



Strategies on Possibility of Cultivation of Water Chestnut with Fish in Integrated Mode, Value Addition and Marketing

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In most of the states of India, water chestnut is mostly found to be cultivated in underutilized waterlogged lowland areas. The potential of waterlogged areas can be tapped by growing some aquatic crops such as water chestnut, makhana and lotus which have enormous economic potentials. These crops may also be utilized as a bioremediation crops as it has tremendous absorption capacity of nutrients including toxic heavy metals from the water. Therefore, some polluted water bodies may also be intensively utilized for cultivation of water chestnut.

Water chestnut growers should also be made aware about successful cultivation of water chestnut in integrative mode with fishes such as air breathing and Indian major carps. In this way they can sustainably improve their economic conditions. Government supported "One Acre Model" trial must be conducted in those districts of the country which have abundant waterlogged areas whose potential is still untapped.

Integrated water chestnut-cum- fish model

The cultivation of water chestnut in integrated mode with fish culture (Aquaculture), the depth of water should be maintained up to 4ft only. It has been found that apart from Indian carp fishes [Rohu (*Labeo rohita*), Catla (*Catla catla*) & Mrigal (*Cirrhinus mrigala*)], air breathing fishes such as cat fishes [Magur (*Clarias batrachus*), Channa (*Channa striatus*), Singhi, Garai] can easily be included in water chestnut growing ponds. Fish rearing with water chestnut offers a benefit to the fish growers from its (fish) possibility of theft. Generally, farmers show reluctance in cultivating fish in water chestnut growing ponds as they think that the growth of fish will not be proper due to lesser infusion of oxygen into the water surface covered by leaves of water chestnut. In this regard farmers need to be educated that the air-breathing fishes like catfishes fit well in such a situation due to their additional respiratory organ as well as habitat preference and nature of growth. Further, they also need to be informed that a technology has been standardized that the 10% area in the middle of pond is kept vacant as refuge area for proper oxygenation for fishes. Magur is released into the pond during mid August when the water chestnut crop attains full canopy growth. At the time of inclusion of fishes in the ponds the mean body weight of fingerlings should vary between 15 and 25 g. On an average 7,500 to 10,000 number of fingerlings may be released in the ponds.

To get better fish yield locally available fish feed must be fed to the fishes. However, one fourth of total fish feed requirement is met through decomposed plant tissues of the water chestnut crop and other weeds and associated fauna and benthic organisms and insects. The another biggest managemental problem which is mainly associated with water chestnut crop

is infestation of water chestnut beetle (*Galerucella birmanica*) which have been proved to be the deadliest insects for the water chestnut.

Water chestnut crop is severely damaged by insect namely singhara beetles. The right control measures for singhara beetle have not yet been developed in the country. Thus the farmers are compelled to apply various insecticides as suggested by the seller of those insecticides to control the infestation of beetles. However, it is known to every insecticides users that these insecticides damage the most to the aquatic ecosystems of the ponds. Under this situation the introduction of cat fishes especially mangur in the beetle infested water chestnut crop has been noticed as the best alternative of the insecticides up to a certain extent as the cat fishes act as the predator of the beetles.

Thus, the integrated farming systems of water chestnut with aquaculture (especially magur) provides congenial environment for the water chestnut in terms of its protection from water chestnut beetle and for fishes pertaining to availability of natural food, maintenance of good chemical properties of water, benthic population structure, and lower degree of cannibalism.

The integrated cropping systems also results in an increase in gross and net productivity of water bodies. The harvesting of water chestnut fruit is generally done during the months of October to December. Thereafter, the whole crop gradually gets decomposed owing to its susceptibility to chilling temperatures prevailing particularly between last week of December and second week of January. The integrated system has registered two fold increase in production of magur fish while the quantum of increase in case of water chestnut is 1.0 to 2.0 t/ha (10 to 12 t/ha). On an average, 40 to 50% more yield has been recorded in fruit yield of water chestnut. The integration of aquaculture with water chestnut increased the average income of farmers by Rs. 33,000/acre as compared to pre adoption situation.

The total average income of the farmers from the the farming was increased by more than 50 per cent after adoption of this technology. For getting higher benefit from rearing of cat fishes, the bottom soil must be rich in mud content (a layer of 15-20 cm depth). 3 to 4 young plants/plantlets of 30-40 cm long are transplanted at a spacing of 1.5 m x 1.5 m. About 4400 to 4500 bundles of plantlets/seedlings (3-4 seedlings in each bundle) are required for 1 ha area. Farm yard manure/compost is applied @ 7-8 t/ha to the water bodies in the last week of May or Ist week of June. The recommended dose of N:P:K fertilizers for the Darbhanga and Madhubani region is 120:60:60 kg/ha. Only the nitrogenous fertilizers will be applied in three splits.

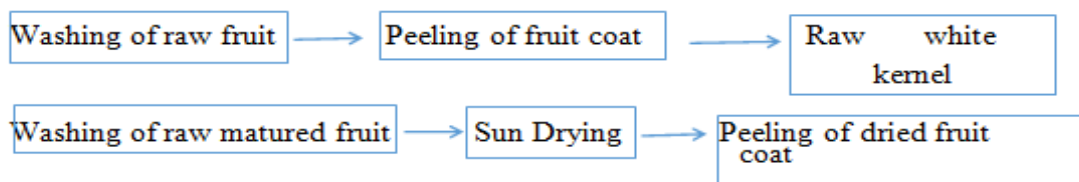


Value addition/processing in water chestnut

Different value added products are being prepared and sold in the market especially at sweet shops. Nowadays several companies have come up in the country which are selling singhara flour and dried singhara kernel under different brand names and same is available in the local market. Some companies need frozen kernel of water chestnut.

Before entering into preparation of value added products, the kernels of singhara must be stored for longer time. Harvested kernels can be stored in the cool chambers where temperature is maintained at 8 to 10°C in sealed plastic bags or containers to prevent from drying out. Some kernels get rot after some times of packing, therefore the same need to be sorted out to prevent the rotting of other safe kernels. Rotting of kernels generally takes place in those kernels which have been damaged during harvesting and latter handling. In this way, the kernels can be stored for one year under viable condition for further cultivation.

Processing of water chestnut fruit



Some value added products of water chestnut have also been prepared at National Research Centre for Makhana, Darbhanga: Singhara dried kernel, Singhara flour, Singhara Burfi, Singhara pickle, and Singhara ka halwa. Singhara flour is used in preparing sinnghara ki panjiri, singhara cutlate, gulab jamun and kulfi.

	
General selling pattern of water chestnut	Frozen kernel of water chestnut
	
Peeled and dried kernel of water chestnut	Fresh & raw water chestnut ready for sale
	
Singhara burfi	Singhara pickle
	
Singhara halwa	Raw singhara kernel

Singhara flour sold in market under different brand names:



Water chestnut cultivation done in residential colonies area adjacent to bypass road of Patna city

Bottlenecks of water chestnut cultivation:

- Lack of improved varieties of water chestnut;
- No facilities of sweet irrigation water having pH between 6.5 to 7.5;
- Good production can be achieved in high water holding soils ranging from silty clay loam soil to clayey soils having pH between 6.5 to 7.5;
- Mainly cultivated by landless uneducated labourers;
- Cultivation is done by only a certain communities who belong to weaker sections;
- There is a great dearth of knowledge about cultivation of water chestnut;
- Lack of government regulated markets;

- No tools are available for plucking and peeling of fruits of water chestnut
- Lack of machines for making different value added processed items;

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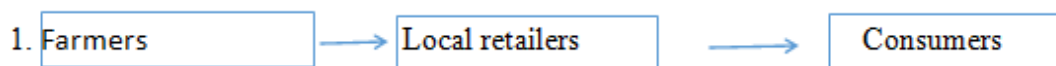
1. Lack of government owned **storage structures (cold storage) at panchayat level**: There is a dire need of such structures where they can keep their produce safely and can get the extended durability for selling the produce at right time when better income is expected.
2. Lack of separate designated/marked place for **singhara mandi** in the local grain mandi: This facility may be created by the district administration of the water chestnut growing districts.
3. There is no subsidy on cultivation of water chestnut: Such provision pertaining to grant of subsidy should also be sought to the state government.
4. Export promotion is not being done even from the cities where air facility is available.

Marketing of water chestnut

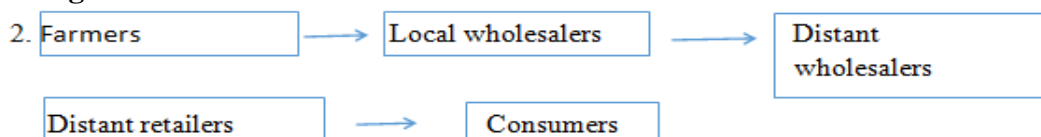
Its marketing is being done at very small level in an unorganized manner and mainly raw water chestnut fruit is sold at a very cheaper rates. Due to this most of the producers are not getting remunerative price. Therefore, the water chestnut producers must be brought in contact with multinational companies who are the bulk purchaser of water chestnut as the farmers are unaware about the different market windows/platforms where they can sale their produce very easily so that they can protect their produce from rotting viz degradation of harvested fruits. The raw water chestnut sellers must be connected with the “**APEDA**” which will educate them about proper packaging and will also provide facilities like hot water treatment, X-ray treatment and issuing quarantine certificate for meeting out the export standard produce.

Currently existing commodity flow channel

Marketing channel-1



Marketing Channel-2



1. The work on fabrication of water chestnut fruit peeler, drier and flour making machines should be initiated on priority basis by the research institutes such as **CIAE, Bhopal** and **CIPHET, Ludhiana**.

2. There is an imperative need of the production of value added products which are having immense nutritional importance.

Uses of water chestnut

- (i) The immature pulp of the fruit, called milky water chestnut, is eaten raw or cooked, while the mature pulp is used to prepare dishes after boiling and drying.
- (ii) Fresh and boiled water chestnuts are used not only as vegetables, but also in tea and in preparing curries.
- (iii) The kernels are dried and sold as nuts, and are also ground into flour for bread (chapattis or poories). The dried nuts (kernels) and flour are sold at Rs 250 and Rs 300/kg, respectively. The nutritive value of the fruits is similar to that of wheat.
- (iv) Water chestnut is also used for preparing tea in Japan, in the commercial production of wine, and for special food during festivals.
- (v) A paste prepared by diluting the dough of water chestnut is an excellent diet for some patients.

The fruit can be consumed raw, boiled, roasted or dried to make flour. The dried kernel is ground to flour called *singhare ka atta* which is used in many religious rituals and can be consumed as a *Phalahar* diet on the Hindu fasting days, in Indian traditional festival “Navratri”.

So many small ponds have been dug up near most of the villages by the government bodies under “*JAL JEEVAN HARIYALI YOJNA*” to improve the status of ground water level. But these water bodies are mainly used for fish cultivation. In such conditions farmers should also be informed that water chestnut cultivation can also be done successfully in a water depth of 1.5’ to 5’ and better return can be achieved. Farmers who are economically sound and having enough land must be encouraged to cultivate water chestnut in some parts of land which are not so much productive for staple crops. They should also be convinced that multi times benefits can be gained by growing water chestnut as compared to paddy and wheat.