

No-1: Azolla: As an Organic Manure for Sustainable Farming

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The Green Revolution of the 1960s, driven by tireless efforts of agricultural scientists, policy makers and farmers, transformed India's farming landscape. The combined use of high-yielding varieties of seeds, improved irrigation systems and chemical fertilizers played a crucial role in achieving food self-sufficiency. The Green Revolution achieved the nation's main goal: ensuring two meals a day for everyone. Among chemical fertilizers, urea, DAP and potash have been the most widely used in agriculture. In Bihar, where agriculture, livestock and fisheries form the backbone of the economy, farmers are relying heavily on these fertilizers. However, rising prices and declining soil fertility has emerged as a serious economic and agricultural crisis. Today, chemical fertilizers have become almost essential, but their unbalanced and indiscriminate use driven by limited awareness of soil nutrient requirements is causing adverse effects on farmers' income, soil health, environment sustainability and fertilizer supply chains. Balanced Use of Fertilizer (BUF) campaign or *Khet Bachao Abhiyan* of Govt of India is an attempt towards addressing these issues.

According to the Fertilizer Association of India's Annual Report (2024-25), the consumption of NPK fertilizers reached 32.93 million metric tonnes, marking a 7.5% increase compared to 2023-24. India's imports of urea, DAP/NP and MOP during 2024-25 stood at 5.65, 4.57, 2.27, and 3.54 million metric tonnes, respectively. Volatility in global raw material prices and geopolitical instability in West Asia have further disrupted fertilizer production and imports, directly increasing farming costs.

In such a situation, natural and biological alternatives have become essential for sustainable development. One such promising solution is Azolla, a naturally available bio-resource that can significantly reduce dependence on chemical nitrogen fertilizers and lower cultivation costs. Yet, due to lack of awareness, its use remains limited to only a small group of progressive farmers.

What is Azolla?

Azolla is a free-floating aquatic fern that plays a significant role in addressing nitrogen (N) deficiency, especially in paddy cultivation. Within its leaf cavities lives a symbiotic nitrogen-fixing cyanobacterium (*Anabaena azollae*), which absorbs atmospheric nitrogen and converts it into a usable form by plants. Because of this natural nitrogen-fixing ability, Azolla is often referred to as the "powerhouse of nitrogen." It acts as a highly effective biofertilizer and green manure for crops like rice. Under favourable conditions, Azolla can double its biomass every 5-7 days, producing about 3-9 tonnes of dry matter per hectare annually. Its growth is influenced by temperature, light, nutrients and water pH. The optimal temperature range is 20-30°C; growth slows below 15°C and stops above 35°C.

Simple method of Azolla production

Azolla cultivation can be done easily at the farm level. A 2×2 meter pit is prepared in a shaded area and lined with plastic sheets. About 10-15 kg of fertile soil and 2-3 kg of cow dung are added, followed by water to maintain a depth of 10-12 cm. Then 100-500 grams of fresh Azolla is introduced. Within 7-10 days, Azolla spreads rapidly and becomes ready for harvesting. With proper maintenance of water and nutrients, continuous production can be achieved. Azolla can also be produced in field conditions where water level can be maintained. Application of phosphatic fertilizer like SSP or rock phosphate (@2-5 g P₂O₅ /square meter) as per soil fertility enhances growth of azolla growth and production.



Figure: Azolla production in tanks

Importance of Azolla in agriculture

Azolla serves as an excellent organic fertilizer in farming. Its use can significantly reduce the need for chemical nitrogen fertilizers. In paddy fields, about 200-300 kg of fresh Azolla per acre can be applied 7-10 days after transplantation. It spreads quickly on the water surface, multiplies, fixes atmospheric nitrogen and improves soil fertility. It also reduces water evaporation, helping retain soil moisture for longer periods and reducing irrigation needs. Additionally, Azolla helps suppress weed growth by forming a natural cover on the water surface. Beyond paddy cultivation, Azolla is also used in wheat, maize, vegetables and horticultural crops as organic manure and mulch after composting. When incorporated into the soil, it increases nitrogen and organic carbon content, thereby improving soil fertility and structure. Its regular use enhances crop growth and yield while reducing cultivation costs, making it especially beneficial for small and marginal farmers.

Use in fisheries

Azolla also plays an important role in fisheries. It contains about 20-25% protein along with calcium, iron and vitamins, making it a highly nutritious feed supplement for fish. Grass carp, which prefers aquatic plants and green feed, benefits greatly from Azolla. However, it should be used in controlled quantities, as excessive coverage of pond surfaces may reduce oxygen levels. Proper use of Azolla in fish ponds improves growth rates and reduces dependency on

expensive commercial fish feed, thereby lowering production costs and increasing income for small fish farmers in rural areas.

Role in animal husbandry

In livestock farming, Azolla is highly valuable as “green fodder.” Rich in protein, minerals, and vitamins, it can be used as a supplementary feed for cattle, buffaloes, goats, pigs and poultry. Regular feeding of Azolla can increase milk production in cattle by 10-20% and improve overall animal health. In poultry farming, it has been observed to enhance egg quality. In the face of rising fodder costs, Azolla offers a low-cost and nutritious alternative for livestock farmers.

The need for awareness

Despite its multiple benefits, Azolla remains underutilized and is largely confined to a small number of progressive farmers only. Most farmers are unaware of its potential due to lack of training and outreach. There is an urgent need to promote awareness at the grassroots level through agricultural extension programs on **balanced fertilizer usage campaigns**. Training farmers in simple Azolla cultivation techniques, nutritional benefits and economic advantages can bring transformative changes in agriculture, fisheries, and livestock sectors. At a time when farming costs are rising and dependence on chemical fertilizers is becoming unsustainable, Azolla emerges as a promising natural solution. The need of the hour is to take this technology from research stations to villages and fields. With proper policy support, training and awareness, Azolla can play a crucial role in strengthening self-reliant and sustainable agriculture.

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