POSSIBILITY OF WEED KILLING IN MAIZE BY HERBICIDES APPLIED AFTER SOWING AND BEFORE SPROUTING

MOGUĆNOST SUZBIJANJA KOROVA U KUKURUZU HERBICIDIMA PRIMENJENIM POSLE SETVE A PRE NICANJA

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Abstract: *Weeds represent one of the limiting factors for reaching high grain yields in maize production. Observation of weed species emergence, as well as proper choice of herbicides and term of their application, can significantly decrease negative effects to maize crops caused by weeds. So the aim of this paper was to explore the effect of weed killers, applied after sowing but before sprouting, on decrease of weed species presence and weed plants number in maize crops. The field trial carried out during 2005 in the vicinity of Leskovac (southern Serbia) was set to observe efficiency of four herbicides (S-metolachlor, acetochlor, alachlor + linuron, and alachlor), applied after sowing but before sprouting, in preventing weeds of maize crops. The trial was set in RCB design with three replications. Number of weed species and plants was counted per m^2, and efficiency coefficient of herbicides was calculated according to Dodell et al. (Stanković, 1969). There were seven weed species in the maize crop with the average number of individuals per m^2 of 123. The highest number of individuals was shown by Setaria ssp. (42 plants/m^2) and Chenopodium album (35 plants/m^2). The highest coefficient of weed killing efficiency was given by acetochlor and amounted 71.54, and the lowest one by s-metolachlor where it was 63.41. All these weed killers expressed a weak effect to Abutilon theophrasti, Convolvulus arvensis, and Sorghum halepense. All the herbicides had a highly significant effect on grain yield value. Maize grain yield ranged between 7.235-8.943 kg/ha.*

Rezime: *Korovi u kukuruzu predstavljaju jedan od ograničavajućih faktora u postizanju visokih prinosa. Praćenjem pojave korovskih vrsta, izborom herbicida i vremenom njihove primene, mogu se u značajnoj meri umanjiti negativni efekti prisustva korova u usevu kukuruza. Cilj ovoga rada je bio ispitati uticaj herbicida primenjenih posle setve a nakon nicanja u smanjenju korovskih vrsta i njihove brojnosti u usevu kukuruza. U ogledu koji je 2005. godine izveden u okolini Leskovca praćena je efikasnost 4 herbicida (S-metolahlor, acetohlor, alahlor + linuron i alahlor) primenjena pose setve, a pre nicanja u suzbijanju korova u kukuruzu. Ogled je postavljen po blok sistemu u tri ponavljanja. Brojnost korovskih vrsta je određena po m^2, a koeficijent efikasnosti herbicida po Dodell-u i sar. (Stanković, 1969). U usevu kukuruza bilo je prisutno 7 korovskih vrsta sa brojnošću od 123 jedinke po m2. Najveću brojnost imale su Setaria ssp. (42 jedinke po m^2) i Chenopodium album (35 jedinki/m^2). Najveći koeficijent efikasnosti u suzbijanju korova imao je acetohlor (preparat Acenit)-71.54, a najslabiji s-metolahlor (preparat Dual Gold) – 63.41. Svi herbicidi su imali vrlo slabo dejstvo na Abutilon theophrasti, Convolvulus arvensis i Sorghum halepense. Svi herbicidi su vrlo značajno uticali na visinu prinosa kuuruza u odnosu na kontrolnu varijantu. Prinos kukuruza se kretao u granicama od 7.235-8.943 kg/ha u zavisnosti od efikasnosti primenjenih herbicida.*

Key words**:** *herbicides, weeds, maize, coefficient of efficiency, grain yield*
Ključne reči**:** *herbicidi, korovi, kukuruz, koeficijent efikasnosti, prinos zrna*

INTRODUCTION

Damage to agriculture caused by weeds is great, and in some reports it is estimated as greater than the damage caused by both diseases and pests. In USA annual loss caused by weeds is about 3.7 billion USD (KOJIĆ and ŠINŽAR, 1985; JANJIĆ and KOJIĆ, 2003). It is necessary to know floristic composition of an agrophytocenosis for a successful chemical weed

killing. Knowledge of qualitative and quantitative relations and season dynamics in weed association enables a proper choice of weed killer type and its dose, term and mode of application (KOJIĆ and ŠINŽAR, 1985; STEFANOVIĆ et al., 1993; MARKOVIĆ et al., 2002; JANJIĆ et al., 2004). Application of soil herbicides shows the effect to weed seeds and it is particularly important for killing weeds propagated by seed. However, for proper effects of weed killing this way good pre-sowing soil cultivation is necessary, as well as presence of water in the cultivated layer. ONĆ-JOVANOVIĆ et al. (2007) point to a significance of application both soil herbicides and the ones applied after sprouting of crop.

This paper is aimed to study the weed killing efficiency of herbicides applied after sowing but before sprouting of maize crop.

MATERIAL AND METHODS

The trial for this study was set in random complete block design with three replications, during 2005, in the vicinity of Leskovac. Maize hybrid NS-640 was used, with a standard maize growing practice. The trial included four soil herbicides: Dual gold (active matter s-metolachlor), Acenit (a.m. acetohlor), Galolin combi (a.m. alahlor + linuron) and Alahlor (a.m. alachlor). The mentioned herbicides were applied after sowing but before sprouting in recommended doses. Number of weed species was counted and expressed per square meter. Efficiency of an herbicide was estimated on the base of weed plants number reduction per square unit. Herbicide efficiency is expressed as coefficients of efficiency according to DODEL et al. (STANKOVIĆ, 1969).

Table 1

Elementary data about the applied herbicides

Variant	Names of the applied herbicides	Preparation	
		Name	Dose
1	s-metolachlor	Dual gold	1.5 l/ha
2	acetochlor	Acenit A 800	2 l/ha
3	alachlor + linuron	Galolin combi	7 l/ha
4	alachlor	Alahlor	4 l/ha
5	Control – no herbicides applied	--	--

Weather conditions. These conditions are particularly important for development of both maize and weeds. Soil moisture level is crucial for the efficiency of soil herbicides. Table 2 shows the rainfall amount of 61 mm in April, when sowing is done, which can be considered as satisfying because there was enough precipitation in previous months. This year is characterized as exceptionally favorable (701 mm of rainfall) with a good rainfall distribution during the vegetation.

Table 2

Rainfall (mm) and air temperature (^oC) in 2005 (Leskovac)

2005	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Air temp.	0.2	-2.5	4.9	10	16.4	18	21.5	19.6	16.7	11.1	4.7	3.4
Rainfall	65	58	67	61	89	75	39	68	42	39	30	68

RESULTS AND DISCUSSIONS

Weed association in this maize crop was floristically poor and consisted of seven weed species, with the weed plants number per square unit of 123 plants/m^2. The most numerous weed species were *Setaria spp.* (42 plants/m^2), *Chenopodium album* (35 plants/m^2) and *Abutilon theophrasti* (23 plants/m^2). The lowest number per square unit was shown by

Polygonum lapathifolium (3 plants/m^2) and *Cynodon dactilon* (2 plants/m^2) (Tab. 3). Among seven weed species, three were perennial, and four were annual ones.

Table 3

Weed plants number and herbicide efficiency in maize crop

Weed species	Trial treatments and the applied herbicides				
	1 s-metolachlor	2 acetochlor	3 alachlor + linuron	4 alachlor	5 Control – no herbicides
	Herbicide efficiency against specific weed species (weed plants per m^2)				
Setaria spp.	3	--	--	--	42
Chenopodium album	11	4	--	6	35
Abutilon theophrasti	25	20	23	25	23
Sorghum halepense	4	7	7	6	14
Convolvulus arvensis	2	1	4	3	4
Polygonum lapathifolium	–	--	--	–	3
Cynodon dactilon	–	3	3	–	2
Total weed species	5	5	4	4	7
Total weed plants per m^2	45	35	37	40	123
	Total herbicide efficiency (%)				
Number of weed species per m^2	5	5	4	4	7
CE* for number of weed species	29	29	43	43	--
CE* for number of weed plants	63.41	71.54	69.92	67.48	--
Maize grain yield (t/ha)	7.65	8.44	8.12	7.93	3,95
LSD values for grain yield: P<0.05 = 0.74 P<0.01 = 0.88					
* CE = Coefficient of efficiency according to Dodel et al.					

The investigated herbicides showed a weak efficiency of weed species number reduction (CE was 29 for s-metolachlor and acetochlor, and 43 for alachlor + linuron and alachlor). Weeds as *Abutilon theophrasti*, *Sorghum halepense* and *Convolvulus arvensis* the studied herbicides did not exterminated, and *Abutilon theophrasti* even showed the same number of plants as in control. The best coefficient of weed killing efficiency was shown by acetochlor (71.54), and the lowest one by s-metolachlor (63.41). The highest maize grain yield (8.44 t/ha) was observed in plots treated by acetochlor, and the lowest one (7.65 t/ha) was obtained with s-metolachlor, and that difference was statistically significant. Among the other herbicides there were no significant differences. The highest maize grain yield was obtained in the variant with the best herbicide efficiency. Obviously, the efficiency of soil herbicides is relatively low, a little above 70 in best case, so corrective herbicide application after sprouting of crop and weeds can be recommended, in order to reach a better reduction of weed number in maize crop and to get a higher maize grain yield. Onć-Jovanović et al. (2008) also recommended combining soil and foliar herbicides for better weed killing in maize crops.

CONCLUSIONS

On the basis of the obtained results we can conclude the following:

– There were seven weed species observed in maize crop, and total number of weed individuals was 123 plants/m^2;

– The most numerous weed species were *Setaria spp.* (42 plants/m^2), *Chenopodium album* (35 plants/m^2) and *Abutilon theophrasti* (23 plants/m^2).

– The studied herbicides showed a weak efficiency of weed species number reduction

(CE was 29 for s-metolachlor and acetochlor, and 43 for alachlor + linuron and alachlor);

– The best coefficient of efficiency weed plants number reduction was shown by acetochlor (71.54), and the lowest one by s-metolachlor (63.41);

– The highest maize grain yield (8.44 t/ha) was reached when the herbicide acetochlor was applied;

– In order to get better effects in weed killing and higher values of maize grain yield it is not enough to apply soil herbicides only, but also the ones applied after sprouting.

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