ABSTRACT

The thesis embodies information on the protein and amino acid requirements of some important cultivable finfish species, and on the efficacy of formulated feeds.

The optimum dietary protein requirements have been quantified for the Indian major carps, namely, *Labeo rohita*, *Cirrhinus mrigala*, *Catla catla*, and the catfish, *Clarias batrachus*, using almost iso-caloric, casein-gelatin based purified test diets. The protein requirements of three species of the major carps measured through dose-response curve, appeared size-dependent. The requirements of *L. rohita* were found to be 40% for the fingerling (4.0-5.5 cm) and 30% for larger (11.0-14.0 cm) fish. *C. mrigala* reflected the best growth at 40% and 35% dietary protein levels in small (3.5-4.5 cm) and large-sized (6.0-7.5 cm) fingerlings, respectively. The protein efficiency ratio (PER) in the two fish species fell almost linearly with protein intake. In *C. catla*, as well, size-dependent variations in protein requirements were evident, with maximum growth obtainable at 40% dietary protein in small (2.4-2.9 cm) and 35% protein in large (7.6-9.6 cm) size-classes. The pattern of changes in PER for this species was, however, different from that noted for *L. rohita* and *C. mrigala*, increasing only up to the requirement levels. Dose-response curve for *C. batrachus* (12.4-13.6 cm) indicated that the fish requires 40% protein in the diet for its optimum
growth. PER in this species was inversely proportional to the level of dietary protein incorporation.

Variations in muscle protein and nucleic acid concentrations have been observed in C. batrachus fed iso-caloric varying crude protein level diets. A clear positive relationship between the amount of dietary protein and muscle protein content was noticeable up to 35% protein incorporation in the diet. Feeding fish above this level of protein decreased the muscle protein content. Similar pattern of changes were seen in the concentration of RNA and the RNA:DNA ratios. The concentration of DNA, on the other hand, declined progressively up to 35% dietary protein level. RNA:DNA and RNA:protein ratios serving as sensitive tools in monitoring the growth and/or protein deposition in fish has been emphasized.

Using iso-caloric and iso-protein test diets, the dietary requirements of indispensable amino acids, most limiting in plant origin feedstuffs, were quantified for L. rohita fingerlings. The break-point obtained over the dose-response curves indicated the dietary requirement for arginine, lysine, methionine and tryptophan as 2.94, 5.88, 2.64 (1% cystine fixed, dry diet) and 0.59% of protein, respectively. Incorporation of higher amounts of the above amino acids in diets did not improve the gains in live weight. Fish receiving diet devoid of these amino acids (C-dose) resulted in marked loss in weight. Although the recovery tests, established the essentiality of these indispensable amino acids
for the fish, a less efficient utilization of crystalline amino acids by this species, as reflected by poor growth, was noticeable.

The efficacy of different oilcakes was tested in dietary formulations for fingerling L. rohita. Soybean oilcake contained diet reflected the best (112%) growth followed by sesame and groundnut oilcake contained diets. The diet containing the cottonseed oilcake gave poor performance in terms of live weight gain. The observed variations in the growth response of fish were attributed to the nutrient quality, particularly to their essential amino acid profile, and to the anti-nutritional factors contained in the oilcakes.

Replacement of fish meal with offal meal was attempted in diets formulated for the fingerlings of the above species. The results indicated that up to 50% of fish meal component in the diet can successfully be replaced with offal meal without altering fish growth or body protein. Dietary formulation containing a combination of 20% fish meal and 30% offal meal produced growth similar to that with 40% fish meal and 10% offal meal diet. Similarly, replacement of fish meal with soybean meal (on protein to protein basis) was attempted in 40% crude protein diets formulated for the fingerlings of this species. Dietary requirement for fish meal protein was successfully reduced to 57% by replacement with 43% soybean meal protein, without significantly altering the growth, conversion efficiencies and carcass composition of the fish. Levels of soybean protein incorporation above 43% depressed fish growth.
The information obtained during the present study are useful in formulating cost-effective practical diets for the semi-intensive or intensive culture of Indian major carps and the catfish.