



Fish farming: Farming of future

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India has to sustain 16 per cent of the world's population on 2.4 per cent of the global land area. It has to feed its burgeoning population using 3 per cent and 5 per cent of global farm land and water resources. Hence, its dependence on aquatic resources for production of additional food is obvious and shall become more and more necessary. Fish, as a source of 'rich food for poor people', can play an important role in improving food security and nutritional status of rural people as indispensable source of micronutrients and vitamins. Where there is a lack of alternative locally produced protein, fish provides the major cheap source of protein intake as well as contributes towards calorie supply for rural people. So, importance of fish is felt as a crucial element in diets. Presently, the per capita availability of fish (8kg) is less than the world average (12kg) and the quantity (11kg) recommended by the WHO for nutritional security. To meet the increasing demand for animal protein, significant development in poultry and livestock farming which otherwise would have limited due to the continuously increasing pressure on land for the production of cereals. There is no scope for spatial expansion of grazing and feeding areas. But in contrast; the shortage of animal protein can be met through the development of fish farming, as it not only requires less cash investment compared to livestock and poultry but also can be produced using a land that is not suitable for agriculture. Indian agriculture is characterized by a dominance of small and marginal farmers (almost 68%) who suffer as result of difficult socio-economic conditions. Nearly 75 per cent of the farm holdings are below 2 hectares and a large portion of rural people survive as small holders. Income from these farms cannot be raised upto the desired level to sufficiently alleviate poverty in rural areas unless existing crop production systems are diversified. Furthermore, increased dependence on one or two major cereal crops (wheat, rice, maize, etc.) witnessed after the green revolution makes the farming economy vulnerable to price fluctuation arising due to demand supply. So, poverty and food



insecurity are common conditions among the rural people hindering the rural employment. In this frame of reference, the fish farming is really showing a ray of hope as a promising enterprise because, the vibrancy of the sector can be visualized by the eleven fold increase that India achieved in fish production in just six decades, *i.e.* from 0.75 million tonnes in 1950-51 to 9.6 million tonnes during 2012-13.

Importance of fish eating :

– Fish represents 15.6 per cent of animal protein supply and 5.6 per cent of total protein supply on a worldwide basis.

– It is estimated that 60 per cent of people in developing countries obtain 40-100 per cent of the animal protein in their diets from fish.

– The uniqueness of fish protein is due to its excellent nutritive value, high digestibility (greater than 90%) and presence of all essential amino acids.

– Fish flesh contains 60-84 per cent water, 15-24 per cent protein, 0.1-22 per cent fat and 1-2 per cent minerals.

– Sea food serves as rich source of polyunsaturated fatty acids [PUFAs], especially omega -3 PUFAs, minerals and vitamins.

– It is the only source of high quality protein available at affordable cost and in sufficient quantity.

– In recent years, the link between fish oil and heart disease has been the subject of thousands of scientific papers.

– An increase in fish oil in the diet results in a marked reduction in blood cholesterol and triglyceride levels and also thrombosis problems.

– Fat soluble vitamins A,D, E and K are present in fish in varying amounts-often in higher concentration than in land animals.

– Salt water fish are rich in iodine.

Available area : Available area for fish production in India is vast and diverse; the marine jurisdictional area alone spans 2.02 million km². Inland fishery resources and potentials; India is blessed with huge inland fishery

resources consisting of 2.36 million ha of ponds and tanks, 1.3 million ha of bheels, jheels and derelict waters, 0.12 million kilometers of canals, 3.15 million ha of reservoirs, 45000 kilometers of rivers, 2.7 million ha of estuaries and 1.2 million ha of brackish water area that could be put to different fish culture and capture practices and all these sources provide one of the richest fish genetic resources of the world. From these vast resources, we capture and produce 9.6 million tonnes of fish.

Site selection : Village ponds, homestead or backyard kitchen ponds, garden or farm ponds, irrigation ponds and occasional ponds such as brick mine pits and quarries, etc. occupy enormous freshwater areas in the tropics and are used for fish culture with minor improvements. However, ponds designed and constructed for fish culture are easier to manage and are expected to give higher production. Although certain well-defined guidelines do exist for the construction of fish ponds, it is mainly the topography of the site which determines the basic design of the pond/farm. There are however, certain basic principles to be considered when choosing a site and deciding the method of pond construction. Selection of proper site for pond construction is the foremost important step in aquaculture production.

How to start a fish farm : Raising fish for profit ranges from growing small fish in a small area of your yard or house to building a full-fledged operation with multiple ponds. Before you start digging a pond or buying fish hatchlings, determine what type of fish you can sell. If space is limited, growing eggs into small fish you sell to other fish farms works best. With more space, you gain the option of growing fish to adult size and selling them to markets that need fresh fish.

Find space : Supplying small fish to other aquaculture businesses requires little space, allowing you to install fish tanks in your basement, barn or a shed. If you plan to raise koi fish or want to raise species that need to reach marketable size for eating, you need an outdoor pond with enough space to accommodate the growing fish. Build a pond in your back yard or on your property, or turn a farm pond into a hatchery for fish growing operation. You can even set up an aquaculture center in a vinyl-lined pool as long as you provide proper air circulation and temperature control.

Choose fish species : Tilapia and catfish are the easiest for new fish farmers to grow. Warm water fish such as tilapia can be grown in an indoor fish farm or outdoors in mild climates. Trout and tilapia can be raised in a vinyl-lined pool. For quick turnaround, grow catfish - a large

fingering reaches 16 ounces in five months. Ideally, hatching your own fish keeps costs down compared to buying young fish.

Buy equipment and supplies : Keeping the water clean is important no matter what type of container or pond you use to raise your fish. A bio or drum filter helps remove toxic ammonia and other waste products produced by the fish. The water needs to be oxygenated with an aerator, air pump or oxygen injector. Invest in a backup generator that keeps the water aerated in case the electricity goes out. You also need to figure out what type of food your fish need. For instance, aquatic plants are a major source of food for fish species in ponds. You must provide all food for fish being raised in tanks.

Create management plan : Develop a written management plan that explain the daily activities you need to handle, such as feeding, checking air filtration equipment and taking the temperature of the water. Describe the amount of food each species at various sizes requires. Include a schedule for measuring water quality and cleaning the ponds. Include a section on evaluating the fish for diseases and how to prevent disease from spreading to the other fish.

Generally cultivated fish species : In order to tap all available food sources in the pond, the aquaculturist will choose fish species which occupy different places in the pond ecosystem, e.g. a filter algae feeder such as tilapia, a benthic feeder such as carp or catfish and a zooplankton feeder (various carp) or submerged weeds feeder such as grass carp. Common carps are - (1) *Cyprinus-Cyprinus carpio* (2) Silver carp- *Hypophthalmichthys molitrix* (3) Grass carp-*Ctenopharyngodon idella* (4) Rohu - *Labeo rohita* (5) Catla- *Catla catla* (6) Mrigal- *Cirrhinus mrigala*.

Integrated fish farming : Integration of fish and another livestock e.g. duck, chicken, pig or agricultural crops depends on availability of livestock or agricultural crop and environmental conditions. Among of these integration; fish and crop integration is more useful to small farmers who cultivate those crops which grow in flooded condition like rice. The paddy fields remain flooded with water for few months in which some fish growth can easily be possible. In this system, pond embankments along with nearby fields are used for growing vegetables and flowers. The fertilized pond water used for irrigation in these crops enhances 15-20 per cent crop yield. In water logged areas, paddy-fish farming has been highly profitable farming systems. This method is helpful to increase the total productivity with less input than a farm where these

activities are carried out separately. Previously, main emphasis was given only on crop cultivation but due to heavy rain, sometimes crops become completely failed, hence there was not sustainable income of farmers. But due to introduction of fish cultivation provides an assurance of income even in harsh weather condition.

Types of fish farms :

Cage system : Which uses cages that are placed in lakes, ponds and oceans that contain the fish. This method is also widely referred to as off-shore cultivation. Fish are kept in the cage like structures and are “artificially fed” and harvested.



Irrigation ditch or pond systems : This basic requirement for this method is to have a ditch or a pond that holds water. This is a unique system because at a small level, fish are artificially fed and the waste produced from the fish is then used to fertilize farmers’ fields.

Composite fish culture : In this system both local and imported fish species, a combination of five or six fish species is used in a single fish pond. These species are selected so that they do not compete for food among them having different types of food habitats. As a result, the food available in all the parts of the pond is used. Fish used in this system include catla and silver carp which are surface feeders, rohu a column feeder and mrigal and common carp which are bottom feeders. Other fish will also feed on the excreta of the common carp and this helps contribute to the efficiency of the system which in optimal conditions will produce 3000–6000 kg of fish per hectare per year.



Integrated recycling system: Which is considered the largest scale method of “pure” fish farming. This approach uses large plastic tanks that are placed inside a greenhouse. There are hydroponic beds that are placed near the plastic tanks. The water in the plastic tanks is circulated to the hydroponic beds, where the fish feed waste goes to provide nutrients to the plant crops that are grown in the hydroponic beds.



Classic fry farming : This method is also known as “flow through system”. This is when sport fish species are raised from eggs and are put in streams and released.

Diseases of fish : The ability of aquatic fungi to cause diseases in fish is well known. Potentially all fresh water,

few marine water fishes and incubating eggs are susceptible to fungal infection. The most common fungal diseases of fish are saprolegniasis, disease caused by Achlya, branchiomycosis, epizootic ulcerative syndrome (EUS) and ichthyophoniasis. Among the diseases most harmful disease is EUS. EUS is also known as red spot disease (RSD) of fish. There is no effective treatment for EUS infected fish in the wild and in aquaculture ponds. To minimize fish losses in infected fish ponds, water exchange should be stopped and lime or hydrated lime and/or salt should be applied.

Farm pond management practices :

- Controlling nuisance weeds in farm pond.
- Maintaining oxygen in farm pond.
- Managing farm ponds for biodiversity.
- Pre-monsoon management-(a) pond evacuation/cleaning (b) pond/bund repair (c) maintenance of water supply.
- Post-monsoon management-(a) to ensure fish seed availability (b) supplementary fish feed (c) organic/inorganic fertilizer (d) water supply.

- Post-stocking management-(a) regular monitoring (b) feed supply (c) water supply (d) sampling properly.

Care should be taken into consideration during management practices :

- Regular monitoring of water level and water quality.
- Adequate supply of supplementary feed to fish for proper growth.
- Maintain input output register for cost benefit in fish culture.
- Give preference to periodical harvesting to promote the fish growth and harvest the fish as cash crop.
- Do not store the feed for longer period.
- Avoid excess and low feeding to fish.
- Do not keep the gap in feeding.
- Apply organic and inorganic fertilizer to maintain the natural food in the pond as per needs.
- Control of aquatic insects.
- Eradication of predatory and weed fishes.
- Ensure that aquarium or tank contains sufficient hiding places and will have safe place for each fish which will reduce aggression.
- Never buy fish showing any symptoms of mishandling, transportation stress, injury etc.

Multi-level marketing process : Marketing channels of both freshwater fishes and shrimps follow multi-level marketing process. In case of freshwater fishes, while the most common channel flows from the fish farmer to the trader and then to the retailer and finally the consumer.

The second most observed channel has the trader selling directly to the consumer, which is the case in local markets, and marketing channel in the upcountry markets also involves the wholesalers. In case of shrimp, the channel, which has the maximum efficiency, caters to the export market. The second links up the farmer to the shrimp collector with the commission agent who in turn caters to the consumer through the processor and the local market agent. The third channel has the local market agent selling to the local retailer who reaches the consumer. The final channel that has been observed is the shrimp farmer-vendor –consumer channel.

Ready to eat products : The international scenario is changing fast and the importance are insisting on new varieties of value added and ready to eat products and stringent quality standards. Diversification and value addition have become the key words now. The export earnings from marine products is proposed to be doubled in the coming few years.

Conclusion : Fisheries in India, is yet another important economic activity especially creating employment in rural sector. This flourishing sector has varied resources and potentials. Only after independence, fisheries together with agriculture have been recognized as a vital sector with regards to generating income. An unparalleled average annual growth rate, of over 4.5 per cent over the years which have placed the country on the forefront of global

fish production only after China. Besides meeting the domestic needs, the dependence of over 14.5 million people on fisheries activities for their livelihood and foreign exchange earnings to the tune of US \$ 3.51 billion (2012-13) from fish and fisheries products, amply justifies the importance of the sector on the country's economy and in livelihood security. Fish farming is a type of business that requires perseverance and adept skills. The first thing to be considered in order to be successful in this kind of business is to be aware of problems with fish farming. Fish are excellent animals to rear. They can convert feed into body tissue more efficiently than most farm animals, transforming about 70 per cent of their feed into flesh. Fish also have excellent dress out qualities, providing an average of 60 per cent body weight as marketable product and a greater proportion of edible, lean tissue than most livestock. Farm reared fish offer a new alternative of agricultural crop that can potentially replace those which are declining in popularity or profitability. Considering the importance of fish eating and doctors' recommendation, day by day fish consumption will enhance surely. Therefore, we can say firmly that in forthcoming years, fish farming is going to be an important and prominent farming. Hence, the extension agency should accelerate their efforts on fish farming to build it as farming of future.

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