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THE INFLUENCE OF NEW HERBICIDES ON THE GROWTH AND THE SOME STRUCTURAL ELEMENTS OF THE YIELD OF FODDER MAIZE

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Abstract

Within the period 2011-2012 in the experimental field of the Agricultural University, Plovdiv, we conducted field experiments using new herbicides on fodder maize. The experiments were based on the block method over an area of 21 m^2 in four repetitions. It has been established that they demonstrate excellent selectivity for this crop and by eliminating the competition of the weeds, they increase the components of the yield and have a positive effect on the growth and the development of maize. The obtained data has been statistically processed based on the ANOVA method.

Key words: *zea mays, herbicides, structural elements, growth.*

INTRODUCTION

In order to obtain high and sustainable yield of maize (*Zea mays* L.), it is necessary to grow it applying irrigation and at the same time fight the weeds by using the most appropriate herbicides (Zhelyazkov, 2007; Tonev et al., 2010; Mahmood and Swenton, 2005; Stoimenova et. al., 2004). The production capacity of the mid-early maize hybrids are determined to a large extent by the quantity and the distribution of the rainfall during the vegetation period. New maize hybrids are constantly being used in practice, testing their productivity in the different agroecological regions around the country (Ilchovska, 2008; Delibaltova and Ivanova, 2009) and determined the impact of pests on crop (Dimitrov et al., 2012).

The strong negative influence of weeds on the growth and the yield of maize as well as the need to use new herbicides on this crop set the objective of this survey, namely, to study the influence of new soil and leaf herbicides on the growth and some structural elements of the yield of fodder maize.

MATERIALS AND METHODS

Within the period 2011-2012 in the experimental field of the Agricultural University, Plovdiv, we made field experiments using new herbicides applied into the soil after sowing and before the germination of the crop and also applied to the leaves during the vegetation period of the maize – a hybrid of Pioner company: Kolomba (450 FAO). The sowing during the two years of the experiment was performed on 21.04.2011 and 23.04.2012. The experiments were made using the block method over an area of 21 m^2 in four repetitions (Table 1).

The agrotechnical activities were conducted in accordance with the commonly used technology for growing maize (processing of the soil, fertilization, sowing, rolling). The soil and leaf herbicides were applied using a knapsack sprayer and a solution of 30-40 l/dka. The efficiency of the herbicides was registered in sample areas (2 for each repetition) i.e. 8 per variant:

- For the soil herbicides – on the 28^{th}, 40^{th} and 56^{th} days after spraying.
- For the leaf herbicides – on the 20^{th} and 40^{th} days after spraying.

The year 2011 was characterized by moderately warm and dry spring considering the small quantity of the rainfall during the winter period (in January the rainfall was far below the norm – it barely reached 24,6 l/m^2 compared with the year 2012 when the quantity of the rainfall was 120,2 l/m^2). The summer of 2011 was very hot and the quantity of the rainfall was close to the norm.

In April 2012, the pre-sowing processing of the soil had already been performed in the conditions of extreme drought (the total quantity of the rainfall for the region in March and April barely reached 27,1 l/m^2), which did not allow the growth of separate groups of weeds typical for that period. However, in May there were heavy precipitations (160,8 l/m^2). This provided conditions for secondary weeding in the experimental areas and contributed to the good efficiency of the soil herbicides.

Table 1. The field experiments performed

Variants	Active substans	Dose
1. Control (K_1)-untreated and not trenced area		
2. Industrial control (K_2) – untreated with 2-3 hoeing		
3. Laudis OD	*44 g/l tembotrion*	200 cm^3/dka (folair application)
4. Lumux 538 SK	*375 g/l s-metolaxlor 125 g/l terbutilazin 37.5 g/l mezotrion*	400 cm^3/dka (soil application)
5. Elumis	*30 g/l nikosulfuron 75 g/l mezotrion*	200 cm^3/dka (folair application)
6. Gardoprim plus gold 500 SK	*312.5 g/l s-metolahlor 187.5 g/l terbutilazin*	450 cm^3/dka (soil application)
7. Wing	*212.5 g/l dimetenamid-P 250 g/l pendimetalin*	400 cm^3/dka (soil application)
8. Stelar	*50 g/l topramezon 160 g/l dikamba*	100 cm^3/dka (folair application)
9. Kaspar 55 WG	*50 g/kg prosulfuron 500 g/kg dikamba*	30 g/dka (folair application)
10. Merlin flex	*240 g/l izoxaflutol*	42 cm^3/dka (soil application)

RESULTS AND DISCUSSIONS

The data on the elements determining the yield has been processed mathematically based on the ANOVA method.

We estimated the degree of provedness of the differences between the indicators regarding the zero control sample (No. 1) and the hoed control sample (No. 2).

Tables 2 and 3 show the height of the plants in the different variants of the treatment registered during the stage of full maturity of the crop within the period of the survey. The smallest height of the maize plants was registered in the zero control sample – 120.7 cm and 154.6 cm, respectively. In variants No. 5, 8 and 9, the values of this indicator reach 139.32 cm but the differences with the zero control sample have not been proven (Table 2). The tallest maize plants were registered in variants No. 4, 6, 7 and No. 3, which is statistically significant compared with the zero control sample. The differences between the treated variants and the hoed control sample are statistically doubtful, which means that the registered heights in all variants are at the level of the hoed control sample.

Table 2. Degree of provedness of the differences with the control sample regarding the height of the plants measured in cm during the experiment with maize plants in their full maturity stage, 2011.

Variants	Average	D ± var. 1	Significance	D ± var. 2	Significance
4	185.47	30.82	+++	9.95	ns
6	179.97	25.36	++	4.45	ns
3	177.25	22.63	++	1.73	ns
2	175.52	20.90	+		
7	174.82	20.20	+	-0.7	ns
8	174.62	20.00	+	-0.9	ns
10	167.87	13.25	Ns	-7.65	ns
9	162.60	7.98	Ns	-12.9	ns
5	159.97	5.35	Ns	-15.5	ns
1	154.62			-20.9	-

$GD_{p5\%}$ = 18.47; $GD_{p1\%}$ = 21.50; $GD_{p\ 0.1\%}$ = 27.30

In 2012, the plants of all variants were taller compared with the previous year 2011, when the height varied from 223.3 to 247.05 cm. The lowest value of this indicator was registered among the plants of the zero control sample – 154.62 cm for the year 2011 and 223.3 cm for the year 2012 (Table 3). The biggest proven height compared with the zero control sample in the tasseling stage of the maize was registered for variants No. 3 (226.0 cm), 4 (216.9 cm) and 8 (215.2 cm) and during the full maturity stage also for variant No. 10 (237.7 cm). For all other variants, these differences compared with the zero control sample are insignificant although higher values were registered during both stages of this crop.

The differences in the height between the variants treated with herbicides and the hoed control sample have not been proven, which puts then into the same category.

As regards the length of the corncob (Table 4), the influence of the examined variants is similar to that registered for the width of the corncob. Only the leaf treatment with Kasper 55 VG-30 g/dka (var. 9) did not have a

substantial influence on the length of the corncob and it is at the same level as that of the zero control sample.

Table 3. Degree of provedness of the differences with the control sample regarding the height of the plants measured in cm during the experiment with maize plants in their full maturity stage, 2012.

Variants	Average	D ± var. 1	Significance	D ± var. 2	Significance
3	247.05	23.75	+++	11.82	ns
8	246.66	23.23	+++	11.32	ns
4	238.35	15.05	+	3.12	ns
10	237.73	14.43	+	2.50	ns
6	236.95	13.65	ns	1.72	ns
7	236.87	13.57	ns	1.64	ns
2	235.23	11.93	ns		
5	232.10	8.80	ns	-3.13	ns
9	227.98	4.68	ns	-7.25	ns
1	223.30			-11.9	

$GDp_{5\%}$ = 13.95; $GDp_{1\%}$ = 17.58; $GDp_{0.1\%}$= 21.33

Table 4. Degree of provedness of the differences with the control samples regarding the length of the corncob measured in cm during the experiment with maize, 2011.

Variants	Average	D ± var. 1	Significance	D ± var 2	Significance
4	17.4	2.23	+++	0.86	+
6	17.0	1.83	+++	0.46	ns
7	16.9	1.73	+++	0.36	ns
3	16.68	1.51	+++	0.14	ns
8	16.58	1.41	+++	0.04	ns
2	16.54	1.37	+++		
5	16.50	1.33	+++	-0.04	ns
10	16.29	1.12	++	-0.25	ns
9	16.01	0.84	ns	-0.53	ns
1	15.17			-1.37	---

$GD_{p5\%}$ = 0.86; $GD_{p1\%}$ = 0.94; $GD_{p\ 0.1\%}$ = 1.16

The highest degree of provedness for this indicator compared with the zero control sample was registered for variant No. 6 – Gardoprim plus Gold 500 SK – 450 cm^3 /da where the length of the corncob was 17.85 cm for the year 2012 and 17.00 cm for the year 2011 and variant No. 4 – Lumax 538 SK-400 cm^3 /da -17.76 cm in the year 2011 and 17.4 cm in 2012 (Tables 4 and 5).

Table 5. Degree of provedness of the differences with the control samples regarding the length of the corncob measured in cm during the experiment with maize, 2012.

Variants	Average	D ± var. 1	Significance	D ± var. 2	Significance
6	17.85	2.56	+++	0.40	ns
4	17.76	2.47	+++	0.31	ns
7	17.46	2.17	++	0.01	ns
2	17.45	2.16	++		
3	17.42	2.13	++	-0.03	ns
5	17.10	1.81	+	-0.35	ns
8	16.48	1.19	ns	-0.97	ns
10	15.55	0.26	ns	-1.90	-
9	15.30	0.01	ns	-2.15	--
1	15.29			-2.16	--

CONCLUSIONS

On average, during the period of the survey in the variants treated with the herbicides Laudis OD applied during the vegetation period of the crop in a dose of 200 m^3/da, Lumax 538 SK-400 cm^3/da and Gardoprim plus Gold 500 SK-450 cm^3/da, applied to the soil, the plants reach the biggest proven height compared with the zero control sample during the full maturity stage of the maize. The differences between all treated variants in the experiment and the hoed control sample have not been statistically proven.

When using the herbicides Gardoprim plus Gold 500 SK, Lumax 538 SK, Wing P-400 cm^3/da and Laudis OD-200 cm^3/dka, we registered higher values for the length of the corncob compared with the zero control sample and regarding the hoed control sample, the differences are not significant for any of the variants with the exception of variant No. 4 in 2011.

In 2011, variants No. 4, 6, 7, 3 and 8 had bigger values of the indicator related to the number of lines on a corncob compared with the two control samples and in 2012 only variant No. 6 showed a value higher than the one of the zero control sample. Such a difference between the variants treated with herbicides and the hoed control sample in 2012 was not registered.

The application of Gardoprim plus Gold (variant 6), Lumax 538 SK (variant 4) and Wing P (variant 7) during the two years of the experiment contributed to the increase of the values of the weight of the grains of one corncob, which has been statistically proven compared with the zero control sample and the

difference with the hoed control sample is insignificant.

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