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Comparison of Growth Performance of Major and Chinese Carps Fed on Floating and Sinking Pelleted Supplementary Feeds in Ponds

Muhammad Yaqoob* Muhammad Ramzan Ali and Sultan Mehmood
Aquaculture and Fisheries Program, National Agricultural Research Center, Park Road, Islamabad

Abstract.- An experiment was conducted to observe the effects of floating and sinking pelleted supplementary feeds on the growth performance of major carps *viz. Labeo rohita, Cirrhinus mrigala, Catla catla* and Chinese carps viz. *Hypophthalmichthys molitrix* and *Ctenopharyngodon idella* in earthen ponds for a period of 230 days. They were fed on floating (T_1) and sinking feeds (T_2) having 20% CP at a rate of 3% body weight once daily. Total fish weight gain was significantly higher in T_1 fed on floating than on sinking pelleted feed in T_2. The performance of individual fish in two treatments was varying. *H. molitrix, C. catla* and *L. rohita* performed better on floating (T_1), while *C. idella* performed best followed by *H. molitrix* on sinking feed (T_2). The growth performance of *C. mrigala* was more or less similar in both the treatments. It was observed that floating feed had much lower value of Food Conversion Ratio (FCR) than sinking feed. It was found that floating feed is better than the sinking feed for increasing per hectare pond production. The physical and hydrological characteristics of ponds were more or less similar during the experimental period.

Key Words: Floating supplementary feed, Indian carps, Chinese carps, growth performance, food conversion ratio.

INTRODUCTION

Good nutrition in animal production systems is essential to economically produce a healthy, high quality product. In fish farming, nutrition is critical because feed represents 40-50% of the production costs. Fish nutrition has advanced dramatically in recent years with the development of new, balanced commercial diets that promote optimal fish growth and health. The development of new species-specific diet formulations supports the aquaculture (fish farming) industry as it expands to satisfy increasing demand for affordable, safe and high-quality fish products (Craig, 2002).

Prepared or artificial diets may be either complete or supplemental. Complete diets supply all the ingredients necessary for the optimal growth and health of the fish. In contrast, supplemental diets are intended only to help support the natural food normally available to fish in ponds (Stickney, 1979). Even when the natural feed forms the main source of nutrition, supplemental feeding with artificial feed is necessary to obtain increased production in ponds (Sinha, 1979; Wee, 1988, 1991). Supplementary feeding plays an important role in intensive and semi-intensive fish culture. It also offers the best means of fish production within shortest possible time in ponds. Supplementary feeding increases the carrying capacity of culture systems and can enhance fish production by manifold (Hepher, 1975; Devaraj *et al.*, 1986). Commercial fish diets are manufactured as either floating or sinking feeds. Both floating and sinking feeds can produce satisfactory growth, but some fish species prefer floating feed and others sinking feed. Most fish species can be trained to accept floating pellets (Albert and Tacon, 1990). Most of supplementary feed in sinking pelleted form goes waste as it sinks to bottom and fish can not consume it. Although floating feeds are more expensive, usually, it is advantageous to feed floating feed, because fish can consume it from the surface or column of water and the farmer can directly observe the feeding requirements of fish and adjust feeding rates accordingly. Determining whether feeding rates are too low or too high is important in maximizing fish growth and feed use efficiency.

Since feeds cost is one of the highest recurring cost in intensive and semi intensive aquaculture. So it is necessary to formulate low cost fish feed from locally available feed ingredients that are economically beneficial for fish farmers (Chakrabharty *et al.*, 1973; Jafri *et al.*, 1992). The

* Corresponding author: yaqoob_afri@yahoo.com
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present level of fish production can be increased by formulation and commercial production of pelleted fish feed that meet nutritive requirements of the fish.

The present study was designed to formulate low cost pelleted sinking and floating feeds using locally available feed ingredients and to evaluate its effects on growth performance of cultureable carps.

MATERIALS AND METHODS

The experiment was conducted in six ponds at Aquaculture and Fisheries Program, National Agricultural Research Centre, Islamabad during March-November, 2005. Each pond was measured 0.02 ha and was supplied with canal water through an inlet pipe. The ponds were filled with water up to a level of 1.5 m and this level was maintained throughout the experimental period. Each pond was stocked with 80 fingerlings of hatchery produced *Labeo rohita*, *Cirrhinus mrigala*, *Catla catla*, *Hypophthalmichtys molitrix* and *Ctenopharyngodon idella* having a mean weight of 10g, 15g, 8g, 9g and 18g in a ratio of 3.5:3:4:2:7.5, respectively at a total stocking density of 4000 fingerlings /ha. At the time of stocking, fish were measured and weighed. These ponds were organically fertilized with cow manure at a cumulative rate of 2500 kg/ha to enhance the primary productivity. Before start feeding, different floating feed formulae were prepared to record their floating stability in water. The feed with best floating stability was tested for its effect on the performance of different fish. Sinking pelleted feed was used as control. The feed ingredients based on agricultural and animal by-products (rice polish, wheat bran, gluten, fish meal, soybean meal, sunflower meal, and corn meal) of floating and sinking pelleted feeds are given in (Table I).

The stocked fish were given feeds (20% CP) once a day at 3% of the total wet fish weight. Supplementation was continued for a period of 230 days. The stocked fish was sampled monthly with the help of a nylon drag net from each pond. The wet fish weight was recorded to observe their growth performance. After obtaining the required data, fish were released back into their respective pond.

Hydrological characteristics of ponds such as water temperature, pH, dissolved oxygen, alkalinity and hardness were determined (Table II). At the end, ponds were completely harvested and the data recorded. Data obtained was subjected to ANOVA and means with significant difference were compared through LSD using statistical software M Stat-C.

Table I.- Composition of floating and sinking fish feeds used for carps culture in ponds.

Feed ingredients	Floating feed (20% CP)	Sinking feed (20% CP)
Rice polish	26	31
Wheat bran	25	25
Gluten 30%	20	20
Fish meal	6	6
Soybean meal	6	6
Sunflower meal	6	6
Canola meal	6	6
CMC (Carboxymethyl cellulose)	-	5
Total	100	100

Table II.- Hydrological characteristics of ponds.

Parameters	Mean values		F-value
	Treatment 1	Treatment 2	
Temperature (°C)	26.39 (19-32)	26.78 (18-32)	0.025474 NS
pH	8.06 (7.5-8.7)	8.04 (7.5-8.5)	0.020177 NS
Dissolved oxygen (mg/l)	4.70 (3.8-7.4)	5.00 (3.2-5.7)	0.554524 NS
Alkalinity (mg/l)	54.40 (130-190)	52.20 (120-210)	0.039604 NS
Hardness (mg/l)	170.20 (116-202)	167.10 (120-222)	0.025671 NS

NS-Non Significant (P>0.05)

RESULTS AND DISCUSSION

Significant variation ($p<0.05$) in growth was observed between the treatments and among the different fish species. Analysis of variance showed significantly higher weight gain by all fish fed with floating feed, while sinking pelleted feed did not show such results except for *C. idella*. These results are in accordance with the work of Gur (1997), who concluded that floating pellets performed better than sinking pellets with the same composition. This may

be due to more leaching of nutrients from the sinking feed than floating feed. Similar results were obtained by Xu and Rogers (1994) that more Oxytetracycline (OTC) leached from sinking feed than from floating feed at 20°C and 30°C. These results are in contrast with the results of Chiu *et al.* (2001).

Table III.- Weight gain in grams and percentage weight gain by different fishes fed on floating and sinking supplementary feeds.

	Floating feed (T_1)	Sinking feed (T_2)	Mean
Weight gain by different fishes			
Labeo rohita	607.667 e	455.667 f	531.67 C
Cirrhinus mrigala	426.000 g	452.000 fg	439.00 D
Catla catla	1053.000 b	450.667 fg	751.00 B
Hypophthalmichthys molitrix	1747.000 a	842.667 c	1294.83A
Ctenopharyngodon idella	339.667 h	718.000 d	528.17 C
Mean total wt. gain	834.667 A	583.800 B	
Percentage weight gain by different fishes			
Labeo rohita	26.306 d	19.726 f	23.016 C
Cirrhinus mrigala	12.294 h	13.045 h	12.669 D
Catla catla	56.981 b	24.387 e	40.684 B
Hypophthalmichthys molitrix	84.031 a	40.532 c	62.281 A
Ctenopharyngodon idella	8.169 i	17.268 g	12.718 D
Mean total percentage wt. gain	37.556 A	22.992 B	

Mean with different smaller and capital letters are significant (P>0.05) among each other.

It was noted that the faster growth rates were high with the floating feed and the lower with the sinking pelleted feed. The performance of all fishes were better on floating feed as compared to sinking feed except *C. idella*, which performed better on sinking feed but the difference was less marked (Table III). *H. molitrix* had gained maximum weight followed by *C. catla* and least by *C. idella*. Growth rates of *L. rohita* and *C. mrigala* in the ponds offered with floating and sinking pelleted feeds tended to be intermediate. Same results were obtained by Sophin and Preston (2005), who concluded that the degree of response was highest for *H. molitrix*, followed by *C. catla* and *L. rohita* and least for *C. mrigala*. The interaction between fish and diets also showed variations in weight gain, which indicate that behavior of different fish, fed on sinking and floating feed was different. *H. molitrix* performed best on floating feed (T1), while *C. idella* performed best on sinking feed (T2). The growth performance by *L. rohita* and *C. mrigala* was more or less similar on sinking feed. These variations in growth response of different fish species on floating and sinking feeds may be due to their feeding habits. *H. molitrix* and *C. catla* are the surface feeders, so they can consume floating feed from the surface and not from the bottom. The intermediate reaction of *L. rohita* might be due to column feeder. Overall survival was also recorded higher (85%) on floating feed as compared to sinking feed, where it was 76%. Due to prevailing low temperature near the end of experiment, fungal infection was appeared in *C. catla*. Due to this, several mortalities were recorded, particularly in T2 where sinking feed was given to stocked fish. It was also observed that floating feed had much lower value of food conversion ratio (FCR) than sinking feed (Table IV).

Table IV.- Average feed offered, weight gain and food conversion ratio of fishes fed on floating and sinking.

	Supplementary feeds		
	Feed offered (g)	Weight gain (g)	FCR
Floating feed (T_1)	1600	834.67	1.916925
Sinking Feed (T_2)	1300	583.8	2.22679

Overall maximum weight gain in both treatments was noted in the months of September and October was due to optimum temperature, while after that the gain in weight become less, which was due to decrease in temperature (Figs. 1, 2). The similar results were reported by Villaluz and Unggui (1983), who studied the effect of temperature on activity, feeding, growth, development and survival of young milk fish. They reported that low temperature (<22.6°C) and hypoxic condition (dissolved oxygen <1 ppm) decreased activity and food intake while high temperature (up to 33°C) had the opposite effect. Growth of fish was faster during

the months of higher temperatures than during the months of low temperatures. The maximum growth of fishes may be due to maximum value of biomass at optimum temperature in month of September, same results were obtained with the findings of Nazneen (1980), who reported that maximum planktonic biomass was observed in the month of August and September.

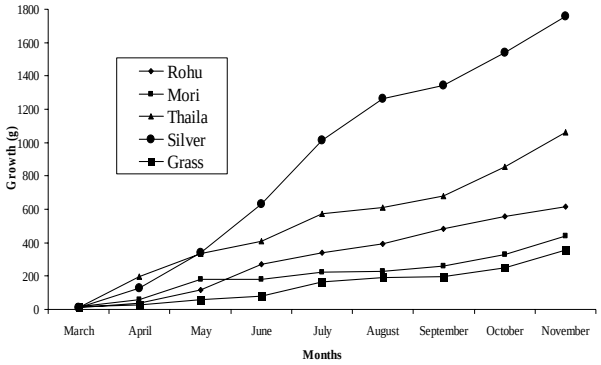

Fig. 1. Monthly growth of different fish species fed on floating pelleted feed (T_1) from March to November.

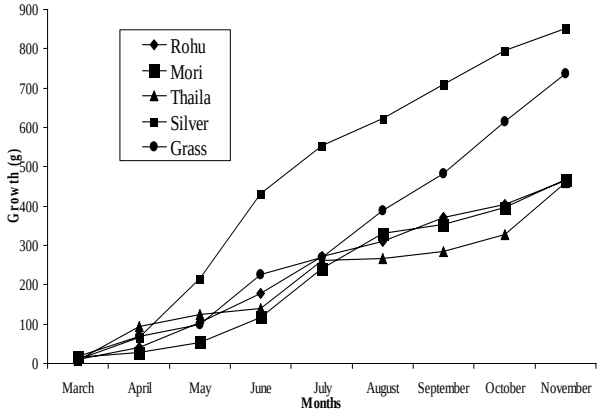

Fig. 2. Monthly growth of different fish species fed on sinking pelleted feed (T_2) from March to November.

It was concluded that floating feed had better results as compared to sinking pelleted feed but not for all fish species, bottom feeder species performed better on sinking feed. This necessitates the development of a program to formulate species-specific fish supplementary feed either floating or sinking based on locally available material needs to be addressed if Pakistan is to enhance the development of its fish culture industry. There is tremendous potential for the use of supplementary fish feed in Pakistan because of abundant culture sites and the high demand for fish for human consumption. Use of supplementary feeds in fish culture in some Asian countries has resulted in production of 7-10 tons/ha per year (Sinha, 1979). Obviously similar levels of production could be obtained in Pakistan with species-specific supplementary feeds in ponds.

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