V Congreso Argentino de Microbiología Agrícola y Ambiental

aam

Libro de Resúmenes

15, 16 y 17 de septiembre de 2021

Modalidad Virtual
Centro de Convenciones Sergio Karakachoff de la Universidad Nacional de La Plata, La Plata, Argentina.

P-AG-54

AN INOCULANT BRADYRHIZOBIUM STRAIN WITH INCREASED MOTILITY IMPROVES YIELD OF SOYBEAN CROPS

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Soybean production is very important in Argentina, where more than 20 million hectares are sowed annually with this crop. Since soybean plants possess a very high N-demand, it is crucial that this agricultural activity is developed in a sustainable way because otherwise, this crop could deplete N-nutrition from the soils, leading to erosion, compaction, and flooding. Soybean roots are nodulated by *Bradyrhizobium* spp., which may fix atmospheric N_2 in symbiosis with the plant, thus contributing to keep the N-status of the soil. For this reason and due to their low cost, *Bradyrhizobium* spp. are widely used in inoculants for soybean crops. However, the efficiency of inoculants is low due to the competition exerted by bradyrhizobia resident in the soil. Among factors that affect the competition for nodulation is the self-propelled motility of the rhizobia.

Previously, we developed an artificial selection method to obtain bradyrhizobial strains with higher motility. *B. japonicum* E109 is the strain recommend by INTA for inoculants production. Therefore, we used E109 to increase its motility, and hereby we obtained the derived *B. japonicum* E109 m^+ strain. This strain possesses 50% more motility than its parental strain in semisolid agar medium, and has the same growth kinetics as the wild type, ruling out the possibility that the increased spreading of E109 m^+ in semisolid agar be due to faster growth.

B. diazoefficiens have two flagella systems, one subpolar and another lateral, characterized by flagellins of different molecular weights. The subpolar flagellum has constitutive expression and the lateral is inducible with L-arabinose as carbon source, but not with D-mannitol as carbon source. However, E109 m^+ expressed both flagella with D-mannitol, as observed with SDS-PAGE of purified flagellins, in agreement with previous results obtained with *B. diazoefficiens* USDA 110.

B. japonicum E109 m^+ nodulated soybean and after that, bacteria recovered from nodules maintained the higher motility phenotype. Field trials were performed to estimate yield when the soybean plots were inoculated with E109 m^+ or the E109 parental strain. Experiments were carried out in San Antonio de Areco, Province of Buenos Aires, in a soil with a competitive resident *Bradyrhizobium* spp. population, employing a randomized complete block design that included uninoculated controls. Grain yields were compared by ANOVA, which indicated that inoculation with E109 m^+ led to significantly higher yield than inoculation with E109 wild type.

Our results suggested that inoculation of soybean with improved motility strains could increase soybean yield by enhancing competition for nodulation in a sustainable way.