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DEVELOPMENT OF LEAST-COST FISH FEED FOR RAINBOW TROUT FROM INDIGENOUS INGREDIENTS AT JUGLOTE, GILGIT

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Abstract: Forty four weeks feeding trial with four levels of dietary fish meal was conducted to investigate the least cost fish feed for the growth of trout, *Oncorhynchus mykiss*. Four types of feeds containing 30, 35, 40 and 45% fish meal with 20, 15, 10 and 5% soybean meal, respectively were formulated and fed to fish at the rate of 1.5-2%/ of their body weight twice a day. Survival rate was maximum by fish fed diet I (D_1) than all other treatments. Growth of fish fed the diets containing 30% lipid increased having low cost is maximum than those of other diets. Production cost (Rs.)/kg was also minimum for diet I (D_1, 120.90) followed by diet II (D_2, 139.36), diet IV (D_4, 139.50) and diet III (D_3, 145.20). It was concluded that the diet with 35% crude protein and having 30% fish meal and 20% soybean meal is suitable for the better growth and production of rainbow trout yearlings.

Key words: Complete fish diet, dietary fishmeal, dietary protein, 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 alternative protein based diets for fish depends on the nutritional quality of ingredients used (Glencross *et al.,* 2007) as well as the nutritional requirements of the fish being cultured. Recently, heightened emphasis has been placed on utilization of sustainable plant products in aqua feeds (Gatlin *et al.*, 2007). Partial or even total replacement of dietary fishmeal with plant protein

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source has been the subject of numerous studies (Kaushik *et al;* 1995; 2004). The use of plant protein often necessitates the addition of one or several crystalline amino acids in order to meet the requirements of the target species (NRC, 1993; Davies and Morris 1997).

In Salmonids fish, individuals exhibit large differences in food consumption that dominant groups gain a higher share of food consumption (Jobling *et al.,* 1989; McCarthy *et al.,* 1992). The increasing cost and decreasing availability of fishmeal, the major source of protein in commercial aquaculture diets has led to the search for alternative protein source. Soybean identified as a viable alternative to fishmeal and has been the subject of many reports relating to the nutrition of rainbow trout *(Oncorhynchus mykiss*). However, one of the most limiting factors on the use of soybean meal (SBM) is the presence of anti-nutritional factors (ANFs) not removed by the commercial extraction processes.

The present study was designed to formulate low cost pelleted feeds using locally available feed ingredients and to evaluate its effects on growth performance of trout, *O. mykiss.*

MATERIALS AND METHODS

The study was performed under ambient conditions (long to decreasing day-lengths and relatively high water temperatures) in northern areas of Gilgit, Baltistan for 44 weeks from March to January. Each nursery pond was measured 20x5x1.6 ft and was supplied with water through an inlet pipe. Each pond was stocked with 50 fish yearlings. Three hundred and sixty fish (mean weight of 138g) were divided amongst nine nursery ponds. Prior to the start of trial the fish were acclimatized to trial conditions. All ponds were supplied with spring water during the first three months and after that 50:50 mixture of spring and stream water. Water input increased from 1.0 L up to 16.0 L/min depending on fish size, stocking density and temperature. Experiment had four diets (*i.e.*, D_1, D_2, D_3 and D_4) with three replicates each. Four diets of almost equal crude protein levels but having different ratios of fish meal and soybean meal were formulated. The feeds after mixing and pelleting were dried in sun light for 2–5 hrs which was then sieved and offered to fish twice a day. The ingredients of four formulated feeds are given in Table I.

Hydrological characteristics of ponds such as water temperature, pH, dissolved oxygen, alkalinity and hardness were determined. Water temperature and feed given were recorded daily, while dissolved oxygen content in the water was measured weekly. Weight gain, length increment and feed conversion ratio (FCR) were recorded monthly. The feed was offered manually 7 days a week two times (9 am and 4 pm) a day. The temperature was ranged between 16-18°C.

Table I: Ingredient composition of fish feeds

Ingredients	Diets			
	D_1	**D_2**	**D_3**	**D_4**
Fish meal	30	35	40	45
Soybean meal	20	15	10	05
Sunflower meal	10	10	10	10
Rice polish	10	10	10	10
Gluten	10	10	10	10
Wheat bran	10	10	10	10
Vitamin C	0.5	0.5	0.5	0.5
Vitamin premix	1.5	1.5	1.5	1.5
Oil	2	2	2	2
DCP	3	3	3	3
CMC	3	3	3	3
Total	**100**	**100**	**100**	**100**

RESULTS

The results of the various growth parameters *i.e.*, mean weight gain, feed conversion ratio (FCR), survival and production of experimental fish showed numerically highest growth production (342 g) and survival (98%) in the D_1 followed by D_4 (335g; 96%), D_2 (320g; 95%) and D_3 (310g; 93%), respectively (Table II). The FCR value was minimum (3.0) for D_1. While it was maximum for D_3 (3.3). Production cost was maximum for D_3 (145) followed by D_4 (139.5) and D_2 (139.36) while minimum cost of production was for D_1 (120.9).

Table II: Weight gain, length increment and feed conversion ratio (FCR) of trout fingerling under experimental feeds D_1-D_4.

Exp. Feed	Mean wt. gain (g)	Length increment. (cm)	Feed Consumed (g)	FCR	Production cost/kg (Rs.)	Survival %
D_1	342	14.5	1060	3.0	120.90	98
D_2	320	13.5	1055	3.2	139.36	95
D_3	310	12.5	1052	3.3	145.20	93
D_4	335	14	1057	3.1	139.50	96

DISCUSSION

Four commercial steam pelleted rainbow trout feeds were evaluated at summer-autumn temperature ranges from 10-22^{o}C over a full rearing period. Fish grew from 138g to 342g mean weight during 44 weeks trial period. The feeds had significant effect only on the final weight of the fish, Daily feed consumption and total amount of feed supplied during the entire trial indicated that the differences in growth performance of the fish can be attributed into quality of the feeds as unrestricted feeds were offered to fish. Replacement of fish meal with soybean was the main difference among the four feeds. Protein levels of the all feeds were near to upper range of the recommended levels for trout growth (Lovell 1989; Cowey, 1992; Goddard, 1996). Calculated gross energies levels were similar and within proposed gross energy levels for maximum growth of salmonids (Cho and Kaushik, 1990).

Experimental fish grew quite rapidly reaching 342g in eleven months. This is much faster than growth in commercial farms of the region where they hardly reach size of 200-250g during the same period. These marked differences have been caused by several factors including provision of imbalanced feeds, water quality parameters, and feeding practices. Water temperature certainly has major influence on food consumption. The optimum growth temperatures for rainbow trout has been accepted as 15-17^{o}C (Stevenson, 1987; Cho and Cowey; 1991: Sumpter, 1992). Based

upon feed cost and feed conversion ratio, 30% fish meal and 20% soybean meal incorporated feed D_1 found to be most suitable for the growth and production of rainbow trout.

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