

Aquaculture as an Economic Enterprise

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Aquaculture/ aqua farming: culture of aquatic organisms, viz, fish, crustaceans, molluscs and aquatic plants under controlled conditions

OBJECTIVES OF AQUACULTURE

- Production of protein rich, nutritive, palatable and easily digestible human food benefiting the whole society through plentiful food supplies at low or reasonable cost.
- Providing new species and strengthening stocks of existing fish in natural and man-made water-bodies through artificial recruitment and transplantation.
- Production of sport fish and support to recreational fishing.
- Recycling of organic wastes of human and livestock origin.
- Production of ornamental fish for aesthetic appeal.
- Providing means of sustenance, livelihood and monetary profit through commercial and industrial aquaculture.
- Production of bait-fish for commercial and sport fishes
- Production of industrial fish

Aims

Holistic development of the fisheries sector by enhancement of fish productivity.

To supplement nutritious protein for the growing population.

To accelerate the overall economy of the country. Improve health, economy, exports, employment and tourism in the country.

More research and development for IGF-1, GH are the key muscle enhancing genes.

The field of nutrigenomics can be explored and secondary metabolites from plant extracts can be used to modify gene expression.

Eg. *Curcuma longa* and *Withania somnifera*

Integrated Aquaculture & its advantages

Efficient utilization of wastes.

More employment opportunities

Efficient Waste management:

Complete recycling of wastes

Generation of more income in similar span of time.

Little economic constraints.

Food and Nutritional security.

little input of time.

Farm activities are not effected

Integrated Aquaculture

Efficiency in resource utilization (aquaculture+ livestock + crops)

Reduces risks by diversifying crops

Recycling of wastes/ by products of one farming system as input for another system

Efficient utilization of available farming space for maximum production

Additional source of food and income

Additional cost for supplementary feeding & fertilization is reduced.

Artificial balanced ecosystem without any waste.

More avenues for employment.

It reduces the input and increases output and economic efficiency.

Provides fish, meat, milk, vegetables, fruits, fodder, eggs, grains, & mushroom etc. altogether.

Potential for rural livelihood & socio-eco status.

Justification for Integrated Aquaculture in INDIA

India being an agrarian economy, produces large quantities of animal & plant residues, to the tune of over 322 & 1,000 million metric tonnes, respectively, on annual basis.

The country supports large bovine population of over 307 million cattle heads, along with 181 million sheep & goats, 16 million pigs, & over 150 million poultry and other livestock.

Justification of Integrated aquaculture

Apart from activities like mushroom cultivation, rabbit rearing, Sericulture, and Apiculture, which provide huge quantities of organic material for aquaculture, the agro-based industries also produce effluents which could be recycled for aquaculture in addition to the domestic sewage to

the extent of over 4,000 million liters on daily basis.

Integrated Aquaculture: Types

Agri-based fish farming

1. Paddy-cum Fish Culture.
2. Horticulture-cum Fish culture.

- (i) Vegetable- cum Fish culture
- (ii) Fruits-cum Fish culture
- (iii) Flowers-cum Fish Culture
- (iv) Mushroom-cum Fish Culture
- (v) Sericulture-Fish Culture
- (vi) Fodder crops- Fish Culture

Live-stock fish farming

1. Fish cum pig Culture.
 2. Fish cum duck culture.
 3. Fish cum Poultry culture.
 4. Fish cum cattle culture
- A. Agri-based fish farming
1. Paddy – cum Fish Culture

- It is commonly practiced in countries like Japan, Malaysia, China and India (Southern and North eastern states: Assam, Bengal, Bihar Orissa, AP).
- Paddy fields remain flooded with water for considerable duration (3-8 months) hence fish can be grown along with rice at low additional cost.
- Traditional varieties of rice that require little inputs of harmful pesticides and fertilizers are more suited.

Advantages of fish- cum paddy culture

- Fish production is done at no additional cost.
 - Rice production is increased by 10-15% due to increase in fertilization by fish excreta.
 - Unwanted aquatic weeds and algae are eliminated by fish.
 - Insect pests of rice like stem borers are eaten by fish.
 - Mosquito larvae are eliminated by fish, thus controlling malaria.
 - Fingerlings produced can also be sold in market.
2. Horticulture-cum Fish Culture
- ICMR recommends 85g of fruits and 300g of vegetables for every human being on daily basis.

Fruits and vegetables are rich in vitamins & minerals.

Crops of fruits, vegetables & flowers can be cultivated on inner and outer dykes and adjoining areas of the fish pond.

Crop plants should be seasonal, evergreen, dwarf, remunerative and less shady.

Horticulture-cum Fish Culture

(i) Fish cum aquatic herb culture

Euryale ferox (Makhana) and *Trapa indica (Singhara)*, two aquatic herbs, can be integrated along with air-breathing or carnivorous fishes.

These cash crops are cultivated in many states as they have both nutritional & medicinal values.

This provides additional income with little input and care.

Horticulture-cum Fish Culture :

Makhana cum fish culture

It is a common practice in Bihar to grow air breathing fishes with Makhana plants.

Fish species suitable for culture are

Heteropneustes fossilis, *Clarius Batracus* and *Anabas testudeniis*.

Trapa cum fish culture

The common chestnut, *Trapa indica* is another herb cultured in Tropical water bodies. It can also be coupled with Fish farming .

(ii) Horticulture-cum Fish Culture

Fruits- Fish Culture

Banana, mango, papaya, lime and coconut plants can be cultivated on the pond embankments in rows, by making ditches between the rows, ditches have continuous supply of water.

Air breathing and larvivorous fishes such as *Channa marulius*, *C. striatus* and *Tilapia* can be cultured in these ditches, which have a rich population of insects larvae.

(iv) Horticulture-cum Fish Culture:

Flowers-cum fish culture

Flowering plants like Rose, jasmine, Marigold, Gladiolus, Chrysanthimum and poppy etc. can be successfully cultivated along the pond embankment.

Flowers provide fragrance and beauty.

They have ready market.

Flowers-cum fish culture provides 20-25% more returns in comparison to aquaculture alone.

(B) Live-stock fish farming

Live-stock resources can be successfully cultured along with a variety of fishes having good food value.

Both indigenous and exotic breeds of live-stock can be accommodated.

Pigs, Poultry, Ducks, Cattles, Goats and Rabbits are good reference of live-stock.

Major carps are the suitable choice.

(i) Fish cum pig culture

Fish culture is linked with pig husbandry by providing pig houses on the pond embankment. wastes and excreta is directly drained into pond.

Pig dung is a good fertilizer.

Fish feeds directly on the excreta which contains 70% digestible food for fish.

This system of integration is very common in China, Taiwan, Vietnam, Thailand, Malaysia, Hungary and some European countries.

(ii) Fish -cum duck culture

The raising of ducks along with composite fish culture is a profitable practice in terms of flesh produced per unit area.

The ducks feed on aquatic insect larvae and enrich the water with their droppings which act as fish feed and also proliferate growth of planktons.

Duck droppings contain 25% inorganic substances including carbon, phosphorus potassium, nitrogen, calcium etc., which acts as fertilizers in fish ponds.

Fish-cum duck culture is plasticized in Assam, A.P., Tripura, Bihar, Tamilnadu, Orissa, Kerala, U.P. etc.

Advantages of fish cum duck culture

Enhanced production coupled with decreased expenditure on fertilizers for the pond.

Duck droppings cause enhanced production of planktons which serve as fish food.

Ducks help in eradication of aquatic weeds (*Lemna*, *Azolla* etc.), aquatic insects, other like mollusks, tadpoles etc.

Ducks act as 'biological aerators' by splashing water with their webbed feet.

Rearing of 300-350 of ducklings is sufficient to fertilize 1 ha of pond by their droppings.

(III) Fish -cum poultry farming

This practice utilizes poultry droppings of fully built-up poultry litter for fish culture.

- The droppings of poultry are rich in nitrogen and phosphorus and are used as fertilizer for fish ponds.

Poultry houses (0.3-0.4 sq. m. space /bird) are constructed above the pond with bamboo sticks so that droppings may directly fertilize the water.

- The enhancement in meat and egg production is accompanied by decreased use of fish food in combined cultures.

Under the integrated fish cum poultry farming chemical fertilizers and supplementary feed for fishes are not required.

(iv) Cattle- cum fish culture

In this system of integration where the cattle dung, oxidized in biogas plants is transferred to fish pond through small channels to act as manure.

It is advantageous to construct cowsheds near the ponds as the cow dung acts as fertilizer for propagation of natural fish food in water like planktons.

5-6 cows can provide adequate manure for 1 ha pond in addition to 9000 lt. milk & 3000-4000 kg. fish annually.

(v) Goat-cum fish integration

Goat's excreta is considered as a very good organic fertilizer. (organic carbon-60%, N-2.7%, P-1.78%, k-2.88%) and its urine is also equally rich in both N & P.

50-60 goats are required to fertilize 1 ha pond.

The goats should be provided with dry, safe, comfortable house protected from excessive heat.

Goats are selective feeders and consume Berseem, Napier grass, Cowpea Soybean, Mulberry etc.

The suitable goat breeds are Jamanapari, Beetal, Barbari, Barbari for milk and Bengal, Sirihi, Deccani are used for meat.

This integration can provide 3500-400 kg fish/ha/year without supplementary feeding and fertilizer.

CONCLUSION

- Fish culture integrated with agriculture and livestock provides a higher source of income to the farmer having a small land holding.
- These practices help in improving production with little additional expenditure.
- It is expected that such practices will increase in the near future in suitable agro-climatic regions of the country as they are dependent on eco-friendly measures and ensure higher returns as well as sustained production levels of fish and other animals.
- Advantages of Integrated fish farming:
Integrated aquaculture offers solution for betterment of rural economy and employment generation, and finally improving socio-economic status of weaker rural community.