	47.34	47.04
Total amount of feed given (kg/69 m^2/112 days)	9.76	9.97

Eventhough there is not much variation in the growth of grass carp and common carp in the two treatments, it can be concluded that the feed formulated by using *Salvinia* leaves is equally good when compared to conventional feed both in terms of its acceptability as well as its effect on the growth of the two species.

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