Nitrogen Fixation: From Molecules to Crop Productivity

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INTERCROPPING OF COINOCULATED SOYBEAN AND SUGAR CANE PRODUCTIVITY

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The interest in combined inoculation of legume plants with symbiotic nitrogen fixing bacteria and PGPRs (Plant Growth Promoting Rhizobacteria) is increasing within the nitrogen fixation field. Recent reports inform about a positive effect on development of legumes produced by the coinoculation of *Rhizobium* and *Bradyrhizobium*, with *Azospirillum*, a diazotrophic PGPR (Burdman et al 1998). Usually *Azospirillum* is associated with *Gramineae* roots, like sugar cane, rice, corn, etc. This association is traduced in a beneficial effect on plant nitrogen nutrition. In Cuban soils, significant increases in productivity of sugar cane have been found when this plant was inoculated with different amounts of *Azospirillum* cultures (Roldós et al 1995). Moreover, *Azospirillum* has been associated with other PGPRs belonging to *Bacillus* genera, obtaining significant increases in N₂ase activity in mixed inocula of *Azospirillum* and *Bacillus* (Khammas et al 1997; Casas et al 1998).

The aim of this work was to evaluate the effect of coinoculation of *Azospirillum*, *Bradyrhizobium* and *Bacillus pumilus* on soybean plants. In parallel, inoculation with *Sinorhizobium fredii* was carried out in order to compare with *Bradyrhizobium* and the possibility to be introduced in Cuban soils. Field experiments in the Matanzas (Cuba) area are being performed to determine the effect of coinoculation of soybean in intercropping with sugar cane (*Saccharum officinarum*) on the final yield of sugar, as an ecological alternative to improve sugar cane productivity.

Experiments have been carried out at green house and field level. In the former, seeds of soybean were sown in sterile conditions and inoculated with *B. japonicum* USDA 110, *A. brasilense* 8-INICA and *B. pumilus* B-12. All possible combinations between these strains were performed. The strain SM11-12 of *S. fredii* was also used. Plants were watered with nitrogen free solution with the exception of controls and of the plants inoculated with B-12, because it is a PGPR, but not diazotrophic bacterium. In field experiments, rows of soybean plants inoculated with the above strains were inserted with rows of sugar cane.

The results indicate: i) Bacterial colonization of soybean roots in plants inoculated only with *Azospirillum*. The possibility that this bacterium correspond to the 8-1 strain has been analysed by immunolocalization. ii) Any type of coinoculation produces similar or better results than plants watered with nitrate, which indicates that it is not necessarily nitrogen fertilization in coinoculated plants and iii) Coinoculation of *B. japonicum* USDA 110 with *B. pumilus* B-1 is the best combination studied.

Burdman S et al (1998) In Elmerich C, Kondorosi A and Newton WE, eds. Biological Nitrogen Fixation for the 21st Century, pp 609-612. Kluwer Academic Publishers.

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