JUST AGRICULTURE
multidisciplinary e-Newsletter

AZOLLA –AN ASSET TO AGRICULTURE

Vasudha Kak[1], Kunal Kishor[2], Keerti Singh[3]
[1]Project Fellow, ICAR-Indian Agricultural Research Institute, New Delhi
[2]Professor, Department of Microbiology, School of Allied Health Sciences, Sharda University, Greater Noida
[3] Professor, Department of Microbiology, Shri Guru Ram Rai University, Dehradun

ARTICLE ID: 006

Management of soil fertility has been the preoccupation of farmers for thousands of years. The use of commercial fertilizers has increased steadily in the last 50 years, rising almost 20-fold to the current rate of 100 million tonnes of nitrogen per year. Without commercial fertilizers, it is estimated that about one-third of the food produced now could not be produced. Fertilizers enhance the growth of plants. This goal is met in two ways, the traditional one being additives that provide nutrients. The second mode by which some fertilizers act is to enhance the effectiveness of the soil by modifying its water retention and aeration.

Now-a-days suitable biotechnological approaches are into practice which can be therefore used to improve the overall crop health and productivity. Biofertilizers also called as Bio-inoculants, are those organic preparations which contain microorganisms that are beneficial to agricultural production particularly with respect to Nitrogen and Phosphorous. When it is applied as seed treatment or as soil application, they have the tendency to multiply rapidly and develop a thick population in the rhizosphere. Biofertilizers can fix atmospheric N through the process of biological nitrogen fixation (BNF), solubilize plant nutrients like phosphates and stimulate plant growth through the synthesis of growth-promoting substances.

CLASSIFICATION

Fertilizers are classified in several ways. They are classified according to whether they provide a single nutrient (e.g., K, P, or N), in which case they are classified as "straight fertilizers." "Multinutrient fertilizers" (or "complex fertilizers") provide two or more nutrients, for example, N and P. Fertilizers are also sometimes classified as inorganic (the topic of most of this article) versus organic. Inorganic fertilizers exclude carbon-containing

JUST AGRICULTURE
multidisciplinary e-Newsletter

materials except for ureas. Organic fertilizers are usually (recycled) plant- or animal-derived matter. Inorganic are sometimes called synthetic fertilizers since various chemical treatments are required for their manufacture. One of the major kind of fertilizers which are getting in use these days are biofertilizers.

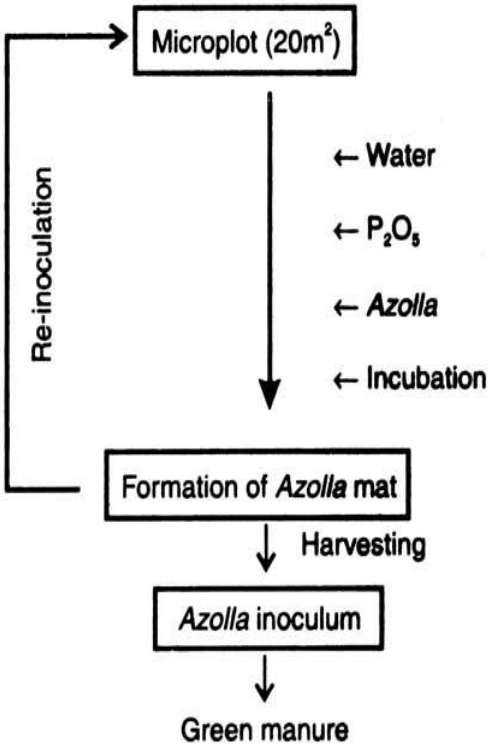
Azolla is also used as a biofertilizer in temperate as well as tropical rice-growing areas. Azolla has been in use widely in countries like China and Vietnam for centuries but it is of a recent introduction in India. Presently there are several *Azolla* species which are under cultivation in India. The global collections of several species of *Azolla* are maintained at CRRI (Cuttack). Within the leaf cavity filaments of *Anabaena azollae* are present. Studies indicate that *Azolla* released nitrogen after its decomposition. It is further observed that about 67% of fixed nitrogen by *Azolla* is released for crop use within 35 days of inoculation.

MASS CULTIVATION OF *AZOLLA*

Microplots ($20m^2$) are prepared in nurseries in which sufficient water (5-10 cm) is added. For good growth *of Azolla*, 4-20 Kg P_2O_5/ha is also amended. Optimum pH (8.0) and temperature (14-30°C) should be maintained. Finally, microplots are inoculated with fresh *Azolla* (0.5 to 0.4 Kg/ m^2). An insecticide (furadon) is used to check the attack of insects. After three, week of growth mat formed by *Azolla* is harvested and the same microplot is inoculated with fresh *Azolla* to repeat the cultivation.

Azolla mat is harvested and dried to use as green manure. There are two methods for its application in the field: (a) incorporation of *Azolla* in soil prior to rice plantation, and *(b)* transplantation of rice followed by water draining and incorporation of *Azolla* (Singh, 1977, 1979, 1980). However, reports from the IRRI (Philippines) reveal that growing of *Azolla* in rice field before rice transplantation increased the yield equivalent to that obtained from 30Kg N/ha as urea or ammonium phosphate.

JUST AGRICULTURE
multidisciplinary e-Newsletter



AZOLLA BENEFITS:

Ø ***Azolla* as a Nitrogen fertilizer for increasing crop yields:** The Nitrogen fertilizer fixed by Azolla becomes available to the rice after the *Azolla* mat is incorporated into the soil and its nitrogen begins to be released through decomposition. For Azolla, it takes 25 to 35 days to provide enough nitrogen for a 4 to 6 ton/ha rice during the rainy season, or a 5 to 8 ton/ha crop under irrigation during the dry season.

Ø **Maintaining soil fertility:** Incorporation and decomposition of *Azolla* will form a humus compound. Humus increases the water holding capacity of soil and promotes aeration, drainage, and aggregation essential for highly productive soils. Organic matter can bind together soil particles and makes clayey soil more friable. Apart from its influence on soil properties, *Azolla* is important in the cycling of nutrients while *Azolla* is growing in Paddy, it fixes N**Error! Filename not specified.** and absorbs nutrients out of the water. When the *Azolla* is composed with the soil and humus is formed and these nutrients are slowly released into the soil as decomposition progresses.

JUST AGRICULTURE
multidisciplinary e-Newsletter

Controlling the growth of Aquatic weeds: It is commonly believed that *Azolla* suppresses the growth of certain aquatic weeds. Weed growth is suppressed once *Azolla* forms a thick, light-proof mat. There are mainly two mechanisms, the most effective method is the light-starvation of young weed seedlings by the blockage of sunlight. And the other is the physical resistance to weed seedling is exposed to heavy, interlocking *Azolla* mat. In the case of weed-infested rice fields, the benefit from *Azolla* weed suppressions may even surpass its benefit as a nitrogen source. Rice seedlings are not affected by Azolla's weed suppression effect because when transplanted, they stand above the *Azolla* mat.

How *Azolla* Increases Yield of Paddy and its Benefits to Farmers

For growing Paddy crop, less than 5% of the nitrogen delivered by *Azolla* immediately. The remaining 95% nitrogen remains in the Azolla's biomass will be utilized until the plants die. Once the *Azolla* plant decomposes, its organic nitrogen will be mineralized and released as ammonia, which is readily available as a biofertilizer for growing rice plants.

There are methods available to maximize the Azolla's nitrogen fertilization, with the result that *Azolla* now has enormous potential to increase rice production worldwide.

When you cultivate paddy with the chemical fertilizers, we spend approximately Rs. 1,500 per acre. And with *Azolla*, the cost of cultivation can come down to 25%. Azolla can increase the paddy yield by 30-40%.

Farmers can create their own nursery for growing this fern. The field for growing *Azolla* should be plowed, leveled, irrigated and we should form small ponds. And it needs 15-20 cm of standing water in the fields. And the farmer may need green *Azolla* at the rate of 20 kg per hectare and it should be mixed with fresh cow dung and then released into the pond.

CONCLUSION:

So with this we come to the conclusion that Biofertilizers do have an edge over other kinds of fertilizers and using one such i.e. *Azolla* can prove beneficial for the farmers of our country by enhancing growth and production.

JUST AGRICULTURE
multidisciplinary e-Newsletter

REFERENCES

1. Wagner, G.M. (1997). "*Azolla*: a review of its biology and utilization". *Bot. Rev*. **63**: 1–26.

2. Evrard, C.; Van Hove, C. (2004). "Taxonomy of the American *Azolla* species (Azollaceae): A critical review". *Systematics and Geography of Plants*. **74**: 301–318.

3. D. Casanova, J. Goudriaan, M. M. C. Forner, and J. C. M. Withagen, "Rice yield prediction from yield components and limiting factors," *European Journal of Agronomy*, vol. 17, no. 1, pp. 41–61, 2002.

4. Kolhe S S, Mitra B N 1987. Effect of *Azolla* as an organic source of nitrogen in rice-wheat cropping system. J Agro. Crop Sci., 159, 212–215.

5. Lumpkin T A, Plucknett D L 1982. *Azolla* As a Green Manure: Use and Management in Crop Production. Westview Press, Boulder, Co., 230 p.

6. Raja N: Biopesticides and biofertilizers: ecofriendly sources for sustainable agriculture. J Biofertil Biopestici. 2013.