

EFFECT OF BACTERIAL INOCULANTS ON GROWTH CHARACTERISTICS OF *SACCHARUM* SPP.

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A study was conducted to elucidate the effect of bacterial inoculants belonging to *Azotobacter* and *Pseudomonas* group on growth characteristics of *Saccharum* spp. Bacterial inoculants differentially influenced plant weight, shoot/root ratio, leaf lamina/leaf sheath ratio and partitioning of dry matter to various plant parts. However, the *Pseudomonas fluorescense* isolate PGr6 and *Azotobacter chroococcum* isolate Ac3 appeared to be more effective in influencing total plant weight. The increase in plant weight was associated with increased shoot/root ratio due to increased shoot biomass with no appreciable change in root biomass. The *Saccharum* genotypes differed in their response to various bacterial inoculants and the same bacterial inoculants may not be equally effective in influencing plant growth parameters.

Key words : *Azotobacter*, bacterial inoculants, growth characteristics, *Pseudomonas*, *Saccharum*.

Rhizobacteria have been known to affect crop-productivity and quality (Bashan *et al.* 1993, Glick 1995). The beneficial effect of these are attributed to increased nitrogen fixation, production of plant growth hormones or influencing seedling emergence, root development, plant vigor and health etc. (Schippers *et al.* 1987, Forlani *et al.* 1995). A variety of bacteria have been used in soil inoculations to augment the supply of nutrients to crop-plants. The present study is an effort to elucidate the effect of inoculation of bacterial isolates of genera *Pseudomonas* and *Azotobacter* on growth characteristics of *Saccharum* species and *Saccharum* spp. hybrid so as to identify the bacteria that may be utilized to harness more of cane productivity.

Four bacterial isolates belonging one each to *Azotobacter chroococcum* (Ac3), *Azotobacter vinelandii* (AvY), *Pseudomonas striata* (Psd201) and *Pseudomonas fluorescense* (PGr6) groups were used. Three *Saccharum* genotypes, belonging one each to *Saccharum barberi* (Maneria), *S. spontaneum* (SES24) and *Saccharum* spp. hybrid (CoS 88216, a commercial cultivar) were used in this study.

The experiment was laid in microplots of 1m x 1m size in three replications with randomized block design. A

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uniform dose of N P K @ 75, 80, 80 kg ha⁻¹ respectively was applied to each micro plot before sowing. Eight bacterial treated sets of *Saccharum* genotypes were placed in each plot. Individual plots were irrigated so as to avoid mixing of bacterial cultures. The data on plant parameters was recorded at Grand Growth Stage of the crop.

Amongst the plant growth promoting microbes studied, *Azotobacter* isolates Ac3 and AvY increased plant weight in *Saccharum* spp. hybrid CoS88216. In *S. spontaneum* (SES24) *Pseudomonas* isolate PGr 6 and *Azotobacter* isolate Ac3 increased plant weight much more as compared to control, Psd 201 and Avy. The isolate PGr6 was more effective in increasing plant weight in *S. barberi* Maneria (Fig.1). Genotypes studied differ in their response to various bacterial inoculants. However, *Pseudomonas fluorescense* isolate PGr6 and *Azotobacter chroococcum* isolate Ac3 appear to be more effective.

Shoot/Root ratio is an important parameter to express growth in sugarcane. In variety CoS88216 and SES24 (*S. spontaneum*) the increase in plant weight was associated with increased shoot/root ratio whereas no such trend was perceptible in *S. barberi* (Fig.2). Generally, there was an increase in shoot biomass with no perceptible change in root biomass. In wheat bacterial inoculation with *Bacillus*

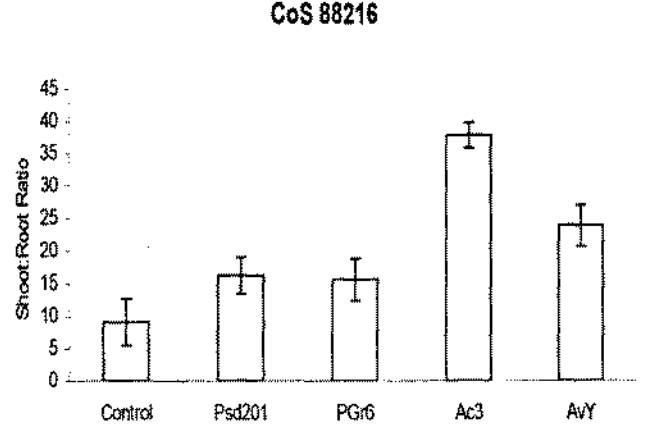
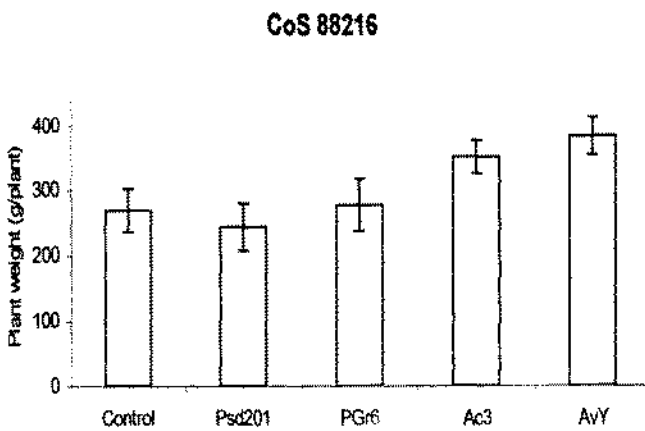
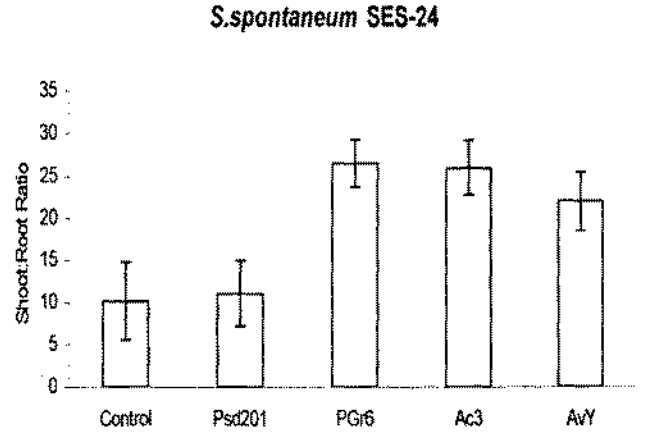
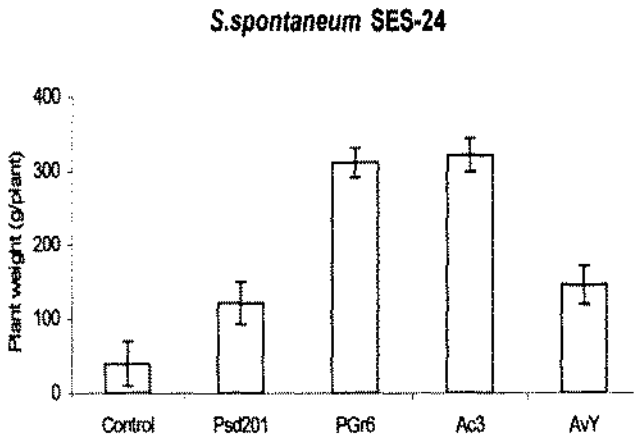
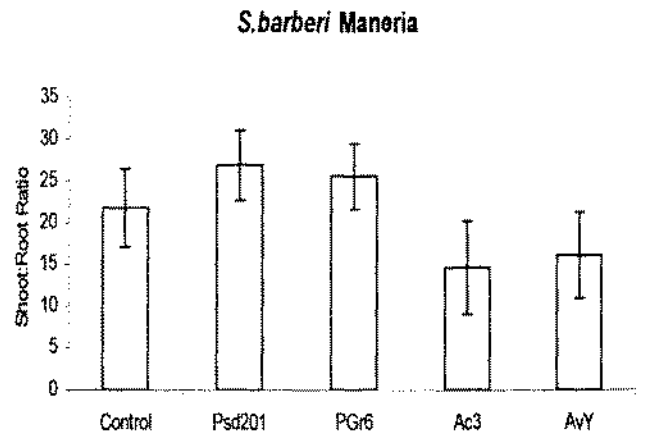
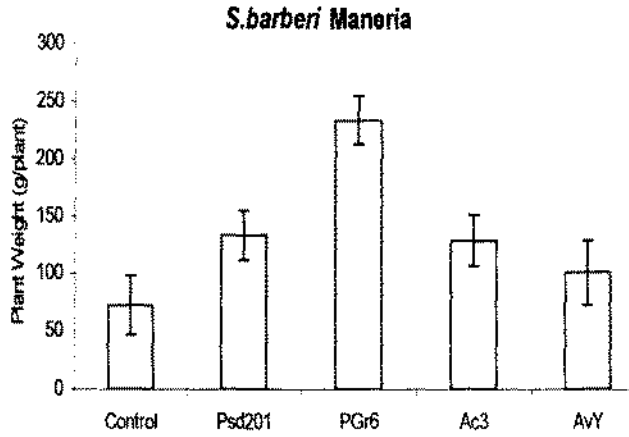


Fig. 1. Effect of bacterial inoculants on total plant weight (bar represents SE) of *Saccharum* sps.

Fig. 2. Effect of bacterial inoculants on shoot:root ratio (bar represents SE) of *Saccharum* sps.

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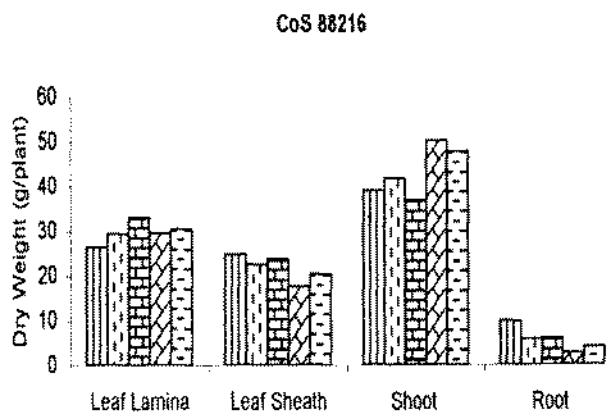
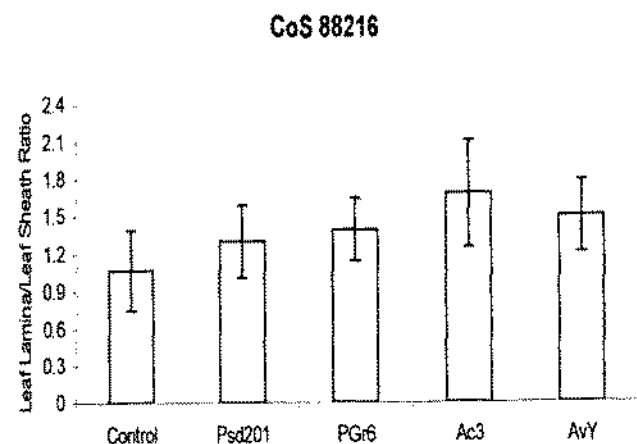
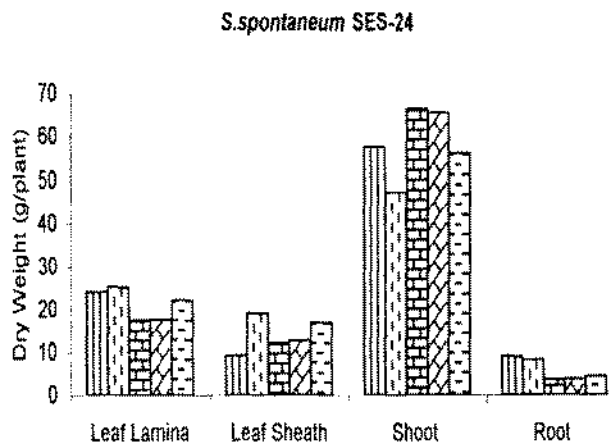
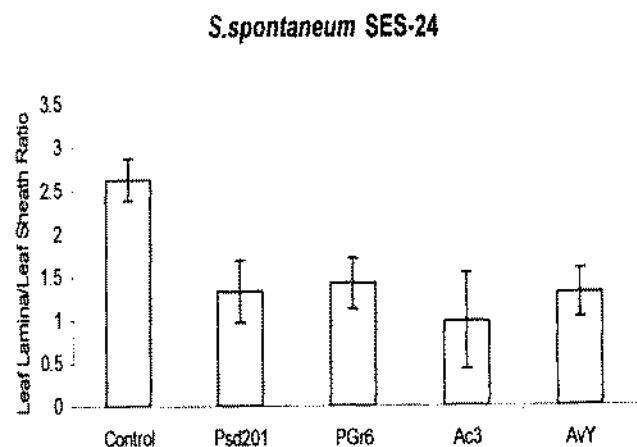
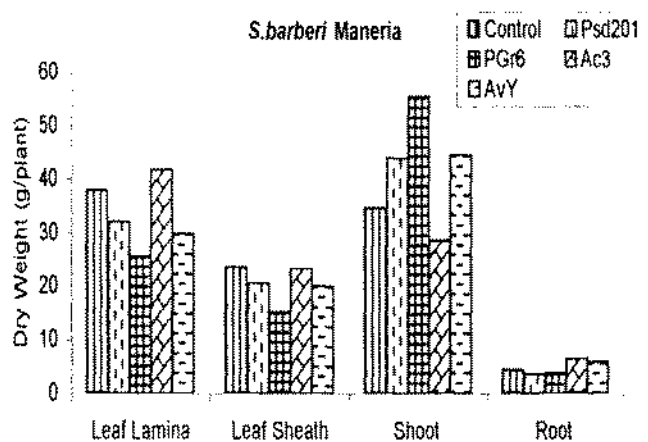
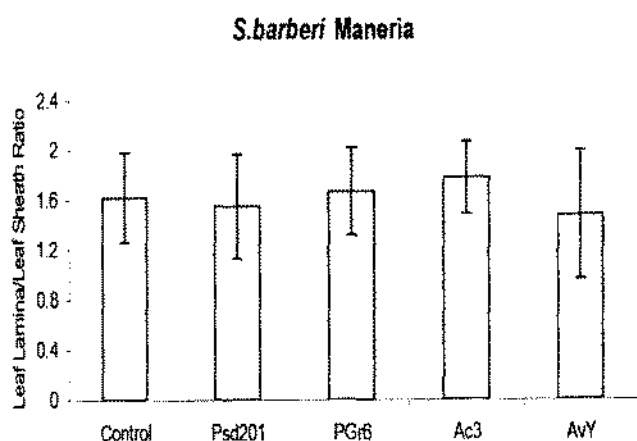


Fig. 3. Effect of bacterial inoculants on leaf lamina: leaf sheath ratio (bar represents SE)

Fig. 4. Effect of bacterial inoculants on dry matter partitioning in different *Saccharum* spp.

polymyxa increased plant dry weight and it was essentially due to an increase in shoot biomass (Gouzou *et al.* 1995).

In sugarcane variety CoS88216, the microbial isolates that increased total plant weight also increased LL/LS (Leaf lamina/leaf sheath) ratio. In *S. spontaneum*, SES24, all the bacterial inoculants decreased the LL/LS ratio as compared to control. However in *S. barberi* Maneria, microbial inoculants were unable to influence LL/LS ratio (Fig. 3).

The partitioning of dry matter to various plants parts in all the three sugarcane genotypes was influenced in response to set inoculation with these plant growth-promoting bacteria (Fig.4). As partitioning of dry matter in *Saccharum* spp. and genotypes is known to be influenced by many factors such as growth, development, planting time and ratooning etc. (Shrivastava *et al.* 1984), this study amply demonstrates that it is also influenced by inoculation with microbes as different genotypes responded differentially to different bacterial inoculants.

REFERENCES

- Bashan, Y., Holguin, G. and Lifshitz, R. (1993). Isolation and characterization of plant growth promoting rhizobacteria. In: B.R. Glick and J.T. Thompson (eds.) *Methods in Plant Molecular Biology and Technology*, pp. 331-345. CRC Press, Boca Raton.
- Forlani, G.R., Pastorelli, R., Branzoni, M. and Favilli, F. (1995). Root colonization efficiency, plant growth promoting activity and potentially related properties in plant associated bacteria. *J. Genet & Breed.* **49**: 343-352.
- Glick, B.R. (1995). The enhancement of plant growth by free living bacteria. *Can J. Microbiol.* **41**: 108-117.
- Gouzou, L., Cheneby, D., Nicolardot, B. and Heulin, T. (1995). Dynamics of the diazotrophs *Bacillus polymyxa* in the rhizosphere of wheat (*Triticum aestivum* L.) after inoculation and its effect on uptake of ¹⁵N-labelled fertilizer. *Eur. J. Agron.* **4**: 47-54.
- Schippers, B., Bakker, A. W. and Bakker P.A.H.M. (1987). Interaction of deleterious and beneficial rhizosphere microorganisms and the effect of cropping practices. *Ann. Rev. Phytopathol.* **25**: 339-358.
- Shrivastava, A.K., Kacker, N.K. and Singh, M. (1984). Partitioning of assimilates in sugarcane I. Influence of growth and development, genotype and crop stands. *Indian J. Plant Physiol.* **27**: 97-103.