INFLUENCE OF ALFALFA BACTERIAL INOCULATION WITH *SINORHIZOBIUM MELILOTI* STRAINS ON FORAGE YIELD

INFLUENȚA INOCULĂRII BACTERIENE A LUCERNEI CU TULPINI DE *SINORHIZOBIUM MELILOTI* ASUPRA PRODUCȚIEI DE FURAJ

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Abstract: *Bacterial inoculation in alfalfa represents an important technological measure to increase the dry matter yield. The bacterial strains used determined an increase of the forage yield with 32.7% in the first year of vegetation, with 32.5% in the second and 36.7% in the third year of vegetation. At the same time, in the variants with bacterial inoculation, the dry matter yield was 9.3-91.5%-fold bigger than in the variant fertilized with N50.*

Rezumat: *Inocularea bacteriană la lucernă constituie o măsură tehnologică importantă de sporire a producției de substanță uscată. Tulpinile bacteriene folosite au realizat o creştere a producției de furaj cu 32,7%, în primul an de vegetație, cu 32,5% în anul al doilea şi cu 36,7% în anul al treilea. Totodată, la variantele cu inoculare bacteriană producția de substanță uscată a fost cu 9,3-91,5% mai mare față de varianta fertilizată cu N50.*

Key words: *alfalfa, bacterial strains, bacterial inoculation, dry matter*
Cuvinte cheie*: lucernă, tulpini bacteriene, inoculare bacteriană, substanță uscată.*

INTRODUCTION

The bacterial inoculation in alfalfa with ameliorated *Sinorhizobium meliloti* strains represents an important measure to increase the biological nitrogen fixation capacity and implicitly the forage yield. The application of this treatment in optimal conditions depends on the ecologic conditions and on the technology applied in the alfalfa crop as well (CHAMBLEE and WARREN, 1980; DRAGOMIR et al., 1978; MOGA et al., 1996; NUTMAN, 1976; ZAHAN, 1970).

This work presents the influence exerted by the inoculation of alfalfa seeds with different bacterial strains on the dry matter yield, under the conditions available in the Banat's field region.

MATERIALS AND METHOD OF RESEARCH

The researches were performed at the Didactic Station of USAMVB Timişoara, on a cambic chernozem-type soil, moderately gleyied, with reduced salinity, during 2006-2008. In order to attain the objectives proposed, we studied the following experimental variants: V_1 – unbacterized; V_2 – N_{50}; V_3 – LC121; V_4 – LC310; V_5 – LC330; V_6 – LC366; V_7 – LC373; V_8 – LC408.

The bacterial strains were supplied by ICDA Fundulea and they were multiplied in laboratory on agar medium. The bacterial inoculation of alfalfa seeds was performed before planting, when the temperature within the soil was at least 6°C.

From a technical viewpoint, the experience was located according to the block method, in four replications, with parcel area of 14 m^2 (2x7), and the planting was performed at the beginning of April 2006.

The dry matter yields were determined every year of vegetation and interpreted with the help of variance analysis.

RESULTS AND DISCUSSIONS

The alfalfa bacterial inoculation with specific *Sinorhizobium meliloti* strains represents an important technological measure in the increase of the forage yield. Therefore, the analysis of the yield results presented in Table1 shows that, in the first year of vegetation, compared with the not-inoculated variant (Mt_1), all the other bacterized variants produced yield growths that were 18.2% - 47.6% bigger. The biggest yield was achieved in the variant inoculated with the bacterial strain LC – 366 (2.76 t/ha), and with the strain LC – 373, with a yield of 2.73 t/ha. These growths are statistically assured.

Table 1

Influence of some bacterial *Sinorhizobium meliloti* strains on dry matter yield (first year of vegetation)

Variant	t/ha	Comparison with Mt1			Comparison with Mt2		
		Dif. t/ha	%	Signif.	Dif. t/ha	%	Signif.
1. Unbacterized (Mt1)	1,87	-	100		-0,40	82,4	
2. N_{50} (Mt_2)	2,27	0,40	121,4		-	100	
3. LC121	2,65	0,78	141,8	*	0,38	116,8	
4. LC310	2,63	0,76	140,7	*	0,36	115,9	
5. LC330	1,90	0,03	102,0		-0,37	84,0	
6. LC366	2,76	0,89	147,6	*	0,49	121,6	
7. LC373	2,73	0,86	146,0	*	0,46	120,2	
8. LC408	2,21	0,34	118,2		-0,06	97,3	
Mean of bacterization	2,48	0,61	132,7	*	0,21	109,3	

DL 5% = 0,61 DL 1% = 1,24 DL 0,1% = 2,89

The bacterial strains tested in the conditions specific to Banat Field are characterized by a good capacity of ecologic and technological adaptation, leading to the obtaining of a mean yield growth of 32.7% (statistically assured) bigger than the unbacterized variant.

If we compare the results obtained in the first year of vegetation with the N-fertilized variant, we may observe that two of the bacterial strains tested (LC – 330 and LC - 408) led to smaller yields than in the variant fertilized with N_{50}, respectively with 3-16%, but not assured statistically. The growths obtained in the case of the other strains are 15.9 – 21.6% bigger than in the N-fertilized variant. On an average, the alfalfa bacterial inoculation produces a growth that is 9.3% bigger than in the variant fertilized with N_{50}.

Alfalfa productive potential, the biggest one, occurs in the second year of vegetation, when the planting was carried out in spring. This feature was also available under conditions of bacterial inoculation of alfalfa seeds. So, successive to the bacterial inoculation, we obtained significant yield growths, compared with the unbacterized control variant, namely between 0.57-4.20 t/ha dry matter, depending on the bacterial strain virulence degree (Table 2).

Among the tested bacterial strains, we remarked the following ones: LC – 121, with a yield growth of 55.1%; LC – 366, with a growth of 44.3%; LC – 310, with a growth of 40.9%.

On an average, compared with the unbacterized variant, the bacterial inoculation leads to a growth of 2.48 t/ha D.M., respectively with 32.5% bigger (distinctly significant) than in the unbacterized variant.

The application of N-fertilization in the second year of vegetation exerted a negative effect on the alfalfa yield, producing only 5.28 t/ha, respectively with 2.35 t/ha D.M. smaller than the unbacterized variant and with 4.83 t/ha smaller than the mean of the bacterized variants.

Table 2

Influence of some bacterial *Sinorhizobium meliloti* strains on dry matter yield (two year of vegetation)

Variant	t/ha	Comparison with Mt_1			Comparison with Mt_2		
		Dif. t/ha	%	Signif.	Dif. t/ha	%	Signif.
1. Unbacterized (Mt_1)	7,63	-	100	*	2,35	100	*
2. N_{50} (Mt_2)	5,28	-2,35	69,22	***	-	144,5	
3. LC121	11,83	4,20	155,1	**	6,55	224,1	***
4. LC310	10,75	3,12	140,9	***	5,47	203,6	***
5. LC330	8,49	0,86	111,3	**	3,21	160,8	**
6. LC366	11,01	3,38	144,3	**	5,73	208,6	***
7. LC373	10,33	2,70	135,4		5,05	195,7	***
8. LC408	8,20	0,57	108,0		2,92	156,0	**
Mean of bacterization	10,11	2,48	132,5		4,83	191,5	***

DL 5%=1,74 DL1%=2,39 DL0,1%=3,25

The effect of alfalfa bacterial inoculation in the first year of vegetation was observed in the third year, too, in the yield growths obtained (Table3). This observation confirms the results obtained by other researchers, too, who proved the existence of a "remnant" effect of the perennial legume bacterial inoculation (DRAGOMIR, 1978; MOGA, 1996).

In the third year of vegetation, all the bacterial strains studied led to yield growths, compared with the unbacterized variant, between 1.05-3.06 t/ha D.M. The biggest growths were obtained in the case of the strains LC-366, LC-310 and LC-121, statistically assured. On an average, the inoculated variants produced, in the third year, too, with 2.22 t/ha D.M. more than the unbacterized control variant (Table 3).

Table 3

Influence exerted by some bacterial *Sinorhizobium meliloti* strains on dry matter yield in alfalfa (third year of vegetation)

Variant	t/ha	Comparison with Mt1			Comparison with Mt2		
		Dif. t/ha	%	Signif.	Dif. t/ha	%	Signif.
1. Unbacterized (Mt_1)	6,06	-	100		0,64	111,8	
2. N_{50} (Mt_2)	5,42	- 0,64	89,5		-	100	
3. LC121	8,62	2,56	142,2	*	3,20	159,1	*
4. LC310	8,68	2,62	143,2	*	3,26	160,2	*
5. LC330	7,11	1,05	117,3		1,69	131,2	
6. LC366	9,12	3,06	150,4	*	3,70	168,3	**
7. LC373	8,42	2,36	138,9		3,00	155,4	*
8. LC408	7,76	1,70	128,0		2,34	143,2	
Mean of bacterization	8,28	2,22	136,7		0,21	152,8	*

DL 5% = 2,52 DL 1% = 3,45 DL 0,1% = 4,70

In the last year of vegetation, the negative effect exerted by alfalfa chemical fertilization was more obvious. Therefore, in the variant fertilized every year of vegetation with N_{50}, we obtained the smallest D.M. yield, compared with the bacterized variants. Compared with the fertilized variant, successive to bacterial inoculation, we obtained a mean yield of 8.28 t/ha D.M., with a growth of 2.86 t/ha bigger, respectively of 52.8%.

CONCLUSIONS

The researches on the processes of nitrogen biological fixation through bacterial inoculation and of soil supply with symbiotic nitrogen led to the following conclusions:

- Alfalfa bacterial inoculation with ameliorated *Sinorhizobium meliloti* strains represents an important technological measure in the increase of forage yield;

- Bacterial inoculation increased the D.M. yield with a mean value of 32.7% in the first year of vegetation, with 32.5% in the second year and 36.7% in the third year of vegetation;
- There are significant differences between the bacterial strains studied, the strains LC-366, LC-330 and LC-408 being remarkable;
- With the bacterial inoculation, we obtained yield growths that were bigger than in the variant fertilized with nitrogen. So, the bacterized variants led to a growth that was 9.3% bigger in the first year of vegetation, 52.8% bigger in the second year and 52.8% bigger in the third year of vegetation.

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