EFFECT OF INOCULATION OF BEAN AND SNAP BEAN

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Microorganisms are the living part of soil and they actively participate in its forming. Microbiological processes in soil are conditioned by organic matter content, and each soil type fertility is connected to its microflora activity. Depending on types of microorganisms which are a part of microbiological fertilizers, activating favourable microbiological processes in soil and increasing their effectiveness can be influenced. There are symbiotic relations between plants and root nodule bacteria in soil under leguminoses. Specific root nodule bacteria for bean and snap bean are *Rhizobium leguminosarum bv. phaseoli,* and nitrogen quantity these bacteria can fix is between 20 and 115 kg N ha $^{-1}$ (Rennie and Kemp, 1983; Rushel *et al,* 1982). According to Plancquaret (1999), bean needs 300 kg N ha $^{-1}$ which is partly provided by symbiotic nitrogen fixation. If there are less than 10 cells per soil gram in soil of autochthonous population of *Rhizobium* adding bacteria, mostly by seed inoculation, increases root nodulation. Present autochthonous root nodule bacterial strains in soil can be less effective than strains added by seed inoculation. By adding NS-Nitragine For Bean a more effective symbiotic community is formed in relation to uninoculated seed, i.e. larger and more quality bean yield is produced (Milić *et al*).

Activity of *Rhizobium leguminosarum bv. phaseoli* depends on many environmental factors in soil, and especially on soil acidity. Because bean is grown on different soils, it is necessary to produce such a mixture of microorganisms that the commercial preparation can be used as inoculant on different soil types or inoculants which contain strains of these microorganisms for soils of extreme acidity values.

Materials and Methods

NS-Nitragin For Bean And Snap Bean is a commercial preparation made in Microbiological Section of the Institute of Field and Vegetable Crops in Novi Sad. Selected strains of *Rhizobium leguminosarum bv phaseoli* (strains 1, 2, 3 and 4) which are a part of the microbiological fertilizer (NS-Nitragin For Bean And Snap Bean) have been tested on nutritive substratum Demolon of different pH values (pH meter Cyber Scan 510) (substratum pH fixed with HCl 1% and NaOH 10%). Previously a starting culture of each strain has been sown (in 200 cm^3 of liquid medium) after 72 hours of culture growing at 28-30 C^o from each starting culture 1 cm^3 has been taken sterile and transported into new liquid medium Demolon of different pH values. After 72 hours of culture growing at 28-30 C^o in shaker, out of each liquid medium of different pH values number of cells of tested strains of *Rhizobium leguminosarum bv phaseoli* have been determined by method of thinning from the starting culture to 10 $^{-13}$.

Inoculation of bean seed of variety Aster and Zlatko, and snap bean of variety Bergold was performed directly prior to sowing by the microbiological fertilizer NS-Nitragin which contains mixture of strains *Rhizobium leguminosarum bv. phaseoli* (1,2,3,4) specific for bean and snap bean. At Experimental Fields in Rimski Šančevi, Vojvodina Province (soil type chernozem Tab.2) during 2005, a trial has been set by random block system in 4 repetitions with and without microbiological fertilizer NS-Nitragin. At the end of vegetation, number od pods and grains and grain mass per plant were determined.

Results and discussion

All strains of *Rhizobium leguminosarum bv phaseoli* (1, 2, 3, 4) are good both for acid and neutral soils. Strain 1 develops weakly on acid medium to pH 5; it reaches greatest development at wider acidity area from pH 6 upwards. Strain 2 has a broader development optimum, beginning at pH 5. Strains 3 and 4 have a narrower value of maximum development at different pH levels. Strain 3 is the most tolerant to environmental acidity change. Strain 4 does not develop at all on extremely acid medium. Strains 3 and 2 tolerate acid environment from pH 4, and strains 1 and 4 grow better on weakly alkaline and neutral mediums (Table 1).

Table 1. Number of microorganisms Rhizobium leguminosarum bv phaseoli on different pH value mediums

Strains	pH 4	pH 4,5	pH 5	pH 5.5	pH 6	pH 6,5	pH 7
1	$1x10^{1}$	$4,66x10^{5}$	$2x10^{4}$	$8,66x10^{7}$	$2,2x10^{12}$	$4,06x10^{12}$	$2,86x10^{12}$
2	$7,66x10^{2}$	$4,33x10^{7}$	$5,53x10^{13}$	$6,43x10^{13}$	$6,9x10^{13}$	$6x10^{12}$	$1,66x10^{9}$
3	$3,3x10^{10}$	$3x10^{9}$	$2,66x10^{11}$	$5,66x10^{12}$	$19,33x10^{13}$	$9,66x10^{12}$	$17x10^{12}$
4	Does not grow	$5,66x10^{5}$	$6,2x10^{13}$	$1,66x10^{12}$	$1,33x10^{11}$	$1,66x10^{9}$	$2,66x10^{10}$

Table 2. Basic soil chemical properties prior to sowing

pH		$CaCO_3$	Humus	Total	AL-P_2O_5	AL-K_2O
in KCl	in H_2O	%	%	N %	mg/100g	mg/100g
7,28	8,01	10,50	2,52	0,161	27,2	21,8

Gathered results have shown that inoculation with strains mixture (NS-Nitragin) had a positive influence on tested parameter of bean yield, while the effect of inoculation was diverse depending on plant genotype. On average, with all tested genotypes inoculation had effect on increased pod and grain number per plant, as well as grain mass per plant, i.e grain yield (Tab.3).

Table 3. Average number of pods, grains and grain dry matter mass per plant with inoculated and uninoculated varieties of bean and snap bean

Varieties	Pod Number		Grain Number		Grain Mass (g)	
	-N	+N	-N	+N	-N	+N
Aster	14,33	14,67	38,00	45,33	13,46	16,21
Bergold	15,22	17,50	37,52	48,33	16,17	18,39
Zlatko	4,80	7,75	13,60	18,50	6,11	9,42
AVERAGE	11,45	13,31	29,71	37,39	11,91	14,67

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