

# Integrated Fish Farming



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# Introduction

- The principle of integrated fish farming involves farming of fish along with livestock or/and agricultural crops.
- This type of farming offers great efficiency in resource utilization, as waste or by product from one system is effectively recycled.
- It also enables effective utilization of available farming space for maximizing production.
- The rising cost of protein-rich fish food and chemical fertilizers as well as the general concern for energy conservation have created awareness in the utilization of rice and other crop fields and livestock wastes for fish culture.
- Fish culture in combination with agriculture or livestock is a unique and lucrative venture and provides a higher farm income, makes available a cheap source of protein for the rural population, increases productivity on small land-holdings and increases the supply of feeds for the farm livestock.

# Scope of Integrated Fish Farming

The scope of integrated farming is considerably wide.

Ducks and geese are raised in pond, and pond-dykes are used for horticultural and agricultural crop products and animal rearing.

The system provides meat, milk, eggs, fruits, vegetables, mushroom, fodder and grains, in addition to fish.

Hence this system provides better production, provides more employment, and improves socio-economic status of farmers and betterment of rural economy.

## Classification of Integrated Fish Farming

Integrated fish farming can be broadly classified into two, namely ***Agriculture-fish and Livestock-fish systems***

***Agriculture-fish systems-*** Agri-based systems include rice-fish integration, horticulture-fish system, mushroom-fish system, seri-fish system.

***Livestock-fish systems-*** Livestock-fish system includes cattle-fish system, pig-fish system, poultry-fish system, duck-fish system, goat-fish system, rabbit-fish system.

# Rice Fish Integrated System

- For the culture of fish in combination with rice, varieties such as Panidhan, Tulsi, CR260 77, ADT 6, ADT 7, Rajarajan and Pattambi 15 and 16 are suitable.
- These varieties not only possess strong root systems but also are also capable of withstanding flooded conditions.
- They have a life span of 180 days and fish culture is possible for about four to five months after their transplantation.
- Harvesting is done when fish attain marketable size.
- Fish culture in rice fields may be attempted in two ways, viz. simultaneous culture and rotation culture.
- In the former, rice and fish are cultivated together and in the latter fish and rice are cultivated alternately.

# Horticulture Fish Integrated System

- The top, inner and outer dykes of ponds as well as adjoining areas can be best utilized for horticulture crops.
- Pond water is used for irrigation and silt, which is a high-quality manure is used for crops, vegetables and fruit bearing plants.
- The success of the system depends on the selection of plants.
- They should be of dwarf type, less shady, evergreen, seasonal and highly remunerative.
- Dwarf variety fruit bearing plants like mango, banana, papaya, coconut and lime are suitable, while pineapple, ginger, turmeric, chilli are grown as intercrops.
- Plantation of flower bearing plants like tuberose, rose, jasmine, gladiolus, marigold and chrysanthemum provide additional income to farmers.

## Sericulture Fish Integrated System

- In this integration, mulberry is the producer silkworm is the first consumer while fish is the secondary consumer, ingesting silkworm faeces directly.
- Inorganic nutrient in the silkworm faeces are utilized by phytoplankton, and filter-feeding fish in turn consumes heterotrophic bacteria.
- The optimum range of temperature and humidity is 15-32°C and 50-90% respectively.
- The seri-fish system provides linkages between mulberry and pond sub-system.
- Harvested mulberry leaves are fed to silkworm and the waste material obtained from silkworm rearing enters fish-pond as a mixture of mulberry leaves and silkworm excrement.

## Duck-Fish Integrated System

- Duck-fish integration is the most common integration in China, Hungary, Germany, Poland, Russia and some parts of India.
- A fish-pond being a semi-closed biological system with several aquatic animals and plants, provide excellent disease-free environment for ducks.
- In return ducks consume juvenile frogs, tadpoles and dragonfly, thus making a safe environment for fish.
- Duck dropping goes directly in pond, which in turn provide essential nutrients to stimulate growth of natural food.
- This has two advantages, there is no loss of energy and fertilization is homogeneous.
- This integrated farming has been followed in West Bengal, Assam, Kerala, Tamil Nadu, Andhra Pradesh, Bihar, Orissa, Tripura and Karnataka.
- Most commonly used breed for this system in India is the Indian runners.

# Chicken-Fish Integrated System

- The droppings of chicks rich in nitrogen and phosphorus would fertilise fishponds.
- Poultry housing, when constructed above the water level using bamboo poles would fertilise fishponds directly.
- This system utilizes poultry droppings for fish culture.
- Production levels of 4500-5000 kg/fish/ha could be obtained by recycling pond manure into fishponds.
- Broiler production provides good and immediate returns to farmers. Procurement of quality chicks, housing, brooding, feeding and disease management are important for this type of system.
- In fish poultry integration, birds housed under intensive system are considered best.
- Birds are kept in confinement with no access to outside.
- Deep litter is well suited for this type of farming. About 6-8 cm thick layer prepared from chopped straw, dry leaves, saw dust or groundnut shell is sufficient.

# Pig-Fish Integrated System

- This system of integration is very common in China, Taiwan, Vietnam, Thailand, Malaysia and Hungary.
- Pigs are fed largely on kitchen waste, aquatic plants and crop wastes.
- The waste produced by 30-35 pigs is equivalent to 1 tonne of ammonium sulphate.
- Exotic breeds such as White Yorkshire, Landrace and Hampshire are reared in pig-sty near the fish pond.
- A floor space of 3-4 m<sup>2</sup> is provided and boars, sows and finish stocks are housed separately.
- Maize, groundnut, wheat-bran, fishmeal, mineral mixes are provided as concentrate feed-mixture.

# Mushroom Fish Integrated System

- Cultivation of edible mushroom in India is quite recent.
- Three types of mushrooms being commercially cultivated in India are *Agaricus bisporus*, *Voloriella* spp. and *Pleurotus* spp., commonly known as European button, paddy straw and oyster mushroom.
- Mushroom cultivation requires high degree of humidity and therefore its cultivation along with aquaculture tremendous scope.
- Method of cultivation involves use of dried paddy-straw chopped into 1.2 cm bits, soaked in water overnight.
- Excess water is drained off.
- Horsegram powder (8 g/kg straw) and spawn (30 g/kg straw) is added and mixed with wet straw in alternating layers.
- Perforated polythene bags are filled with substrate and kept in room at 21o-35oC with required light and ventilation.
- The mycelial growth occurs within 11-14 days. Polythene bags are cut open at this stage, water is sprayed twice a day and in a few days mushroom crop becomes ready for harvest.
- The paddy-straw after mushroom cultivation is utilized for cattle feeding.

# Cattle Fish Integrated System

- ❖ A large population of cows and buffaloes exists in the country which plays a vital role in the national economy.
- ❖ Fish farming can become more production-oriented if integrated with cattle farming.
- ❖ Cattle are allowed to graze on pond banks and grassy areas in the vicinity and manure is either collected or washed directly from the cattle sheds into the ponds.
- ❖ It has been proved that in the composite fish culture (rohu, catla, mrigal and 3 Chinese carps) when the ponds are manured with cowdung @15,000 kg/ha/year, an excellent yield of 5,000 kg fish/ha/year can be obtained.
- ❖ Fertilization of nurseries and rearing ponds with cowdung is a widespread practice in Pakistan.
- ❖ However, there is a strong need to standardize the number of animals required to provide manure per unit area of fish ponds.
- ❖ It has been estimated that fresh cowdung manure voided by two cows is sufficient to fertilize one ha of pond area.

# Ecosystem of Integrated Fish Farming

## ***Integrated fish farming system works in following way***

- Trapping of solar energy and production of organic matter by primary producers.
- Utilization of primary producers by phagotrophs or tertiary consumers.
- Decomposition of primary producers and phagotrophs by saprotrophs or osmotrophs.
- Release of nutrients for producers.

## ***The animal waste in water body enter into the food chain in three different ways***

- Feed Certain bottom feeders like *Cyprinus carpio* and *Cirrhinus mrigala* directly utilized the organic particles which are generally coated with bacteria along with other material.
- Autotrophic production Some of the decomposed portion of waste products provides nutrients for the micro-flora (autotrophs), while non-mineralised portion provides food base for bacteria and protozoa (heterotrophs).
- Temperature, light, micro and macroflora, inorganic nutrients, carbon, phosphorous and nitrogen are the basic inputs required for photosynthesis process.
- Heterotrophic production Micro fauna (zooplankton) feed on small manure
- particles coated with bacteria.
- In the process, bacteria is digested while rest is excreted.
- In this heterotrophic production system micro fauna (protozoans and zooplanktons) are produced finally shortening food chain.
- This system of production is not linked with the process of photosynthesis.

## Advantages of Fish farming systems

- Fish provides high quality animal protein for human consumption.
- A farmer can often integrate fish farming into the existing farm to create additional income and improve its water management.
- Fish growth in ponds can be controlled the farmers themselves select the fish species they wish to raise.
- The fish produced in a pond are the owner's property they are secure and can be harvested at will.
- Effective land use effective use of marginal land e.g. land that is too poor, or too costly to drain for agriculture can be profitably devoted to fish farming provided that it is suitably prepared.

## Advantages of Integrated Fish Farming Systems

- Integrated fish farming systems utilise the waste of live stock, poultry and agriculture by-products for fish production.
- About 40-50 kg of organic manure can produce 1 kg of fish.
- Fish farms having an integration with mulberry cultivation, sericulture and silk extraction from cocoons allow the pupae to be utilised fish feed and the worm faeces and wastewater from the processing factory to be used as pond fertilisers.
- Pond silt can be used as fertiliser for fodder crops which in turn can be used to raise live-stock and poultry or as fish feed.

## Cont.....

- Thus a recycling of waste is done in integrated fish farming system.
- The scope of integration in a fish farm is considerably wide.
- Ducks and geese may be raised on the pond, pond dykes may be used for fruit plants and mulberry cultivation or for raising pigs, cattle, and dyke slopes for fodder production.
- Integrated fish farming systems not only fish but meat, milk, eggs, fruits, vegetables, mushrooms etc. can be obtained.
- This system fully utilizes the water body, the water surface, the land, and the pond silt to increase food production for human consumption.