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Irrigation Effects on the Intensity of Plant Disease *Colletotrichum dematium* var. *truncata* causing Soybean Anthracnose

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Abstract: Irrigation effects on the soybean anthracnose, caused by *Colletotrichum dematium* var. *truncata*, were studied. It was found out that irrigation conditions during 1989 and 1990, higher soil humidity, crop microclimate and suitable temperatures were mainly responsible for the occurrence of anthracnose. Irrigation made in 4 shifts resulted in the disease intensity of 4.8% in 1989 and 2.3% in 1990, whereas that made in 3 shifts significantly reduced disease intensity (2.0 and 0.9%). In the absence of irrigation, only a very small (0.4 % in 1989) or no percentage of affected plants (1990) were reported. Under irrigation conditions, 3.4% and 1.6% accounted for the damaged plants in 1989 and 1990, respectively, averaging 2.5 % for both years. The soybean cultivars indicated a differing level of susceptibility to *C. dematium* var. *truncata*.

Key words: soybean, cultivar, irrigation, *Colletotrichum dematium* var. *truncata*

Introduction

Considering great economic and agricultural benefits of soybean, its production can and should be largely improved using irrigation, as the most efficient cultural practice. However, only little information about irrigation effects on anthracnose have been provided so far. Numerous opinions confirm its adverse effects on the production of soybean, lupin, alfalfa of warmer and more humid areas (Gondran, 1989, Gondran et al. 1990, 1994). Similarly, Backman et al. (1979), Hepperley et al. (1983), Khare et Chacko (1983) emphasized that increased precipitations during the second vegetation of soybean contributed to a range of infections, which, in turn, led to lower yields. The results of Khare et Chacko (1983) pointed to a great role raindrops play in parasite transfer from soil to plants.

Since the environmental factors and production technology are of great importance to soybean yield, the objective of this paper was to study irrigation effects on the occurrence of soybean anthracnose, caused by *Colletotrichum dematium* var. *truncata*.

Material and Methods

Irrigation effects on the plant infection due to *C. dematium* var. *truncata*, causing soybean anthracnose, were studied on the experimental field of the Institute of Crops and Vegetables in Novi Sad on the chernozem soil during 1989 and 1990. Seven soybean cultivars were used for the experiment: two early-maturity, O maturity group (NS-6 and NS-L-106), three medium-maturity, I maturity group (NS-9, NS-10 and NS-16), two late-maturity and II maturity group (NS-21 and Corsoy). These cultivars were grown under conditions with and without irrigation.

After appropriate soil preparation, sowing was performed regularly with four replications according to randomized split-block-design. The surface of the elementary plot was 36 m². The following crop densities were used: 560.000, 515.000 and 476.000 germinating grains/ha for the O, I and II maturity group of cultivars, respectively.

Sprinkler irrigations were applied in different number. In the first variant, three irrigations 60 l/m² each, in the second, four, with first three 40 l/m² and the fourth 60 l/m², were applied. In both cases, the amount of irrigation water (180 l/m²) and irrigation dates were the same.

The intensity of soybean infection, caused by *C. dematium* var. *truncata* was assessed prior harvest, with four loci 25 plants each (100 plants/replication) found infected per each replication. The intensity of disease was determined, using the range from 0-9 (0= no symptoms of disease; 9=91-100% of disease symptoms). Disease index was calculated according to the formula of Mc Kinney (1923).

Data processing was made, following the analysis of variance (ANOVA) and significance determination of the differences between mean values, following t-test.

Environmental Conditions

Throughout vegetation, the mean 10-day air temperatures were 17,9°C (1989) and 17,7°C (1990). Compared with 1989, the mean 10-day air temperatures were reported to be lower in April by 2,8°C and July and September of 1990 by 1,3°C, but higher by 2,0°C in May and June of the same year (Tab.1.).

Tab.1. - The mean 10-day air temperatures (°C) and precipitations (l/m²), R.Šančevi, 1989 and 1990

Mmonth	10-day period	Air temperature		Precipitations	
		1989.	1990.	1989.	1990.
IV	I	14,8	11,1	3,1	3,9
	II	14,1	10,6	23,5	20,4
	III	13,0	11,8	55,5	9,9
		14,0	11,2		
V				82,1	34,2
	I	11,5	16,6	34,3	4,0
	II	17,4	18,7	19,2	9,8
	III	17,3	17,0	12,7	4,1
VI		15,4	17,4		
	I			66,2	17,9
	II	17,8	18,0	60,6	26,9
	III	16,1	18,5	14,0	40,1
VII		19,6	23,2	17,9	2,8
		17,8	19,9		
	I			92,5	69,8
	II	24,5	20,7	-	17,0
VIII	III	21,9	20,6	10,3	2,7
		21,2	22,4	0,8	8,7
		22,5	21,2		
	I			11,1	28,4
IX	II	19,9	21,6	31,1	0,4
	III	24,9	22,2	-	0,6
		18,9	20,8	41,3	13,7
		21,2	21,5		
IV-IX	I			72,4	14,7
	II	15,0	17,2	13,5	7,5
	III	18,0	13,5	2,2	16,5
		16,2	14,5	14,3	28,0
IV-IX		16,4	15,1		
	x	17,9	17,7	30,0	52,0
	Σ			354,3	217,0

As regards precipitations, 354,3 l/m² fell from April to September, 1989, and 217,0 l/m² in the extremely dry year, 1990 (the longterm average for 1983/93 amounting to 337,6 l/m²).

Of all cultural practices used in the experiment, irrigation seemed to be the most efficient one for anthracnose assessment.

Results and Discussion

The results of irrigation effects on infection intensity due to *C. dematium* var. *truncata* are presented in Tab.2.

Under excellent growth conditions of soybean in 1989, the highest average index of the disease was detected with four (4,8%), significantly lower with three (2,0%) and only slight without irrigations (0,4%). Under conditions of good distribution and good availability of precipitation and irrigation amounts, the disease intensity proved highest with variety Corsoy (10%), considerably lower with NS-L-106, NS-6, NS-9 and NS-16 (4,9%-6,7%) and lowest with NS-10 and NS-16 (1,7-2,8%), (Tab.2.).

Contrary to 1989, during big draughts of 1990, the average index of disease was 2,3% with 4 and 0,9% with 3 irrigations, suggesting significant differences. In the same year, in the variant with 4 irrigations, the intensity of the *C. dematium* var. *truncata* ranged from 0,5% (NS-10) to 4,2% (Corsoy), and with 3 irrigations from 0,1% (NS-9 and NS-10) to 2,5% (Corsoy). This infection is known to appear from emergence to maturing of soybean so that crops show a high susceptibility to this pathogen all through the vegetation, particularly from the beginning of flowering to grain filling (Hepperley et al., 1983., Backman et al., 1979., Jasnic et al., 1988).

The highest susceptibility to disease prevailed in July and August. In the variant with 4 irrigations, suitable soil moisture and crop microclimate could be maintained for a longer time, which favoured infection growth (4,8% in 1989 and 2,3% in 1990). In contrast, in the variant with 3 irrigations, the intensity of anthracnose was much weaker despite regularly applied irrigations from the very beginning of flowering to grain filling.

Tab.2. The Intensity of Soybean Anthracnose with and without Irrigation (%)

Varietet	Maturity group	(1989)				(1990)				$\bar{x}_{1,2}$	$\bar{X}$
		Irrigat. number				Irrigat. number					
		4	3	$\bar{x}_1$	$\emptyset$	4	3	$\bar{x}_2$	$\emptyset$		
NS-6	0	5,3	4,5	4,9	0,3	1,4	1,0	1,2	0,0	3,1	2,1
NS-L-106	0	4,9	1,7	3,3	0,1	1,5	0,5	1,0	0,0	2,2	1,5
NS-9	I	6,0	2,3	4,2	1,1	3,5	0,1	1,8	0,0	3,0	2,2
NS-10	I	0,7	0,7	0,7	0,0	0,5	0,1	0,3	0,0	0,5	0,3
NS-16	I	6,7	2,8	4,8	1,1	4,0	2,0	3,0	0,0	3,9	2,8
NS 21	II	0,2	0,0	0,1	0,0	1,0	0,2	0,6	0,0	0,4	0,2
Corsoy	II	10,0	2,1	6,1	0,3	4,2	2,5	3,4	0,0	4,7	3,2
Average		4,8	2,0	3,4	0,4	2,3	0,9	1,6	0,0	2,5	1,7

LSD (Year) 0.05 0.9
0.01 1.3

LSD (Variety) 0.05 1.8
0.01 2.4

In this variant, the first irrigation was made on 7th July and second on 27th July, with only 3 weeks left between the two irrigations, being too short a time to allow infection to intensify. Similarly, Backman et al. (1979) pointed out that more frequent rainfalls might benefited plant and seed infection caused by this pathogen from flowering to grainfilling.

Only minor symptoms of the disease (0.4%) could be spotted under non-irrigation conditions in 1989, but none during big draughts in 1990 (Tab.2.).

In general, during 1989 and 1990, the key reasons for the occurrence of anthracnose were

precipitation amounts and their distribution, temperatures and irrigation despite distinctive differences in soybean susceptibility to *C. dematium* var. *truncata*.

Conclusion

The obtained results of the 2-year studies on irrigation effects on the soybean infection, caused by *Colletotrichum dematium* var. *truncata* suggest the following:

- The intensity of infection caused by *C. dematium* var. *truncata* seemed much stronger in 1989 than in 1990 due to suitable weather conditions over vegetation (higher precipitation amounts and their better distribution).

- Greater number of irrigations favoured disease intensity and vice versa, i.e. under conditions without irrigation, the symptoms of anthracnose were either rare (1989) or none (1990).

- The differences in susceptibility to *C. dematium* var. *truncata* were also obvious. Thus, the American variety Corsoy appeared to be most susceptible, and inland ones most resistant to the anthracnose occurring in field.

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**UTICAJ NAVODNJAVANJA NA INTENZITET NAPADA
Colletotrichum dematium var. *truncata* PROUZROKOVAČA
ANTRAKNOZE SOJE**

-originalni naučni rad-

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Rezime

Ispitivan je uticaj navodnjavanja na intenzitet pojave antraknoze soje prouzrokovane *Colletotrichum dematium* var. *truncata*. U uslovima navodnjavanja tokom 1989. i 1990. godine, povećana vlažnost zemljišta i mikroklimata u usevu, kao i povoljni temperaturni uslovi su uticali na pojavu antraknoze soje. Zalivanjem u 4 navrata intenzitet oboljenja je bio 1989. godine 4,8%, a 1990. godine 2,3%. U isto vreme, zalivanjem u 3 navrata intenzitet oboljenja je bio značajno niži (2,0%, odnosno 0,9%). U uslovima bez navodnjavanja udeo obolelih biljaka je bio veoma nizak 1989. godine (0,4%), a 1990. godine pojava oboljenja nije zapažena. U uslovima navodnjavanja, prosečan intenzitet pojave antraknoze je bio u 1989. godini 3,4%, a 1990. godine 1,6%, odnosno 1989. i 1990. godine prosečno 2,5%. Ispitivane sorte soje su ispoljile različiti stepen osetljivosti prema *C. dematium* var. *truncata*.