

## EFFICIENCY OF BIOLOGICAL NITROGEN FIXATION IN ALFALFA BY INTRODUCED AND NATIVE RHIZOBIA

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Biological Nitrogen fixation (BNF) in Argentina has been estimated to range between 90 to 450 kg N<sub>2</sub> ha<sup>-1</sup> yr<sup>-1</sup>, depending on environmental conditions (1). Considering those figures, it would be important to determine what proportion of this fixed N<sub>2</sub> is due to introduced (inoculated) or naturalized (soil) rhizobia. Therefore, to quantify the competitive ability and the relative efficiency of both rhizobia populations may provide valuable information for studying the BNF system as a whole. The objectives of this paper were: I- to evaluate BNF in inoculated and non-inoculated alfalfa under field conditions; and II- to assess the competitive ability and the relative fixation efficiency of introduced and naturalized rhizobia strains. A field trial was planted at INTA Manfredi (31° 49' S lat, 63° 48' W long) using a RCB design with four replicates and two treatments: inoculated (*Sinorhizobium meliloti* strain B399) and non-inoculated (control). Plots had 6 x 14m and were 3-m apart from the adjacent ones. Plant material was cv Barbara SP INTA, seeded at 11 kg ha<sup>-1</sup> in rows 20-cm apart. Forage harvests were done at 10% blooming or 5-cm high regrowth shoots. The trial was conducted during three growing seasons (September 2003 to February 2006). Forage yield (kg DM ha<sup>-1</sup>) and DM nitrogen content (Kjeldhal) were determined for each cut. In order to estimate BNF, N<sup>15</sup> was applied to 1 x 0.5 m subplots (never at the same place in successive cuts) and then the proportion of nitrogen derived from the atmosphere (N<sub>da</sub>) was calculated by the isotope N<sup>15</sup> dilution technique (value A). To study the proportion of nodules (PNO) that were colonized by the inoculated B399 strain (marked with resistance to spectinomycin and streptomycin), all the nodules in 0.225 m<sup>3</sup> of soil (a 1-m long, 0.15-m wide and 1-m deep area) were collected from one row in three reps from the inoculated treatment at spring and fall of every growing season. Then, the proportion of B399 and naturalized rhizobia in nodules was determined at two root strata: 0-39 and 40-90 cm. Differences between treatments for all variables were determined by ANOVA. Average forage yield was 16.33 tn DM ha<sup>-1</sup> yr<sup>-1</sup> and 18.53 tn DM ha<sup>-1</sup> yr<sup>-1</sup> for the inoculated and non-inoculated treatments, respectively. Therefore, for the non-limiting soil conditions of Manfredi, inoculation with the selected rhizobia strain B399 did not positively impact forage production compared to soil rhizobia population. For the inoculated and non-inoculated treatments, average BNF (aerial biomass) were 230.8 and 175.8 kg N ha<sup>-1</sup> yr<sup>-1</sup> and average N<sub>da</sub> were 68% and 61%, respectively. Overall, N<sub>2</sub> fixation and N<sub>da</sub> were higher (p<0.05) on the inoculated treatment only for the second growing season (2004-2005). In the inoculated plots, the proportion of nodules colonized by the introduced B399 strain ranged from 45% and 53% at 0-39 and 40-90 cm strata, respectively. Those values agree with previous studies on the competitive ability of introduced rhizobia in Argentina (1). It was concluded that the non-limiting soil conditions at Manfredi did not decrease nodule formation nor nodule functioning (> 60% of crop total N need derived from fixation) and that overall soil rhizobia fixing efficiency was comparable to the one from the selected B399 strain.

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(1) Racca, R. *et al.*, 2001. Contribución de la fijación biológica de nitrógeno a la nutrición nitrogenada de la alfalfa en la Región Pampeana. Ed. INTA. Bs As, Argentina, 56 pp.