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Field Evaluation of nine Soybean Varieties

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Abstract: Nine soybean varieties different maturity groups were assessed under field conditions The experiment was conducted. during 1994, 1995, 1996, and 1997 at the Rimski Šancevi Experiment Field of the Institute of Field and Vegetable Crops in Novi Sad. We examined parameters: number of nodules per plant, dry matter mass of plants, nitrogen content and yield. The number of nodules formed was considerably higher in 1995. Dry matter mass and nitrogen content of plant were higher in 1994 and 1995 than in other years of investigation, but the highest grain yield was recorded in 1997. On average of four years variety Vojvodanka gave the highest yield which was in positive correlation with other examinated parameters.

Key words: dry matter mass, Nitragin, nitrogen content, soybean, varieties, yield.

Introduction

To improve the N_2-fixing capacity of legumes through plant breeding and strain selection in nodule bacteria is a complex challenge facing plant breeders and microbiologists. Our previous studies (Saric et al, 1987; 1988; 1990; Mrkovacki et al, 1989; 1990, 1992; 1996) were aimed to select efficient strains of nodule bacteria for particular plant genotypes. A new direction in research is the study of variations in the nitrogen-fixing capacity of the host plant (Bliss, 1987; Ellis, 1996).

Burias and Planchon (1990) investigated four soybean cultivars of different geographical origin and earliness in order to gain a deeper insight into interactions between the N_2-fixing potential and seed yield in soybean as well as

to determine whether the improvement of symbiotic N_2-fixing ability might constitute a way of selection for increasing yield.

The main objective of this paper was to determine the differences in actual nitrogen fixation between soybean varieties grown under field conditions, as well as yield as an agronomic indicator.

Materials and methods

The experiment was conducted during 1994, 1995, 1996 and 1997 at the Rimski Šancevi Experimental field of the Institute of Field and Vegetable Crops in Novi Sad. It was conducted in chernozem soil. Nine soybean genotypes (Jelica, Krajina, Afrodita, Backa, Panonka, Balkan, Ravnica, Vera and Vojvodanka) were used in the complete randomized block design with four replications. In all years the soybean seeds were inoculated with Nitragin produced at the Institute. Inoculation of soybean is a common agricultural practice for the area because there are not indegenous rhizobia. A composite mixture of effective *B. japonicum* strains is from Collection NSCNFM registred in WFCC World Data Center on Microorganisms, Japan (patent YU P-416-95, Mrkovacki, Milic, Saric). Samples were taken when most of the plants were in growth stages R5 and R6. Five plants per replication were dug out, after which their roots were washed and the nodules separated, weighted and counted. The nodules and the vegetative parts of the plant were dryed at 105^0C for 24 hours. Dry weights were recorded for each sample, after which the samples were analyzed for total nitrogen using the Kjeldahl method.

Results

Nodule number

The number of nodules formed was considerably higher in 1995 than in other years of investigation. The nodule number per plant ranged from 21.61 to 34.44 the lowest being in the variety Jelica and the highest in the variety Vojvodanka (Table 1).

Table 1. Number of nodules (No/plant) of soybean varieties

Varieties	Maturity group	Year				Average
		1994	1995	1996	1997	
Jelica	00	17.4	30.77	17.86	20.43	21.61
Krajina	00	23.17	73.18	16.60	17.63	32.78
Afrodita	0	20.7	42.40	17.63	20.54	25.32
Backa	0	15.4	36.88	15.26	19.97	21.88
Panonka	0	14.0	39.66	17.73	/	23.79
Balkan	I	12.7	40.20	14.96	21.08	22.23
Ravnica	I	17.5	55.22	12.70	20.86	26.57
Vera	I	22.1	34.66	15.86	17.96	22.64
Vojvodanka	II	25.6	77.44	14.86	19.86	34.44
Average		18.79	47.82	15.94	19.79	

Dry matter mass of whole plant

This parameter turned out to be higher in 1994 and 1995 than in next two years. At average of all years the varieties Vojvodanka and Vera had the highest mass (11.786 and 11.156 mg/plant) and the varieties Backa and Krajina the lowest (9.037 and 9.036 mg/plant) (Table 2).

Table 2. Dry matter mass (mg/plant) of soybean varieties

Varieties	Maturity group	Year				Average
		1994	1995	1996	1997	
Jelica	00	11508	9889	12068	8770	10559
Krajina	00	9982	9658	7825	8789	9063
Afrodita	0	9294	16309	6751	7023	9844
Backa	0	11782	9537	8356	6473	9037
Panonka	0	10325	12063	9,152	/	10513
Balkan	I	11452	9138	13269	9134	10748
Ravnica	I	11048	12526	7651	9784	10252
Vera	I	12460	11207	9749	11209	11156
Vojvodanka	II	15875	12451	10240	8577	11786
Average		11525	11420	9451	8720	

Nitrogen content of whole plant

The lowest nitrogen content was observed in the varieties Krajina and Backa. The varieties Vojvodanka and Vera had highest concentration of nitrogen (Table 3). The highest nitrogen content was observed in 1994 and 1995 as well as dry matter mass.

Table 3. Nitrogen content (mg/plant) of soybean varieties

Varieties	Maturity group	Year				Average
		1994	1995	1996	1997	
Jelica	00	399.18	406.85	435.91	288.54	382.62
Krajina	00	346.55	336.73	270.97	394.81	337.26
Afrodita	0	418.31	575.56	293.46	254.58	385.48
Backa	0	370.69	410.68	315.91	299.99	349.32
Panonka	0	400.81	475.84	305.63	/	394.09
Balkan	I	267.53	427.29	520.04	432.65	411.88
Ravnica	I	382.31	472.43	296.55	446.41	399.42
Vera	I	458.48	383.43	486.07	453.94	443.98
Vojvodanka	II	560.51	516.20	394.20	367.48	459.76
Average		400.48	445.00	368.15	367.30	

Yield

The highest grain yield was recorded in 1997, the lowest in 1994. On average of four years variety Vojvodanka gave the highest yield, than varieties Ravnica, Vera, and Afrodita (Table 4).

Table 4. Yield (kg/ha) of soybean varieties

Varieties	Maturity group	Year				Average
		1994	1995	1996	1997	
Jelica	00	3012	3371	3488	3772	3411
Krajina	00	3049	3573	3559	4021	3550
Afrodita	0	2887	3877	3909	4635	3827
Backa	0	2638	3485	4055	4354	3633
Panonka	0	2766	3752	3469	/	3329
Balkan	I	2500	3973	4042	4257	3693
Ravnica	I	2547	4403	4287	4702	3985
Vera	I	2596	4413	4314	4302	3906
Vojvodanka	II	2525	4496	4612	4748	4095
Average		2724	3927	3970	4349	

Discussion

Crop menagement and environmental factors greatly influence seed quality. These factors may best be studied in order to better understand the control of the expression of the higher potential of some improved genotypes in current field crop conditions (Bouniols et al, 1997). The results of Pracht et al. (1994) have shown that the soybean yield parameters are affected by complex mechanisms of genetic control and that a change of a particular physiological trait, such as nodulation, does necessarily lead to an increase in the efficiency of N_2-fixation and does not necessarilly increase yields.

But, in our study variety Vojvodanka had the highest number of nodules and dry matter mass of plant as well as the highest nitrogen content in whole plant.

An increase in nodulation does necessarily bring about an increse in yields. Nodule number is generally thought not to be a reliable indicator of the extent of nitrogen fixation, that is to say, a higher number of nodules formed on the root of a plant does not guarantee that the symbiotic association will be more efficient (Mrkovacki, 1990). Still, some studies, such as Bergersen et al. (1989) and Duque et al. (1985) have shown N_2-fixation to be correlated with nodule number.

In our study, the highest yields in four years were recorded in the variety Vojvodanka and positive correlation was found between examined parameters and yield. An improvement of the nodulation and N_2-fixation abilities might thus constitute a way of selection for increasing yield in parallel with the search for the best microsymbiont genotype combination.

The nitrogen fixing capacity of soybean can be improved by breeding. For this purpose, a simple, quick, inexpensive, and reliable method is needed to

determine the nitrogen fixing capacity of plants. The nitrogen fixing capacity of different soybean genotypes should be one of the criteria in soybean breeding for higher grain yields and other agronomic characters (Buttery et al, 1992).

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ISPITIVANJA DEVET SORATA SOJE U POLJSKIM USLOVIMA

-originalni naučni rad-

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Rezime

Cilj ovih istrazivanja bio je da se ispitaju razlike u aktuelnoj azotofiksaciji izmedu sorata soje gajenih u poljskim uslovima putem nodulacionih i azotofikascionih pokazatelja kao i agronomskog pokazatelja prinosa. Ispitano je 9 sorata soje ((Jelica, Krajina, Afrodita, Backa, Panonka, Balkan, Ravnica, Vera i Vojvodanka). Na oglednim poljima Instituta za ratarstvo i povrtarstvo u Novom Sadu na Rimskim Šancevima postavljen je ogled u toku 1994, 1995, 1996 i 1997. setva je izvršena uz obaveznu primenu mikrobiološkog preparata Nitragina. Uzorci biljaka za analizu su uzimani kada je vecina biljaka bila u fazi R5 i R6 i to sa 5 mesta po 5 biljaka. Odredivan je broj kvrzica po biljci, masa suve materije, % i sadrzaj azota. Azot je odredivan po metodu Kjeldahl-a. Na kraju vegetacije obracunat je prinos sa 14% vlage. U proseku za sve 4 godine sorta Vojvodanka je imala najveci broj kvrzica, masu suve materije, sadrzaj azota po biljci a takode i prinos.