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THE EFFECT OF DIFFERENT WEED CONTROL TECHNOLOGIES ON WEED SPECIES COMPOSITION OF MAIZE

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ABSTRACT
In our investigation we used different weed control technologies in the different phenology states of the maize. The farm experiment has been carried out in Hungary, Kunágota, on flat surface, homogeneous quality chernozem soil, on 1000 m^2 plots, in 4 replications.
The experiment can be regarded as 9 weed-control strategies where, in addition to the untreated control, two chemicals are applied (Laudis, Capreno) in different doses, two mechanical weed-control technologies, and two combination of chemicals and mechanicals weed-control technologies were used. Mechanical weed-control place connected to the herbicide treatments in different times: until 4-6-leave age weedless, in 4-6-leave age hoed once, in 4-6-leave age cultivation once.
Our results were assessed by chemical efficiency examination in five periods. Our resoult show that the two tested herbicides were efficient against weeds. Laudis was more effective, than Capreno against *Setaria pumila*. The dose enlargement of Capreno only slightly increased the herbicidal efficiency. The decreased dosage of Capreno was not efficient enough against *Abutilon theophrasti*.

Keywords: maize, mechanical weed-control, combination of chemicals and mechanicals weed-control, mechanicals weed-control, weed survey

INTRODUCTION

In the past decades, maize was produced on the largest scale in Hungary. Weeds mean one of the most important problems in maize fields (NAGY AND SÁRVÁRI, 2005.). The weed-control of maize is possible with mechanical weed-control technologies, with chemicals and with combination of chemicals and mechanicals weed-control technologies, aside from the agrotechnical methods. The right decision on protection, which focuses on only the occurring species, can suitably repress their presence, and can halt future spreading in the given crop, can only be made with suitable knowledge of our arable lands and the weeds that infect those.
Since the fourth national weed field survey (1996-1997), significant changes have taken place in our arable lands (GYULAI ET AL., 2016). The past one and a half decades have seen a rearranging of the ownership structure of Hungary's lands, with the number of people farming small areas of land having increased together with the sizes of the lands they farm (ÁNGYÁN, 1997). This has also led to substantial changes in the dominance relationships of field crop weeds, which in turn has increased the spreading of several weed species (NOVÁK ET AL. 2009.). In addition to all the above, a change in herbicide use is one of the other important factors that plays a role in weed flora changes.
Adjudication of the different methods happen by weed survey (ASPINAL AND MILTHORPE, 1959; BLEASDALE, 1960; HARPER, 1961, 1977; DONALD, 1963).

The object of our study is that we determine the effect of different weed-control technologies of maize on weed species composition and on weed control efficiency.

MATERIAL AND METHOD

The experiments were carried out in Békés county, Kunágota, in 2017 on good quality, homogeneous, flat surface chernozem soil. Sunflower was the forecrop of our farm experiment. The sunflower forecrop was sprayed with Pulsar. As fertilizer, 54 kg ha^{-1} N active agent was emitted in springtime. The sowing was done with Dekalb DKC 5275 maize hybrid, on 5 April 2017, with 70,000 seeds m^{-2} amounts of seeds, interline spacing was 75 cm. The research was established farm conditions on 20 x 50 m plots. *Table 1* shows the applied weed-control technologies in the experiment.

Table 1. Weed-control technologies in the experiment

Treatments	Rate (l ha^{-1})	Mode of application
1. untreated control		all the time weedy
2. mechanical weed-control		in 4-6-leave age hoed once
3. mechanical weed-control		until 4-6-leaves age weedless
4. Laudis	2	postemergence (in maize 4-6-leaves age)
5. Capreno	0.4	postemergence (in maize 4-6-leaves age)
6. Capreno	0.3	postemergence (in maize 4-6-leaves age)
7. Capreno	0.2	postemergence (in maize 4-6-leaves age)
8. Laudis	2	postemergence (in maize 4-6-leaves age) + in 4-6-leaves age cultivation once
9. Capreno	0.3	postemergence (in maize 4-6-leave age) + in 4-6-leaves age cultivation once

Table 2 contains the meteorological data during the time of the experiment.

Table 2. Meteorological data during the experiment

Months	Decade	Average temp. (°C)	Precipitation (mm)
April	1.	12.25	10
	2.	9.3	22
	3.	12.1	4
May	1.	15.35	6
	2.	18.25	20
	3.	19.18	20
June	1.	21.25	16
	2.	21.18	7
	3.	25	13
July	1.	23.7	1
	2.	22.9	11
	3.	23.86	31
August	1.	27.75	14
	2.	23.85	18
	3.	21.31	0
September	1.	20.27	35
Total			**228**

We estimated the applied weed-control methods with weed surveying in 4 repeats, on 2 x 2 meter random layout plot. We performed weed surveying five times:

- before treatments (16 May 2017)
- 2 weeks after treatments (31 May 2017)
- 1 month after treatments (14 June 2017)
- in maize flowering age (5 July 2017)
- before harvest (9 September 2017)

RESULTS

Table 3 contains the weed species composition of the control parcel and *Table 4* shows the effect of examined weed-control methods.

Table 3. The weed species composition of control parcels

Latin name	Bayer code	Dates of weed survey				
		16 May	31 May	14 June	5 July	9 September
Abutilon theophrasti	ABUTH	1.12	3.12	3.63	3.78	3.88
Amaranthus retroflexus	AMARE	0.25	5.25	6.88	7.20	7.50
Ambrosia artemisiifolia	AMBEL	0.63	6.12	8.25	9.83	10.13
Capsella bursa-pastoris	CAPBP	1.00	2.12	2.63	2.69	2.88
Chenopodium album	CHEAL	3.29	6.13	9.25	9.03	9.13
Convolvulus arvensis	CONAR	1.34	2.12	2.25	2.33	2.63
Datura stramonium	DATST	0.59	3.75	4.50	4.68	4.88
Helianthus annuus	HELAN	8.04	14.50	16.13	17.43	20.13
Persicaria maculosa	POLPE	0.32	1.12	2.25	2.43	2.63
Rubus caesius	RUBCA	0.00	0.50	0.55	0.63	0.69
Setaria pumila	SETPF	4.71	5.13	5.88	7.63	10.83
Taraxacum officinale	TAROF	0.11	0.20	0.35	0.56	0.83

The weed species composition of control parcels for characteristics to weed flora mainly consisted of late-summer annual weeds belonging, we found a few perennial weeds (*Convolvulus arvensis, Rubus caesius, Taraxacum officinale*).

We have observed that in 4-6-leaves age cultivation once, after the mechanical control on the parcels weeds soon germinated, so we found more and more T4 type weeds. The two tested herbicides were efficient against weeds on chemical control parcells (4., 5., 6., 7., 8., 9.), however the mechanical control treatments (8., 9.) did not significantly affect herbicidal efficiency. The dose enlargement of Capreno only slightly increased the

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herbicidal efficiency, however the decreased dosage of Capreno was not efficient enough against *Abutilon theophrasti*.

CONCLUSIONS

Weed flora mainly consisted of late-summer annual weeds belonging to T4 type, we found a few perennial weeds (*Convolvulus arvensis, Rubus caesius, Taraxacum officinale*). We found more and more T4 type weeds after the first hoeing of the maize.
The 2 tested herbicides were efficient against weeds. Laudis was more effective, than Capreno against *Setaria pumila*. The dose enlargement of Capreno only slightly increased the herbicidal efficiency. The decreased dosage of Capreno was not efficient enough against *Abutilon theophrasti*.

Table 4. Weed-control efficiency in different weed control technologies

Treatment No.	No. of weed survey	ABUTH	AMARE	AMBEL	CAPBP	CHEAL	CONAR	DATST	HELAN	POLPE	RUBCA	SETPF	TAROF
2.	2.	100	93	100	100	81	100	83	94	78	100	60	100
	3.	100	97	100	100	85	100	88	97	80	100	65	100
	4.	97	95	100	91	89	100	85	98	90	100	53	100
	5.	97	95	100	91	89	100	85	99	90	100	52	100
4.	2.	76	100	100	96	100	88	100	100	78	100	90	100
	3.	83	100	100	100	100	89	100	100	89	100	88	100
	4.	83	100	100	100	100	89	100	100	100	100	87	100
	5.	84	100	100	100	100	95	100	100	100	100	86	100
5.	2.	100	100	100	100	98	100	100	100	100	100	89	100
	3.	100	100	100	100	99	100	100	100	100	100	87	100
	4.	100	100	100	100	99	100	100	100	100	100	89	100
	5.	100	100	100	100	99	100	100	100	100	100	85	100
6.	2.	100	98	100	100	99	100	100	99	100	100	83	100
	3.	100	100	100	100	97	100	100	98	100	100	85	100
	4.	100	100	100	100	98	100	100	100	100	100	86	100
	5.	100	100	100	100	98	100	100	100	100	100	82	100
7.	2.	80	100	100	100	85	100	100	100	100	100	68	100
	3.	80	100	100	100	94	100	100	100	100	100	72	100
	4.	78	100	100	100	94	100	99	100	100	100	80	100
	5.	70	100	99	100	94	100	98	100	100	100	80	100
8.	2.	85	100	100	96	100	88	100	100	78	100	90	100
	3.	93	100	100	100	100	89	100	100	89	100	88	100
	4.	93	100	100	100	98	89	99	100	100	100	87	100
	5.	94	100	100	100	98	95	100	100	99	100	86	100
9.	2.	90	98	100	100	99	100	100	99	100	100	83	100
	3.	95	100	100	100	97	100	100	98	100	100	85	100
	4.	99	100	100	100	98	100	98	100	100	100	86	100
	5.	97	99	100	100	98	100	99	100	99	100	82	100

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