



## Popular Article

Domain: Agriculture Science

Vol 4 Issue 8, August 2025, 3998-4002

### Azolla- Production and its potential applications

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[DOI:10.5281/TrendsInAgri.16935816](https://doi.org/10.5281/TrendsInAgri.16935816)

#### *Introduction*

In the recent past agriculture as a profession is losing its charm among the farmers. This has been attributed to several reasons; important among them are spiraling cost of inputs coupled with uncertainty in the price of the product. This has been aggravated by non-availability of assured irrigation due to depletion in ground water. This has in turn manifested as distress among the farmers in substantial areas in Andhra Pradesh, Maharashtra, Karnataka and Kerala, which are otherwise considered as agriculturally developed areas. A couple of committees have gone into the root cause of distress and suggested that alternate income generating opportunities can be a major remedy for such disappointment among the farming community. Animal husbandry is one such alternative available to such distressed farmers. Again, availability of quality fodder to the animals is the major impediment in scientific management of animals because India, having only 2.4% of the world's geographical area sustains 11% of the world's livestock population. It accounts for 55% of the world's buffalo population, 20% of the goat population and 16% of the cattle population. This has put unbearable burden on our natural vegetation. Azolla, hitherto used mainly as a green manure in paddy has tremendous potential to meet the growing demand for fodder among the small farmers taking up animal husbandry.

#### **About Azolla**

Azolla is an aquatic floating fern, found in temperate climate suitable for paddy cultivation. The fern appears as a green mat over water. The Blue Green Algae cyanobacteria (*Anabaena azollae*) present as a symbiont with this fern in the lower cavities actually fixes atmospheric nitrogen. The rate of nitrogen fixed is around 25 kg/ha. As green manure, Azolla is grown alone for two to three weeks in flooded fields. Afterwards, water is drained out and Azolla fern is incorporated in the field before transplanting of paddy. Otherwise, 4-5 q of fresh Azolla is applied in standing water one week after planting of paddy. Dry Azolla flakes can be used as poultry feed and green Azolla is also a good

feed for fish. It can be used as a bio-fertilizer, a mosquito repellent, in the preparation of salads and above all as a bio-scavenger as it takes away all heavy metals.



### **Nutrition value in Azolla**

Azolla is very rich in proteins, essential amino acids, vitamins (vitamin A, vitamin B12, Beta Carotene), growth promoter intermediaries and minerals including calcium, phosphorous, potassium, ferrous, copper, magnesium. On a dry weight basis, azolla has 25-35% protein content, 10-15% mineral content, and 7-10% comprising a combination of amino acids.

### **There are five species of Azolla**

- *Azolla carotina*
- *Azolla filiculoids*
- *Azolla mexicana*
- *Azolla microphylla*
- *Azolla pinnata*

The *Azolla pinnata* is a common species that is highly used in India

### Preparation of Azolla

For scientific and continuous production of Azolla requires cement concrete tanks or pits lined with tarpaulin sheet of size 6 ft long, 4ft wide, and 1ft deep as shallow depth is ideal for Azolla growth. Due care should be taken so that water can stand in the tank or pit. Sieved fertile soil mixed with dung and water must be evenly plastered at the bottom of tanks. Fill the tank with water till the water collects to a height of 10 to 15 cm above the soil. Allow the soil particle to settle down. Remove the layer of foam and scum that forms on the surface of the water. The foam impedes the growth and root penetration of Azolla. Allow the tank to stand overnight. On the following day, spread around 200 g of fresh Azolla inoculum over the surface of the water. It takes about 1-2 weeks for Azolla to form a mat over the water surface. The water level in the tank should be maintained especially during the summer months. To reduce excessive ambient light, a shade made out of coconut leaves/Shade net may be laid above the tank. This also prevents dew formation on the growing Azolla during winter.

Initially, Azolla will spread over the entire bed and will take the shape of a thick mat within seven days. After the seventh day, 1.5 kg of Azolla can be harvested every day. Azolla should be harvested in plastic trays with sieve. The Azolla wash can be used as bio-manure for plants grown nearby. Cow dung mixture removed by Azolla mass has to be supplemented at least once seven days after harvest. A mixture made of cow dung, soil, and water should be added once in seven days. After every 60 days, the soil is removed from the bed and another 15 kg of fresh fertile soil is added into the bed to avoid nitrogen build-up and also provide nutrients to the Azolla. Fresh inoculation of Azolla after removing soil and water should be made at least once in six months repeating the whole process afresh.

### Importance of Azolla

#### 1. Agricultural Importance

- **Biofertilizer:** Contains *Anabaena azollae* (a nitrogen-fixing cyanobacterium) that enriches soil with nitrogen. Reduces the need for chemical nitrogen fertilizers in rice fields by **up to 30–40%**.
- **Green Manure:** When incorporated into soil, it decomposes quickly, improving soil fertility and structure.
- **Weed Control:** Grows rapidly and forms a dense mat over water, suppressing weed growth in paddy fields.

#### 2. Livestock

##### Animal Feed:

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- Rich in **protein (20–30%)**, vitamins, and minerals.
- Used as feed for cows, poultry, pigs, goats, and rabbits.
- Improves milk yield in cattle and egg production in poultry.

**Fish Feed:**

- Supports aquaculture by serving as natural food for fish and ducks.

**3. Environmental Importance**

- **Carbon Sequestration:** Absorbs large amounts of carbon dioxide during growth, helping combat climate change.
- **Bioremediation:** Can absorb heavy metals and nutrients from wastewater, purifying it.
- **Eco-friendly farming:** Reduces reliance on chemical fertilizers and pesticides.

**4. Economic Benefits**

- **Low-cost alternative:** Farmers save money by reducing fertilizer use.
- **Sustainable agriculture:** Supports organic farming systems.
- **Income generation:** Azolla cultivation can be done in small ponds at home or farm level for feed and manure.

**Utilization of Azolla as Animal****1. For Dairy Cattle & Buffaloes**

- **Nutrient-rich** (20–30% protein, amino acids, vitamins, beta-carotene, minerals like calcium, iron).
- Fed **fresh (after washing)**, either:
  - **Mixed with concentrate feed or bran** (1–1.5 kg/day per animal).
  - Directly with fodder.
- Benefits:
  - Increases **milk yield**.
  - Improves **milk quality** (fatter and SNF – solids-not-fat).

**2. For Poultry**

Can replace **20–25% of commercial poultry feed**.

- Methods:
  - Mixed with regular poultry mash.
  - Fed fresh in chopped form.
- Benefits:
  - Improves **egg production**.
  - Enhances **egg yolk color** due to beta-carotene.
  - Boosts immunity and growth in broilers.

### 3. For Goats and Sheep

- Fed fresh or dried (mixed with concentrate feed).
- Improves growth rate and weight gain.
- Reduces feed cost significantly.

### Utilization of Azolla as a Nutrient to Crops

#### 1. As Green Manure

- Azolla is grown in waterlogged fields (like rice paddies).
- After 2–3 weeks of growth, it is incorporated into the soil before or after transplanting rice.
- It decomposes quickly and releases:
  - **Nitrogen (40–60 kg/ha per crop season)**
  - Phosphorus, potassium, and micronutrients.
- Improves **soil fertility** and reduces need for chemical fertilizers.

#### 2. As Dual Crop (Rice + Azolla)

- Azolla can be grown **alongside rice**.
- It forms a floating mat on the water surface, fixing nitrogen continuously.
- Provides **20–30 kg N/ha** during the crop season.
- Also **suppresses weeds** by covering water surface.

#### 3. As Soil Conditioner

- When incorporated, Azolla adds **organic matter** → improves soil texture, aeration, and water-holding capacity.
- Enhances microbial activity in soil.

#### 4. In Crop Rotation & Intercropping

- Can be used in **crop rotations** with paddy, vegetables, and pulses to maintain fertility.
- In dryland farming, Azolla biomass (collected from tanks/ponds) can be applied to fields like compost.

#### 5. Nutrient Release

Within **7–10 days of incorporation**, Azolla decomposes and releases nutrients:

- **Nitrogen** (acts like urea but eco-friendly).
- **Organic carbon** (boosts microbial life).
- Improves availability of **P & K** by mobilizing them.