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## RESEARCH ARTICLE

# EFFECTS OF DIAZOTROPHIC AZOTOBACTER BIOFERTILIZER ON THE GROWTH PROFILE OF SORGHUM BICOLOUR IN POT CULTURE STUDIES

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**ABSTRACT**

The present study was focused on the evaluation of diazotrophic *Azotobacter* biofertilizer potential of strain on the growth of *Sorghum bicolor*. Two potential *Azotobacter* strains were mass cultured and used as diazotrophic biofertilizer for crop study with *S.bicolor* in various treatments as individual culture and its combination using pot culture for 30 days. The result of pot culture studies reveals that the combined application of *Azotobacter* Strain 1 and 2 increased the growth of *Sorghum* crop. Thus, these two diazotrophic *Azotobacter* strains could be used as efficient and ecofriendly biofertilizer for the improved crop production.



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## INTRODUCTION

The utilization of soil microorganisms that live in the rhizosphere and interface with plant root system has been well documented (Basaglia *et al*., 2003). The increase of crop productivity has influenced by rhizobacteria through N2 fixing, phosphate solubilizing, and phytohormone production. A bacterium could have diverse capacities in the vegetation cycle (Timmusk *et al*., 2003) and broadly reported that numerous types of rhizobacteria can colonize *Sorghum*, Maize, Cassava and Sugarcane (Dobereiner *et al*., 1997, Boddey *et al*., 2003, Herschkovitz *et al*., 2005). *Azotobacter* is one such a rhizobacteria efficiently colonize around the root system of many crops ability to fix atmospheric nitrogen into ammonia and thus support the plant growth and developments. *Azotobacter* is a heterotrophic free living nitrogen fixing microscopic organism and is basically Gram-negative, substantial ovoid pleomorphic cells of 1.5-2.0 µm or more in the distance across going from poles to coccoid cells. They happen independently, in combined or unpredictable clusters and at some point in chains of shifting length. They don't create endospores yet frame sores. They are motile by peritricshous flagella or non-motile. *Azotobacter* sp. is most particularly noted for their nitrogen altering capacity yet they have likewise been noted for their capacity to produce with a spectrum of compounds including phytohormones (IAA, gibberellins and cytokinins), vitamins and siderophores (Narula *et al*., 1981, Neito and Frankenberger 1989, Tindale *et al*., 2000). Hence, the present study was undertaken on the evaluation of the growth profile of *Sorghum* crop treated with *Azotobacter* biofertilizer.

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## MATERIALS AND METHODS

### Mass multiplication of *Azotobacter* for bio-fertilizer production in laboratory

The two selected Azotobacter strains were grown on Burk's medium through submerged culture technique (Amutha *et al.,* 2014). The culture was maintained at $30^0$C with continuous agitation till the cell count reaches to $10^{-8}$ -$10^{-9}$ cells/ml. The culture broth thus prepared was used as biofertilizer inoculums for crop study.

### Effects of *Azotobacter* biofertilizers application on the growth performance of *Sorghum*

The certified seeds of *Sorghum bicolor* were obtained from Tamil Nadu Agricultural University, Madurai and determined the crop growth performance with application of *Azotobacter* biofertilizer in pot culture studies following the standard experimental design (Mahalingam *et al.,* 2014). The application of *Azotobacter* biofertilizer on the crop was done through seed inoculation. The undamaged, healthy *S.bicolor* seeds were soaked in overnight culture of two different *Azotobacter* strains kept in shaking incubator with 37˚C, 120 rev min$^{-1}$ for 6 hrs. The pre-treated *Sorghum* seeds with two different *Azotobacter* inoculums as individually culture and in combination were sown in the experimental of pots with various treatments including chemical fertilizer treatment and control without fertilizer. The details of experimental design are given in Table-1

**Table 1. Experimental Design of Pot Culture with *Sorghum bicolour* treatment *Azotobacter* biofertilizer**

| Treatment No | Treatment particulars |
|---|---|
| $T_0$ | Red Soil + Sand(1:1) |
| $T_1$ | Red Soil + Sand (1:1)+Azotobacter (Strain-1 inoculum $10^6$CFU ml$^{-1}$) |
| $T_2$ | Red Soil + Sand (1:1)+Azotobacter (Strain-2 inoculum $10^6$CFU ml$^{-1}$) |
| $T_3$ | Red Soil + Sand (1:1)+Azotobacter (Strain-1&2 inoculum$10^3$CFU ml$^{-1}$ each) |
| $T_4$ | Red Soil + Sand (1:1)+Recommended dose of NPK* |

*Recommended dose of NPK
Nitrogen -0.38g; Phosphours- 0.60g; Potassium-0.09g

The experimental treatment were maintained in triplicates and regularly watered. The growth profiles of sorghum crop in various treatments were determined periodically on 10$^{th}$, 20$^{th,}$ 30$^{th}$. The growth profile includes germination efficiency, leaf area, root and shoot length, fresh and dry biomass.

## RESULTS AND DISCUSSION

Worldwide, there is a profound need to explore varied agro-ecological niches for the presence of native beneficial microorganisms. Many studies have been undertaken to understand the nature and properties of these unique microbes which harbor potential plant growth promoting traits. With increasing awareness about adverse effects of chemical fertilizers. It is important to search for an alternate ecofriendly fertilizer for agriculture practice. Azotobacter based biofertilizer is one such an emerging alternate for chemical fertilizer and improves the agricultural productivity. The Present study investigates the growth performance of *Sorghum* crop in various treatments with applications of *Azotobacter* biofertilizer.

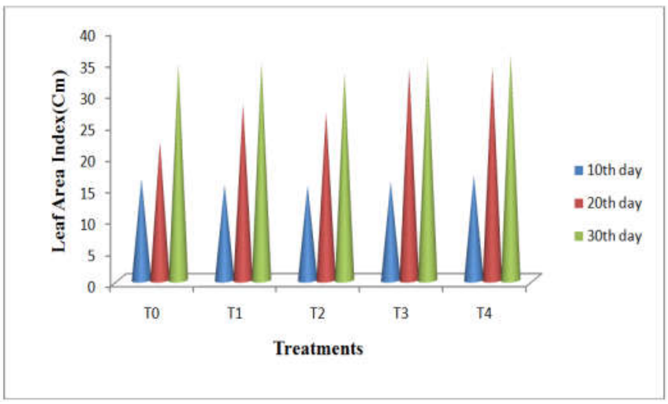


**Fig.1. Changes in leaf area index in *Sorghum* crop treated with diazotrophic biofertilizers and chemical fertilizer on 10$^{th}$,20$^{th}$,30$^{th}$ days**

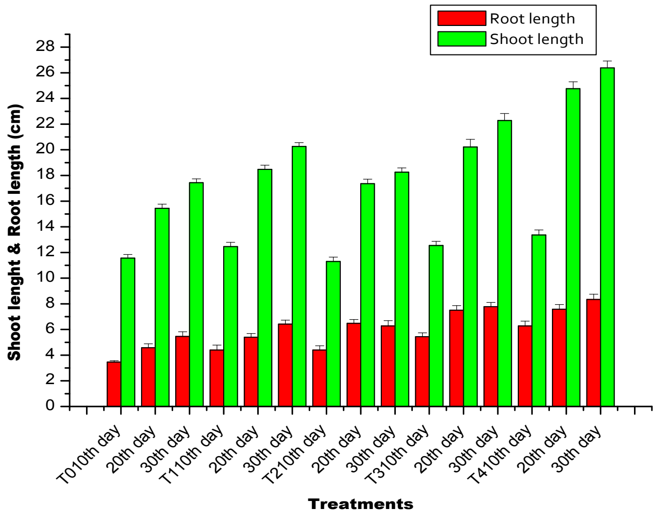


**Fig. 2. Changes in Root and Shoot length of whole plants treated with diazotrophic biofertilizers and Chemical fertilizer on 10$^{th}$ 20$^{th}$ 30$^{th}$ days**

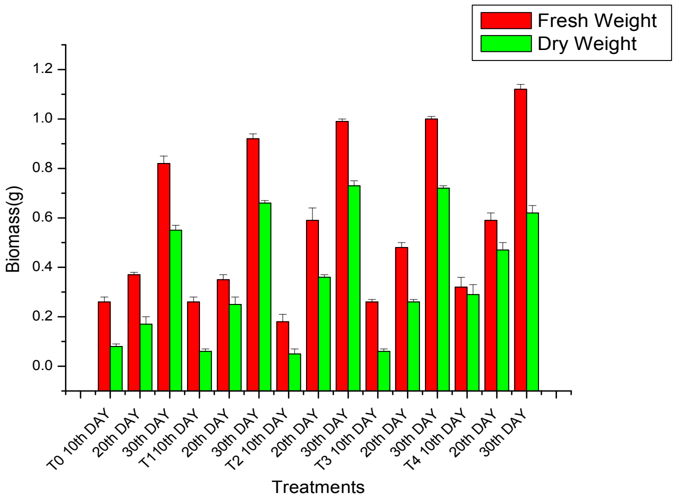


**Fig. 3. Changes in Fresh Weight and Dry Weight of whole plants treated with diazotrophic biofertilizers and Chemical fertilizer on 10$^{th}$ 20$^{th}$ 30$^{th}$ days**

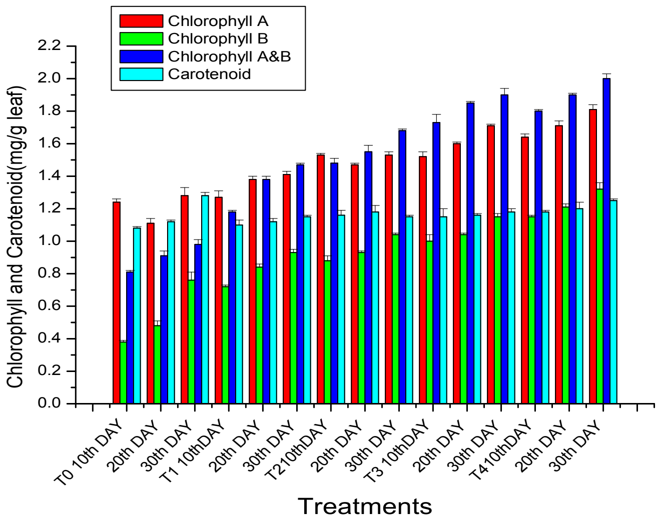


**Fig. 4. Changes in Chlorophyll and Carotenoid contents in the leaf of Sorghum crop treated with diazotrophic biofertilizers on 10$^{th}$, 20th, 30th Day**

The results on the growth profile of *Sorghum* includes leaf area, root length, shoot length, fresh & dry weight, Chlorophyll and Carotenoid contents were recorded in Figures 1 to 4. Out of two Azotobacter strains, the strain 1 gives the better effect of plant growth promoters when compared to other because it has the high IAA production as well as the nitrogen-fixing ability. Similarly, Panwar *et al*. (2000) reported that inoculation of wheat with *Azotobacter* increased root and shoot dry biomass, leaf area and yield of the crop as compared to uninoculated control. Zambere and Konde (1983) found that inoculation with *A. chrococcum* increased the number of tillers per plant, dry weight, grain yield and N content of grain.The increased nutrient uptake parameters could be attributed to the enhancement of the root growth and development. The differences in plant growth promotion among the isolates are attributed to their individual rhizospheric competencies. Future studies are required to prove the nature of these isolates and to harness their potential as bio-inoculants in agriculture.

### Conclusion

In this study, five diazotrophic isolates were isolated from rhizosphere soil samples (one strain from each soil sample). Based on morphological and biochemical characteristics all five selected diazotrophic bacterial strains were identified as *Azotobacter* sp. Among that, the predominant *Azotobacter* sp. was selected and used as biofertilizer for crop production study. The selected *Azotobacter* strain has the potential to fix biological nitrogen and thus it could be an efficient biofertilizer for sustainable agriculture practices.

## REFERENCES

Abd El-Lattief, E. A. 2011. Nitrogen management effect on the production of two sweet sorghum cultivars under Arid Regions conditions. *Asian Journal of Crop Science*, *3*(2), 77-84.

Ahmed, S. 1995. *Agriculture-fertilizer interface in Asia: issues of growth and sustainability*. Science Publishers, Inc.

Amutha, R., Karunakaran, S., Dhanasekaran, S., Hemalatha, K., Monika, R., Shanmugapriya, P. and Sornalath, T. 2014. Isolation and mass production of biofertilizer (Azotobacter and phosphobacter). *International Journal of Latest Research in Science and Technology*, *3*, 79-81.

Basaglia, M., Casella, S., Peach, U., Poggiolini, S., Vamerali, T., Mosca, G., Vanderleyden. J., De Troch, P. and Nuti, M. P. 2003. Field release of genetically marked Azospirillum brasilense in association with Sorghum bicolor L. *Plant and soil*, *256*(2), 281-290.

Bishop, P. E., Jarlenski, D. M. and Hetherington, D. R. 1980. Evidence for an alternative nitrogen fixation system in Azotobacter vinelandii. *Proceedings of the national academy of sciences*, *77*(12), 7342-7346.

Boddey, R. M., Urquiaga, S., Alves, B. J. and Reis, V. 2003. Endophytic nitrogen fixation in sugarcane: present knowledge and future applications. *Plant and Soil*, *252*(1), 139-149.

Döbereiner, J. 1997. Biological nitrogen fixation in the tropics: social and economic contributions. *Soil Biology and Biochemistry*, *29*(5), 771-774.

Herschkovitz, Y., Lerner, A., Davidov, Y., Okon, Y. and Jurkevitch, E. 2005. Azospirillum brasilense does not affect population structure of specific rhizobacterial communities of inoculated maize (Zea mays). *Environmental Microbiology*, *7*(11), 1847-1852.

Narula, N., Lakshminarayana, K. and Tauro, P. 1981. Ammonia excretion by Azotobacter chroococcum. *Biotechnology and Bioengineering*, *23*(2), 467-470.

Nieto, K. F. and Frankenberger, W. T. 1989. Biosynthesis of cytokinins by Azotobacter chroococcum. *Soil Biology and Biochemistry*, *21*(7), 967-972.

Panwar, A. S., Balyan, J. S. and Verma, V. S. 2000. Yield and quality of radish (Raphanus sativus) seed as affected by fertility levels and biofertilizers. *Indian Journal of Agronomy*, *45*(4), 822-826.

Timmusk, S. 2003. Mechanism of action of the plant growth promoting bacterium Paenibacillus polymyxa. Ph.D.Thesis, Uppsala University, Uppsala, Sweden,42.

Tindale, A. E., Mehrotra, M., Ottem, D. and Page, W. J. 2000. Dual regulation of catecholate siderophore biosynthesis in Azotobacter vinelandii by iron and oxidative stress. *Microbiology*, *146*(7), 1617-1626.

Zambere, M.A., Konde, B. and Sonar, K.R. 1983. Effect of *Azotobacter* chroococcum and Azospirillum Brasilense inoculation under graded levels of nitrogen on growth and yield of wheat. *Plant Soil*, 9, 61-67.

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