

Comparative Study of Fish Yields with Plant Protein Sources and Fish Meal

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Abstract

Two iso-nitrogenous and iso-caloric diets were formulated using *Azolla*, Soya bean and oilcakes as a sole protein source in diet B and fishmeal as sole protein in diet A. Six ponds were used as experimental ponds. The fishes of three ponds were supplied with *Azolla* diet B while the fishes of other three ponds were supplied with fish meal diet A. Growth of the fish in three ponds with plant protein sources was significant than in the fishes of other ponds with fish meal diet A. The yield of fish supplemented with *Azolla*, Soya beans and Oilcakes was higher than that of fish supplied with fishmeal diet.

Introduction

Nepal is an agricultural country where nearly 90% of the total population is involved in agriculture. The total productivity of fish in Nepal is 1.99 tonnes/hectare (FAO 1991, FAO1992) which comes to be 0.6% of the total agriculture. The total production and productivity of fish culture is very low in Nepal as compare to other countries due to the fact that fish culture is totally dependent upon natural food and very less or no supplementary food is provided to fishes by farmers. There is a great scope to enhance production of fish by supplementary feed. (Pantha 1993)

Soya bean

Soya bean meal is an excellent source of dietary protein for animals. Whole Soya bean contains about 40% of protein and 18% of Fat. The fat can be used by a feed formulator to add appreciable amounts of essential fatty acids to diet, and can also be used as a source of protein sparing energy (Jauncy and Ross1982)

Oilcakes

Of the available plant proteins, Oilcakes are the most promising alternative to fishmeal diets. Oilcakes are the residues after the removal of the greater part of oil from oil seed. Most are tropical origin and are rich in protein (20%-50%) and include Soya bean, Cottonseed, Groundnut, Sun flower seed etc (Jauncy and Ross1982). Oilcakes contain 30.5% of crude protein and 14.7% of fat (Capper 1979).

Azolla

Azolla, a small aquatic macrophyte which is a common in most Asian rice fields, ponds and roadside ditches has considerable potential in fish culture, especially in rice fish system (Amalzan *et al.*1986). Fresh *Azolla* was preferred by a variety of both herbivorous and carnivorous fish. This aquatic macrophyte has a high content of protein; more over it has a high productivity for which it was selected for protein source for the experiment.

Materials and Methods

The experiment was performed at the Kathmandu Central Hatchery, (KCH) Balaju. The Total farm covers an area of 25 ha in which water surface covers 0.78 ha .6 ponds were

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selected for the experiment. The ponds were drained completely; weeds were cleaned and treated with hydrated lime at the rate of 500 kg/ha before the experiment. The ponds having area of 0.05 ha were limed at the rate of 25 kg per pond. Then the ponds were left few days for complete drying and were filled with water up to 60 cm. Water samples in the experimental ponds were analyzed before stocking the fingerlings. The different water quality parameters were recorded with the help of Hachkit (Hach Company, LoveLand, Colorado-USA)

Common carp (*Cyprinus carpio*), Silver Carp (*Hypophthalmichthys molitrix*), Rohu (*Labeo rohita*) and Mrigal (*Cirrhinus mrigala*) were selected for the experiment. An average initial weight of these fish were 30.0gm, 5.1gm, 8.1gm and 16.29gm respectively. The stocking rate of fish was 6000 fingerlings per hectare. The total numbers of fish used were 1650 out of which the number of Common Carp, Silver Carp, Rohu and Mrigal were 824, 330, 248 and 248 corresponding with 50, 20, 15 and 15 stocking percentage respectively. Two types of diets were selected; *Azolla*, Soya bean and Oilcakes in sole protein source as diet B and imported but locally available fishmeal as diet A.

Fingerlings were fed at the rate of 5% of body weight per day avoiding the feed required for silver carp. Total feed required per day was calculated according to the total body weights of the common carp, Rohu and Mrigal. Thus after stocking 281 gm day⁻¹ of diet A and 260gm day⁻¹ of diet B were given to the respective ponds. After 21 days growth check up was done and calculated the total growth of each variety of fish.

To supply the remaining nutrient requirement of the fish, ponds were manure once a week to produce natural food. 25 kg /week and 18.5kg/week of manure were supplied in ponds of 0.05ha and 0.0375 ha respectively.

Physico-chemical parameters (temperature, dissolved oxygen, pH, alkalinity, free CO₂ and

total hardness) of water were analyzed by using standard methods of APHA (1989).

Results and Discussion

Depth of pond has an important role in the production of a pond. A pond having a depth of 2m was considered congenial from the viewpoint of biological productivity of a pond. In the present experiment, although the average depth of the ponds was 0.8m, temperature recorded was 21.9° C to 23.9° C in all ponds. Dissolved oxygen before stocking ranged in between 5.6mg/l to 10.1mg/l. pH ranges was found in between 6.7 to 8.1. Alkalinity ranged from 153 to 190mg/l at stocking and 170 to 195mg/l at harvesting period. CO₂ concentration range in between 1.5 to 2.3mg/l. Total hardness ranged in between 149 to 209mg/l.

During this experiment diet A and diets B were observed to be equally accepted by fishes. The colour, texture and the smell of the diet throughout the experiment period appeared to have no effects on the voracious feeding nature of the fish.

Within the experimental period growth per day were found higher on fishes having diet B. Growth rate of common carp and silver carps were high in diet B as compare to diet A whereas the growth per day is similar in Rohu and Mrigal in both the diets (Diet A and diet B).

In this experiment average yield was 25.8 kg within 42 days. The total yields in all the ponds are given in Table.1 and 2. It was also observed that yield of fish was higher with diet B than with diet A. The yield in 8 months period was 2568.10kg in Diet A and 3839.90kg in diet B. So yield percentage increased in 8 months was 49.52% higher in diet B than diet A. Mean fish weight and mean total length of the fish fed with diet B was higher than diet A in common carp and silver carp. The growth performance of Rohu and Mrigal were similar in both the diets.

Weight increment of common carp showed that in the 1st year, it attained 300gms (Alikunhi 1966), 50 cm long Silver carp in 2nd year gain 1,803gm weight (Chang *et al.*1983) while Rohu at the end of 2nd year measured 1.75kg (Khan and Jhingran 1975) and Mrigal in the 1st year attained 245.7gm(Khan and Jhingran 1979). In the present experiment within 42 days of experimental periods common carp weighs 213.5gm (diet B) and 174.8gm (diet A). Silver carp attained average weight of 151.3gm with diet B and 85.7gm with diet A. Similarly Rohu measured 75.7gm with diet B and 52.8gm with diet A and Mrigal of 46.33gm with diet B and 49.6gm with diet A.

The temperature recorded through out the experimental period ranged from 21.9° C to 23.9° C, which is an optimal temperature for carp culture. Dissolved Oxygen is one the most

important factor affecting growth and causing mortality. Oxygen requirement of Common carp, Silver carp, Rohu and Mrigal are 0.2 to 0.8mg/l, 0.3 to 1.1 mg/l and 0.7 mg/l respectively (Boyd 1988). Dissolved oxygen recorded in this experiment was 5.1 to 10.5mg/l. The optimum pH recorded value of fish ranged 6.5 to 9 (Woynarovich 1981). The optimum pH recorded was 6.7 to 8.1 in all ponds. Total alkalinity was 100 mg/l, which is an ideal for fish growth. Total hardness ranged from 82 mg/l to 209mg/l through out the experimental period. In the experiment 89.01kg of diet was fed within 42 days, which helped to produce 62 kg fish. For the production of 1 kg of fish total diet required was 143 kg. By feeding 66.24kg of diet B, about 92.4kg of fish was produced within 42 days. Thus to produce 1 kg of fish, total feed required was 0.716kg.

Table 1. Yield as comparison to both the diets.

| Fish Species | Diet A | | | Diet B | | |
|------------------|-------------------|---------------------|------------|-------------------|---------------------|------------|
| | Stocking Wt. (Kg) | Harvesting Wt. (Kg) | Yield (Kg) | Stocking Wt. (Kg) | Harvesting Wt. (Kg) | Yield (Kg) |
| 1. Common Carp | 13.94 | 63.08 | 49.14 | 12.53 | 80.5 | 67.93 |
| 2. Silver Carp | 0.729 | 7.78 | 7.051 | 0.97 | 19.05 | 18.08 |
| 3. Rohu | 0.944 | 5.22 | 4.27 | 1.05 | 5.68 | 4.63 |
| 4. Mrigal | 2.05 | 3.65 | 1.60 | 2.053 | 3.83 | 1.77 |
| Total | 17.663 | 79.73 | 62.06 | 16.60 | 109.06 | 92.41 |
| Yield/Day | | | 1.47 | | | 2.2 |

Table 2. Projected yield within eight months/hectare.

| Fish Species | Diet A | | | | | | |
|----------------|-------------------|-----------------|---------------------------|--------------|---------------------------------|---------------------------|----------------------|
| | Initial Wt. (Kg.) | Final Wt. (Kg.) | Total Yield (Kg.) 42 days | Yield Kg/day | Yield Kg./8 month per 0.137 ha. | Yield Kg./8 month per ha. | Fish Species Yield % |
| 1. Common carp | 13.94 | 63.80 | 49.1 | 1.16 | 278.4 | 2032.1 | 79.1 |
| 2. Silver carp | 0.729 | 7.78 | 7.051 | 0.167 | 40.08 | 292.5 | 11.4 |
| 3. Rohu | 0.944 | 5.22 | 4.27 | 0.101 | 24.24 | 176.9 | 6.9 |
| 4. Mrigal | 2.05 | 3.65 | 1.60 | 0.038 | 9.12 | 66.56 | 2.6 |
| Total | 17.66 | 79.73 | 62.02 | 1.46 | 351.84 | 2568.07 | 100 |

| Fish Species | Diet B | | | | | | |
|----------------|--------------------|-----------------|---------------------------|--------------|---------------------------------|---------------------------|----------------------|
| | Initial Wt.. (Kg.) | Final Wt. (Kg.) | Total Yield (Kg.) 42 days | Yield Kg/day | Yield Kg./8 month per 0.137 ha. | Yield Kg./8 month per ha. | Fish Species Yield % |
| 1. Common carp | 12.53 | 80.5 | 67.97 | 1.61 | 386.4 | 2820.4 | 73.50 |
| 2. Silver carp | 0.97 | 19.05 | 18.08 | 0.43 | 103.2 | 753.3 | 19.60 |
| 3. Rohu | 1.05 | 5.68 | 4.63 | 0.11 | 26.45 | 192.7 | 5.0 |
| 4. Mrigal | 2.053 | 3.83 | 1.77 | 0.042 | 10.08 | 73.57 | 1.90 |
| Total | 16.60 | 109.06 | 92.45 | 2.192 | 526.13 | 3839.97 | 100 |

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