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Fish Farming: A Boon for Enhancing Farmer's Income and Livelihood

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Abstract

In Jammu and Kashmir State, there is a huge network of water resources which are usually in the shape of cold water streams, perennial rivers, lakes, reservoirs, sars, irrigation canals and several high altitude lakes. Besides, there are a great number of community and private ponds which may plays an important role in the fish production enhancement for state. As per the website of Department of Fisheries J&K Government, total fish production of the state was about 20.70 thousand tons (2017-18). Out of which 482 tons was contributed by trout fish. Due to its vast network of aquatic resources, fish and fisheries of Jammu and Kashmir State has great scope and potential to grow and develop exponentially. The State has great potential to promote diversified fisheries in terms of its unique agro-climatic conditions. The Jammu and Kashmir state comprises of three regions viz. Jammu, Kashmir and Ladakh. Due to varied climatic conditions in these three regions, all have the great potential to develop and promote the various commercially important fish species. Jammu division itself has unique agro climatic conditions and offers potential for the development of both warm as well as cold water fisheries. Most of the districts of Jammu Province such as Doda, Ramban, Kishtwar, Jammu, Udhampur, Reasi, Kathua, Rajouri and Poonch offer great potential for the warm water and/or cold water fisheries and aquaculture. While in Kashmir valley, the temperate climate is favourable only for the development of cold water fisheries and aquaculture. The areas of Ladakh regions which comprise of Leh and Kargil are suitable for the development of cold water fisheries and Aquaculture. In all these regions some varieties of carp and/or trout are already introduced and cultured successfully and some farmers are earnings handsome income. There is great untapped potential in fisheries sector. On national level only one third of freshwater aquaculture and small portion of brackish water resources have been utilized for aquaculture. Reservoirs fisheries is also highly under-utilized (Av. annual yield – only 20 Kg/ha). A great amount of waste land in the farmer's field as well as water logged land is also available in the state which may find a potential use in aquaculture sector. Many farmers are now gets attentive about the benefits/profits of aquaculture and thus coming forward for the adoption of Aquaculture along with traditional agriculture. In the coming years, it is hopeful that the fish production of the state will grow exponentially and the wide gap between the demand and supply will be minimized.

Keywords: Fish farming; Aquaculture; Culture system.

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Introduction

Fish farming plays an important role in addressing nutritional and livelihood security, especially of the rural poor in developing countries. Fish are rich sources of protein, essential fatty acids, vitamins and minerals. The fats and fatty acids in fish, particularly Omega 3 fatty acids, are highly beneficial and difficult to obtain from other food sources. The growing gap between supply and demand globally will impact on the health and nutrition of low income families, unless efforts are made to increase the production to meet the growing demand. Fish farming means culture of commercially important fish species or some other aquatic organism under controlled conditions. Fish farming is usually called as Aquaculture. Aquaculture is a new and wide name for what once we called 'fish culture. Present concept of fish farming/aquaculture incorporates culture of all aquatic organisms by following certain management techniques which includes water quality, choice food etc. and to protect them from unwanted predators, diseases, pollutants or any other things which are harmful to them. The aquatic organisms which are normally used for aquaculture for food purpose include fishes, prawns, shrimps, crabs, mussels and some live food organisms like algae and zooplankton.

Aquaculture is essentially an Asian farming practice. India is endowed with vast and varied aquatic resources, of which small portion are being utilized for aquaculture. Aquaculture continues to increase in volume and value of output in many countries of the world, filling the gap between the supply and demand for fish and fishery products, improving nutrition and contributing to the household economy, particularly in rural areas. Besides, there is immense scope for the betterment of mankind through aquaculture. Currently, China leads in Aquaculture production in the world followed by India, but the difference in production is almost 8-9 times. In India, the average growth rate of Aquaculture is about 8%.

Importance of aquaculture

- Integration of fish farming with agriculture and/or animal husbandry is known to be more profitable than agriculture alone.
- Fish culture gives efficient means for recycling agricultural and domestic wastes, in order to help/protect our environment.
- Many high valued and commercially important aquatic items such as trout, ornamental fish and many other may helps in earning good returns.
- Artificial recruitment in the water bodies by fish seed produced in fish hatcheries through aquaculture (ranching), could certainly add new fishery resources or increase existing fish stocks.
- Through Aquaculture, we can utilize the unutilized large size water bodies for fish production by adopting pen/cage culture types of culture systems.
- Aquaculture has the potential to help in generating employment for many unemployed and under-employed people. Aquaculture based farming system is economically viable and can help greatly to stop the migration from villages to urban areas.
- Besides, from human nutrition point of view, the fish food is not only easily digestive but is also rich in essential amino acids like lysine and methionine. The unique poly unsaturated fatty acids (PUFA) namely, eicosa pentaenoic acid of fish is known to reduce the cholesterol level of blood and save human beings from coronary diseases. Further, vitamins and minerals are also present in good quantities in fish.

Types of culture systems

Aquaculture is conducted in all the three types of aquatic environments:

1. *Freshwater aquaculture:* It involves the culture in the water bodies having salinity level of less than 0.5 parts per thousand (ppt).
2. *Brackish water aquaculture:* It involves the culture in the water bodies having salinity level ranges from 0.5 to 30 ppt, and;
3. *Mari culture or sea farming:* It involves the culture in the water bodies having salinity level of more than 30 ppt.

The species of flora and fauna inhabiting the three types of water bodies are accordingly called freshwater species, brackish water species and marine species. Freshwater which is most extensively used sector of aquaculture, is further divided into two segments.

a. *Cold waters* of higher altitudes having temperature range of < 18°C and
b. *Warm waters* of plains having temperature range of > 18°C

Aquaculture practices in these waters are, therefore, called coldwater aquaculture and warm water aquaculture, respectively. Aquaculture is practiced through various methods. Freshwater aquaculture is carried out in fish ponds, fish pens, fish cages, raceways and on a limited scale in paddy fields. Culture of fishes in ponds is the oldest form of aquaculture and throughout the country, this (pond) culture system is mainly adopted by the farmers.

Fish Ponds and their types

Detailed Knowledge regarding different types of fish ponds is a prerequisite for a profitable business in fish culture. A fish farm comprises of different types of ponds namely nursery ponds, rearing ponds, production ponds and breeding ponds etc. The number and dimensions of these ponds mainly depends upon the water resource, variety and size of fish to be cultured and type of management. A typical fish pond is a drainable water body with an inlet for the entry of water from water source and an outlet for draining the pond during harvest.

Types of Fish ponds

Nursery Pond

Nursery ponds are smaller (0.02-0.06 ha) and is mainly prepared to nurse the hatchlings for a period of about two to three weeks i.e. until they become fry (2.5-4.0 cm). The depth of the water column may be between 1.0 1nd 1.5 m. The maximum stocking density of hatchlings is about 10 millions/ha. However these ponds are used as nursery only for a short time, they could be used three or four times in a single breeding season. During the other seasons, the nurseries can also be used as production ponds.

Rearing Ponds

Rearing ponds are fairly larger than nursery ponds and sizes usually range between 0.06 and 0.1 ha. In these, the fry are grown for about two to three months or until they attain fingerlings stage (4-10 cm). The depth of water column may be between 1.5 and 2.0 m. Like nursery ponds, when rearing ponds are not in use for rearing purpose, they can serves as production ponds.

Production Ponds

In production/stocking ponds, the fingerlings are raised to marketable size fish. The size of this pond varies from 0.1 to 2.0 ha, as ponds larger than 2 ha are not suitable for efficient management. In production ponds for carp culture, the depth of water column should be between 2 and 2.5 m.

Breeding Ponds

These ponds are only needed for breeding purposes. These are used to stock brooders of the fish species to breed.

In case the source of water is turbid, a small sedimentation pond or a filtration system may also be constructed to filter the water before its direct entry into the fish ponds. If areas of water scarcity and high seepage are to be utilized for fish farming, cemented ponds may be constructed there. However, such ponds should be treated/ overlaid with a soil bed/cover of 30-50 cm soil, in order to give the natural substratum with rich organic matter for higher production and growth.

Different levels of Aquaculture

Depending on the intensity of operation and degree of management, aquaculture practices are classified into following four operations/levels:-

1. Extensive aquaculture
2. Semi- intensive aquaculture
3. Intensive aquaculture
4. Super intensive aquaculture

Extensive aquaculture: In extensive level of aquaculture, low stocking densities of 2000-5000 carp fingerlings are used and no supplemental feed is given. Fertilization may be due to stimulate the growth and production of natural food in the water. In such types of culture system, carp culture does not require water exchange during culture period. The ponds used for extensive aquaculture are usually large. The production is generally low, less than 0.5 ton/ha/yr in the case of carps.

Semi-intensive level: Semi-intensive aquaculture uses medium size ponds 0.5 ha each with comparatively higher stocking densities than extensive aquaculture (5000-10000 carp fingerlings/ ha). Supplementary feeding is done in moderate amounts. In carp culture, water replenishment is done once or twice a month @10%. The production averages around 3-7 tons/ha/yr of carps.

Intensive level: In intensive level of aquaculture,

the pond size is generally small (about 0.2 ha approximately) with very high density of culture organisms i.e. 20000 to 25000 carp fingerlings/ha are stocked. The system is totally dependent on the use of formulated feeds. Feeding of the stock is done at regular intervals. Water replacement under intensive culture is effected on a daily basis. Production under intensive level of aquaculture is much higher, for example, about 12 to 15 tons/ha/ year in carp culture.

Super-intensive level: Super intensive aquaculture needs running water supply and complete daily water exchange is performed. This system is mostly practiced in cement tanks, fiberglass tanks and raceways etc. which are fitted with high efficiency biological filters for continues recirculation of water. The size of the tank ranges between 50-100m^3. The cultured organisms are fed with high quality formulated feed. The feed is given through demand feeders. The water quality is regularly monitored with electronic gadgets. Stocking density ranges between 40,000 to 50,000 carp fingerlings/ha. The production ranges between 15-20 tons/ha/yr in case of carps.

Management practices for carp culture

- *Selection of species*

The species to be selected for aquaculture should have following characteristics:

1. It should have high growth rate
2. It should have capabilities of efficiently utilize and convert the organic production of the water into fish flesh
3. It should be compatible with other species under culture
4. It should be hardy to live in changing physico-chemical conditions such as temperature, pH, turbidity, carbon dioxide and dissolved oxygen
5. Able to reproduce under confined conditions
6. It should be easy to handle and harvest
7. It should have good market demand

In carp culture, usually three Indian major carps viz. *Catla catla, Labeo rohita and Cirrhinus mrigala* and three exotic carps such as *Hypophthalmichthyes molitrix, Ctynopharyngodon idella and cyprinus carpio* are selected for culture. This is mainly because of their fast growth and compatibility among each other.

Some Important Cultural System of Aquaculture

- Composite fish culture
- Integrated farming system
- Raceway culture
- Cage culture
- Pen culture

Composite fish culture

A fish pond is a complex ecosystem as the surface is occupied by the floating organisms such as phyto and zoo plankton; the column region has live and dead organic matter sunk from the surface and the bottom is enriched with detritus or dead organic matter. The marginal areas harbor a variety of aquatic vegetation. The different trophic levels of a pond could be utilized for increasing the profitability of fish culture. Keeping this in mind, the concept of Composite fish culture has been developed. The main objective of this culture system is to select and grow compatible species of fish of different feeding habits to exploit all the types of food available in the different nook and corners of the fish pond for maximizing fish production. The common species of carps having compatibility and different feeding habits and which comes under composite fish culture are Indian major carps such as catla, rohu and mrigal and exotic carps such as common carp, silver carp and grass carp.

Integrated farming system

Here, otherwise waste output of one enterprise can be utilized as inputs for other enterprise.

- Wastes/by products produced through agriculture are consumed by cattle and fishes and converted to proteins that build up animal flesh.
- Water from fish ponds can be used as inputs for agriculture/horticulture crops as well as for veterinary enterprises. Mud from fish ponds can be utilized as organic fertilizer for agriculture/horticulture crops.
- All the wastes from veterinary enterprises are utilized as inputs for aquaculture and agriculture.

Cage culture

Cage aquaculture is a method used for raising aquatic organisms (fish, prawns, mollusks,

crabs etc.) within an enclosure, which is installed in suspended state in ponds, reservoirs, lakes, rivers or any other large size water body. In India, it is initiated with the raising of fry (20-25 mm) to advance fingerlings (100-150 mm) in water bodies/ reservoirs to increase their production. Cages can be of various shapes and sizes. Rectangular cages are however, preferred for easy operation and management.

Pen culture

Aquaculture in pens implies rising of required aquatic organisms (fish, prawn, mollusks etc.) in an enclosure which is formed by cordoning off areas of an open water body such as inter-tidal areas of the sea or fore shore waters of lakes, reservoirs, river, wet lands etc by net barriers.

Pens are generally constructed on the shore side, in semi-circular, rectangular or square shapes as per the suitability of the site. They are constructed by barricading the other three sides by a wall of nylon netting hung from poles driven to the bottom. The framework is generally made out of bamboo and other locally available wood.

Raceway culture

Raceways are designed to provide a flow through system to enable the culture/rearing of much denser population of aquatic animals. An abundant flow of good quality, well oxygenated water is essential to provide respiratory needs and to flush out metabolic wastes, particularly ammonia. Raceways are obviously smaller in size than ponds and occupy much less space. Site selection for a raceway farm has to be done with special care. Naturally the most important consideration is the water supply. The main source of water is springs, streams, deep wells and/or lakes. In Jammu and Kashmir, raceways are widely used for trout culture.

Conclusion

The present article indicates that if the available water as well as farm resources are utilized judiciously and farmers/unemployed youths are advised about the benefits and techniques of latest aquaculture technologies along with agricultural enterprises, there will be an increase in per unit area production and productivity and it will be helpful for the enhancement of income and improvement of livelihood security of farmers.

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