

**GENERAL
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Fish husbandry with its great potential has gained enormous importance in the recent years as a source of cheaper animal protein for human consumption and as an industry by itself, particularly in the rural areas of West Bengal and India. The Indian major carps as well as Exotic carps are the most important economic species of fresh water commonly reared in Indian ponds. Traditional carp culture mainly depends on the availability of natural food in the pond, but it depends mostly on water quality and pond fertilization. Therefore, a necessity in the selection of the locally available good and enriched manure's particularly, in the areas where the fish farmers could not able to provide much in terms of money for effective growth and increasing production of fish. Moreover, the formulated diets sometimes become too expensive to reach the hands of the rural fish farmers due to escalating price of the feed ingredients. Fish enjoys a very special consideration and occupies an important place because of its nutritive or food value. Its nutritional value brings it to the forefront. Fish and protein are intimately associated. By increasing the fish production the protein demand of the world can easily be over come and solved. India has its large water bodies for culture fisheries. Aquaculture practices of India are quite rich in comparison to other tropical and temperate countries. It is to be mentioned that fisheries are broadly classified into – capture fisheries and culture fisheries. The culture fisheries include inland water bodies – fresh water and brackish water. All the Indian culturable water bodies are not yet utilized for fish production. In comparison to the other countries of Asia, fish share less percentage of protein in India (FAO, 1968). Dayal (1982) reported that the edible protein

of fresh water and estuarine fishes in India contribute about 14.0 –25.0 percent of protein requirement of our country. The National Commission of Agriculture observed that fisheries from inland water have great demand and market value because of it's good taste and flavour. These inland waters can supply protein to the people at a cheaper rate by increasing the rate of fish production.

Fish culture for the goal of production of the fish as food for mankind occupies a great place in human civilization from time immemorial. Fresh water fish culture is an age old practice in India, specially in the eastern region – West Bengal, Bihar, Orissa and Assam. Carp culture is a household practice. A little change has so far been seen in pisciculture adopting the technique of the fishery scientists.

The progress in the fishery science made in the last few decades has been tremendous. Research in fisheries science of last 50 years have improved the technique of fish culture but the techniques are waiting for wider use in production units. Our moto is to develop such a technology which can easily knock at the door of the rural farmers and they can also understand easily the utility to such technology.

India's culturable fresh water resources have been estimated. Out of a total of sixteen lakh hectares only about six lakh hectares are being currently utilised for fish production. However, ten lakh hectares can be utilised for fish production. The remaining six lakh hectares can be immediately utilised for culture after reclamation.

Besides these, there are two million hectares of brackish water culture fisheries area but their utilization are still negligible. Though the resources are plentiful, the level of fish production has not yet attained any great height except prawn and shrimp farming.

The fresh water ponds and tanks of West Bengal stand as an asset in India. There are about 1,089,876 ponds and tanks in West Bengal with an approximate area of more than 28466.55 hectares (State Planning Board, 1974). Further, much more fresh water area brings under aquaculture of carps particularly the 'Jhora' fed fish ponds of Darjeeling hills and 'Khadan' of China clay mines and others in South Bengal. Of there 53 percent are perennial and the rest contain water for 7 to 8 months in a year. Besides this, the reservoir area of West Bengal is more than 235678.80 hectares. Potentiality of inland fishery resources in West Bengal is one of the richest in India. Among fish producing states in India, West Bengal ranks first. During 1964-74 inland fish catch in West Bengal grew at a rate of 8.80 percent annually (compound) since 1970, the fish production in the state has been increasing only at the rate of 3.31 percent per annum. Though potentially rich, the per hectares yield in West Bengal is still very low. The average yield for fresh water fish culture is reported to be 600 Kg ha^{-1} year $^{-1}$. The brackish water culture yield is 5-8 Kg ha^{-1} year $^{-1}$ (Jhingran, 1978). It is quite clear from the above that there is a great scope to increase the fish production by proper utilization of the inland water resources (Jhingran, 1975). If proper scientific line is developed and proceeded in that line, the wide gap that exists between the need and the production will be reduced. The master plan committee appointed by the Government of West Bengal has recommended that each individual should be provided with fifty grams of fish flesh per day. On the assumption that 80 percent population of West Bengal are fish eater, and on the basis of population estimates in 2000, ten lakhs tonnes of fish are necessary. The actual production of 1980-81, stood at 3.37 lakh tonnes (Economic review 1980). To fulfil the demand, production should reach in that level. Moreover considering the rate of growth

of population to about two percent (2.07 percent during 1971-81), the requirement for fish flesh will still be higher to fulfil the largest. During 1964-1980, per capita fish output in West Bengal grew at an annual rate of 4.28 percent (compound) only. The question arises whether the above 50 grams can be supplied to the people. It can only be possible if the uncultivated areas are properly utilized without involving much cost. Marine sources are not sufficient enough, and riverine have also so many hazards because of population and other factors. On the other hand tanks and ponds of West Bengal with a total area of 28466.55 hectares are awaiting for proper utilization. By utilizing all the ecological niches of ponds through intensive fish culture production can be boosted up. The development of pond culture holds the key to the solution of the problem of ensuring required fish protein to the people. And for this, it is urgent that a clearcut strategy is formulated for optimum utilization of ecological niches of the pond. No doubt the Government has developed and popularised the proper technique of pisciculture in stocking pond management for heralding an era of "aquaculture" or "fish revolution" through pond fish culture (Jhingran, 1978b).

The composite fish culture technology has been found to be viable. There are obstacles for the adoption of the technology which should be removed to bring fish revolution. The technology of fish culture can not alone ensure a decisive break through in production. Economics and Institutional factor must be conducive for translating field experiment into the actual practice. The economics and ownerships are the two major problems which retard the adoption of the modern technology.

Composite fish culture is a fertilizer intensive technology. Consequently the diffusion of this cultural practice will continue to be weak unless the supply of fertilizers

can be applied properly. The diffusion of new technique will be heavily conditioned by availability of fertilizers and deficiency of the supply of fertilizers is a serious obstacle.

The use of fertilizer in the pisciculture is so costly that a poor fisherman or pond owner will hesitate to take risk. Intermediate technology based upon low cost and easily available local manure will have to be applied, so that pond owner may be induced easily to introduce such technology in the field. It is mentioned earlier that fish is a rich source of protein, lipid and other nutrients, also essential for human body. In developing countries very large percentage of world's population does not get the requisite amount of energy in terms of caloric and protein (Dayal, 1982). Similar situation exists in India and West Bengal. Efforts are made for production to supply a daily three ounces of nutritious animal protein (fish flesh) as recommended by nutritive advisory committee in daily balanced diet for the Indians which supplies 24 percent of total energy for the proper physical and mental development (Rath, 1978).

The quantitative deficiency of protein in developing countries is compounded by the fact that most of it is derived from vegetable sources, such as cereals and tubers. Animal protein is better suited to human diet as it is easier to assimilate and also has a higher concentration of protein.

Among animal sources of protein fish is particularly valuable. Apart from having a quantitatively better composition of proteins, fish protein is also highly concentrated. The edible protein of fresh water and estuarine fishes in India were shown to contain 14-25% protein. In marine fishes also it varies from 9-26%. Different species of fish vary in

their fat contents. Some varieties of fresh water fish contain as little 0.06% fat where as some can contain upto 20%.

Among animals true fats are stored up in the adipose tissue. Which is found in the subcutaneous inter muscular and in the abdominal regions. Proteins and lipids are most important constituent of muscle beside other organs.

A number of investigators worked on and analyzed the protein and lipid content in fresh water fishes. But a perusal of the available literature indicates a paucity of work on the effect of manures on the protein and lipid contents in fish including carps. Only a fragmentary work on the effect of manure on the protein and lipid in fishes is known (Mitra and Pal, 1982). Work on the effect of manures in protein and lipid contents in carps, essential for compensating the ill balanced cereal diet in West Bengal and also in India, would be an essential subject of investigation. With this aim in view the present work has been undertaken by utilizing cow-dung, pig-dung, poultry manure & tea garden wastes as fertilizer for fish production. The study as such has been organised in two parts. Part-I gives the results of the experiments carried out for two years in a few village ponds. An attempt has also been made in this part to evaluate the associated changes in cost and production levels. In Part – II, experiments on the estimation of protein and lipid to show the effect of the manures used has been undertaken. For the investigation three major carps – *Catla catla*, (Hamilton), *Labeo rohita* (Hamilton) and *Cirrhinus mrigala* (Hamilton) commonly known as Catla, Rohu and Mrigal respectively or in combination with the exotic carps, *Ctenopharyngodon idella*, *Cyprinus carpio*, *Hypophthalmichthys molitrix* and *Carassius auratus* etc. will be worked out. An attempt will also be made to produce a model on economic viability of 'Jhora fed fish culture of Darjeeling Hills

studies on the locally available organic Manures and production of Indian major carps in combination with the exotic carps in to the hills of Eastern Himalayans (Darjeeling Hills) would place the culture of carps on top priority. Particularly when the inputs required will be low and record high production of fish protein per unit area of water in ensured with higher economic return.

The proposed programme of investigation, therefore, aims to explore how best the locally available organic manures can be used in the carps and there by rendering carp culture practices economically more viable in the hills.