RESEARCH CONCERNING THE EFFICACY AND NODULATION CAPACITY OF SOME SELECTED RHIZOBIA STAINS WITH SPECIFICITY FOR LUPIN AND BEAN PLANTS

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Abstract: *The use of ecological methods, promoting sustainable technologies with low inputs represents a contemporaneous subject at an international scale. Because of this reason, the adoption of alternatives in maintaining and increasing of soil fertility is a constant concern in this domain. The microorganisms witch improve the fertility status of the soil and contribute to plant growth, have been termed biofertilizers and are receiving worldwide attention for use as microbial inoculants in agriculture. Vessey, 2003, defined biofertilizer as "a substances which contains living microoganisms which, when applied to seed, plants surfaces, or soil, colonizes the rhizosphere or the interior of the plant and promotes growth by increasing the supply or availability of primary nutrients to the host plant. The Papilionaceae group are the most known family of plants that have symbiotic bacteria partnership to meet nitrogen requirements by biological way. In any cultural system for crop legumes, such as principal culture, intercropping, crop rotation, allied crops through utilization of performing symbiotic strains for nitrogen fixation, the improvement of total nitrogen content in soil is assured. The present paper shows results about efficacy and nodulation capacity of selected strains of Bradyrhizobium lupini and Rhizobium phaseoli compared with native strains belong to edaphical microflora. Efficiency was tested by inoculating seed of Lupinus angustifolius with strains LP53, LP73, LP78 and LP83 from the laboratory collection of Soil Biology, Fundulea. For bean, Phaseolus vulgaris were used FsS2, FsS4, FsS6 and FsS9 strains isolated from agricultural perimeter Sîrbova village, Timis County, in summer 2007. After 6 weeks of plant growth was determined stem length, dry biomass accumulation, the number and volume for nodosity. Strain Lp 78 for lupins and FsS2 for beans proved to be most efficient genotypes, in the same culturally conditions, values recorded on the number, volume of nodosity and accumulation of dry matter / plant exceeding control samples, without bacterial treatment.*

Key words: *Rhizobium stains, efficacy, crop legumes nodosity, total nitrogen content*

INTRODUCTION

The use of ecological methods, promoting sustainable technologies with low inputs represents a contemporaneous subject at an international scale. Because of this reason, the adoption of alternatives in maintaining and increasing of soil fertility is a constant concern in this domain (SOUZA FILHO, HILDO M.,1998, GREGORY P.J., 2006). The microorganisms witch improve the fertility status of the soil and contribute to plant growth, have been termed biofertilizers and are receiving worldwide attention for use as microbial inoculants in agriculture (MCKENZIE B., 2007). Vessey, 2003, defined *biofertilizer* as "a substances which contains living microoganisms which, when applied to seed, plants surfaces, or soil, colonizes the rhizosphere or the interior of the plant and promotes growth by increasing the supply or availability of primary nutrients to the host plant. The *Papilionaceae* group are the most known family of plants that have symbiotic bacteria partnership to meet nitrogen requirements by biological way. In any cultural system for crop legumes, such as principal culture,

intercropping, crop rotation, allied crops through utilization of performing symbiotic strains for nitrogen fixation, the improvement of total nitrogen content in soil is assured. In agriculture, lupin is used as green manure, especially in rotation with wheat, because of the symbiosis with the nitrogen fixing bacteria which permit the accumulation of high nitrogen content in plants. Beans are an important plant for human nourishment due to high crude protein content with high nutritional qualities (FREIRE, J. AND , SACCOL DE SA E., 2006).

MATERIAL AND METHODS

The present paper shows results about efficacy and nodulation capacity of selected strains of *Bradyrhizobium lupini* and *Rhizobium phaseoli* compared with native strains belong to edaphical microflora. Efficiency was tested by inoculating seed of *Lupinus angustifolius* with strains LP53, LP73, LP78 and LP83 from the laboratory collection of Soil Biology, Fundulea. For bean, *Phaseolus vulgaris* were used FsS2, FsS4, FsS6 and FsS9 strains isolated from agricultural perimeter Sîrbova village, Timis County, in summer 2007. After 6 weeks of plant growth, in the plots with 500 ml capacity, in same conditions, was determined stem length, dry biomass accumulation (ŞUMĂLAN R., DOBREI CARMEN, 2002), total nitrogen content (RADULOV ISIDORA, LAŢO ALINA, CRISTA F., 2004), the number and volume for nodosity per plant.

RESULTS AND DISCUSSIONS

The efficacy of the Bradyrhizobium and Rhizobium strains regarding the stem length, dry biomass accumulation and total nitrogen content in the plants

Six weeks after shooting, plants from different experimental variants are in different stages of development. It could be observed that plants without bacterial inoculation are shorter, and are forming floral buds; meanwhile the inoculated plants are flowering and forming pods. Regarding the stem length of the variants, the values are 42% greater when the lupin seeds are inoculated with bacterial suspension of the strain Lp 73. The strain Lp 83 determines a growth of dry weight of 26% higher than the control (table 1). In case of bean plants, FsS2 strain is remarkable of stem length and dry biomass accumulation parameters.

Table 1.

The variation of plants' growing in *Bradyrhizobium lupini* and *Rhizobium phaseoli* stains treatment case

Param. / Var.	dry biomass (%)		Stem length (cm)	
	$\bar{x} \pm s_x$	%	$\bar{x} \pm s_x$	%
Control lupin indigenous strains	*23.6±2.50*	*100*	*24.50±2.0*	*100*
Lp 78	26.3±1.40	111	31.18±0.20	127
Lp 73	25.5±2.80	108	35.20±1.10	142
Lp 53	28.3±2.40	119	31.03±2.0	127
Lp 83	29.7±1.40	126	30.15±3.20	123
Control bean	*11.05±2,03*	*100*	*5.16±0.93*	*100*
FsS_2	15.62±2.42	173	10.67±1.67	207
FsS_4	15.1±3.65	187	9.24±1.05	179
FsS_6	14.19±2.45	128	6.86±1.22	133
FsS_9	14,36±2	130	9.52±1.92	184

To test the effectiveness of strains for nitrogen fixation, total nitrogen content was determined by Kjeldahl method (RADULOV ISIDORA, et al., 2004). The results shown in Figure 1 shows a high total nitrogen accumulation for stain FsS2 about 3,45% Nt, followed by Fss4 and FsS6. The smallest amount of total nitrogen was determined in treatment with FsS9. For the lupin plants, the biggest amount of nitrogen accumulated was for Lp83 stains, about 5,92%, and the smallest was Lp 78, about 3,9% .

*The efficacy of the Bradyrhizobium strains regarding the nodulation capacity***.** From the analysis of the obtained data (Table 2.) it can be observed that the strain LP83, with the nodulation mean of 2.75 has the lowest capacity of nodulation. However, the higher volume compensates for the small number of the nodules, making an average growing of the stem length and the dry biomass. (ŞUMĂLAN RENATA et al 2008, DOBREI .et al 2008). The FsS2 has the biggest capacity of nodulation because the nodules number and volume is high on plants, Table 3.

Table 2.

The variation of nodulation parameters of lupine plants

Param. / Var.	Nodules number		Nodules volume(cm^3)	
	$\bar{x} \pm s_x$	%	$\bar{x} \pm s_x$	%
native strains (control)	5.25±2	100	0.35±0.1	100
Lp 78	8.25±1.1	157	0.4±0	114
Lp 73	5.5±1.2	104	0.39±0.0	111
Lp 53	6.75±0.4	129	0.45±0.1	129
Lp 83	2.75±1.9	52	0.43±0.1	123

Table 3.

The variation of nodulation parameters of bean plants

Param. / Var.	Nodules number (%)		Nodules volume (cm^3)	
	$\bar{x} \pm s_x$	%	$\bar{x} \pm s_x$	%
native strains (control)	5,6±3,61	100	0,15±0,15	100
Fs S_2	18,6±9,13	332	0,32±0,15	213
Fs S_4	12,8±8,49	229	0,24±0,12	160
Fs S_6	7,8±2,14	139	0,14±0,05	93
Fs S_9	2,4±2,33	43	0,02±0,04	13

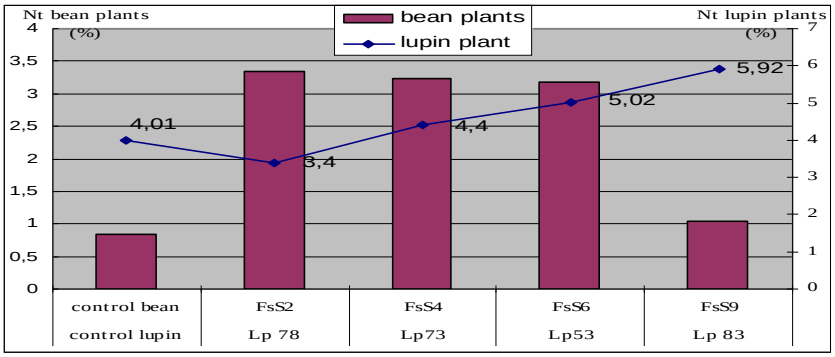

Fig. 1. The effectiveness of rizobia strains depending of total nitrogen content/plant (Nt%)

CONCLUSIONS

- Soil natives' microflora contains populations of rhizobia with a remarkable infection capacity but a low efficacy, fact proved by the reduced growing rhythm and accumulation of nitrogen content on plant.
- The numbers of nodules do not reflect an efficient biological nitrogen fixation.
- Greater nodules assure an efficient nitrogen fixation, determining a more vigorous growth of the plants, also with a higher dry biomass and total nitrogen content.
- The most effectiveness nitrogen rhizobia stains in the accumulation of nitrogen were Lp 83 for lupin plants and FsS2 for bean plants.
- Using efficient strains, a stimulation of the plants' development can be observed, much more accentuated than using indigenous edaphic strains.

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