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EFFECT OF FORMULATED DIET ON FISH PRODUCTION IN POLYCULTURE SYSTEM

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ABSTRACT

A feed trial was conducted to determine growth of three Indian major carps i.e. *Catla catla* (0.31g), *Labeo rohita* (0.22g) and *Cyprinus carpio* (0.4 g) under intensive culture system. They were fed with a formulated diet with the composition of Casein, Gelatin, Dextrin, Cod liver oil, Cellulose, Carboxylmethyl cellulose, Miner pre mix, Vitamin mix and Oxytetracycline. The whole mixture contain 45.8% crude protein on a dry weight basis and served for 75 days twice a day at 3% of body weight. It was noticed that all frys did not exhibit same results. Among experimental specimen *Catla catla* respond significantly by exhibiting least FCR value 3.735±2.293 followed by SGR 2.405±1.642 and % weight gain 34.3±13.9.

Key words: Intensive aquaculture, formulated diets, carp polyculture.

INTRODUCTION

Inland aquaculture is the field that can be adequately for quality protein production. The have maximum protein yield from limited area of land through polyculture practices. Polyculture yields a higher production than single species farming because any single species can not utilize all the available food in a pond because of it a specific feeding habits (Kumar, 1992). Fish culture requires a relatively high amount of it a specific feeding production than that of any other farming system (Werner, 1991)

The polyculture of three Indian major carps named *Catia catla, Labeo rohita and Cyprinus carpio* (Sinha, 1979, Chaudry *et al.*, 1974) is one of the most successful polyculture systems in the world. They can spawn easily; manage under farm conditions, not seriously affected by disease problems when not stressed. They are diligent feeder efficiency utilize planktonic organism as well as animalcules living near the banks or the bottoms of ponds and rivers and eat different variety of formulated foods. They grow rapidly and tolerate a wide range of temperatures and dissolved oxygen (Lovell *et al,*. 1978). Because of high investments in building the ponds, fixed costs are so high that they can be covered only by high fish yields per unit area these high yields can be obtained only by stocking more fish per hectare and feeding them on formulated diet; only then fish culture is economical. An economical diet must produce a Kg of healthy fish at the least cost during a normal growing season. In development of economical diet, one cannot ignore the facts that some differences in feed composition will be introduce by seasonal changes in the ingredients (Chaudry *et al.*, 1975)

Generally four types of feed are produced and marketed; complete, supplemental (variable mixture of ingredients for extensive culture), concentrate (supplemental with main protein source), and premix (vitamins, minerals and drugs with a carrier) (Sinha, 1979). The basic information required for feed formulation includes: nutrient requirements of feed ingredients; expected feed consumption; feed additives required and type of feed processing desired (Sehgal *et al.*, 1985) Growth, reproduction, behavior pattern, nutrient storage enzyme activity, and gross and histological appearance of the tissues are the major criteria used to assess the nutritional adequacy of diets.

The main objectives of diet formulation is to utilize knowledge of nutrient requirements locally available feed ingredients and digestive capacity of fish in the development of a nutrionally balanced mixture of feed stuffs which will be eaten sufficient amounts to provide optimum production at an acceptable cost. Recent dramatic expansion of fish culture give rise a separate off shoot as an industry for producing quality feed. Therefore, the latest trend in aquaculture nutrition is focused on the use of formulated diets for polyculture system and foe last four decades, great efforts have been made to enhance the use of formulated diets. The literature survey showed that formulated diet could be used successfully for better yields (Khan *et al.*, 1991; Santiago *et al.*, 1989; Alami-Durant *et al.*, 1991; Sziaminska *et al.*,1990; Bergot, 1986; Koskela, 1988; Alam and Mullah, 1988; Vinogradov and Kanideva, 1990) .

MATERIALS AND METHODS

Forty-day old frys of *C. catla* (0.31gm), *L. rohita* (0.22gm) and *C. carpio* (0.4gm) were kept in 3x1 feet glass aquarium in duplicate containing formulated diet of casein, gelatin, dextrin, cod liver oil, cellulose, carboxy methylcellulose, mineral premix, vitamin mix, and oxytetracycline (Tables 1-3).Prior to the start of experiment, frys were acclimatized for ten days to standardized experimental conditions of 24 hours of aeration.

The experimental diet containing 45.8% crude protein (Devaraj and Seeneppa, 1989) on a dry weight basis was prepared .The dry ingredients except oil were weighed with cellulose and blended using an electrical grinder ,and the required quantity of cod liver oil was added to the ingredient mixture. Later, water (80ml/100g feed ingredients) was added and hand mixed until it formed a stiff dough .This was extruded without added heat through a 2mm die in a hand miner. The spaghetti like strings were air dried, powdered and hand sieved to size (<1mm).The feed was stored in high gauge plastic bags under room temperature until further use.

The feeding trial was carried out for 120 days. Fish were fed at their maintenance ratio based on weight of fish, twice a day at 0900 and 1500 hours. The left over feed and excreta were cleaned the next morning before first feeding by siphoning. Total weight of fish in each aquarium was measured fortnightly (twice a week) followed physico-chemical features of water throughout the study period. Total dissolved solid (TDS) was recorded and portable TDS meter. Dissolved oxygen, free carbon dioxide, total alkalinity, calcium hardness and chloride were determined titrimatically as described in AOAC, 1990. Free ammonia, nitrite nitrogen, nitrate nitrogen was estimated by using chemical test kits.

RESULTS AND DISCUSION

The pH, dissolved oxygen, free carbon dioxide, Ca-hardness, total dissolved solids, free ammonia, nitrate nitrogen, nitrite nitrogen and chloride of water during the study period were 6.86±0.176,4.813±0.832 ppm, 0.8±0.00 ppm, 0.093±0.707 mg/l, 0.300±0.092 mg/l, 0.337±0.0518 mg/l and 3.24±0.707 mg/l respectively. (Table 8). The three Indian major carps (*Catla catla, Labeo rohita and Cyprinus carpio*) exhibited non-linear increase in weight gain difference. (Table 5). It is evident that at the same rate of feeding level (3% of body weight) *Labeo rohita* attain better weight gain followed by *Catla catla* and *Cyprinus carpio* i.e. 0.968±0.739,0.348±0.201 and 0.26±0.312 respectively. Nutritive quality of formulated diet presented in table 6 in term of feed conversion ratio (FCR), specific growth rate (SGR) and % weight gain.

Table 1.Composition of formulated diet (100g).

S.No	Ingredients	Weight (%)
1	Caseien	42.89
2	Gelatin	8.54
3	Dextrin	16.73
4	Cod liver oil	8.00
5	Carboxymethyle cellulose	7.69
6	Mineral premix	4.50
7	Vitamin premix	1.50
8	Oxytetracycline	0.15
	Total	**100.00**

The composition of diet is presented in Tables 1-3 containing 48.5% crude protein. Daily feed allowance (DFA) which was calculated to feed the frys at 3% body weight, produced approximately similar growth response in the beginning of feeding trial. When the Frys got same amount of feed they start to grow better than previous. Increase in growth rate was observed in *L. rohita* followed by *C. catla* and *C. carpio*. Das and Ray (1989), have also noticed a significant increase in weight gain in the finger lings of *Cirrhinus mirigala* at feeding levels ranging from 3 to 30% body weight and significantly lesser growth at 45% feeding level when fed with the diet containing 35% crude protein.

In the present study the growth was found to be non linear although the experimental fish specie belong to same family of Cyprinidae and have great ability to convert plant origin protein into high valued animal protein. This

variation can be attributed to the inherent capacity of experimental frys to grow, differences in feed quality and water temperature.

Table 2. Composition of Roche multivitamin tablets.

S.No	Ingredients	Quantity
1	Vitamin A,I.P.(as acetate)	2500 IU
2	Thiamin mononitrate I.P.(Vit.B1)	2.0 mg
3	Riboflavin I.P.(Vit.B2)	3.0 mg
4	Nicotinamide I.P.	25.0 mg
5	Pyridoxine hydrochloride I.P.(Vit. B6)	1.5 mg
6	Calcium pantothenate USP.	50.0 mg
7	Cyanocobalamine I.P. B 12)	1.0 mg
8	Ascorbic acid I.P. (Vit. C)	50.0 mg
9	Cholecalciferol (Vit. D3) USP.	200 mg
10	Vitamin-E ENF(As di-Alpha-Tocopherol acetate)	10.0 mg
11	Biotin (Vit. H)	0.0 mg
12	Calcium phosphate I.P.	0.208 g
13	Dried phosphate I.P.	48.00 mg
14	Mangnesium phosphate dibasic	48.00 mg
15	Manganese hypophosphate	0.60 mg
16	Total phosphorus in preparation	44.60 mg

Table 3.Composition of mineral mixture used in formulated diet (100g).

S.No	Ingredients	Quantity
1	Potassium dihydration phosphate	23.98
2	Calcium orthophosphate	40.16
3	Sodium dehydration phosphate	8.72
4	Sodium chloride	6.00
5	Magnesium sulphate	12.75
6	Potassium chloride	5.00
7	Ferrous sulphate	2.50
8	Zinc sulphate	0.55
9	Maganese sulphate	0.25
10	Copper sulphate	0.0785
11	Cobalt chloride	0.0105
12	Potassium iodide	0.0017
13	Aluminium chloride	0.0018

Table 4. Initial and final weight of three Indian major carps in control.

FN	*Catla catla*			*Labeo rohita*			*Cyprinus carpio*		
	Initial weight	Final weight	Difference	Initial weight	Final weight	Difference	Initial weight	Final weight	Difference
1	0.31	0.45	0.14	0.22	0.25	0.03	0.40	0.42	0.02
2	0.45	0.48	0.03	0.25	0.3	0.05	0.42	0.45	0.03
3	0.48	0.5	0.02	0.3	0.32	0.30	0.45	0.48	0.04
4	0.5	0.52	0.02	0.32	0.36	0.04	0.48	0.52	0.02
5	0.52	0.56	0.04	0.36	0.38	0.02	0.52	0.54	0.02
6	0.56	0.6	0.04	0.38	0.4	0.02	0.54	0.56	0.02
7	0.6	0.8	0.2	0.4	0.45	0.05	0.56	0.6	0.04
8	0.8	1.0	0.2	0.45	0.5	0.05	0.6	0.8	0.2

Table 5. Initial and final weight of three Indian major carps fed with formulated diet.

FN	*Catla catla*			*Labeo rohita*			*Cyprinus carpio*		
	Initial weight	Final weight	Difference	Initial weight	Final weight	Difference	Initial weight	Final weigh t	Difference
1	0.31	0.5	0.19	0.22	0.3	0.08	0.4	0.52	0.12
2	0.5	0.65	0.15	0.3	0.5	0.2	0.52	0.6	0.08
3	0.65	0.8	0.15	0.5	0.62	0.12	0.6	0.71	0.11
4	0.8	0.92	0.12	0.62	0.75	0.13	0.71	0.8	0.09
5	0.92	1.3	0.38	0.75	0.86	0.11	0.8	0.9	0.1
6	1.3	1.8	0.5	0.86	0.93	0.07	0.9	1.2	0.3
7	1.8	2.5	0.7	0.93	1.5	0.5	1.2	2.2	1.0
8	2.5	3.2	0.7	1.5	2.5	1.0	2.2	3.5	1.3

Table 6. % Weight gain, specific growth rate (SGR) and average daily weight gain (ADG) of three Indian major carps fed with formulated diet.

F.N	*Catla catla*				*Labeo rohita*				*Cyprinus carpio*			
	DFA	FCR	SGR	Weight gain %	DFA	FCR	SGR	Weight gain %	DFA	FCR	SGR	Weight gain %
1.	0.37	1.9	1.26	61.2	0.26	3.25	0.53	36	0.48	4	0.8	30
2.	0.6	4.0	1	30	0.36	1.8	1.33	66	0.62	7.75	0.53	15
3.	0.78	5.2	1	23	0.6	5.0	0.8	24	0.72	6.54	0.73	18
4.	0.96	8	0.8	15	0.74	5.69	0.86	20	0.85	9.44	0.6	12
5.	1.10	0.26	2.53	41	0.9	8.18	0.73	14	0.96	9.0	0.66	12
6.	1.56	3.12	3.33	38	1.03	14.7	0.46	8	1.08	3.60	2.0	33
7.	2.1	3.08	4.66	38	1.11	1.94	3.8	61	1.44	1.44	6.66	83
8.	3	4.28	4.66	28	1.8	1.8	6.66	40	2.64	2.03	8.66	59
Men ± S.D.	**1.316 ± 0.884**	**3.735 ± 2.293**	**2.405 ± 1.642**	**34.3 ± 13.9**	**0.850 ± 0.488**	**5.30 ± 4.43**	**1.896 ± 2.210**	**33.7 ± 21.18**	**1.099 ± 0.690**	**5.48 ± 3.12**	**2.58 ± 3.21**	**32.7 ± 25.6**

Table 7.Water quality in control.

FN	Temperature	pH	DO	Free CO_2	Total alkalinity	Hardness	TDS	Ammonia	Nitrite	Nitrate	Chloride
1	33	7	3.5	0.8	460	58	60	0.05	0.2	0.3	2.99
2	35.2	6.8	3.9	0.8	360	57.2	100	0.05	0.3	0.4	2.99
3	32.2	6.8	4.5	0.8	240	32.4	120	0.1	0.4	0.4	1.99
4	29	6.5	5.6	0.8	460	38	150	0.1	0.4	0.4	2.99
5	31.3	6.8	6.0	0.8	280	38.4	160	0.1	0.4	0.3	2.99
6	32.1	7	5.2	0.8	500	37.2	170	0.15	0.3	0.3	3.99
7	33.1	7	4.9	0.8	540	36.4	170	0.1	0.2	0.3	3.99
8	31.0	7	4.9	0.8	620	36.0	200	0.1	0.2	0.3	3.99

Based on daily feed allowance (DFA), it is calculated that Catla fry consume maximum feed and exhibit better values of specific growth rates (SGR) (Table 6) compared to others. The present study can be attributed to the better-feed consumption as fish consume feed to meet its dietary nutritional requirements (Lovell, 1978). The quality of feed has a significant role on the food conversion ratio (FCR). The value of FCR differs greatly among the experimental fish species. Andrew and Stickney (1972) and Das and Ray (1989) have also observed similar trends

of better conversion ratio and conversion efficiency at 3-5% ration levels. The decrease in the efficiency of assimilation and digestion can also be reason for the poor conversion efficiency of the diet.

Sen *et al.* (1978) and Mohanty *et al.* (1990) observed that protein requirement of Indian major carps lie between 40 and 45%. Parther and Lovell 1973 postulated that high levels of protein without sufficient energy in the diet might be harmful to fish. In view of cost effective feed formulation, a balance of protein and energy in the diets is of vital importance in order to reduce the cost of feed since protein is the costliest item in the diet.

Table 8.Water quality in treatment.

FN	Temperature	pH	DO	Free CO_2	Total alkalinity	Hardness	TDS	Ammonia	Nitrite	Nitrate	Chloride
1	32.5	6.8	3.7	0.8	500	70	190	0.1	0.2	0.3	2.99
2	35	6.8	4.2	0.8	360	57.6	80	0.1	0.3	0.4	1.99
3	32	6.8	4.8	0.8	280	40	90	0.15	0.3	0.3	1.99
4	29	6.5	6.2	0.8	260	32	160	0.15	0.4	0.3	2.99
5	31	6.5	7.1	0.8	420	32.8	170	0.15	0.4	0.3	2.99
6	32	6.8	5.8	0.8	280	40	170	0.2	0.2	0.4	3.99
7	33	7	4.3	0.8	320	32	140	0.2	0.2	0.4	3.99
8	30	7	5.5	0.8	320	37.6	230	0.2	0.2	0.4	3.99

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