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IRRIGATION AND NITROGEN FERTILIZATION INFLUENCES ON PROPERTIES OF SOYBEAN (*GLYCINE MAX* (L.) MERR.*)* VARIETIES

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SUMMARY

Field trials were set during a two year period under field conditions in Osijek. The aim was to confirm an influence of irrigation rate, nitrogen (N) fertilization and soybean varieties on seed yield and some yield components. The irrigation treatments were: control (A1); soil moisture content from 60% to 100% retention water capacity (RWC, A2) and soil moisture content from 80% to 100% RWC (A3). Rate of N was sub sub-factor: 0 (B1); 100 (B2) and 200 kg N ha^{-1} (B3), were applied. Una (C1) and Anica (C2) soybean varieties were a sub-sub factor (C). Mean soybean seed yields were 3082 kg ha^{-1} and 3538 kg ha^{-1} in 2006 and 2007, respectively. Irrigation resulted high statistically influence in soybean seed yield in both investigated years. Variety Una yielded (3179 kg ha^{-1}) statistically very higher than Anica in 2006. Irrigation had significant effect in pod number plant^{-1} only in year 2007. Interactions AB and AC were significant in pod number plant^{-1}, in one year, while BC interaction was in both years. Thousand seed weight (g) resulted in significant effect in irrigation treatment in both years, N fertilization effect in year 2007, while variety Una had highly significant higher value than variety Anica, in both years. Irrigation, N fertilization and variety had statistical very significant influence on seed weight plant^{-1} in one year, only. Seed weight plant^{-1} interaction effects AB, BC and ABC were very significant in one year, while BC interaction was in both years. Irrigation and variety had significant influence on seed number plant^{-1} in both years, while interactions AB, AC, BC and ABC showed significant effect in both years or very significant once.

Key-words: soybean, irrigation, nitrogen fertilization, yield, yield components

INTRODUCTION

Soybean is an important industrial crop in Croatia and in the last ten years (2000-2009) mean soybean harvested area was 45888 ha (from 35789 to 62810 ha) with average seed yield 2.0 t ha^{-1} (Central Croatian Bureau of Statistic, 2010). Seed yields of soybean varied in close connection with amount and distribution of precipitation during the vegetation period (Vučić and Bošnjak, 1980; Bošnjak, 2008; Kovačević et al., 2010; Josipović et al., 2010), intensity and longings of dry period in different growing stage (Rao and Reddy, 1990; Dragović, 1994; Brevedan and Egli, 2003; Bošnjak, 2008), properties of cultivars (Sudarić et al., 1996; Sudarić et al., 2004; Sudarić et al., 2009) soil properties and successful performing of other agro technical measures (Sudarić et al., 2009, Fehr, 1983 and Specht et al., 1999 according to Sudaric et al., 2004). Some general aspects of irrigation and nitrogen (N) fertilization effects were shown by Mađar and Vratarić (1980), Vučić and Bošnjak (1980), Bošnjak et al. (2008), Josipović et al. (2010). Bošnjak (2008) and Josipović et al. (2010) confirmed that the highest soybean seed yield was when the soil water content was maintained from 60% field water capacity (RWC) to 100% RWC. The mentioned authors also confirmed, that maintenance soil water content from 80% RWC to 100% RWC resulted in seed yield lower than on the irrigation control treatment. Vučić (1976) confirmed that irrigation, in most cases of growing soybean, increased seed yield by 30% while Mađar and Vratarić (1980) achieved higher seed yield from 23% to 49%.

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Irrigation is very important factor of stabile soybean seed yield but proper quantity of applied N (Sorensen and Penas, 1978; Jurić et al., 1995; Josipović et al., 2010) and soybean cultivar are also important. Thus, Josipović et al. (2010) concluded that irrigation and N fertilization resulted in statistically significant difference in soybean seed yield in the fourth year. The highest soybean seed yield (4.13 t ha^{-1}) achieved when soil moisture was maintenaid from 60% to 100% RWC and 100 kg ha^{-1} N. De Mooy et al. (1973) and Welch et al. (1973), according to Brevedan et al., (1978) confirmed that N fertilization effect on seed yield soybean reduced soybean seed yield. Bhangoo et al. (1972), Johnson and Hume (1972), Lyons and Earley (1972) and Mederski et al. (1958, cit. Sorensen and Penas, 1978), confirmed small growing soybean seed yield as influence of N fertilization. Opposite the mentioned results, Beard and Hoover (1971), Lyons and Early (1952), Mederski et al. (1958), Wagner (1962), Welch et al. (1973, cit. Sorensen and Penas, 1978), Jurić et al. (1995) confirmed that N fertilization did not result in growing soybean seed yield. Number of pods $plant^{-1}$ is important quantitative property in the structure of soybean seed yield (Bernard, 1967; Soldati 1995, cit. Sudaric, 1999 and cit. Vrataric and Sudaric, 2008), because the satisfactory pollination and embryogenesis satisfactory number of pods per plant is prerequisition of high soybean seed yield. Soybean seed plumpness, usually known as thousand seed weight, is quantitative property which considerable depends on genetic basis and environment effect (Vratarić and Sudarić, 2008) and breeders use their own experience concerning genetic source and environment in which breeding is done. Number of seed $plant^{-1}$ is a seed yield component ordered by genetic basis and its variability is a result of environment effect (Vratarić and Sudarić, 2008) being in close positive connection with soybean seed yield (Vrataric, 1983; Le Roy et al., 1991; Akhter and Sneller, 1996 cit. Vrataric and Sudaric, 2008). Number of seed $plant^{-1}$ is the most important seed yield component (Soldati, 1995, cit. Vrataric and Sudarić, 2008). The objective of this study was testing irrigation and N fertilization impact on two soybean varieties seed yield and some yield components under field conditions.

MATERIAL AND METHODS

In this study influence of irrigation rates (IR) and N fertilization was tested on two soybean cultivars under field conditions on Osijek (45º32" N and 18º44" E; 90 m altitude) humofluvisol soil type. The soil had retention water capacity near 36.6% volume. The treatments of IR (main factor, A) were: A1=non irrigation; A2=soil water content from 60% to 100% of RWC and A3= soil water content from 80% to 100% of RWC.

Water amount added by IR was as follows: A1=control treatment (0 mm in both investigated years); A2=twice by 40 mm and three times by 40 mm (in year 2006 and 2007); A3=three times by 35 mm and five times by 35 mm (in year 2006 and 2007). N fertilization effect (B) was: B1=control treatment (0 kg N ha^{-1}; B2=100 kg N ha^{-1} and B3=200 kg N ha^{-1}. The 100 kg ha^{-1} P_2O_5 and 150 kg ha^{-1} K_2O were applied in form of NPK 0:20:30 fertilizers (500 kg ha^{-1} as a basic and pre sowing fertilization, split in twice). Urea was used for N fertilization in basic fertilization, before ploughing one half, (0, 50 and 100 kg ha^{-1}, for B1, B2 and B3) and rest of N in pre sowing fertilization second half, (0, 50 and 100 kg ha^{-1}, for B1, B2 and B3 treatment, respectively). Soybean cultivars (sub sub-factor C) were C1=Una and C2=Anica (0 maturity group, created at Agricultural Institute Osijek). The field trial experiments were designed as split-split plot with randomized blocks in three replications. Experimental basic plot of soybean cultivar (C) was 45 m^2, N fertilization (B) 135 m^2 and irrigation (A) 405 m^2. Self propelled irrigation sprinkler was used. Soybean was planted in the middle of April and harvested at the end of November. Planned plant densities were 550 plants m^{-2}. Seed yields were calculated on 13% seed moisture basis. The given data was statistically performed by SAS, model GLM, split-plot design. Pod number $plant^{-1}$, number of seed $plant^{-1}$, weight of 1000 seeds and weight of seeds $plant^{-1}$ were analysed in this paper. Growing season 2006 was favourable while 2007 was less favourable (dry and bad rainfall distribution) regarding rainfall (Table 1). Air temperature was 1.4 ºC and even 2.2 ºC higher in growing season than long term value in year 2006 and 2007, respectively. Rainfall shortage, especially during July is in close connection with low yields of spring crops in Croatia (Kovačević et al., 2010).

Table 1. Rainfall and mean air temperatures (MAT, years 2006, 2007 and long term mean Osijek, Weather Bureau)

Tablica 1. Količina oborina i prosječna temperatura zraka (PMT, 2006., 2007. i prosjek, Osijek)

Month *Mjesec*	Osijek Weather Bureau: years 2006-2007 and long-term mean (LTM: 1971-2000) *Klimatološka postaja Osijek: 2006. i 2007. godina i višegodišnji prosjek (VGP: 1971.-2000.)*					
	Rainfall (mm) – *Oborine*, mm		MAT (ºC) - *PMT* (ºC)		LTM – *VGP*	
	2006	2007	2006	2007	mm	ºC
April	95.5	0.7	12.9	13.7	54.1	11.3
May	79.3	48.5	17.0	19.0	59.2	16.7
June	92.5	60.6	20.5	22.7	82.0	19.6
July	15.3	31.7	24.8	24.8	66.3	21.3
August	122.6	89.0	20.3	23.5	61.9	20.8
September	8.7	71.2	17.9	14.8	51.0	16.5
IV-IX	413.9	301.7	18.9	19.7	368.3	17.5

RESULTS AND DISCUSSION

Soybean seed yield (Table 2) is the most important property for both breeders and producers. Seed yield is comprehensive property and consists of many components of quantitative parameters, whose genetic base is polygenic (Sudaric, 1999). Mean soybean seed yields were 3082 kg ha^{-1} and 3538 kg ha^{-1} in year 2006 and 2007, respectively. Irrigation as the main factor resulted in high statistically difference, P≥0.01, in soybean seed yield in both investigated years and among all the treatments. It is in a close connection with investigation of Mađar and Vratarić (1980), Vučić and Bošnjak (1980), but only partly with Bošnjak (2008) and Josipović et al. (2010). N fertilization (B) had no statistical significant difference in soybean seed yield in both years, in spite of higher yield recorded on B2 and B3 treatments. The mentioned results are in accordance with Beard and Hoover (1971), Lyons and Early (1952), Mederski et al. (1958), Wagner (1962), Welch et al. (1973, cit. Sorensen and Penas, 1978), Jurić et al. (1995) which confirmed that N fertilization did not result in increasing soybean seed yield. The given results are opposite to Josipović et al. (2010), De Mooy et al. (1973) and Welch et al. (1973, according to Brevedan et al., 1978) which confirmed statistical significant higher yield by N effect. These are in close connection with Kovačević and Josipović (2010) which proved impact of climate conditions (environment effect = clime conditions + soil conditions + agro technical practice + their interactions). Cultivar effect (C) in seed yield resulted in high statistically influence, P≥0.01, in year 2006. Variety Una (C1) yielded (3179 kg ha^{-1}) statistically very higher in 2006 whereas Anica had higher yield (3555 kg ha^{-1}) in 2007 (not significance difference). Interaction effect of irrigation and N fertilization (in year 2006) and irrigation and variety (in year 2007) was statistically high significant only in on year.

Pod number plant^{-1} had statistically significant influence in irrigation, in one year (2007) only, while in N fertilization and variety not. Interaction AB in year 2007 and interaction AC in 2006 recorded statistical significant effect (P≥0.05), while interaction BC recorded statistical significant effect, in both years, in pod number plant^{-1}. The highest pod number plant^{-1} (31.4 and 31.2) was recorded on A3 treatments, on the B3 treatments (31.6 and 31.4) and by the Anica variety (C2, 30.3 and 30.1) in both investigated years (no statistically significance, Table 2).

Thousand seed weight (g) resulted in significant effect in irrigation treatment in both years, N fertilization effect in year 2007, while high significant effect in both years had soybean variety. Higher value had variety Una (136,7 g and 116,7 g) than Anica (132.0 g and 110.3 g) in both years (Table 2). Those results are in close connection with confirmation of Vratarić and Sudarić (2008) that thousand seed weight is quantitative property considerable dependent on genetic basis and environment impact.

Table 2 Means of the soybean seed yield, pod number plant^{-1}, TGW and LSD value

Tablica 2. Prosječni urod zrna soje, broj mahuna po biljci, masa 1000 zrna i LSD vrijednosti

Influence of irrigation (factor A: A1=no irrigation, A2=60% to 100% RWC, A3= 80% to 100% RWC), N fertilization (factor B: B1=0 kg N ha^{-1}, B2=100 kg N ha^{-1} and B3=200 kg N ha^{-1}) and genotype (factor C=soybean variety: C1=Una, C2=Anica); RWC=Retention water capacity; ns=not significant

Factor A	B1 0 kg N ha^{-1}		B2 100 kg N ha^{-1}		B3 200 kg N ha^{-1}		Factor A	B1 0 kg N ha^{-1}		B2 100 kg N ha^{-1}		B3 200 kg N ha^{-1}	
	C1	C2	C1	C2	C1	C2		C1	C2	C1	C2	C1	C2
Soybean seed yield (kg ha^{-1}) / *Prinos zrna soje (kg ha^{-1})*													
	The growing season 2006 / *Vegetacija 2006. g*							The growing season 2007 / *Vegetacija 2007. g*					
A1	3058	2868	2989	2615	3183	3195	A1	3300	2996	3613	3467	3531	3542
A2	3220	2992	3376	3273	3220	2895	A2	3619	3539	3494	3244	3516	3615
A3	3214	3018	3169	3157	3178	2858	A3	3595	4022	3598	3615	3547	3958
xBC	3164	2959	3178	3015	3194	2983	xBC	3505	3519	3568	3442	3531	3705

	Interaction AB				AC		xA		Interaction AB				AC		xA
	B1	B2	B3		C1	C2			B1	B2	B3		C1	C2	
A1	2963	2802	3189	A1	3077	2892	2985	A1	3148	3540	3537	A1	3481	3335	3408
A2	3106	3325	3058	A2	3272	3054	3163	A2	3579	3369	3565	A2	3543	3466	3504
A3	3116	3163	3018	A3	3187	3011	3099	A3	3808	3606	3752	A3	3580	3865	3722
xB	3062	3096	3088	xC	3179	2986	3082	xB	3512	3505	3618	xC	3535	3555	3538

Analysis of variance (LSD) / *Analiza varijance (LSD)*								Analysis of variance (LSD) / *Analiza varijance (LSD)*							
	A	B	C	AB	AC	BC	ABC		A	B	C	AB	AC	BC	ABC
5%	46.7	ns	93.7	192	ns	ns	ns	5%	61.5	ns	ns	ns	184	ns	ns
1%	64.0	ns	127	290	ns	ns	ns	1%	84.2	ns	ns	ns	264	ns	ns

Nastavak tablice

Influence of irrigation (factor A: A1=no irrigation, A2=60% to 100% RWC, A3= 80% to 100% RWC), N fertilization (factor B: B1=0 kg N ha^{-1}, B2=100 kg N ha^{-1} and B3=200 kg N ha^{-1}) and genotype (factor C=soybean variety: C1=Una, C2=Anica); RWC=Retention water capacity; ns=not significant

Factor A	B1 0 kg N ha^{-1}		B2 100 kg N ha^{-1}		B3 200 kg N ha^{-1}		Factor A	B1 0 kg N ha^{-1}		B2 100 kg N ha^{-1}		B3 200 kg N ha^{-1}	
	C1	C2	C1	C2	C1	C2		C1	C2	C1	C2	C1	C2
Pod number plant^{-1} / Broj mahuna po biljci													
	The growing season 2006 / *Vegetacija 2006. godina*							The growing season 2007 / *Vegetacija 2007. godina*					
A1	31.0	25.6	25.0	32.9	33.6	32.2	A1	26.4	30.0	25.7	33.1	35.3	33.7
A2	30.3	21.7	30.1	31.1	30.7	30.8	A2	25.0	25.4	30.2	32.2	31.0	25.6
A3	33.3	33.6	26.6	32.6	30.0	32.4	A3	34.1	33.8	24.4	32.4	29.4	33.3
xBC	31.5	26.9	27.2	32.2	31.4	31.8	xBC	28.5	29.7	26.8	32.6	31.9	30.9

	Interaction AB				AC		x.A		Interaction AB				AC		x.A
	B1	B2	B3		C1	C2			B1	B2	B3		C1	C2	
A1	28.3	29.0	32.9	A1	29.9	30.2	30.0	A1	28.2	29.4	34.5	A1	29.2	32.7	30.7
A2	26.0	30.6	30.7	A2	30.4	27.9	29.1	A2	25.2	31.2	28.3	A2	28.7	28.2	28.2
A3	33.5	29.6	31.2	A3	30.0	32.9	31.4	A3	33.9	28.4	31.3	A3	29.3	31.2	31.2
xB	29.2	29.7	31.6	xC	30.1	30.3	30.3	xB	29.1	29.7	31.4	xC	29.1	30.1	30.1

Analysis of variance (LSD) / *Analiza varijance (LSD)*								Analysis of variance (LSD) / *Analiza varijance (LSD)*							
	A	B	C	AB	AC	BC	ABC		A	B	C	AB	AC	BC	ABC
5%	ns	ns	ns	ns	3.4	3.4	ns	5%	3.0	ns	ns	6.5	ns	4.8	ns
1%	ns	ns	ns	ns	4.9	ns	ns	1%	4.1	ns	ns	ns	ns	ns	ns

Thousand seed weight / Masa tisuću zrna														
	The growing season 2006 / *Vegetacija 2006. godina*							The growing season 2007 / *Vegetacija 2007. godina*					
A1	128.0	124.0	132.1	127.6	140.6	131.6	A1	111.7	105.0	112.5	110.0	124.2	110.0
A2	136.3	137.0	140.4	132.3	135.2	131.2	A2	115.0	107.0	120.0	120.0	114.2	111.3
A3	142.0	133.6	141.0	140.0	134.8	131.1	A3	111.7	111.3	116.7	106.7	119.2	111.7
xBC	135.4	131.5	137.8	133.3	136.9	131.3	xBC	114.4	107.8	116.4	112.2	119.2	111.0

	Interaction AB				AC		xA		Interaction AB				AC		xA
	B1	B2	B3		C1	C2			B1	B2	B3		C1	C2	
A1	126.0	129.8	136.1	A1	133.6	127.7	130.6	A1	108.3	111.3	117.1	A1	116.1	108.3	112.2
A2	136.7	136.4	133.2	A2	137.3	133.5	135.4	A2	111.0	120.0	112.8	A2	116.4	112.8	114.6
A3	137.8	140.5	133.0	A3	139.3	134.9	137.1	A3	114.0	111.7	115.4	A3	117.5	109.9	113.7
xB	133.5	135.6	134.1	xC	136.7	132.0	134.4	xB	111.1	114.3	115.1	xC	116.7	110.3	113.5

Analysis of variance (LSD) / *Analiza varijance (LSD)*								Analysis of variance (LSD) / *Analiza varijance (LSD)*							
	A	B	C	AB	AC	BC	ABC		A	B	C	AB	AC	BC	ABC
5%	5.4	ns	3.1	10.5	5.9	5.9	14.3	5%	1.6	3.9	2.7	7.8	5.1	5.1	12.4
1%	ns	ns	4.1	ns	8.4	ns	ns	1%	ns	ns	3.6	ns	7.3	7.3	ns

Irrigation, N fertilization and variety had statistical very significant effect on seed weight plant^{-1} in one year, only. Variety Una had statistically very significant higher seed weight plant^{-1} (18.4 g) compared to Anica (16.1 g) only in 2006. Seed weight plant^{-1} interactions effects AB, BC and ABC were very significant in one year, while BC interaction was in both years (Table 3).

Table 3 Means of the seed weight plant^{-1}, number of seed plant^{-1} and LDS values

Tablica 3. Prosječna masa zrna po biljci, broj zrna po biljci i LSD vrijednosti

Influence of irrigation (factor A: A1=no irrigation, A2=60% to 100% RWC, A3= 80% to 100% RWC), N fertilization (factor B: B1=0 kg N ha^{-1}, B2=100 kg N ha^{-1} and B3=200 kg N ha^{-1}) and genotype (factor C=soybean variety: C1=Una, C2=Anica); RWC=Retention water capacity; ns=not significant

Factor A	B1 0 kg N ha^{-1}		B2 100 kg N ha^{-1}		B3 200 kg N ha^{-1}		Factor A	B1 0 kg N ha^{-1}		B2 100 kg N ha^{-1}		B3 200 kg N ha^{-1}	
	C1	C2	C1	C2	C1	C2		C1	C2	C1	C2	C1	C2
Means seed weight plant^{-1} / Prosječna masa zrna po biljci													
	The growing season 2006 / *Vegetacija 2006. g*							The growing season 2007 / *Vegetacija 2007. g*					
A1	19.3	12.8	15.2	17.7	20.4	17.8	A1	12.3	12.3	11.5	14.6	17.6	14.8
A2	19.7	12.4	18.9	16.8	18.5	17.5	A2	13.8	11.5	14.5	14.7	15.3	11.5
A3	20.3	17.7	15.6	16.6	18.1	15.3	A3	15.3	14.1	11.7	13.9	16.0	17.4
xBC	19.8	14.3	16.6	17.0	19.0	16.9	xBC	13.8	12.7	12.6	14.4	16.3	14.5

	Interaction AB				AC		xA		Interaction AB				AC		xA
	B1	B2	B3		C1	C2			B1	B2	B3		C1	C2	
A1	16.1	16.5	19.1	A1	18.3	16.1	17.2	A1	12.3	13.0	16.2	A1	13.8	13.9	13.9
A2	16.0	17.8	18.0	A2	19.0	15.6	17.3	A2	12.7	14.6	13.4	A2	14.5	12.6	13.5
A3	19.0	16.1	16.7	A3	18.0	16.5	17.3	A3	14.7	12.8	16.7	A3	14.3	15.1	14.7
xB	17.0	16.8	17.9	xC	18.4	16.1	17.3	xB	13.2	13.5	15.4	xC	14.2	13.9	14.0

Analysis of variance (LSD) / *Analiza varijance (LSD)*								Analysis of variance (LSD) / *Analiza varijance (LSD)*							
	A	B	C	AB	AC	BC	ABC		A	B	C	AB	AC	BC	ABC
5%	1.5	ns	0.9	ns	1.8	1.8	4.4	5%	ns	1.2	ns	2.4	ns	1.8	ns
1%	2.1	ns	1.3	ns	2.6	2.6	8.0	1%	ns	1.6	ns	3.6	ns	2.6	ns

Mean number of seed plant^{-1} / Prosječan broj zrna po biljci														
	The growing season 2006 / *Vegetacija 2006. g*							The growing season 2007 / *Vegetacija 2007. godina*						
A1	133.9	102.2	114.3	127.2	131.9	129.1	A1	111.9	117.6	103.2	120.0	128.0	132.0
A2	130.8	90.7	127.7	123.7	131.1	126.6	A2	119.0	110.7	120.2	122.5	127.4	108.0
A3	134.9	130.0	112.9	117.2	131.0	115.2	A3	127.0	127.7	99.7	124.8	126.9	147.3
xBC	133.2	107.6	118.3	122.7	131.3	123.6	xBC	114.4	123.2	122.2	113.7	117.8	133.2

	Interaction AB				AC		xA		Interaction AB				AC		xA
	B1	B2	B3		C1	C2			B1	B2	B3		C1	C2	
A1	118.0	120.7	130.5	A1	126.7	119.5	123.1	A1	114.8	111.6	130.0	A1	119.3	118.7	118.8
A2	110.7	125.7	128.9	A2	129.8	113.7	121.7	A2	114.8	121.3	117.7	A2	107.7	122.4	117.9
A3	132.4	115.1	123.1	A3	126.3	120.8	123.5	A3	127.3	112.3	137.1	A3	127.4	129.1	125.6
xB	120.4	120.5	127.5	xC	127.6	118.0	122.8	xB	119.0	115.0	128.3	xC	118.1	123.4	120.8

Analysis of variance (LSD) / *Analiza varijance (LSD)*								Analysis of variance (LSD) / *Analiza varijance (LSD)*							
	A	B	C	AB	AC	BC	ABC		A	B	C	AB	AC	BC	ABC
5%	8.6	ns	4.3	20.0	8.3	8.3	20.2	5%	3.7	ns	5.3	11.7	11.1	11.1	27.1
1%	11.8	ns	5.9	ns	12.0	12.0	37.1	1%	5.0	ns	ns	17.7	16.0	16.0	ns

Irrigation and soybean variety resulted in significant or very significant effect on number of seed plant^{-1} in both years, while N fertilization not (Table 3). Interactions AB, AC, BC and ABC showed significant effect in both years or very significant, in one year, in number of seed plant^{-1}.

CONCLUSION

Mean soybean seed yields were 3082 kg ha^{-1} and 3538 kg ha^{-1} in years 2006 and 2007. Irrigation resulted in high statistical influence in soybean seed yield in both investigated years. Variety Una yielded (3179 kg ha^{-1}) statistically very higher than Anica in 2006. Irrigation had significant effect in pod number plant^{-1} only in year 2007. Interactions AB and AC were significant in pod number plant^{-1}, in one year, while BC interaction was in both years. Thousand seed weight (g) resulted in significant effect in irrigation treatment in both years, N fertilization effect in year 2007, while variety Una had highly significant higher value than variety Anica, in both years. Irrigation, N fertilization and variety had statistical very significant influence on seed weight plant^{-1} in one year, only. Seed weight plant^{-1} interactions effects AB, BC and ABC were very significant in one year, while BC interaction was in both years. Irrigation and variety had significant influence on seed number plant^{-1} in both

years, while interactions AB, AC, BC and ABC showed significant effect in both years or very significant one.

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UTJECAJ NAVODNJAVANJA I GNOJIDBE DUŠIKOM NA SVOJSTVA SORATA SOJE (*Glycine max* (L.) Merr.)

SAŽETAK

Na području Osijeka tijekom dvije godine postavljeni su poljski pokusi. Cilj je rada bio utvrditi utjecaj navodnjavanja, gnojidbe dušikom (N) i kultivara soje na urod i neke komponente uroda. Varijante navodnjavanja bile su kontrola (A1); održavanje sadržaja vode u tlu od 60% do 100% retencijskoga kapaciteta za vodu (RKV, A2) i održavanje sadržaja vode u tlu od 80% do 100% RKV (A3). Količina N bio je podfaktor: 0 kg N ha^{-1} (B1); 100 (B2) i 200 kg N ha^{-1} (B3). Sorte Una (C1) i Anica (C2) bile su pod-podfaktor (C). Prosječan urod zrna soje bio je 3082 i 3538 kg ha^{-1} 2006., odnosno 2007. godine. Navodnjavanje je rezultiralo statistički vrlo značajnom razlikom u urodu zrna soje u obje godine. Sorta Una imala je (3179 kg ha^{-1}) statistički značajno veći urod od Anice u 2006. godini. Navodnjavanje je rezultiralo statistički značajnom razlikom u broju mahuna po biljci samo u 2007. godini. Interakcija AB i AC na broj mahuna po biljci bila je statistički značajna u jednoj godini, a interakcija BC u obje godine. Masa tisuću zrna (g) rezultirala je značajnim učinkom navodnjavanja u obje godine, učinak gnojidbe N u 2007. godini, dok je sorta Una bila vrlo značajno veća od Anice u obje godine. Navodnjavanje, gnojidba N i sorta soje rezultiralo je sa statistički značajnom masom zrna po biljci samo u jednoj godini. Interakcije AB, BC i ABC bile su vrlo značajne u masi zrna po biljci u jednoj godini, dok je interakcija BC bila značajna u obje godine. Navodnjavanje i sorta soje rezultirali su vrlo značajnim utjecajem na broj zrna po biljci u obje godine istraživanja, dok su interakcije AB, AC, BC i ABC bile značajne u obje godine ili vrlo značajne u jednoj godini.

Ključne riječi: soja, navodnjavanje, gnojidba dušikom, urod zrna, komponente uroda zrna

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