# *Ipomoea aquatica* – an aquaculture friendly macrophyte

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Water spinach or 'morning glory', *Ipomoea aquatica* (Forssk) is a common emergent aquatic plant that can grow freely over the water surface or over marshy ground. Named for its beautiful flowers, a single stem can grow up to 20 meters in length with profuse branching, and its apical shoot may advance 10cm per day under suitable conditions. Morning glory is basically a vine, which may form dense masses of tangled vegetation, thus developing impenetrable canopies over the water surface, restricting light penetration into the depths. It is found growing wildly in tropical and subtropical countries and is cultivated widely in China, Indonesia, Thailand, Vietnam, Myanmar, Philippines, Bangladesh, and in India (Naskar, 1990). Morning glory has probably been cultivated for more than 2000 years. It is sold in tightly packed bunches in Asian markets and considered as one of the most cheap as well as delicious leafy vegetables preferred by all groups of consumers – rich and poor.

*Morning glory is widely consumed throughout the region.*

## Morning glory – an ideal substratum for periphyton growth

Morning glory can play a significant role in providing a natural substratum for periphyton, which is an ideal food for many species of fish. Investigations have shown that a number of periphyton species, mostly filamentous algae, grow around the periphery of the stem. Older stems develop a thick mat of periphyton upon which fish graze. The roots developing from each node, also harbour periphyton. In our local investigations, we have periphyton to be principally composed of species from two distinct families viz., Cyanophyceae and Chlorophyceae, along with a variety of zooplankton including *Brachionus* sp. All the algae listed below are filamentous and some of them have holdfasts, a characteristic feature of periphyton.

List of periphyton categorized by family:

**Cyanophyceae**

- *Phormidium sp.*
- *Oscillatoria sp.*
- *Rivularia sp.*

**Cholorophyceae**

- *Ulothrix sp.*
- *Oedogonium sp.*
- *Characium sp.*
- *Microspora sp.*
- *Cladophora sp.*
- *Amphithrix sp.*
- *Chaetophora sp*.

## Morning glory - a support for organic farming

Periphyton-based organic farming is now widely recognised as a source of contaminant-free products in tune with social aspirations and consumer preference. Organic aquafarming is being promoted widely as a safer alternative to the use of chemicals in aquaculture (van Dam, 2002, Azim, 2003). In this connection, morning glory-based substratum may be developed to increase natural productivity of water bodies by producing a large amount of periphyton. The present study has determined that an older stem usually provides a periphyton-covered surface area of about 28 $cm^2$. In organic farming systems, morning glory may act as a suitable substratum to allow the growing of autotrophs around which heterotrophs congregate. This practice gradually helps to enhance the natural productivity of water body by producing a considerable amount of natural food organisms essential for fish culture and production with minimum exogenous input.

## Morning glory – a nutritious aquatic plant

Morning glory has long been cultivated in order to harvest its leaves and stems as leafy vegetables, which are one of the most preferred foods found in the major meal of rural India, particularly in Bengal during the summer months. Nutrients analysis of *I. aquatica* has shown that it contains a remarkably high amount of crude protein and organic matter, along with low of crude fibre, making it potentially suitable as a fish feed component. A critical analysis carried out to investigate the nutritional qualities of *I. aquatica* determined its composition to be 32.2% crude protein, 10.8% crude fiber, 6% crude lipid, 6.0% and 30.0% ash. The total carbohydrate (NFE +crude fibre), was 31.8%. Micronutrient content (per g): vitamin B1 (thiamin), 87μg; nicotinic

acid, 0.6 mg; riboflavin, 120 μg; vitamin C (ascorbic acid), 1.37 mg; along with substantial carotenoids: β–carotene, xanthophylls and taraxanthin. Mineral content included K, 41.4 mg; Mg, 31.0 mg; Zn, 1.7 mg; Cu, 0.1 mg; Ca, 2.0 mg; Na, 5.0 mg; P, 1.0 mg; along with gross energy content, 337.9 kcal per 100g; and protein/energy value was 95.3 mg protein/ kcal.

When formulated feed prepared using *I. aquatica* was given for 60 days to the fingerlings of three carp species viz., *Labeo rohita*, *Catla catla*, and *Cyprinus mrigala* to evaluate its efficacy as a fish feed, feed conversion efficiency (FCR) ranged from 1.8 – 2.5, gain in body weight ranged from 18.2 – 33.3g, protein efficiency ratio ranged from 0.7 – 1.0, and protein retention and specific growth rate were in the range 0.7– 1.0% per day.

Significantly, *I. aquatica* has been found to contain a very low amount of antinutrients as trypsin inhibitor, calcium oxalate, tannin, and phytate, compared to other leafy vegetables. A critical biochemical analysis of fish tissues (liver, muscle + blood) in the post-feeding efficacy of formulated diet containing *I. aquatica* plant has also supported it as a potential fish feed and have been able to enhance in maintaining the fish growth up to optimum level.

## Fish food and fodder

This species can play a significant role directly as a food for fish, especially for grass carp, Ctenopharyngodon idella, a voracious grass eater, which can consume every day an amount of grass equal to its body weight. In such condition, morning glory vegetation may be put and maintained in the periphery of water bodies where grass carp are cultured. In view of nutrient conversion efficiency, maintenance of morning glory vegetation in any water body may also fetch two benefits at a time: Morning glory eating grass carp are to be treated as an organic product that will have more consumer preference, and thus may generate profitable revenue. 2. Morning glory eating grass carp indirectly benefits the health of consumers, as it is a source of rich nutrients that ultimately reach to grass carp eaters. Grass carp along with other fish like rohu (*Labeo rohita*) may be cultured in the same water bodies for organic farming as a part of integration: the former eat morning glory vegetation, while later graze over periphyton assembled around the morning glory stem. It is also used as a fodder given to cattle, pig and goats, which prefer to relish it. Chopped and boiled, it is given to the pregnant cow to improve the health of the young.

## Cultivation

### Pre-cultivation practice

Morning glory grows easily in marshy places or even in full course water bodies. It is propagated by seeds, or by stem cuttings. Packed viable seeds are now available in market. These seeds are sown over marshy places during peak winter period. Farmers collect stem fragments by chopping them into several pieces, each of which must have at least single node from which roots initiate. In case of full course water bodies, long stems can be put at the edge of the ponds, and then fixed in place with bamboo poles.

### Land preparation and plantation

The ground where seeds/ stem cuttings are to be sown/planted should be hydric soil or saturated. There is no need to take any special care to prepare the ground before sowing/planting of seeds/stem cuttings unlike other conventional crops. Seeds are simply sown over the ground, taking one month to reach a harvestable stage.

### Harvest and production

The first harvest may take place one month after seed sowing and then can be done at weekly intervals. During the first harvest, stem cuttings can be prepared for transplantation elsewhere and once established cuttings may be made at any time. It has been estimated that about 60 kg can be harvested per 100 $m^2$ during first cutting, which then induces crop to sprout a number of branches which increase the biomass production even more. Consequently the second harvest may be double that of the first, gradually increasing to four times before beginning to decline.

### Economy

One bundle of morning glory typically weighing around 200 g costs about Rupees 1.50 (1US$=Rs. 45.00). Market surveys have shown that harvesting costs increase up to the fifth harvest and then gradually decline, while the production increases.

## Conclusion

Morning glory cultivation may bring several advantages at a time in the scenario of south Asian perspective. There are vast areas of low lying lands in the region, which remain inundated during post monsoon period and remain exposed as marshy ground till late winter. As morning glory has characteristics of both seasonal crops and perennial vegetation, it may be utilized as circumstance permits: In seasonal wetlands it can be cultivated by sowing seeds in late winter, and yields may be harvested till the early summer when farms can no longer sustain the crop. In full course water bodies, it may be kept and maintained around the periphery of the ponds. In such case, harvesting may be difficult, but it may be used for fish feed, especially for grass carp. In organic farming the young shoots may be harvested for leafy vegetables; simultaneously older stems may continue to provide a periphyton support system for grazing fish like carp. When it is found covering the pond prolifically, it must be thinned out periodically to maintain a suitable density and permit light to penetrate the water. Through these practices low lying inundated areas and wetlands to be used cultivating morning glory to serve the dual purposes – one as a delicious leafy vegetables of high nutritive value and the other as an ideal substratum for carp culture in particular.

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