

NICOSULPHURON EFFICACY IN ANNUAL AND PERENNIAL WEED CONTROL IN MAIZE

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Abstract

High fertilization of soils in Romania, groundwater and intake correlated with biological reserve in the soil creates favorable conditions for growth and development both for plants and for weeds, especially Sorghum halepense. Due to the high degree of weed infestation it can reach to partially or even total crop calamity. The present work is based on studies that were carried out in maize at a farm in Afumati, Ilfov County. Sulfonylurea-based herbicide nicosulphuron was applied post-emergence at doses of 0.8, 1.0 and 1.5 l/ha, when the maize crop had minimum 2 leaves, BBCH 12. The experiments were placed in randomized blocks and observations aimed at degree of effectiveness in controlling weeds and crop selectivity. From observations made in recent years result in a change in the ratio between monocotyledonous and dicotyledonous species in favor of monocotyledonous especially for the perennial weeds. In these studies the observations were made before the treatment (0 days), 14, 28 and at 42 days after treatment. The predominant species identified were: Sorghum halepense, Echinochloa crus-galli, Setaria spp. The herbicide based on nicosulphuron had a good efficacy in controlling annual and perennial weeds in maize crops. At the dose of 0.8 l/ha monocotyledonous weeds were not fully controlled. For Sorghum halepense species the best results were obtained at the dose of 1.5 l/ha. No phytotoxicity symptoms have been shown in the study.

Key words: control, herbicide, nicosulphuron, weeds.

INTRODUCTION

Regardless of the historical stage and maize cultivation system, the highest costs in the production process are with weeds control. By its biology nature, corn plants are characterized as lacking the ability to compete with weeds, especially in the early stages of vegetation. Slow growth of corn plants in the first 4-6 weeks after emergence, associated with a low density (4-6 plant/m²), creates a major advantage in the competition since the beginning in favor of weeds. Weeds by their number, by rapacity for space, water and food, are causing great damage to maize crops. Depending on the degree of weed infestation, the damage varies between 30-80% of the production obtained, and in case of infestation with species *Sorghum halepense* from rhizomes sometimes can reach to total compromise of the crop (Sarpe et al., 1976, Chirila et al., 2001, Berca, 1996, 2004). In this context, the paper presents data on the efficacy of nicosulphuron, sulfonylurea-base herbicides, in control of annual and perennial monocotyledonous weeds

in maize, aiming to improve agricultural technology and obtaining stable crops.

MATERIALS AND METHODS

The experiments were placed at SC Agricola Afumati, Ilfov, Romania, in randomized blocks, in 4 repetitions with plot area of 30 m² on loamy clay soil with a pH of 6.5 and an organic matter content of 2.5%. Each experimental block included an untreated and a standard reference.

Weed density was assessed in ground % and in coupla/m². Weed control (efficacy) was assessed at 14, 28, 42 days after application in coupla/m² and % control comparative with untreated. Also, were performed observations on the weeds present in the experimental plots before treatment, and selectivity - at each date of the efficacy assessments.

Determination of segetal flora was performed on a square meter using a metric frame. Statistical preparation of the results was based on the analysis of ARM-9 (P=.05, Student-Newman-Keuls).

RESULTS AND DISCUSSIONS

Maize, the main cultivated plant in Romanian agriculture, shows a strong and diversified infestation with monocotyledonous and dicotyledonous annual and perennial weeds. The agriculture practiced in recent years has led to changes in the structure and frequency of weeds in maize both quantitatively and especially qualitatively.

Grass weed species have become more damaging than dicotyledonous, with an increasing frequency of *Echinochloa crus-galli*, *Setaria* spp., *Sorghum halepense* and *Elymus repens*. Romania has one of the highest degrees

of infestation with *Sorghum halepense*. The large number of seeds (2000-5000/plant) and extensive rhizome system makes this weed difficult to control (Chirila, 2001).

Maximum sensitivity toward infestation with *Sorghum halepense* manifests itself in the early stages of vegetation.

The predominant species identified in the studied locations were: *Sorghum halepense*, *Echinochloa crus-galli* and *Setaria* spp. (Table 1).

In the experimental field were present also other weed species: *Amaranthus retroflexus*, *Convolvulus arvensis*, *Xanthium italicum*, *Solanum nigrum*, but with a low density.

Table 1. Growth stage of dominant weeds

Weeds	BBCH	Description
SORHA <i>Sorghum halepense</i>	1 st assessment 14	4 true leaves unfolded
	2 nd assessment 17	7 true leaves unfolded
	3 rd assessment 22	G=4 tillers visible
	4 th assessment 48	V= Constant new development of young plants-vegetative reproductive organs reach final size
ECHCG <i>Echinochloa crus-galli</i>	1 st assessment 13	3 true leaves unfolded
	2 nd assessment 16	6 true leaves unfolded
	3 rd assessment 22	2 side shoots visible; 2 tillers visible
	4 th assessment 43	Harvestable vegetative plant parts or vegetatively propagated organs have reached 30% of final size;
SETSS <i>Setaria</i> spp.	1 st assessment 12	2 true leaves unfolded
	2 nd assessment 15	5 true leaves unfolded
	3 rd assessment 21	First side shoots visible
	4 th assessment 34	Stem (rosette) 30% of final length (diameter); 4 nodes detectable

Coverage with species *Sorghum halepense* in the experimental field was high: 57.7% before treatment application, 66.8% at 14 days, 67.5% at 28 days and 71.0% at 42 days after treatment application. In these conditions of weed infestation, the nicosulphuron, sulfonylurea-based herbicide had a good efficacy in control of annual and perennial monocotyledonous weeds in maize. At 14 days after treatment the

herbicide had a very good efficacy in control of *Sorghum halepense* (98.0%), *Echinochloa crus-galli* (100%) and *Setaria* spp. (100%), at a dose of 1.5 l/ha, the results being similar to those of the standard reference (Table 2). Good results were recorded at the dose of 0.8 l/ha respectively: 90.0% for *Sorghum halepense*, 92.8% for *Echinochloa crus-galli* and 100% for *Setaria* spp.

Table 2. The efficacy of herbicides in maize crop after 14 days of treatment

Treatment name	Dose l/ha	Weeds					
		<i>Sorghum halepense</i>		<i>Setaria</i> spp.		<i>Echinochloa crus-galli</i>	
		Dens. (%) ¹	E. (%) ²	Dens. (%)	E. (%)	Dens. (%)	E. (%)
Untreated		66.8	0.0	15.5	0.0	6.0	0.0
Nicosulphuron	0.8	9.0 a	90.0 b	0.0 a	100 a	0.8 a	92.8 ab
	1.0	5.5 ab	94.8 ab	0.0 a	100 a	0.3 a	93.8 ab
	1.5	3.0 b	97.3 a	0.0 a	100 a	0.0 a	100 a
Standard reference	1.5	0.5 b	99.5 a	0.0 a	100 a	0.0 a	100 a
LSD (P=.05)		2.91	3.74	0.22	0.00	0.81	16.21
Standard Deviation		2.01	2.59	0.15	0.00	0.56	11.22

¹Dens. = density (ground %)

²E.= efficacy (control %)

Nicosulphuron applied in postemergence is quickly absorbed by weeds mainly through the leaves and roots, is then translocated into the sap stream to the apical meristems, where they cause irreversible disturbances in cell division. The total control of weeds is carried out in a longer period of up to three weeks. The weed ceases to grow immediately after treatment. Observations shows that the action of the herbicide is influenced by climatic conditions and vegetation at the time of application, absorption and translocation are more intense and faster when weeds have optimal growth conditions (light, heat, water, food) and thus the inhibitory effect is more complete. In order to fully penetrate into the plant, it is necessary

that after treatment, precipitations does not fall for a period of 4-5 hours. Subsequent observations (28 and 42 days after treatment) confirmed the good results of the nicosulphuron herbicide in control of annual and perennial monocotyledonous weeds in maize (Tables 3 and 4). At the dose of 1.5 l/ha, the effect of the herbicide was maintained throughout the growing season of maize: *Sorghum halepense* (91.5%), *Echinochloa crus-galli* (100%) and *Setaria* spp. (98.0%) at 42 days after treatment. At the dose of 0.8 l/ha species *Sorghum halepense* is not entirely controlled such as control rate decreased from 85.5% at 28 days to 61.3% at 42 days after treatment application.

Table 3. Efficacy of herbicides in maize crop after 28 days of treatment

Treatment name	Dose l/ha	Weeds					
		<i>Sorghum halepense</i>		<i>Setaria</i> spp.		<i>Echinochloa crus-galli</i>	
		Dens. (%)	E. (%)	Dens. (%)	E. (%)	Dens. (%)	E. (%)
Untreated		67.5	0.0	9.5	0.0	10.5	0.0
Nicosulphuron	0.8	12.3 b	85.5 c	1.0 b	90.0 a	0.0 a	96.2
	1.0	7.3 cd	91.0 abc	0.0 b	100 a	0.0 a	100 a
	1.5	5.8 de	94.3 abc	0.0 b	100 a	0.0 a	100 a
Standard reference	1.5	3.0 ef	97.0 ab	0.0 b	100 a	0.0 a	100 a
LSD (P=.05)		3.04	7.15	1.09	9.47	0.44	10.89
Standard Deviation		2.11	4.95	0.76	6.42	0.30	7.54

Table 4. Efficacy of herbicides in maize crop after 42 days of treatment

Treatment name	Dose l/ha	Weeds					
		<i>Sorghum halepense</i>		<i>Setaria</i> spp.		<i>Echinochloa crus-galli</i>	
		Dens. (%)	E. (%)	Dens. (%)	E. (%)	Dens. (%)	E. (%)
Untreated	-	71.0	0.0	18.0	0.0	14.5	0.0
Nicosulphuron	0.8	29.8 a	61.3 d	2.5 b	87.5 a	1.0 a	85.5 a
	1.0	9.5 cd	88.8 b	1.0 bc	96.3 a	0.8 a	91.8 a
	1.5	7.5	91.5 b	0.5 bc	98.0 a	0.0 a	100 a
Standard reference	1.5	7.5	91.5 b	0.0 c	100 a	0.3 a	93.8 a
LSD (P=.05)		2.90	3.21	1.49	7.60	0.87	11.91
Standard Deviation		2.01	2.22	1.03	5.27	0.60	8.24

No phytotoxicity symptoms have been shown in the experimental plot. No symptoms of chlorosis, necrosis, leaf deformation, height reduction, distortion and delay at flowering in plots treated with herbicides nicosulphuron. Maize plants managed by its own mechanism to metabolize the active substance and convert it to biologically inactive compounds, so the majority of maize hybrids show no phytotoxicity symptoms. In treated plots, maize plants were more vigorous and taller and culture density was much higher compared to control (Figure 1).



Figure 1. Aspects regarding nicosulphuron efficacy at 28 days after treatment.

CONCLUSIONS

The degree of weeds in maize was high, the predominant weed species was a perennial weed, *Sorghum halepense*, with a coverage rate of over 70% at 42 days after treatment application.

Also annual monocotyledonous weed species *Echinochloa crus-galli* and *Setaria* spp. were present with low density percentage, 14.5% and 18%.

The herbicide based on nicosulphuron had a good efficacy in controlling annual and perennial weeds in maize crops.

At the dose of 0.8 l/ha *Sorghum halepense* is not entirely controlled.

For *Sorghum halepense* species the best results were obtained at the dose of 1.5 l/ha. No phytotoxicity symptoms have been shown in experimental plots.

No symptoms of chlorosis, necrosis, leaf deformation, height reduction, distortion and delay at flowering in plots treated with nicosulphuron.

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REFERENCES

- Berca M., 1996. Weed control in crops. Fermierul Roman Publishing House, Bucharest.
- Berca M., 2004. Integrated weed management. Ceres Publishing House, Bucharest.
- Chirila C., 2001. Weed biology. Ceres Publishing House, Bucharest.
- Sarpe N., Ciorlaus A., Ghinea L., Vladutu I., 1976. Herbicides. Principles and Practice in weed control. Ceres Publishing House, Bucharest.