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# Evaluating Potential of *Spirulina* as Innoculant for Pulses

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**Abstract :** Many non- heterocystous cyanobacteria are also capable of nitrogen fixation and improve plant growth. *Spirulina platensis* and *S. maxima* at concentration of 500 mg and 1000 mg/kg soil were tested on two plants *Phaseolus aureus* and *P. mungo*. Growth was measured in terms of plant shoot lengths. The leaf chlorophyll content and protein content of the grains of both the plants were analyzed. Shoot length of both the plants were increased to almost two to two and a half times after 30 days. The leaf chlorophyll content and the protein content in the grains of the plants were not improved significantly. Conclusion was drawn that inoculation of *Spirulina* shows no beneficial effects in the crop plants though it gives excellent results in increase of protein contents in human beings.

**Key words :** Non-heterocystous, Nitrogen fixation, Shoot length, Chlorophyll content, Protein content.

## Introduction

Cyanobacteria are considered as an important group of microorganisms capable of fixing atmospheric nitrogen. They have a unique potential to contribute to productivity in a variety of agricultural and ecological situations. Most paddy soils have a natural population of cyanobacteria which provides a potential source of nitrogen fixation at no cost. Many cyanobacteria fix nitrogen under aerobic conditions in specialized cells called heterocyst which comprise 5-10% of cells in a filament (Gantar, 2000). Many cyanobacteria are also capable of using atmospheric dinitrogen ($N_2$) as the source of nitrogen and this is what most commonly termed nitrogen fixation. Non-heterocystous cyanobacteria are also able to promote plant growth and can also be used as biofertilizer.

Besides fixing atmospheric nitrogen, cyanobacteria play a major role in reducing soil erosion because of ability to secrete polysaccharides that bind soil (Nayak and Prassana, 2007). Also they control soil run off and increase soil organic matter content and in producing certain substances which enhance the growth of plants (Ordog, 1999). Due to this important characteristic of nitrogen fixation, the utility of cyanobacteria in agriculture to enhance production is beyond doubt.

*Spirulina* is an excellent natural food that contains a wide spectrum of nutrients that inclu**de proteins, carbohydrates, vitamins, minerals, â- carotene and super antioxidants apart from trace elements. The protein content is as high as 60- 70% of its dry weight.** *Spirulina* has a high concentration of vitamins and lipid in the amount of 4-7% is also present in it. The essential **fatty acids ã- linolenic acids** and also 13.6% of carbohydrates are present (Ciferri, 1983; Cohen, 1997; Mahajan and Kamat, 1995). It is claimed that *Spirulina* enhances nucleus enzymes, bone marrow, stem cells, macrophages, T cells and natural killer cells. Due to these therapeutic properties of *Spirulina*, they are available in the market as capsules and tablets and are consumed by human beings.

The present study was undertaken on two plants *Phaseolus aureus* and *Phaseolus mungo* to study the effects of inoculation of *Spirulina viz. S. platensis and S. maxima* on the growth of these plants and protein content of their grains.

## Materials and Methods

### *Culturing of Spirulina*

Pure culture of *S. platensis* and *S. maxima* were obtained from CCUBGA, IARI, New Delhi and was cultured in CFTRI medium. The culture was harvested after 15 days by filtration and subsequent drying.

### Inoculation of *Spirulina*

*S. platensis* and *S. maxima* were mixed with soil in quantities of 500 mg and 1000 mg/kg separately. These soils were taken into clay pots. Soil was pre sterilized to avoid contamination. All sets were prepared in triplicates. In each pot 5 seeds of each plant were sown and kept for germination in open atmosphere. Watering was done daily to keep the soil moist. Control plants were also sown in the experiment.

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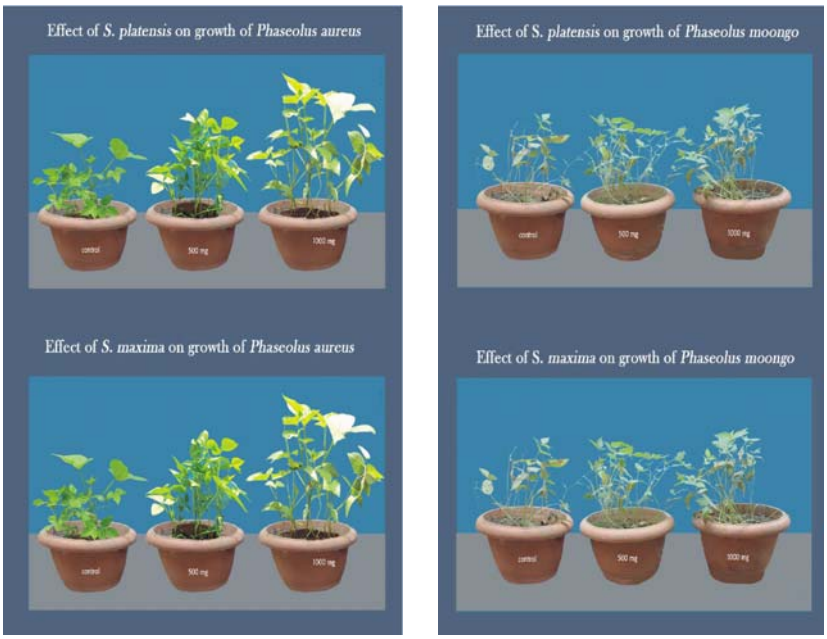


growth stimulative effect of the cyanobacteria on plants may be attributed to elevated levels of $GA_3$ which is known to inhibit chlorophyllase activity (Drazkiewicz, 1994).

The protein content of the grains of *P. aureus* and *P. mungo* were analyzed. The protein content was also not improved much as compared to control plants. Ghallab and Salem (2001) stated that, in wheat plant, growth characters and nutrients, sugar, amino acids and growth regulators (1AA, $GA_3$ and kinetin) as well as crude protein contents of the tested plant, increased by using biofertilizer; Cerealin (*Azospirillum* spp.) and Nemales (*Serratia spp.*). They concluded that the growth promotion of plant by cyanobacteria may not necessarily affect the protein content or pigment content but may be attributed to the secretion of plant growth regulators by the organism.

Innoculation of *Spirulina* enhanced the shoot length of the plants while there was no improvement in the leaf chlorophyll content and the protein content of the grains of the plants. Hence, it is concluded that inoculation of *Spirulina* shows no beneficial effects in the enhancement of chlorophyll and protein content.

Recently, it has been demonstrated that high yielding varieties which need high levels of nitrogenous fertilizers also respond to algal inoculation by increasing yield up to 10-15 percent, which has been attributed to the growth promoting substances secreted by blue green

**Table 2: Leaf Chlorophyll Content (mg/g) of Plants after inoculation *Spirulina***

| Species | *P. aureus* | | | *P. mungo* | | |
|---|---|---|---|---|---|---|
| | **Control** | **500 mg** | **1000 mg** | **Control** | **500 mg** | **1000 mg** |
| *S. platensis* | 0.2 ± 0.02 | $0.21^{ns}$ ± 0.01 | $0.23^{ns}$ ± 0.03 | 0.14 ± 0.02 | $0.15^{ns}$ ± 0.02 | $0.16^{ns}$ ± 0.03 |
| *S. maxima* | 0.21 ± 0.01 | $0.22^{ns}$ ± 0.02 | $0.23^{ns}$ ± 0.03 | 0.14 ± 0.02 | $0.16^{ns}$ ± 0.01 | $0.16^{ns}$ ± 0.03 |

*Values are given as mean ± S.D for three set in each group.*
*Experimental groups were compared with control, ns p> 0.05, *p< 0.05, **p<0.001*