

Diazotrophs Enrich Soil Texture and Promote the Yield of *Cyamopsis Tetragonoloba*

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Research Article

Received: 05/08/2021

Accepted: 19/08/2021

Published: 26/08/2021

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Keywords: Diazotrophs; *Cyamopsis*
tetragonoloba;

ABSTRACT

Diazotrophs has been shown to enhance the moisture holding capacity of the soil and reduce environmental pollution. Application of diazotrophs (*Oscillatoria* and *Azolla pinata*) to the soil bed promoted the growth of beneficial microbes and secretion of soil conducting substances by these microbes. It enhanced the early growth and yield attribute properties in legume plants like *Cyamopsis tetragonoloba*. A report showed that treatment of (500g/Kg) diazotrophs increase soil nutrients than the control. Potassium was decreased 50% when the soil treated with 500mg/Kg *Oscillatoria* species respectively over control. The increment of nitrogen was 20%, when the plants treated with *Anabeana azollae* (*Azolla pinnata*) 500mg/Kg soil, respectively over control.

INTRODUCTION

Soil is a store house for organic plant nutrients. The soil is subjected to a continuous depletion of nutrients due to its continuous use by crops. A good quality soil is one that is 45% minerals (sand, silt, and clay), 25% water, 25% air, and 5% organic and living matter. The mineral portion of a soil which makes up half of the volume contains about 93% silica, aluminium and iron oxides; 4% calcium, potassium and magnesium oxides and 3% titanium, sodium and very small amount of nitrogen, sulphur, phosphorous, boron, manganese, zinc, copper, chlorine, molybdenum and many other elements. However, of all these minerals only fourteen are essential to plant and these are called essential elements Depletion of soil fertility, low fertilizer-use efficiency and growing environmental pollution are of major concern to agriculture, in terms of crop productivity. The microbes have been known to contribute to the soil fertility and sustainable green energy production. Besides, abundant use of chemical fertilizers leads to increased yield, but it also results in increased soil salinity decreased soil porosity and in generally poor soil health. Cyanobacteria have an emerged potential as biofertilizer which are economical and environment friendly (Chittora et al., 2020). Cyanobacteria commonly known as blue-green-algae are not truly eukaryotic algae. They are Gram-negative prokaryotes, perform oxygenic photosynthesis, and also fix atmospheric N₂. They are ubiquitous in ponds, lakes, water streams, rivers, and wetlands. cyanobacteria could play a potential role in the enhancement of

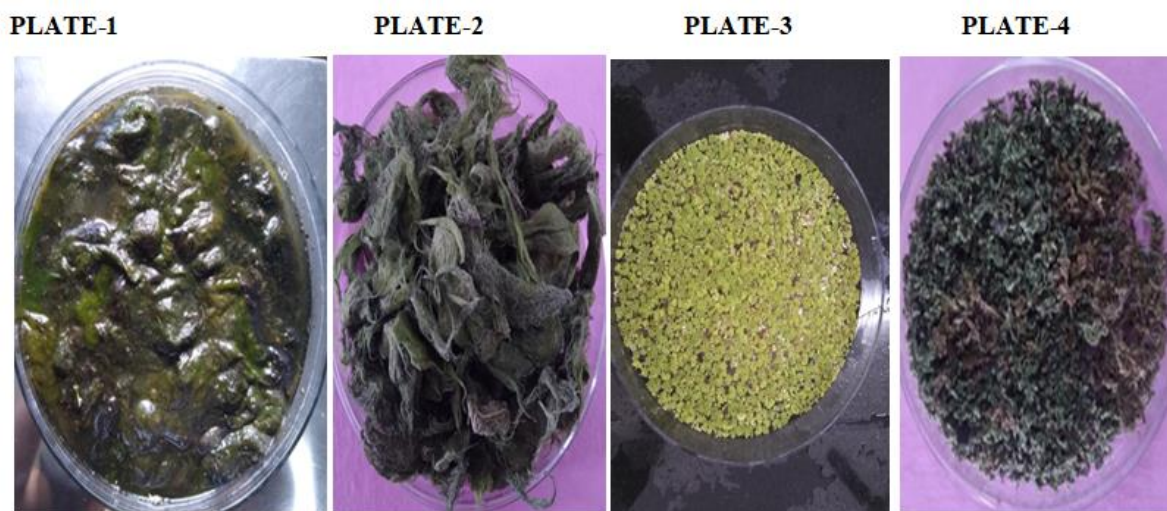
agriculture productivity they can easily survive the extreme environments such as hot springs, hyper-saline waters, freezing environments, and arid deserts. Blue green algae such as *Oscillatoria* and *Anabaena* their association with crop plants are being exploited in the production of biofertilizers [1]. *Oscillatoria* is a genus of filamentous cyanobacterium consists of a single row of cells forming trichomes or un-branched filaments with a very thin gelatinous sheath. *Azolla* is one of the aquatic pteridophyte that may be used as animal food, as green manure biofertilizer. It's symbiotic relationship with the nitrogen-fixing blue-green alga (cyanobacterium) *Anabaena azollae*. This symbiosis helps in the quick growth and multiplication of the fern and in quick growth and multiplication of the fern and in the creation of a huge amount of biomass on the water surface. It is then harvested, dried and used as biofertilizer to supplement the needs of nitrogen in many plants. This study was carried out to utilize the available Diazotrophs, (*Oscillatoria* and *Anabaena azollae*) in soil and to analyze the growth promoting and nutritional values of *Cyamopsis tetragonoloba*.

MATERIAL AND METHODS

The diazotrophs sample *Oscillatoria* was collect from Karapattu, a village pond Ganasapuram, Krishnagiri Dist of Tamilnadu state, India. *Anabaena azollae* was cultivated and collected from Karapattu. The collected algal sample were identified by using the key of Prescott. After the identification, the algal material was spread on blotting paper to remove excess water. They were shade dried. The dried samples are weighed used for different concentration on further analysis. The soil samples were analyzed at Tamilnadu Govt. Agriculture department, Krishnagiri, Tamil Nadu, South India (Figure 1) [2].

Oscillatoria: *Oscillatoria* is a filamentous cyanobacterian algae has single row of cells form trichome around a very thin gelatinous sheath. The alga was dark blue green in colour, growing in clusters at the bottom of the stream.

Figure 1. Different plate materials of *Oscillatoria* species.



- Plate 1: Collected materials of *Oscillatoria* species.
- Plate 2: Dried materials of *Oscillatoria* species.
- Plate 3: Cultivated material of *Anabaena azollae* (*Azolla pinnata*)
- Plate 4: Dried material of *Anabaena azollae* (*Azolla pinnata*)

Azolla: *Azolla* is a small leaf floating pteridophyte a symbiotic relationship with the Cyanobacterium *Anabaena* which fix atmospheric nitrogen and gives the plant access to the essential nutrients.

Test Crop Plant: The test plants selected for the present study was *Cyamopsis tetragonoloba*(L) Taub which is widely cultivated in India [3].

Plant Culture: In the present investigation, 10 pots were used for raising the crops. The pots were filled with 5kg of soil, which was evenly mixed with *Oscillatoria*, *Anabaena azollae* (*Azolla pinnata*) alone and both of them mixed and

recommended level of 100 g, 200 g, 300 g, 400 g, 500 g/kg in one set up of experimental. Five seeds were sown at a depth of 1.5 cm in each bag. They were kept in the net house to prevent damages caused by birds, rats, squirrels and other animals. The polythene bags were labeled in particular doses and rearranged at regular intervals so as to ensure uniform environmental impact on the plants growth. The weeds were removed regularly and watering was done once in 2 days for the test plants. All the experiments were conducted in triplicates.

Field soil sample were collected from control before sowing and after harvest of the crop. The sample was air dried, powdered, sieved through 2 mm sieve and their physico-chemical properties were analysed. The soil sample were analysed at Govt. Agriculture department, Krishnagiri, Tamil Nadu, South India.

RESULT AND DISCUSSION

Application of dried material of diazotrophs (*Oscillatoria* and *Anabaena azollae*) has been shown to enhance the nitrogen holding capacity of the soil. Application of diazotrophs to the soil bed promoted the photosynthetic pigment composition and amino acid content of *Cyamopsis tetragonoloba*. The high amount of (500 g/Kg) diazotrophs absorbed by plants and increased flower and fruit percentage. A report showed that treatment of high amount of (500g/Kg) diazotrophs increase soil nutrients than the control [4]. These macro nutrients like nitrogen, phosphorus, potassium and micro nutrients like iron, manganese, zinc and copper values are given Table 1.

Table 1. Soil analysis and physico chemical parameters of both *Oscillatoria* and *Azolla pinata* Biofertilizers (500 g/Kg).

Parameter	Control	<i>Oscillatoria</i>	<i>Azolla pinata</i>	<i>Oscillatoria</i> and <i>Azolla pinata</i>
N	68	71	82	86
P	22	20	20	21
K	302	196	257	202
Micronutrients				
Fe	7.64	10.64	12.78	13.71
Mn	2.64	2.41	3.48	2.81
Zn	0.61	0.78	0.72	0.64
Cu	0.71	0.7	0.23	0.41

All the parameters expressed in mg/Kg

The physico-chemical properties of *Oscillatoria* and *Anabaena azollae* 500mg/Kg soil has been analysed and presented in Table 1. Potassium was decreased 50% when the soil treated with 500mg/Kg *Oscillatoria* species respectively, over control. The increment of nitrogen was 20%, when the plants treated with *Anabaena azollae* 500mg/Kg soil, respectively over control. Sabrina Naz reported *Oscillatoria* sp. is not only a source of nitrogen, but also organic matters and growth promoting substances for rice cultivation. It can reduce ecological and biochemical imbalance in a rice field. It is ecologically sound alternative of chemical fertilizers. Both the *Oscillatoria* and *Anabaena azollae* 500 mg/Kg soil has increased the nitrogen and reduced potassium content. Among the two biofertilizers, the *Anabaena azollae* 500 mg/Kg soil contained higher levels of nitrogen, iron and manganese [5].

CONCLUSION

The dried material of diazotrophs of *Oscillatoria* and *Anabaena azollae* (*Azolla pinnata*) induced maximum germination, root and shoot growth in *Cyamopsis tetragonoloba*. The nutritional values and mineral composition of medicinal plants are being used as dietary supplements by humans. The nutritional composition of selected *Cyamopsis tetragonoloba* was found as good nutritive value. In the present study, use of biofertilizers of our experimental algae *Oscillatoria* and *Anabaena azollae* generally increased the rate of growth and yield of Clusterbean (*Cyamopsis tetragonoloba*). The biochemical analysis of the experimental plants showed that the *Anabaena azollae* treated plants showed more photosynthetic leaves compared to *Oscillatoria* treated plants. The present study has clearly established *Anabaena azollae* (*Azolla pinnata*) 500 mg/Kg has increased the soil nitrogen. Similar type of work was done *Azolla* thus incorporated decomposes within about 8-10 days and releases the fixed

nitrogen. Continuous application of *Anabeana azollae* (*Azolla pinnata*) increase the organic nitrogen content to the soil significantly. Use this organism as a successful feed and biofertilizer in future.

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