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EFFECTS OF CROP DENSITY AND HERBICIDE APPLICATION ON FLORISTIC COMPOSITION AND STRUCTURE OF MAIZE WEED COMMUNITY

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Abstract: The distribution of weeds in maize hybrids grown in different crop densities with and without herbicide application was observed in the present study. The floristic composition and structure of weed community were estimated according to the occurrence of distributed weed species, number of their plants and their mass per area unit. These parameters were monitored as they more precisely determine competitive effects of different maize crop densities on weeds. Furthermore, effects of mentioned factors on maize grain yield were studied.

The analysis of variance for the RCB design, within statistical and biometrical procedures, alongside with LSD- and t-test, as a correlation analysis between dry weight of weeds and maize plant height and grain yield were used for data processing in relation to the observed densities and hybrids (Steel and Torrie, 1960).

Obtained results indicate that the increase of crop densities statistically significantly affected decreasing of the number of plants per species and weight of weeds. In comparison with the non-treated variant, the variant with herbicide application showed that this application resulted in significant decrease of weed species, number of plants per species, fresh and dry weight. The number of weed plants per species was higher in the hybrid H_1 (ZPSC 42A) than in the hybrid H_2 (ZPSC 704) in both years.

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The average maize plant heights statistically significantly differed in dependence on the herbicide application and a hybrid. The crop density affected leaf area, leaf area index and number of leaves per maize plant. Grain yield of maize was the highest in the highest density (D_3) when herbicides were applied (T) and in the hybrid H_2 during both years of investigation.

Key words: maize, weeds, weed community, crop density, herbicide application, hybrid.

Introduction

Weeds are the main limiting factor for high yield of recently developed high yielding maize hybrids. The broadcast row crop weed community, such as the maize crop weed association, encompasses numerous weed species diversely distributed over certain habitats. Since maize, as a grown plant, determines conditions of the agrophytocoenosis, while its number - distances between both, rows and plants in the row, i.e. crop density and intensity of development, determines the special microclimatic conditions. These conditions together with environmental factors (climatic, edaphic, orographic) and measures applied by man, directly affect formation of specific weed crop community (Šinžar and Stefanović, 1986; Stefanović, 1987). A total of 213 weed species, developed in maize crop in Serbia, consists of 192 (90%), i.e. 21 (10%) dicot, i.e. monocot weeds, respectively (Šinžar et al., 1996). According to floristic-phytocenologic studies of Kojić (1975), Šinžar and Dejović (1975), it can be concluded that the row crop weed association *Hibisco-Eragrostietum megastachuae* Tx. 1950 of the alliance *Eragrostion* Tx. 1950 prevalis in maize crop at the location of the investigation. Although broadleaf weeds, regarding their spread and distribution, prevail in maize crop, a special place in weed communities of this crop belongs to weeds of the family *Poaceae,* whose distribution has been increased by the long-standing application of herbicides (Stefanović and Šinžar, 1992).

The impact of weeds on maize is the most pronounced in the initial stage of maize growth when competition between weeds and crops is the strongest. Competition is a rival relation between crops and weeds in the process of uptake of elements necessary for growth and development (Kropff and van Laar, 1993). Under conditions of deficit of some of environmental factors such as temperature, water, available nutrients and light, weeds are very often more competitive than the crop. Thereby, normal supply of basic elements necessary for maize maximum growth and development is disturbed.

The long-standing application of herbicides has been the most important and main measure of weed control in maize crop. Beside high efficiency in weed control, this measure can lead to many adverse consequences among which the following ones are the most important: changes of floristic composition and structure of weed communities, spreading of resistant, and especially perennial weed species of the family *Poaceae,* occurrence of weed species resistant to applied herbicides, detrimental effects on grown plants, accumulation of herbicides and their residues in soil, water and plant parts (Lozanovski et al, 1980; Šinžar et al., 1988; Ajder, 1991, Seiler et al., 1992; Šinžar and Stefanović, 1993; Stefanović et al., 1994). Today, due to many undesirable changes occurring in maize agrophytocoenosis, a weed control system means the integrated weed management implying several measures which lessen weed abundance, but do not decrease maize yield and do not endanger environment (Swanton and Weise, 1996).

Crop density ranks high among production technology measures and maize cultivation. Maize growth at the optimum or slightly higher crop density, with no gaps, can greatly contribute to the weed coverage decrease and mitigation of yield reduction due to weed distribution (Walker and Buchanan, 1982; Swanton and Weise, 1991). The optimum maize crop density under weedfree conditions depends on a genotype, climatic and edaphic conditions of a growing region. To that end it is necessary to have as many data on response of different hybrids to certain densities as possible, especially for arid regions (Tollenaar, 1991; 1992). Production technology measures, such as narrow row spacing when genotypes „tolerating" higher density are grown, are based on better utilisation of light by the crop and prevention of weed resurgence (Yelverton and Coble, 1991; Holt, 1995). According to Tollenaar et al. (1994) the density increase results in the weed biomass decrease and due to it maize competitiveness is higher than that of weeds.

The effect of crop density and herbicide application on floristic composition and structure of maize weed community was investigated in this two-maize hybrid study. The experiments were set up to determine competitive effects of the increased maize hybrid density on weeds. In relation to this, the study also encompassed monitoring of changes of certain morphological traits and maize grain yield as indicators of the level of damage caused by weeds under investigation conditions.

Material and Methods

The trials were carried out on the experimental field of the Maize Research Institute, Zemun Polje, on slightly calcareous chernozem during 1996 and 1997. The level of weed infestation of two maize hybrids, grown in three different densities under conditions with and without herbicide application, was observed. In both experimental years, winter wheat was a preceding crop.

The trials were set up according to 4-replicate three factorial block design. Crop densities (factor A) were as follows: 40,816 plants ha^{-1} (D_1), 69,686 plants ha^{-1} (D_2) and 98,522 plants ha^{-1} (D_3). Inter-row spacing of 70 cm was equal for all three densities. The combination of herbicides atrazine + metolachlore in the amount of 1.0 and 2.88 l a.i. ha^{-1} after planting and prior emergence (factor B) was applied in the treated variant. Herbicides were not applied in the control variant

(C). Two maize hybrids (factor C) of different FAO maturity groups H_1 - ZPSC 42 (FAO 400) and H_2 - ZPSC 704 (FAO 700) were studied.

The weed community composition under conditions with and without herbicide application was analysed in both years. Weed distribution was determined in each density of each hybrid in both treated and control variant. The number of weed species as well as the number of their plants were determined per square meter. Then, fresh weight of each weed species individually and the total dry weight of all samples collected from 1 m^2 area were determined. The following morphological traits of maize were observed: plant height, number of leaves per plant, leaf area with leaf area index and maize hybrid grain yield. The number of leaves per plant, leaf area and leaf area index were esteemed only in 1997.

Obtained data were statistically processed by the factorial analysis of variance (ANOVA) for each year individually. Significance was analysed by LSD- and t-test. Moreover, the correlation analysis between dry weight of weeds and maize plant height and grain yield was performed in dependence on both crop densities and hybrids (Steel and Torrie, 1960).

Results and Discussion

In 1996, 23 weed species with 83.9 plants per m^2 were detected in the control variant with the lowest crop density (D_1) (Table 1). The greater density was (D_2 and D_3) the lower number of weeds (17 and 14, respectively) and their plants per m^2 (65.8 and 61.3, respectively) were. The following species, detected in the lowest density (D_1), were not observed in the density D_2: *Senecio vulgaris, Panicum crus-galli, Convolvulus sepium, Stachys annua, Reseda lutea, Abutilon theophrasti and Lamium purpureum.*

Tab. 1. - Weed species and the number of their individuals (plants m^{-2}) in dependence on crop density in 1996

L.F.	Weed species	Control			Treatment		
		D_1	D_2	D_3	D_1	D_2	D_3
1	2	3	4	5	6	7	8
T	*Amaranthus albus* L.	13.8	15.5	13.3	5.3	4.8	3.7
T	*Solanum nigrum* L.	15.5	13.3	10.3	8.3	5.5	6.0
T	*Amaranthus retroflexus* L.	14.2	10.8	9.3	3.2	3.7	1.8
G	*Cirsium arvense* (L.) Scop.	10.2	6.3	8.0	9.3	2.7	0.3
G	*Convolvulus arvensis* L.	6.7	5.2	4.7	6.0	3.8	3.3
T	*Hibiscus trionum* L.	4.0	4.5	2.3	1.8	0.7	1.5
T	*Chenopodium hybridum* L.	5.0	2.2	1.8	1.2	1.7	0.2
G	*Sorghum halepense* (L.) Pers.	3.8	2.3	2.2	3.0	1.8	1.3
T	*Datura stramonium* L.	3.3	1.2	2.8	1.7	0.3	1.3
T	*Digitaria sanguinalis* (L.) Scop.	0.8	2.2	3.7	6.3	5.2	4.5
T	*Portulaca oleracea* L.	1.5	0.7	1.7	0.3	0.2	0.3
G	*Sonchus arvensis* L.	1.3	0.5	0.7	-	-	-
T	*Chenopodium album* L.	0.5	0.3	0.2	0.2	-	0.2
T	*Senecio vulgaris* L.	0.7	-	-	-	-	-

1	2	3	4	5	6	7	8
T	*Panicum crus-galli* (L.) R et Sch.	0.5	-	-	-	-	-
G	*Convolvulus sepium* (L.) R.Br.	0.5	-	-	-	-	-
T	*Sonchus oleraceus* (L.) Gou.	0.3	0.2	-	-	-	-
T	*Stachys annua* L.	0.2	-	0.3	-	0.2	-
T	*Anagallis arvensis* L.	0.2	0.2	-	-	-	-
T	*Sinapis arvensis* L.	0.2	0.2	-	-	-	-
T	*Reseda lutea* L.	0.3	-	-	-	-	-
T	*Abutilon theophrasti* Medik.	0.2	-	-	0.2	-	-
T	*Amaranthus blitoides* S.Watson	-	0.2	-	-	-	-
T	*Lamium purpureum* L.	0.2	-	-	-	-	-
T	*Heliotropium europaeum* L.	-	-	-	0.5	-	-
Total number of weed species		23	17	14	14	12	12
Total number of weed plants		83.9	65.8	61.3	47.3	30.6	24.4
Total fresh weight of weeds		1746.8	1319.6	1043.3	413.7	183.0	139.1

Beside mentioned species the following ones were not detected in the highest density (D_3): *Sonchus oleraceus, Anagallis arvensis* and *Amaranthus blitoides.* Almost all stated weed species have index 4 as a parameter for light. It displays their great light demands, due to which longer periods of shading in greater densities are unfavourable for their development (Kojić et al., 1997). The number of weed plants was decreased even more under conditions of herbicide application and crop density increase - it ranged from 47.3 to 24.4 plants per m^2 in densities D_1 and D_3, respectively, i.e. it decreased by 48.4%. Effects of higher maize crop density under conditions with and without herbicide application is even more conspicuous in the decrease of fresh weight of distributed weed species. The total fresh weed weight decreased by 40.3% (from 1746.8 g m^{-2} in the density D_1 to 1043.3 g m^{-2} in the density D_3) under conditions without herbicide application. The decrease of the total weed fresh weight was even more expressed in the treated variant (66.4%).

In 1997, similar trend was observed - the maize crop density increase led to the decrease of the number of species, their individual plants and fresh weight of weeds per m^2 under conditions with and without herbicide application (Table 2). The following species failed to appear with the increase of crop density from D_1 to D_2: *Bilderdykia convolvulus, Heliotropium europaeum, Stellaria media, Sonchus asper, Reseda lutea, Amaranthus blitoides, Taraxacum officinale* and *Polygonum lapathifolium.* Furthermore, neither the species *Sonchus arvensis* nor the species *Ambrosia artemisiifolia* were observed in the highest crop density D_3. The analysis of the distributed species showed that although these species had differed from those in 1996, light demands of the majority was great. The number of distributed species under conditions without herbicide application and higher maize crop densities decreased from 140.7 to 110.2 plants per m^2 or by 21.7%. The corresponding values under conditions with herbicide application decreased from 32.7 to 19.4 plants per m^2 or by 40.7%.

Tab. 2. - Weed species and the number of their individuals (plants m^{-2}) in dependence on crop density in 1997

L.F.	Weed species	Control			Treatment		
		D_1	D_2	D_3	D_1	D_2	D_3
T	*Chenopodium hybridum* L.	29.2	22.0	29.7	6.0	5.5	2.8
T	*Solanum nigrum* L.	26.8	22.6	19.3	4.0	3.0	1.2
T	*Amaranthus retroflexus* L.	22.0	19.0	16.5	2.3	1.5	0.5
G	*Convolvulus arvensis* L.	9.3	7.2	6.8	10.0	9.8	9.0
T	*Stachys annua* L.	10.5	8.3	3.7	0.5	0.7	-
T	*Amaranthus albus* L.	8.7	6.7	5.5	0.2	0.3	0.2
T	*Chenopodium album* L.	6.8	5.5	6.5	0.5	0.7	0.3
T	*Datura stramonium* L.	5.3	6.5	4.5	2.0	2.8	0.8
G	*Cirsium arvense* (L.) Scop.	3.8	1.7	7.2	2.5	8.0	1.5
G	*Convolvulus sepium* (L.) R.Br.	4.2	5.7	2.0	1.0	0.7	0.7
T	*Digitaria sanguinalis* (L.) Scop.	2.7	3.0	2.2	0.5	0.3	0.2
T	*Hibiscus trionum* L.	2.5	0.8	2.2	1.7	0.2	0.7
T	*Anagallis arvensis* L.	3.0	3.7	1.2	-	-	-
T	*Portulaca oleracea* L.	1.3	0.7	1.0	-	0.2	-
G	*Sorghum halepense* (L.) Pers.	1.0	1.2	0.3	1.0	0.5	0.8
T	*Panicum crus-galli* (L.) R.et Sch.	0.5	0.2	0.3	-	-	-
T	*Sinapis arvensis* L.	0.5	0.3	-	-	-	-
T	*Setaria glauca* (L.) Beauv.	0.3	0.2	0.3	-	-	-
T	*Bilderdykia convolvulus* (L.) Dum.	0.2	-	0.3	-	-	-
T	*Stellaria media* (L.) Vill.	0.5	-	-	-	-	-
G	*Sonchus arvensis* L.	-	0.3	-	-	-	-
T	*Setaria verticillata* (L.) P.B.	-	-	0.3	-	-	0.2
T	*Heliotropium europaeum* L.	0.3	-	-	-	0.2	-
T	*Ambrosia artemisiifolia* L.	0.2	0.2	-	0.2	-	-
T	*Setaria viridis* (L.) Beauv.	-	0.2	0.2	-	-	-
T	*Sonchus asper* (L.) Hill	0.3	-	-	-	-	-
T	*Resead lutea* L.	0.2	-	-	-	-	-
T	*Amaranthus blitoides* S. Watson	0.2	-	-	-	-	-
T	*Abutilon theophrasti* Medik.	-	-	0.2	0.3	-	0.5
G	*Taraxacum officinale* Web.	0.2	-	-	-	-	-
T	*Polygonum aviculare* L.	0.2	-	-	-	-	-
Total number of weed species		27	21	21	15	15	14
Total number of weed plants		140.7	116.0	110.2	32.7	34.4	19.4
Total fresh weight of weeds		1834.7	1075.1	807.2	283.7	179.9	123.3

The increase of crop density in 1997 led to the decrease of the total fresh weight of weeds under conditions without herbicide application by 56.0%, i.e. from 1834.7 g m^{-2} in D_1 to 807.2 g m^{-2} in D_3. The corresponding values in the variant with herbicide application amounted to 56.5% (decreased from 283.7 g m^{-2} in D_1 to 123.3 g m^{-2} in D_3).

The crop density increase had similar effects on dry weight of weeds as on the number of individual plants and fresh weight of weeds. The statistical analysis of data for dry weight of weeds in 1996 pointed to significant differences among densities (factor A), treatments (factor B) and their interaction (AxB) (Table 3).

Tab. 3. - Dry weight of weeds (g m^{-2}) in 1996 in relation of crop density (factor A), herbicide application (factor B) and their interaction (AxB)

Density	$\overline{X}$ (AxB) Control	Treatment	$\overline{X}$ (A)
D_1	654.70^a	141.60^d	398.10^a
D_2	459.90^b	43.60^e	251.80^b
D_3	281.50^c	46.30^e	163.90^c
$\overline{X}$ (B)	465.04**	77.18**	

Values of means are designated by the same letters and they do not significantly differ one from another according to LSD-test at 0.01 probability level
* P<0.05
**P<0.01
$LSD_{0.01}$ for factor A = 19.1 t-test$_{00.1}$ for factor B = 8.6027
for interaction of factors AxB = 32.13

The highest average value of dry weight of weeds (398.10 g m^{-2}) was determined in the variant D_1, i.e. in the lowest crop density. Moreover, in comparison to the variant without herbicide application, significant decrease of dry weight of distributed weeds was determined in the variant with herbicide application (465.04 g m^{-2} and 77.18 g m^{-2}). In the crop density x herbicide application interaction, the lowest values of dry weight of weeds (43.60 and 46.30 g m^{-2}) were detected in the treated variant with higher densities (D_2 and D_3, respectively). Values determined for dry weight of weeds distributed in maize crop in relation to investigation factors in 1997 are presented in Table 4.

Tab. 4. - Dry weight of weeds (g m^{-2}) in 1997 in relation of crop density (factor A), herbicide application (factor B) and their interaction (AxB)

Density	$\overline{X}$ (AxB) Control	Treatment	$\overline{X}$ (A)
D_1	426.8^a	137.5^c	282.1^a
D_2	195.3^b	39.0^d	117.2^b
D_3	190.7^b	16.1^d	103.4^b
$\overline{X}$ (B)	270.9**	64.2**	

Values of means are designated by the same letters and they do not significantly differ one from another according to LSD-test at 0.01 probability level
* P<0.05
**P<0.01
$LSD_{0.01}$ for factor A = 15.35 t-test$_{00.1}$ for factor B = 6.3309
for interaction of factors AxB = 25.81

The results of the LSD-test indicate highly significant differences in average values for dry weight of weeds over investigated densities and their interaction with herbicide application. The t-test of mean separation for dry weight of weeds in 1997 shows that there are highly significant differences between the treated and control variant. The 1997 results, presented in Table 4, do not indicate significant differences among average values for dry weight of weeds in D_2 and D_3. Furthermore, the lowest values of dry weight of weeds (16.1 g m^{-2}) were obtained in crop density x herbicide application interaction, i.e. in the highest crop density D_3 when herbicides were applied.

The analysis of results on effects of higher maize crop densities on floristic composition and structure of weed community in both years of investigation points out to justification of the combined application of chemicals and production technology measures in weed control. Weed distribution under investigation conditions of maize growing lessened due to interspecific- and intraspecific competition. In other words, the crop itself, as well as other weed species are competitors with each weed species under the conditions of higher crop densities. However, obtained results indicate that higher crop density does not affect equally all weed species. In the majority of weed species, the number of individual plants and fresh weight per m^2 were reduced by higher crop densities in both years. Nevertheless, there were some exceptions. For instance, higher crop densities in 1996 did not lead to the decrease of neither weed individuals nor fresh weight per m^2 of the species *Digitaria sanguinalis.* In 1997 the higher crop density did not affect the species *Cirsium arvense.* Therefore, the increased maize crop density or at least the recommended one with herbicide application leads to even better results in reducing weeds distributed in this crop. The results on positive effects of higher crop densities on decreasing of dry weight of weeds are in accordance with results of previous studies (Tollenaar et al., 1994).

Based on obtained results, determined effects of observed hybrids on weed distribution were not statistically significant, while the effect of herbicide application on the decrease of dry weight of weeds was highly significant in both years of investigation (Table 5). Highly significant decrease of dry weight of weeds in the treated variant in relation to the control is a result of efficient herbicide application, which is in relation with sufficient amounts of precipitation.

Tab. 5.- Effects of studied hybrids and herbicide application on dry weight of weeds (g m^{-2})

		1996	1997
	H_1	261.59^{ns}	166.75^{ns}
Hybrids	H_2	227.53^{ns}	145.05^{ns}
		$t_{0.01} = 0.4494$	$t_{0.01} = 0.5298$
Herbicide	Control	465.04**	270.90**
Application	Treatment	77.18**	64.20**
		$t_{0.01} = 8.6027$	$t_{0.01} = 6.3309$

ns P>0.05, **P<0.01

In 1996, based on the LSD-test, higher grain yield (10.95 t ha^{-1}) was obtained in the highest crop density (D_3), under conditions of herbicide application (11.14 t ha^{-1}) and in hybrid H_2 (10.63 t ha^{-1}) (Tables 6a, b). The equal regularity was observed in 1997 and the corresponding values amounted to 12.28, 12.07 and 11.23 t ha^{-1}, respectively.

The analysis of correlations among studied factors (Tables 6a, b) was performed with the purpose of better observation and clarification of ultimate effects of crop densities, herbicide application and hybrids on weed distribution (dry weight) and, depending on it, on their effects on maize (plant height and grain yield). The correlation coefficient was negative for almost all observed variables and mostly statistically highly significant, pointing to the fact that the increase of dry weight of weeds led to the reduction in plant height and grain yield of maize. Effects of crop densities on the decrease of dry weight of weeds, and thereby on the increase of maize grain yield were pronounced in both years, hence correlation coefficients were decreasing with crop density increasing and were the lowest in D_3. The values of correlation coefficients between dry weight of weeds and maize plant height were significantly higher in the hybrid H_2 in both years, indicating that this hybrid, due to its greater height, had stronger competitive effects on weeds. On the other hand, correlation coefficients between dry weight of weeds and maize grain yield were significantly higher in the less yielding hybrid H_1. Obtained results are in accordance with morphological and biological traits of this hybrid, which matures earlier and is shorter, wherefore leaves more free space for the development of weeds.

Tab. 6a. - Correlation coefficients (r) between weed dry weight and maize plant height

	1996			1997		
	Weeds dry weight	Maize plant height	r	Weed dry weight	Maize plant height	r
D_1	398.1	246.85	- 0.890**	282.1	251.36	- 0.650**
D_2	251.8	247.63	- 0.814**	117.2	255.93	- 0.534*
D_3	163.9	247.71	- 0.882**	103.4	253.06	- 0.492ns
Hybrid 1	261.6	245.42	- 0.632**	166.75	244.85	- 0.523**
Hybrid 2	280.6	249.36	- 0.770**	168.38	262.04	- 0.689**
Treatment	77.18	263.81	- 0.309ns	64.2	264.0	0.121ns
Control	465.04	230.59	0.247ns	270.9	242.9	- 0.238ns

* P < 0.05 ** P < 0.01 ns- non significant

Tab. 6b. - Correlation coefficients (r) between weed dry weight and maize grain yield

	1996			1997		
	Weed dry weight	Maize grain yield	r	Weed dry weight	Maize grain yield	r
D_1	398.1	9.41	- 0.846**	282.1	9.82	- 0.695**
D_2	251.8	10.05	- 0.726**	117.2	11.92	- 0.810**
D_3	163.9	10.95	- 0.612*	103.4	12.28	- 0.717**
Hybrid 1	261.6	9.64	- 0.844**	166.75	10.98	- 0.915**
Hybrid 2	280.6	10.63	- 0.699**	168.38	11.23	- 0.672**
Treatment	77.18	11.14	- 0.321	64.2	12.07	- 0.702**
Control	465.04	9.13	- 0.595**	270.9	10.18	- 0.800**

* P < 0.05 ** P < 0.01 ns- non significant

Considering all stated results, it can be established that all observed factors (crop density, herbicide application and hybrid) affected weeds and maize, depending on the investigated year. The choice of maize hybrids for a particular region and their growing in recommended, but never in lower densities, with the adequate herbicide application, leads to successful weed control. Crop density alone, as a cropping practice, is not sufficient to reduce weed coverage. Its application and mean is full only within the integrated weed management system, as one in a chain of measures with the same purpose. Due to this, the studies on this complex problem should be continued with a view to more detailed observation of interaction between maize and weeds.

Conclusion

The studies pointed to the following conclusions:

Qualitative and quantitative distribution of certain weed species in weed community in both years of investigation was significantly decreasing with the increase of maize crop density.

The statistical analysis of data on dry weight of weeds in 1996 showed highly significant differences among densities (factor A), treatments (factor B) and their interaction (AxB). In the density x herbicide interaction, the lowest values of dry weight of weeds were determined in the treated variant in higher densities D_2 (43.60 g m^{-2}) and D_3 (46.30 g m^{-2}).

Based on LSD-test for dry weight of weed in 1997 differences of average values of dry weight over studied densities and their interaction with herbicide application were highly significant.

The statistical analysis (t-test) did not show significant difference between observed hybrids in their effects on the reduction of dry weight of weeds.

The herbicide application resulted in significant decrease of the number of individual weed plants and their dry weight. Highly statistically significant differences between the average values for dry weight of weeds in the treated and control variant were determined by the t-test.

In 1996, based on the LSD-test, higher grain yield (10.95 t ha^{-1}) was obtained in the highest crop density (D_3), under conditions of herbicide application (11.14 t ha^{-1}) and in hybrid H_2 (10.63 t ha^{-1})

The equal regularity was observed in 1997 and the corresponding values amounted to 12.28, 12.07 and 11.23 t ha^{-1}, respectively.

The correlation coefficients were negative for almost all observed variables.

Based on the overall analysis of effects of various crop densities, different hybrids as well as herbicide application on the number, fresh weight and the type of weeds, on one hand, and maize plant height and grain yield, on the other hand, it can be stated that the weed community reduced with higher crop densities under conditions of herbicide application. At the same time, obtained high grain yields justify such a mode of growing of the hybrid H_1 (ZPSC 42A) and the hybrid H_2 (ZPSC 704) in the location of Zemun Polje.

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UTICAJ GUSTINE USEVA I PRIMENE HERBICIDA NA FLORISTIČKI SASTAV I GRAĐU KOROVSKE ZAJEDNICE KUKURUZA (*Zea mays* L.)

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Rezime

U radu je proučavana zastupljenost vrsta korova u hibridima kukuruza gajenim u različitim gustinama useva u uslovima sa i bez primene herbicida. Ocenjivan je floristički sastav i građa korovske zajednice na osnovu zastupljenosti prisutnih vrsta korova, broja njihovih jedinki i mase po jedinici površine kao pokazatelja koji preciznije određuju kompetitivno delovanje različitih gustina kukuruza na korove. Pored toga proučavano je delovanje navedenih faktora na neke morfološke osobine i prinos zrna kukuruza. U okviru statističko-biometrijskih metoda obrade podataka korišćeni su analiza varijanse za RCB dizajn, LSD- i t-test kao i korelaciona analiza između suve mase korova i visine biljaka i prinosa zrna kukuruza u zavisnosti od ispitivanih gustina i hibrida (Steel i Torrie, 1960). Rezultati istraživanja su pokazali da je povećanje gustine useva statistički vrlo značajno uticalo na smanjenje broja jedinki i mase korova. U uslovima primene herbicida utvrđeno je značajno manje vrsta korova, njihovih jedinki, sveže i suve mase u odnosu na varijantu bez primene herbicida. Broj jedinki korova bio je, u obe godine, veći kod hibrida H_1. Prosečne vrednosti visine biljaka kukuruza su se statistički vrlo značajno razlikovale u zavisnosti od primene herbicida i hibrida. Gustina useva uticala je na veličinu lisne površine, indeks lisne površine i broj listova po biljci kukuruza. Prinos zrna kukuruza bio je veći u najvećoj gustini (G_3), u uslovima primene herbicida (T) i kod hibrida H_2, u obe godine ispitivanja.

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