Azolla Plant

BY

Dr. Padmakantha Wanduragala

BSc(Bot);(sp), MSc(Agri), PhD(Bio-Phy)

E-mail psbwanduragala@gmail.com

The Azolla

A Fertilizer to Save The Environment

&

to Save Money

A lecture on Non - Poisonous Modern Technology Indigenous Farming

By
Dr. Padmakantha Wanduragala

Organized by Government Medical Officers Association and
Association of Scholarly Practitioners
Sri Lanka

01

Let's identify the Azolla plant

Azolla plant is a small plant belonging to the type of fern that grows floating in water. It is a fast growing green plant that absorbs nutrients through its roots. The specialty of this plant is the ability to fix atmospheric Nitrogen by the Cyanobacteria Anabina azollae (*Anabaena azollae*) which lives symbiotically in its leaves. This makes atmospheric nitrogen available for plants to utilize. Currently, various countries of the world have been tempted to use the Azolla plant as a natural way to provide nitrogen nutrients required for farming, which is a big problem at present. Thus, it can be used as a source of nitrogen in an environmentally friendly manner at a low cost. There is information that the Azolla plant has been used since ancient times. For centuries, it has been recognized as a useful plant in countries such as China, Vietnam, Japan, Thailand, and the Philippines, and has been used as a natural fertilizer in agriculture, especially for rice cultivation, due to its ability to fix Nitrogen. It has also been used as animal feed in animal husbandry.

Later, with the popularization of chemical fertilizers, the knowledge about Azolla gradually disappeared. About 35 years ago, when Dr.Padmakantha Wanduragala worked as a research assistant in the Department of Botany, University of Peradeniya, he conducted experiments on the use of this Azolla plant to supply Nitrogen nutrients to rice cultivation and submitted research reports.

But up to now, no authority has taken advantage of this. Our effort is to put this knowledge to use by popularizing it.

02

Botanical information of Azolla plant

Azolla is a small plant that floats on the surface of water with a short branched stem bearing branch roots. It obtains nutrients from water through its root system. Also, a very fast growing plant. The most important thing is the symbiosis of a species of Nitrogen-fixing Cyanobacteria in the leaves of Azolla plants. The organism obtains the nutrients it needs from the plant and passes atmospheric Nitrogen to the host plant.

03

Scientific nomenclature of Azolla plant.

In scientific nomenclature, plants and animals are identified and systematically classified according to a taxon hierarchy. Several species of the Azolla plant belonging to the plant kingdom can be identified. The scientific nomenclature of one of them, *Azolla caroliniana*, is as follows.

Domain	Eukaryota
Kingdom	Plantae
Phylum	Pteridophyta
Class	Filicopsida
Family	Azollaceae
Genus	Azolla
Species	Azolla caroliniana

04
Azolla plant species

Dr. Padmakantha Wanduragala has used several species of Azolla plants for his research work.

They are,

- *Azolla filiculoides*
- *Azolla pinata*
- *Azolla microphylla*
- *Azolla imbricata*
- *Azolla caroliniana*

Among these Azolla plant species, *Azolla caroliniana* has been shown to be the most appropriate plant species to be used to provide nitrogen for paddy cultivation in Sri Lanka, suitable for the Sri Lankan environment.

Azolla Microphylla

Azolla Imbricata

Azolla Pinnata

Azolla Filiculoides

Azolla Caroliniana

05

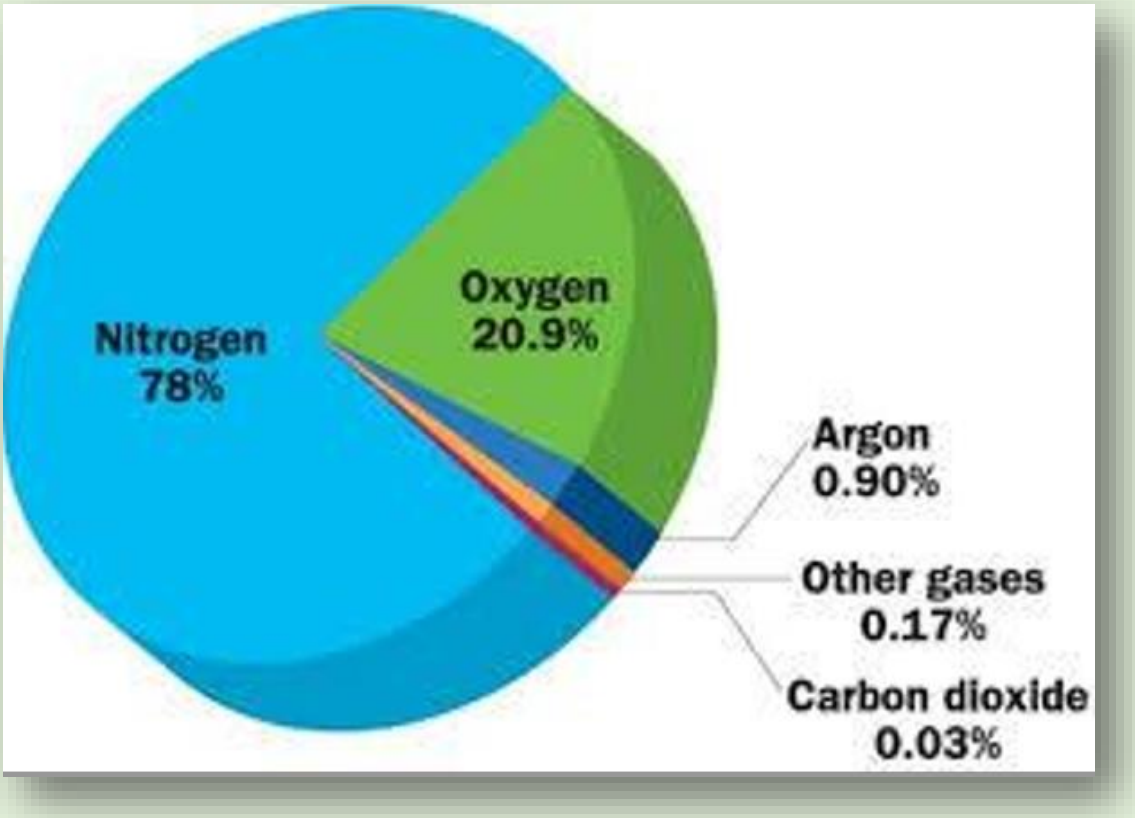
Distribution of Azolla plant.

The Azolla plant grows in ponds, reservoirs and rice field in warm and tropical regions around the world. It is extremely sensitive to moisture. Therefore, water is an essential element for its growth. Azolla plant require about 25% - 50% sunlight for growth. The optimum temperature is around 25^0C. Azolla plant grows very rapidly under these optimal environmental conditions.

06

How Azolla plants Fix atmospheric nitrogen

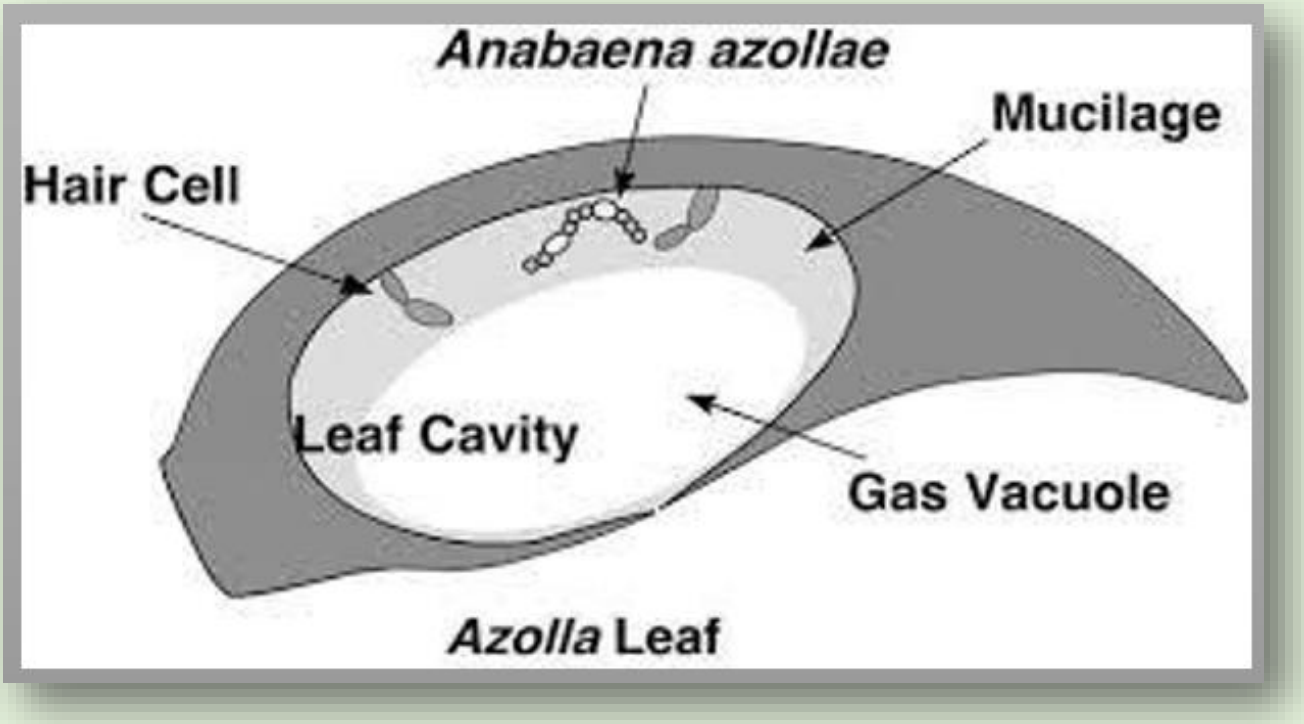
Nitrogen is an essential element for plants to sustain their life. Plant roots absorb those elements from the soil solution. The main source of nitrogen is the atmosphere. About 78% of the atmosphere is nitrogen gas. But plants are not able to absorb this nitrogen gas directly. For that, it should be made to be able to be absorbed by the plants.



Composition of the gases in the atmosphere

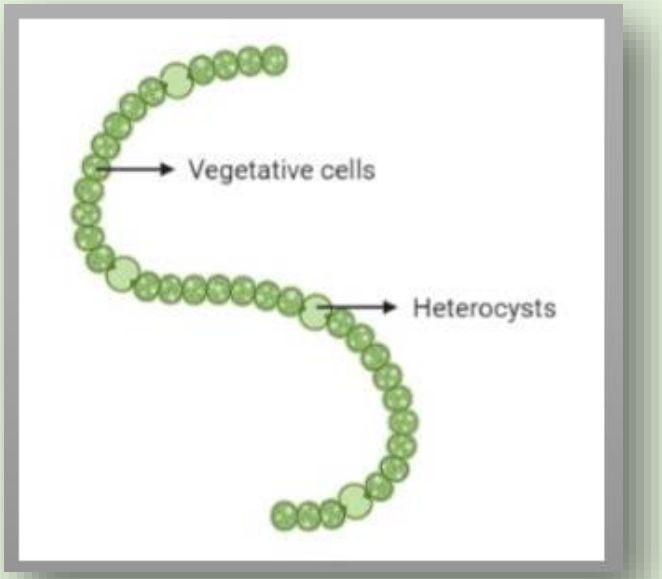
Thus, some bacteria and blue-green algae have the ability to make atmospheric Nitrogen absorbable by plants. Anabeana and Nostoc, Azotobacter, Rhizobium are some such Cyanobacteria species. They can be seen in two ways, namely,

1. Free-living Nitrogen fixing
2. Living symbiotically with another group of organisms as nitrogen fixing organisms.



How cyanobacteria live in Azolla leaves

Heterocyst cell type specialized for Nitrogen fixation in these protozoan cyanobacteria. It contains the enzyme Nitrogenase.



Anabaena azollae

The enzyme converts atmospheric nitrogen gas into Ammonium ions. ($N_2 > NH_4^+$)

Thus plants can meet their Nitrogen requirement.

Anabaena azollae

07

How to grow Azolla plant

The preparation of Azolla plant specimens to be used in rice cultivation should be done outside the farm land. For this it is necessary to make a shallow tank. A cement tank is ideal. It is enough to be 8 meters long, 1 meter wide and 8 inches deep. After that, paddy soil is filled to a height of 8 inches. The Pond is filled with water to a height of about 2 inches, and finally a plant sample is introduced into it. Within few days after the introduction of the Azolla plant, this plant spreads rapidly throughout the water level of the tank. Then they can be used for cultivation as per requirement.

A cultivated tank prepared for the cultivation of Azolla.

Azolla plant specimens

08

How to use it for rice cultivation

Azolla plant is used for rice cultivation in two ways.

The first method

One method is to prepare plots before starting rice cultivation and apply a small sample of plants to each plot. In a very short time, they develop well throughout the tank. Then the plant is buried.

The second method

The other method is to let the Azolla plant grow in the field, and after the field have grown to some extent, with the help of a weeder, the Azolla plants are buried in the soil. This can only be done if paddy plants are grown in a row. After being buried in the soil, the nutrients contained in the plants are added to the soil by the decomposition of the plants. They can be absorbed by the plant.

As the Azolla plant grows as a layer, the growth of wild plants is stunted. This reduces the use of herbicides.

With the help of a weeder, submerge the plant in the soil

09

Can Azolla plants pollute reservoirs.?

There is an opinion that when the Azolla plant is used for rice cultivation, it can spread to the water sources through water and grow all over the water level of the reservoirs like Common water hyacinth and salvinia and they can also be polluted. But the Azolla plant does not grow like that throughout the reservoir.

Hyacinth polluting water

10

How to use Azolla for animal feed

Azolla plants are used for animal feed in animal farms. Azolla in tanks should be washed thoroughly before feeding to animals. Thus purified and prepared Azolla can be mixed with rice or other animal feed or hay or given to animals. About 2kg per day for cattle and 0.5kg per day for goats can be given along with other animal feed. Also for hens 0.2kg - 0.3kg can be given along with other animal feed. This Azolla feed is beneficial for every animal on the farm.

Usages as an animal feeds

11

Let's save the environment with Azolla.

Every human activity should not exceed the environment and support the environment. Farming, which is a human activity, has an impact on the environment. But the traditional Sri Lankan agricultural culture did not harm the environment. It is not because of anything else but because natural techniques have been used for it. Fixing of nitrogen through Azolla can be pointed out as such a natural method used in agriculture. It also saves the environment because it is a natural method that fix the nitrogen needed for cultivation. By adding Azolla to the soil, it provides the fertilizer required for cultivation. Azolla also helps to control invasive weeds in reservoirs. Azolla is also used as an animal feed and the waste of animals that get a natural feed is also disposed of in a way that does not harm the environment. Azolla product is natural. Chemical free. Azolla is completely natural because no oil, machinery or artificial methods are used in the production of Azolla for cultivation. There is no environmental damage. Azolla production requires

only water and paddy soil. So, without working hard to save the environment, let's fix the nitrogen requirement of the paddy through Azolla.

11

Special message

The Azolla plant is a wonderful product of nature. This fixers atmospheric nitrogen for living organisms. Therefore, the Azolla plant can be used in agriculture as an environmentally friendly nitrogen source at no cost to the farmer. Also, it does not cause any harm to the environment.

It is a very valuable work to contribute to the establishment of sustainable farming in our motherland through the transmission of the knowledge you have gained about the importance of the Azolla plant through this booklet to the next generation.

Thank You..!

Translate By C.Dilshan Jayasinghe
078 88 63 369 – Whatsapp and Phone