



## Short Communication

# Effect of *Azolla* Extract on Growth Performance of *Pisum Sativum*

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Received 28<sup>th</sup> June 2013, revised 8<sup>th</sup> July 2013, accepted 6<sup>th</sup> August 2013

## Abstract

A study on the effect of biofertilizer *Azolla pinnata* extract on growth performance of *Pisum sativum* was carried out. The seeds were soaked in both *azolla* extract and water. Former performed better when compared to the control. The (20%) concentration of aqueous extract of *Azolla* promoted the better seedling growth in terms of shoot length, root length, fresh weight and dry weight.

**Keywords:** Bio fertilizer, *azolla* extract, organic farming.

## Introduction

The water fern *Azolla* belongs to the family of Azollaceae. The fern *Azolla* contains an endosymbiont blue green algae *anabaena azollae*, which helps for the fixation and nitrogen assimilation.

*Azolla* is rich source of proteins, essential amino acids, vitamins (vitamin A, vitamin B12, Beta Carotene), growth promoter intermediaries and minerals like calcium, phosphorous, potassium, ferrous, copper, magnesium etc. It contains 25-30% protein, 10-15% mineral content and 7-10%, a combination of amino acids, bio-active substances and biopolymers. But very low carbohydrate and oil content. So the *Azolla*, forms an economic and efficient feed substitutes for livestock, because of its high protein and low lignin content it becomes easily digested by livestock.

It is an ideal feed substitute for almost all animals, and it is a biofertilizer too. It is cultivated in a large scale in other countries and we the Indians have also yet to be cultivated it, in a large scale.

N<sub>2</sub>-fixing *Azolla* and blue-green algae (cyanobacteria) are good utilizers of solar energy and provide organic matter to the soil.<sup>1</sup> Mandal *et al.* owed the positive effect of N<sub>2</sub>-fixing cyanobacteria on plant growth and yield of crops to the production of growth-promoting substances, i.e., gibberellins, cytokinins, auxins, abscisic acids, vitamins, antibiotics and amino acids<sup>2</sup>. It also forms an important Nitrogen balancing biological source of many crops. According to cyanobacteria and *Azolla* can serve as good nitrogen supplement to plants<sup>3</sup>. Cyanobacteria inside the *azolla* can release nutrient into soil in an easily available form to plants<sup>4</sup>. On death and decay *Azolla* releases nutrients as fresh matter in water Marwaha *et al.*<sup>5</sup>.

## Material and Methods

**Collection of *Azolla*:** *Azolla* (Azollaceae) used in the present study was collected from the Botanical Garden of Carmel College, Mala. The plants were made free of unwanted impurities by rinsing with water. Then the plants were spread on blotting paper to remove excess water.

**Preparation of biofertilizer extract:** One kg of *azolla* was boiled with 1 liter of distilled water for 30 minutes and filtered. The filtrate was taken as 100 % concentration of the *azolla* extract and from this, different concentrations (5 %, 10 %, 20 %, 30 %, 40 %, and 50 %) were prepared using distilled water. Then, it was refrigerated between 0 and 4 °C.

**Selection of crop plant:** *Pisum sativum* of Fabaceae family was selected as crop plant. The seeds were collected from Seed Bank of Kerala Agricultural University, Kerala, India. The seeds of almost uniform size, colour and weight were selected for the experiment.

**Experiment:** Twenty five seeds were soaked in different concentration viz., 5 %, 10 %, 20 %, 30 %, 40 %, 50 % and 100% aqueous extracts of *azolla* for 24 hrs and thereafter, they were placed in filter paper placed in Petri plates and were watered with tap water regularly. Control was water soaked seeds. On 15<sup>th</sup> day samples were taken from each set and the growth parameters including percentage of germination, fresh and dry weight, length of shoot and root were calculated.

## Results and Discussion

There was an increase in the germination percentage up to 20% concentration and declination thereafter. No germination above 50%. Only (19 %) germination was found in water soaked seeds at 50 % concentration. In 20% concentration shoot length (16.32cm), root length (6.7 cm), fresh and dry weight (3.967, 0.807 g) were observed. But at the same time at 50%

concentration the shoot length was (8.20 cm), fresh weight (1.98 g) and dry weight (0.701 g).

*Pisum sativum* seeds soaked in lower concentrations of the azolla extract showed high germination rate, while higher concentrations inhibited the germination. This behaviour may be due to the presence of some natural growth promoting hormones like auxins, gibberellins, cytokinins, trace elements, vitamins and amino acid in lower concentrations. An increase was observed for shoot length at 20% concentration.

In the area of agriculture, cyanobacteria are of importance in view of being used as nitrogen fixing biofertilizer either in free living or as symbiosis with the water fern azolla<sup>6</sup>. In this study, the use of *Azolla* extract applied in different concentrations improved the germination percentage, root shoot length, fresh and dry weight etc., Simpson *et al.* (1994) explained that in case of using *Azolla* for rice cultivation, incorporation of dry or fresh *Azolla* into soil, generally decreased Soil pH with priority to fresh *Azolla*, while urea raise the pH values<sup>7</sup>. They attributed this trend to that the fertilization with urea stimulates *Azolla* growth and increases their photosynthetic activity. Therefore, the dissolved CO<sub>2</sub> in the soil is reduced, leading to reduce the soil pH. The soil pH may be decreased due to the polysaccharides, peptides, lipids, organic acids excreted by the cyanobacteria and *Azolla in to the soil*<sup>8</sup>. They also added that, the presence of these materials in their extracts adsorb both sodium and magnesium ions upon they get in touch with soil and thus prevent the harm effect of salinity against the cultivated plants. Salt affected soils are highly deficient in organic matter and nitrogen. The efficiency of nitrogen fertilizers is very poor due to extensive losses through volatilization in salt affected soils<sup>9</sup>. Nitrogen available in the soil were also increased due to bio fertilizer treatments over the use of 100% N treatment (control). These findings were observed by Strik and Staden who explained that incorporation of fresh or dry *Azolla* into soil increased significantly the soil organic matter, which in turn upon its decomposition by the soil microorganisms had released the macro and micronutrients into soil, leading to increase the soil available N, P and K<sup>10</sup>. Also,

under salt stress condition, cyanobacteria added to the soil either as free living and/or as *Azolla* symbiont lead to add to the soil organic matter, which is consequently increased the soil fertility in terms of increasing the number of soil l bacteria, evolution of CO<sub>2</sub>, enzyme activities etc.<sup>11</sup>.

Using cyanobacteria filtrate plus *Azolla* extract as foliar spraying (T9) leads to increase significantly barley yield and its components under salt stress condition. As per Abd EL-Baky *et al.* *Chlorella ellipsoida* and *Spirulina maxima* spray led to good growth and yield performance of of wheat compared to those received 100% N without algae extract spraying<sup>12</sup>. Also the algal extracts significantly increased the contents of the total chlorophyll and antioxidant phenomenon and there is increase of wheat fresh weight, grain weight and yield and yield components. Algal spray application significantly increased the plant nutrients content and had a positive effect on plant growth, oxidation behaviour and activity of antioxidant enzymes in plants affected by salt stress. Cyanobacteria and *Azolla* extracts contains cytokinins, gibberellins and auxins content to promote the plant growth and help to overcome the adverse effect of salinity in saline soil. This is why these organisms are being used as biofertilizer to increase yield especially in reclaimed and salt stressed soils<sup>13</sup>.

### Conclusion

In conclusion, the biofertilizer *Azolla* extract is having good fertilizer activity. The extract acts as a desirable biological fertilizer supplement to chemical fertilizer for organic farming. The extract is non toxic, harmless, nonflammable and effective to all plants for attaining better germination, growth and yield. So we have to take necessary steps to cultivate them in large scale.

### Acknowledgments

The author is grateful to the Head, Department of Botany and all other staff of Carmel College, Mala, Thrissur, Kerala, India for the facilities provided.

**Table-1**  
**Effect of Azolla extract on germination and growth of *Pisum sativum***

	Germination %	Shoot length (cm)	root length (cm)	Fresh weight (g)	Dry weight (g)
Control	85	10.5	4	1.82	0.679
5%	97	15	5.2	2.06	0.731
10 %	97	16.3	6.77	3.93	0.873
20 %	99	16.96	7.4	3.97	0.882
30 %	93	15.8	5.8	3.73	0.875
40 %	78	11.8	5.6	1.98	0.790
50 %	37	11	3.6	1.98	0.701

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