Efficiency of biofertilizers on the seedling growth and biochemical attributes of *Vigna radiata* (L.)

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ABSTRACT

Biological activities are markedly enhanced by microbial interactions in the rhizosphere of plants. Such syntrophic associations are of ecological importance with implied agricultural significance. The plant growth promoting rhizobacteria can influence plant growth directly through the production of phytohormones and indirectly through nitrogen fixation and production of biocontrol agents against soil-borne phytopathogens. The application of biofertilizers significantly increased the growth parameters of shoot length, root length, fresh weight and dry weight, photosynthetic activities and biochemical parameters such as protein and amino acid of Vigna radiata L. at all growth stages. The greatest growth was recorded in Rhizobium + Azospirillum (T_3) compared to the other treatments.

Keywords: *Biofertilizers, Green gram, Chlorophyll, Protein, Amino acid, Fresh and Dry weight*

1. INTRODUCTION

Biofertilizers are eco friendly and source of multiple nutrients inputs of biological origin for plant growth. The Bio-organic fertilizers can increase the quality and improve the output paving the way for sustainable agriculture. For the last one-decade, biofertilizers are used in large quantity as an eco-friendly approach to reduce the use of chemical fertilizers, improve soil fertility status and for improvement of crop production by their biological activity in the Rhizosphere. Biofertilizer like *Rhizobium*, *Azotobacter*, *Azospirillum* and blue green algae (BGA) are in use since long time ago. *Rhizobium* inoculants are used for leguminous crops. *Azotobactor* is used on crops like wheat, maize, mustard, black gram, cotton, potato and other vegetable crops. *Azospirillum* inoculants are recommended mainly for sorghum, millets, maize, black gram, sugarcane and wheat [1].

Biofertilizers are low cost, renewable sources of plant nutrients which supplement chemical fertilizers. Biofertilizer is one of the best and modern tools for agriculture. Use of biofertilizer is of great importance because they are components of integrated nutrient management. They are cost effective and renewable source of energy for plants and help in reducing the use of chemical fertilizers for sustainable agriculture [2].

Nitrogen fixing Rhizobacteria, *Azospirillum* has beneficial effects on both plant growth and yields of many crops and is of great agronomic importance. *Azospirillum* can utilize atmospheric nitrogen and contribute to plant nitrogen nutrition, it can also improve the plant nutrient uptake and contribute towards the balance of the root environment through protection against pathogens and equilibrate nutrient flow in the soil. It can fix atmospheric nitrogen to the tune of about 15-20 kg/N/acre/year, which reflects in an increase in the crop yield by 15-20 %. It has the potential to reduce the consumption of chemical nitrogen fertilizer by 20-30 %.

Pulses play a vital role in Indian agricultural crop production. Pulses are important sources of food in rural as well as urban in India. They are very rich in protein, particularly to the vegetarian who constitutes the bulk of population in India. Green gram is an annual food leguminosae member. It is very nutritious and is recommended for diabetics. Biofertilizers are small microbes which can be created by contain living cells of nitrogen fixing and phosphate solubalizing microorganism for treatment of seed or soil. Nitrogen is an essential nutrient for growth of different crops; its application is beset with economic burdens and environmental risks. Biological nitrogen fixation not only improves plant growth but also helps to minimize the use of chemical nitrogen fertilizers, so that the cost of production and environmental risks are reduced.

Contribution of pulses to agriculture and daily life has been tremendous besides being one of the important constituents of our diet. An important feature of green gram crop is it has the potential of producing higher yield depending on the genotypes studied [3]. An important feature of green gram crop is its ability to establish a symbiotic partnership with specific bacteria, setting up the biological N_2-fixation in root nodules that supply the plant's needs for

Nitrogen [4]. Green gram is one of the important food legumes and most valuable commercial spice crops grown for its fruits in India. It is very meager with other pulses and hence, the present investigation is aimed to increase the yield and quality attributes in green gram with the use of organic biofertilizers.

2. MATERIALS AND METHOD

The seeds of green gram (*Vigna radiata*) and biofertilizers (*Rhizobium* and *Azospirillum*) were obtained from Agricultural farm located in Karur, Tamil Nadu.

2.1 Experiments Design

Pot culture experiments were conducted with green gram to known the effect of biofertilizers (*Rhizobium*, *Azospirillum* and *Rhizobium* + *Azospirillum*) on growth and biochemical performance period of 30 days. Five plant samples were randomly collected at regular intervals (seedling and flowering) and they were used for observations of morphological parameters like root length, shoot length, fresh weight and dry weight of root and shoot.

2.2 Biochemical analyses

The photosynthetic pigments like chlorophyll 'a' and 'b' estimated by [5] biochemical contents such as estimation of protein by [6] and estimation of amino acids [7] were valued in the 15th and 30th days old seedlings grown in the pot culture conditions.

3. RESULT AND DISCUSSION

The results Fig-1 revealed that shoot length was significantly increased by applied different bioinoculant on 15th and 30th day observation of *Vigna radiata. Rhizobium* + *Azospirillum* inoculation significantly increased shoot length were recorded respectively more over uninoculated control. The results are in conformity with findings of [8] in *Zea mays*, [9] in sweet corn and [10] in tomato plants. They found that dry matter production increased about 50%.

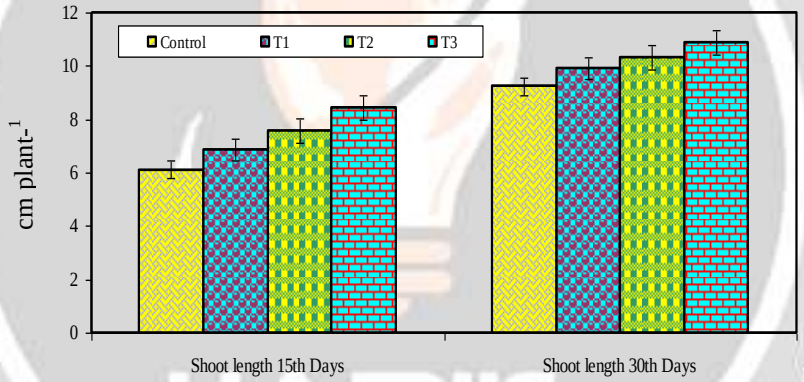

Fig-1 Effect of Biofertilizers on shoot length of *Vigna radiata* L. at various intervals

The obtained results revealed that root length of *Vigna radiata* was significantly increased by applied different bioinoculant on 15th and 30th day observation in Fig-2. *Rhizobium* + *Azospirillum* inoculation more significantly increased root length 6.18 and 9.11 cm/plant were recorded respectively over uninoculated control 4.13 and 7.43 cm/plant. These results accordance with [11] found out the effect of biofertilizer application methods and inorganic fertilizers on the growth, seed application with three biofertilizers, *Azospirillum*, *Azotobacter* and Phosphorus solubilizing bacteria.

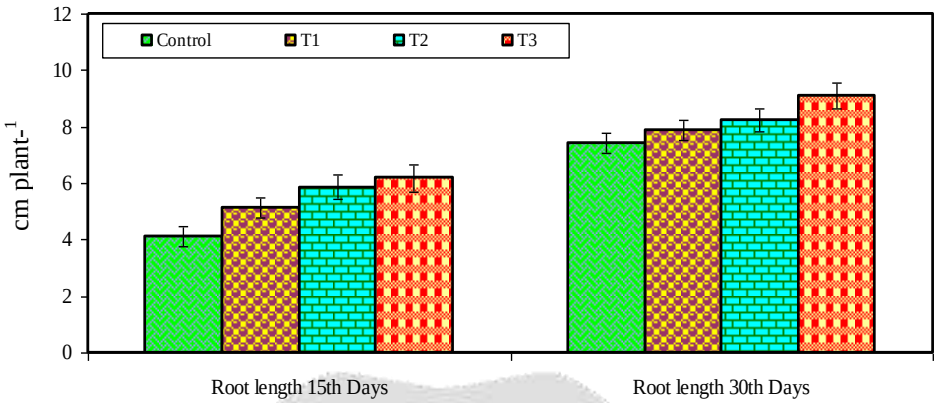

Fig-2 Effect of Biofertilizers on root length of *Vigna radiata* L. at various intervals

Fig 3 showed that fresh weight was significantly increased by applied different bioinoculant on 15th and 30th day observation of *Vigna radiata*. *Rhizobium* + *Azospirillum* inoculation more significantly increased fresh weight 4.68 and 6.23 mg/g were recorded respectively over uninoculated control 2.51 and 3.68 mg/g, whereas the minimum shoot length was observed in individual inoculation of *Rhizobium* of 3.08 and 4.22 mg/g and *Azospirillum* was 3.91 and 4.50 mg/g. These results accordance with [12] has indicated that the use of biofertilizer combined with chemical fertilizers has increased the shoot fresh weight and shoot dry weight of *Asparagus*.

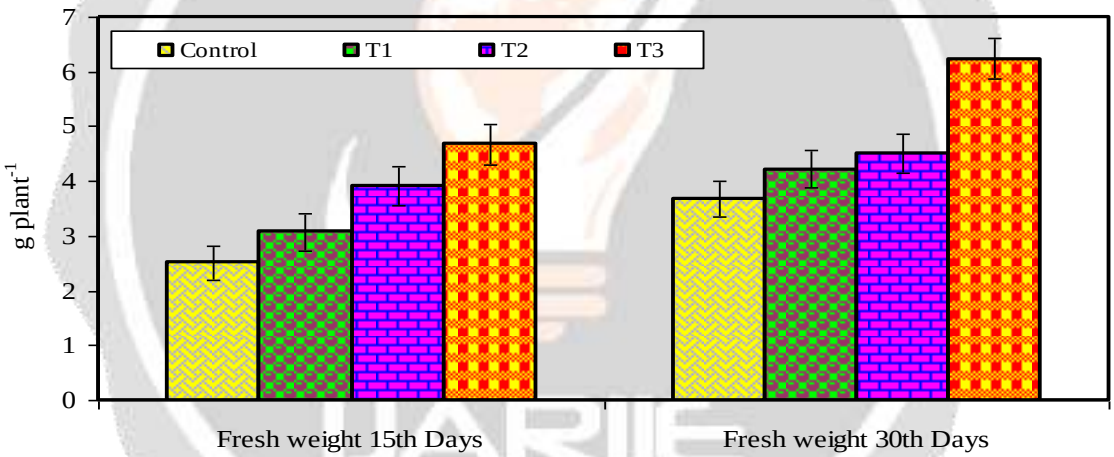

Fig-3 Effect of Biofertilizers on fresh weight of *Vigna radiata* L. at various intervals

Further analysis of Fig-4 revealed that dry weight was significantly increased by applied different bioinoculant on 15th and 30th day observation of *Vigna radiata*. *Rhizobium* + *Azospirillum* inoculation more significantly increased dry weight were recorded respectively over uninoculated control, even though the minimum dry weight was observed in individual inoculation of *Rhizobium* and *Azospirillum*. These results can be supported by the finding of [13] in marigold, [14] in tomato and [15] in vegetable and fruits.

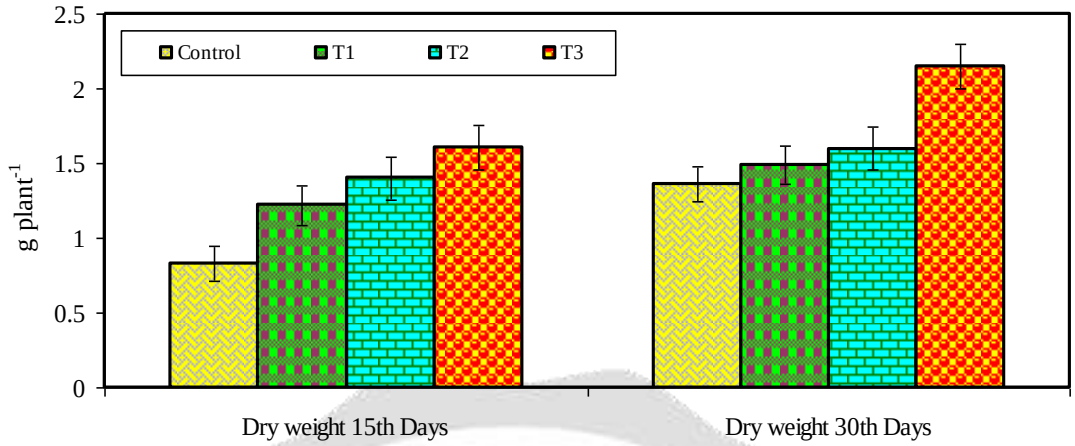

Fig-4 Effect of Biofertilizers on dry weight of *Vigna radiata* L. at various intervals

Fig 5 reported that the chlorophyll 'a' was significantly increased by applied different bioinoculant on 15th and 30th day observation of *Vigna radiata. Rhizobium + Azospirillum* inoculation more significantly increased chlorophyll 'a' 0.511 and 0.562 mg/g were recorded respectively over uninoculated control 0.384 and 0.309 mg/g, although the minimum chlorophyll 'a' was observed in individual inoculation of *Rhizobium* of 0.391 and 0.430 mg/g and *Azospirillum* was 0.422 and 0.488 mg/g. This result accordance with [16] the chlorophyll 'a' was found to be higher in T1 (0.166 ± 0.034 mg/g) on 30th day, T1 on 45th day (0.242 ± 0.076 mg/g) and T2 (0.386 ± 0.049) on the 60th day. This shows that *Azosprillum* increases the chlorophyll pigments initially, but at later stage of growth, presence of VAM increases the chlorophyll 'a' pigment.

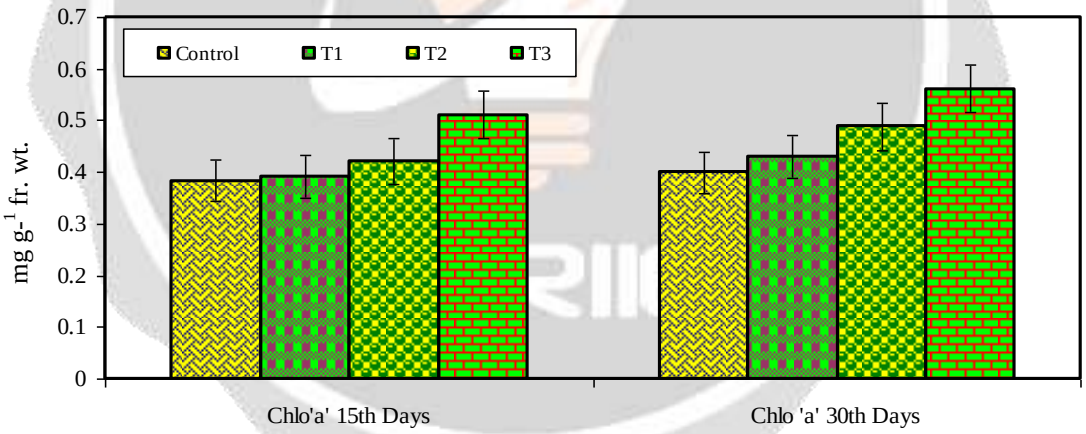

Fig-5 Effect of Biofertilizers on chlorophyll 'a' of *Vigna radiata* L. at various intervals

The obtained results Fig-6 revealed that chlorophyll 'b' was significantly increased by applied different bioinoculant on 15th and 30th day observation of *Vigna radiata. Rhizobium + Azospirillum* inoculation more significantly increased chlorophyll 'b' was recorded respectively over uninoculated control. The minimum chlorophyll 'b' was observed in individual inoculation of *Rhizobium* and *Azospirillum*. Similar result was also reported by [16] the chlorophyll 'b' content was found to be higher in T2 (0.131± 0.020 mg/g) on 30th day, T1 (0.429 ± 0.051 mg/g) on 45th day and T4 (0.498 ±0.204mg/g) on the 60th day. This result shows that the chlorophyll 'b' pigment gradually increases when there is combination of bio-fertilizers and on the 60th day higher chlorophyll 'b' content.

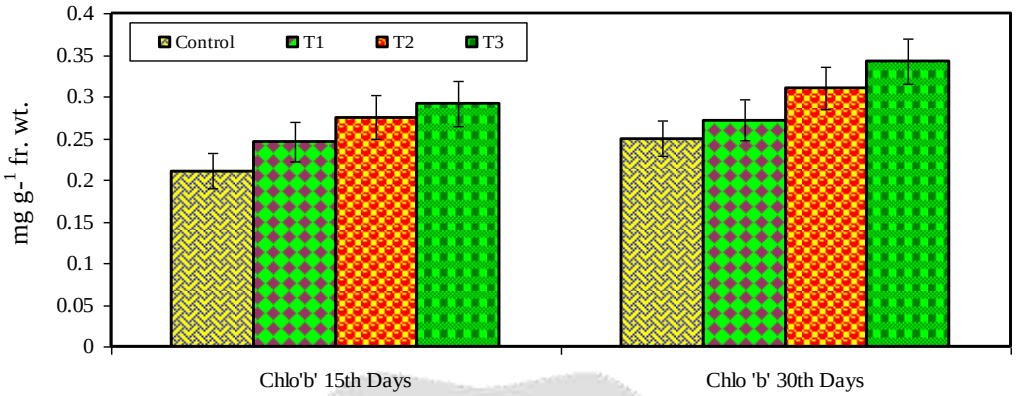

Fig-6 Effect of Biofertilizers on chlorophyll 'b' of *Vigna radiata* L. at various intervals

Fig 7 revealed that biochemical content like protein was significantly increased by applied different bioinoculant on 15th and 30th day observation of *Vigna radiata. Rhizobium* + *Azospirillum* inoculation more significantly increased protein 0.511 and 0.562 mg/g were recorded respectively over uninoculated control 44.51 and 53.76 mg/g. The minimum protein was observed in individual inoculation of *Rhizobium* of 67.39 and 86.72 mg/g and *Azospirillum* was 55.09 and 77.51 mg/g. Similar result was reported by [5] significant increase in protein content (22.01mg/gm fresh weight) of the leaves was obtained by the treatment T4 over control which was only 17.00 mg/gm fresh weight.

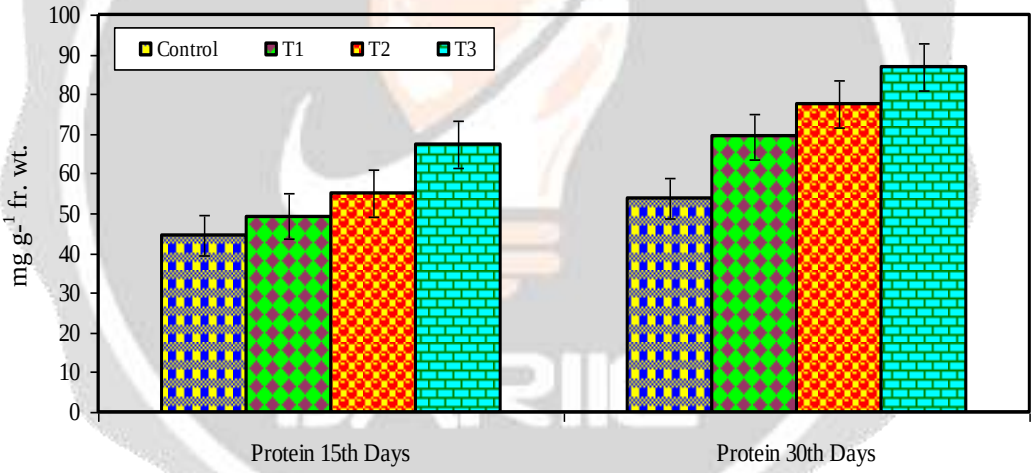

Fig-7 Effect of Biofertilizers on protein content of *Vigna radiata* L. at various intervals

The data in Fig 8 reported that the biochemical content like amino acid was gradually increased by applied different bioinoculant on 15th and 30th day observation of *Vigna radiata. Rhizobium* + *Azospirillum* inoculation more significantly increased amino acid 3.113 and 3.646 mg/g were recorded respectively over uninoculated control 2.440 and 2.641 mg/g, even though the minimum amino acid was observed in individual inoculation of *Rhizobium* of 2.614 and 2.936 mg/g and *Azospirillum* was 2.764 and 3.196 mg/g. Similar results as observed by [17] the seeds treated with biofertilizer and chemical fertilizer showed a significant increase in the growth and biochemical such amino acid, protein and chlorophyll content as of plant *Vigna radiata*. This result concluded that plants treated with biofertilizers showed better growth and biochemical parameters.

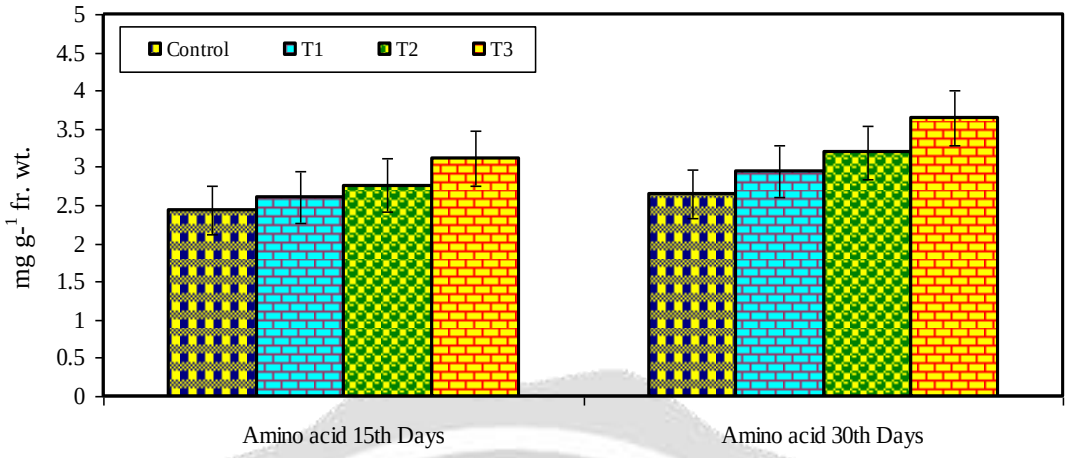

Fig-8 Effect of Biofertilizers on amino acid of *Vigna radiata* L. at various intervals

4. CONCLUSION

Biofertilizers play an important role in improving nutrient supplies and their easy availability to crop. They are eco-friendly and low cost agricultural inputs. The biofertilizers containing a specific microorganisms in concentrated from which is derived either from the plant roots or from the root zone. Leguminous plants involve symbiotic associations with *Rhizobium* bacterium in order to fix N_2. The green manures obtained from plant debris are having considerable amounts of N_2 in the soil when compared to the green manures from non-leguminous plants. The application of biofertilizers not only promoted growth but also decreased plant damages by insect pests.

5. REFERENCES

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