

Azolla Culture in an Aquaponics Unit

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Azolla (mosquito fern, duckweed fern, fairy moss, water fern) is a aquatic ferns in the family Salviniaceae. Azolla the Super plant that contents 4-5 times more protein than hybrid napier. It is a heterosporous aquatic fern distributed all around the world. Freely floating on the water surface. It can be used in animal and poultry feed as a protein source.

The genus *Azolla* was established by the French naturalist Jean-Baptiste Lamarck in 1783 based on the specimens collected by Philibert Commerson and his assistant Jeanne Baré from the Magellan region of South America during Louis-Antoine de Bourgainville's 1766-1769 expedition around the world:

Azolla is sometimes called 'small duckweed', but this is a misleading name. Azolla is a pteridophyte, whereas duckweed (also known as 'water lens' or 'bayroot') is an aquatic angiosperm (flowering plant) of the family Lemnoideae which has five genera: *Spirodela*, *Landoltia*, *Lemna*, *Wolffiella* and *Wolffia*. Unlike azolla, duckweed does not contain endosymbiotic cyanobacteria. Azolla and duckweed are often found growing together in freshwater ponds, lakes and other bodies of still or sluggish water.

Types of Azolla

There are six species of Azolla – Azolla Carolina, Azolla nilotica, Azolla filiculoids, Azolla Mexicana, Azolla microphylla and Azolla pinnata. The *Azolla Pinnata* is a common species in India. But *Azolla microphylla* is a suitable species for quick biomass production under tropical and sub-tropical climate condition. The most common species of Azolla in India is Azolla pinnata. It produces more than 4 to 5 times of protein of excellent quality in comparison to lucern and hybrid napier.

Characters of Azolla

Azolla is a aquatic ferns characterized by its small floating sporophyte, which consists of a profusely branched stem bearing alternately arranged imbricate leaves and pendulous roots The leaves are

two-lobed: one floating dorsal lobe and one submerged ventral lobe. It must grow in water or wet mud, and it dies within a few hours under dry conditions. Azolla can survive a water pH range of 3.5–10, but optimum growth occurs when the water is between pH 4.5 and 7. The optimum temperature for azolla is between 64 and 82°F (18–28°C).

Azolla hybrids

Hybrids are commonly produced and selected because they have desirable characteristics not found or inconsistently present in the parent individuals or populations. Azolla hybrids have been developed to improve the plant's temperature tolerance and biomass production. For example, hybridization between *A. microphylla* and *A. filiculoides* improves annual biomass production, as illustrated by a study by Van Cat *et al.* (1989). In the parent material, the latter grows better in the spring, while the former grows better in the summer and autumn due to its higher-temperature tolerance. The hybrid, however, produced biomass comparable to that of *A. filiculoides* in the spring and comparable to that of *A. microphylla* in the summer and autumn, thus boosting overall annual production.

Van Cat *et al.* (1989) showed that the hybrid did not show stress (characterized by a red color) under phosphorus- or calcium-deficient conditions and that the hybrid had a higher nitrogen content than the parent *A. microphylla*. Biomass production in the field was also higher in the hybrid than that of *A. microphylla*.

Azolla Cultivation Procedure

Slurry made of 2 kg cow dung and 30 g of Super Phosphate mixed in 10 litres of water, is poured onto the sheet. More water is poured on to raise the water level to about 10 cm. To cover the 6 feet X 4 feet pond, 1 kg of fresh Azolla culture is required. Apply this culture uniformly in the pond. Make sure to have the water depth at least 5 to 6 inches in the pond. This will grow rapidly and fill the pit within 10 – 15 days.

Advantages of Azolla

- It can easily be produced in large quantity required as green manure in both the seasons – Kharif and Rabi.
- It can fix atmospheric CO₂ and nitrogen
- It solubilises Zn, Fe and Mn and make them available to the rice.
- Azolla can be a substitute for chemical nitrogenous fertilizers to a certain
- Azolla helps in weed control and suppresses tender weeds such as Chara and Nitella in rice field.
- In natural way, Azolla releases plant growth regulators and vitamins which are very much required to enhance the growth of paddy crop.
- Azolla helps increase the crop yield and quality. It also plays a great role in functioning as a green manure in order to maintain the fertility of the soil.
- It acts as a renewable biofertilizer not only in paddy fields for growing the productivity of certain crops but also helps to influence soil fertility by decomposing itself rapidly and its nutrients are released in the water to enrich the soil as well as the field suitable for the next crop.
- the role of azolla in livestock production and described the feeding of azolla to dairy cows increased milk production by 15 to 20% and also improved the weight of broiler without any adverse effects.
- Around 10 q of Azolla is required for a hectare of land.

Nutrition value in Azolla

Azolla is very rich in protein (25-35%), Calcium (67 mg/100g) and Iron (7.3 mg/100g). The comparative analysis of the nutrient content of azolla vis-à-vis other fodder source is depicted in the table 1.

Limitations of Azolla Culture

Huge quantity of inoculums is required which is difficult for transplanting action during rainy days. Temperature more than 35°C is not suitable. Extreme low temperature is also not suitable. Non availability of technology to use Azolla as dry inoculum.

Precaution to be adopted in azolla cultivation

- A shady place, preferably under a tree, with sufficient sunlight should be chosen for the Azolla production unit.
- A place of direct sunlight should be avoided.
- All corners of the pit should be of the same level so that the water level can be maintained uniformly
- pH of the medium should be between 5.5 to 7.
- Suitable nutrients such as cow dung slurry, micronutrients should be supplemented as and when required. The gradual decrease of the growth rate in the pond water was mainly due to phosphorus deficiency.
- Temperature is an important factor for good growth. It should be around 35 degrees Celsius.
- Maintenance of pure culture is essential for good yield.
- Azolla should be harvested regularly to avoid overcrowding.

Table 1: Comparison of biomass and protein content of Azolla with other fodder

S. No.	Item	Annual production of biomass (MT/ha)	Dry matter content (MT/ha)	Protein content (%)
1	Hybrid Napier	250	50	4
2	Kolakattao grass	40	8	0.8
3	Lucerne	80	16	3.2
4	Cowpea	35	7	1.4
5	Subabul	80	16	3.2
6	Sorghum	40	3.2	0.6
7	Azolla	1,000	80	24

Source: Dr P Kamalasanan et al. 2004 "Azolla -A sustainable feed substitute for livestock", Spice India.