

## **Integrated Aquaculture**

Nowadays, the economy is mainly based on the field of agriculture and software development in the area of Information Technology. For achieving rapid progress in rural area, our strategy must focus on; conserving natural resources, enhancing efficient use of resources, increasing productivity and profitability and improving quality and competitiveness through reduced unit cost of production.

Water is emerging as international challenge and its most efficient management as well as recycling has been given high priority in the plan of formulation. Recycling of crop residue as well as agricultural by products inclusion of nitrogen fixing legumes in rotation, bio fertilizers, vermicultres, agro forestry, nutrient solubilising micro-organisms, efficient nutrient up taking plant varieties etc. are being strategies in the research mandate. Improved efficiency of farm machinery, agro- input and resource conservation technologies of minimum tillage are being researched to minimize the cost of production.

Integrated Fish Farming is one of the best examples of mixed farming. This type of farming practices in different forms mostly in the East and South East Asian countries is one of the important ecological balanced sustainable technologies. The technology involves a combination of fish polyculture integrated with crop or live stock production. On farm waste recycling, an important component of integrated fish farming is highly advantageous to the farmers as it improves the economy of production and decrease the adverse environmental impact of farming.

Integrated fish farming refers to the simultaneous culture of fish or shell fish along with other culture systems. It may also be defined as the sequential linkage between two or more culture practices. Generally integrated farming means the production or culture of two or more farming practices but when fish becomes its major component it is called as integrated fish farming. Fish culture can be integrated with several systems for efficient resource utilisation.

The integration of aquaculture with livestock or crop farming provides quality protein food, resource utilisation, recycling of farm waste, employment generation and economic development. Integrated fish farming is well developed culture practice in China followed by Hungary, Germany and Malaysia. Our country, India, is organic-based and derives inputs from agriculture and animal husbandry. The integrated fish farming is accepted as a sustainable form of aquaculture. For integration we can use recycled effluents from agro-based industries as well as food processing plants.

Integrated fish farming serves as a model of sustainable food production by following certain principles:

- The waste products of one biological system serve as nutrients for a second biological system.
- The integration of fish and plants results in a polyculture that increases diversity and yields multiple products.
- Water is re-used through biological filtration and recirculation.
- Local food production provides access to healthy foods and enhances the local economy.

## **ECOSYSTEM OF INTEGRATED AQUACULTURE**

The integrated fish farming includes the

1. process of trapping solar energy,
2. production of organic material by primary producers (autotrophs),
3. its utilisation by phagotrophs,
4. decomposition of autotrophs & phagotrophs by saprotrophs,
5. release of nutrients for autotrophs.

## **ADVANTAGES OF INTEGRATED FISH FARMING**

- Efficient waste utilisation from different culture practice for fish production.
- It reduces the additional cost for supplementary feeding as well as fertilisation.
- It is an artificial balanced ecosystem where there is no waste.
- It provides more employment avenues.
- It reduces the input and increases output and economic efficiency.
- The integrated fish farming provides fish along with meat (chicken, duck, beef, pork etc.), milk, vegetables, fruits, eggs, grains, fodder, mushroom etc.
- This practice has potential to increase the production and socio-economic status of weaker section of our society.

## **TYPES OF INTEGRATED FISH FARMING**

Basically the integrated fish farming is of two types

- a) Agri-based fish farming

## b) Live-stock fish farming

The fish-cum live-stock farming is realised as innovation for recycling of organic wastes as well as production of high class protein at low cost.

### (a) Agri-based fish farming

**1) Paddy —cum-fish culture** In India, this farming is practised in the states of Bihar, West Bengal, Orissa and Assam where enough water is present in the paddy fields. The paddy fields retain water for 3-8 months in a year. The interest in this practice has declined in recent years due to the use of pesticides to protect high yielding varieties of paddy.

This practice can be done in following types of paddy plots-

**i) Perimeter type-** paddy grows in the middle.

**ii) Central pond type** — paddy growing area is on the perimeter.

**iii) Lateral trench system-** trenches are provided on either one or both sides of the moderately sloping field.

The variety of rice used in this culture is Panidhan, Jalmagna, CR26077, Tulsi etc. while the fish spp. are Indian major carps, *Channa spp*, *Oreochromis mossambicus*, *Clarias batrachus*, *Anabas testudineus*, silver carp, grass carp, common carp. The total production in such practice is approximately 90 quintal from 2 paddy crops while the fish production is about 1000 kg from 1 ha.

### 2) Horticulture-cum-fish farming

The horticulture-cum-fish farming system includes the culture of fruits, vegetables and flowers on the embankment of the pond. The fruits and vegetables contain various nutritive elements and the Indian Council of Medical Research has recommended 85g of fruits and 300g of vegetables to consume daily. For horticulture crop production the inner and outer dykes of the pond and adjoining areas are used. The selection of plant is the main criteria for the success of this system. The plant should be dwarf, seasonal, evergreen, remunerative and less shady. The fruit crops which can be used are Mango, Banana, Papaya, Coconut, Lime etc. and the vegetables like Brinjal, Tomato, Cucumber, Gourds, Chilli, Carrot, Raddish, Turnip, Spinach, Peas, Cabbage, Cauliflower, Ladies finger can be grown according to their season throughout the year. The flower plantation on the embankment is also useful. We can use the plants like Rose, Jasmine, Gladiolus, Marigold and Chrysanthemum etc. which provides additional income to the farmer and beauty to the farm. This system provides 20-25% more return in comparison to aquaculture alone.

The agri-based fish farming includes the mushroom fish system, sericulture-fish system, fodder crop integration etc. Pond bundhs may also used for growing pulses and oil seed crops. Aquatic cash crop like Makhana (*Euryale ferox*) and Singhara (*Trapa spp*) integration can also be done along with air-breathing or carnivorous fishes.