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SUSTAINABLE USE OF PREEMERGENT HERBICIDES IN RAPE CROPS

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Abstract: Weed control in oilseed rape is a necessity, given both infestations with dicotyledonous and monocotyledonous weeds and because of frequent drills that don't allow for mechanical works. Pre-emergent herbicide in rape crops is an important link for obtaining stable crops. The paper presents data on the benefits of weed control in winter rape, herbicides applied at pre-emergence, aiming to improve the culture technology, so the beginning of winter the rape plants to be well developed to withstand low temperatures in winter and in spring to be able to continue vegetative cycle in the best conditions.

***Key words**: rape; control; weeds; herbicide.*

INTRODUCTION

The importance of winter rape crop has increased considerably in recent years because it provides the raw material for industry, representing a renewable alternative to fossil energy sources. One of the main problems are the weeds in oilseed rape crops. The spectrum of weeds in rape crops has a specific characteristic and is in constant evolution. These developments are all the more apparent as they are studied for a longer time, on large agricultural areas and allowing conclusions to be drawn regarding the emergence of new species of weeds to the growing importance of some of the existing or reduce the importance of others (Berca, 2004).

Such studies, observations and conclusions were presented by many researchers (Sarpe et al., 1976; Berca, 1996, 2004; Budoi & Penescu, 1996; Chirilă, 2001) showing that, as a general rule, the number of weed species decreases, so as the number of weeds/m², but that new species appear in the foreground.

Weed control in oilseed rape is a necessity, given both infestations with dicotyledonous weeds and monocotyledonous weeds and because of frequent drills that do not allow for mechanical works. Preemergent herbicide in rape crops are an important link for obtaining stable crops. Rape forms 50% of its production since the autumn, and the crop is demanding regarding the technology applied in this season, the plant not tolerating heavy presence of weeds. Some weed species (i.e. *Amaranthus, Chenopodium, Solanum* genera) do not survive at low temperatures, but the damage is already evident before the winter by reducing density culture. There are many weed species that can overwinter and fructify in next spring and reach maturity: *Anthemis arvensis*, *Capsella bursa pastoris*, *Matricaria inodora*, *Papaver rhoeas*, *Thlaspi arvense* etc.

In this context, the paper presents data on the benefits of weed control in winter rape with herbicides applied at pre-emergence, aimed at improving crop technology.

MATERIALS AND METHODS

The experimental field was placed at Didactic farm Moara Domneasca - UASVM Bucharest, in randomized blocks, 4 repetitions with a surface plot of 24 m², on a reddish brown soil with a pH of 7.5 and an organic matter content of 2,5%. The herbicides metazachlor (400 g/l) and dimetachlor (500 g/l) + clomazone (40 g/l) were applied at 2.0 l/ha, at pre-emergence.

Weeds control expressed in efficacy (%) was assessed at 14, 28, 42 days after application and at spring regrowth in coupla/m^2 and % control comparative with untreated. Also, there were performed observations on the weeds present in the experimental plots before treatment, and selectivity - at each date of the efficacy assessment. 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

Rape crop is sensitive to weed infestation in early stages (Chirilă, 2001). The weeds present in the experimental field were: *Echinochloa crus-galli*, *Setaria* spp., *Matricaria* spp., *Galium aparine*, *Chenopodium album*, *Convolvulus arvensis*, *Lamium purpureum* and *Veronica* spp. (Table 1).

Table 1. Growth stage of dominant weeds in the experimental field

Weeds	BBCH	Description
Veronica spp.	1st assessment 12	2 true leaves unfolded
	2nd assessment 14	4 true leaves unfolded
	3rd assessment 19	9 true leaves unfolded
	4th assessment 21	First side shoots visible
	5th assessment 48	V= Constant new development of young plants-vegetative reproductive organs reach final size
Setaria spp.	1st assessment 12	2 true leaves unfolded
	2nd assessment 15	5 true leaves unfolded
	3rd assessment 21	First side shoots visible G = tillers visible
	4th assessment 23	G = first awns visible V= constant new development of young. plants-vegetative reproductive organs reach final size
	5th assessment 12	2 true leaves unfolded
Echinochloa crus-galli	1st assessment 13	3 true leaves unfolded
	2nd assessment 16	6 true leaves unfolded
	3rd assessment 22	G = 4 tillers visible
	4th assessment 24	G = first awns visible V= constant new development of young. plants-vegetative reproductive organs reach final size
	5th assessment 17	2 true leaves unfolded
Lamium purpureum	1st assessment 13	3 true leaves unfolded
	2nd assessment 16	6 true leaves unfolded
	3rd assessment 18	8 true leaves unfolded
	4th assessment 21	First side shoots visible;
	5th assessment 15	5 true leaves unfolded
Galium aparine	1st assessment 12	2 true leaves unfolded
	2nd assessment 16	6 true leaves unfolded
	3rd assessment 19	9 true leaves unfolded

	4th assessment 21	First side shoots visible
	5th assessment 29	9 side shoots visible
Chenopodium album	1st assessment 13	3 true leaves unfolded
	2nd assessment 16	6 true leaves unfolded
	3rd assessment 19	9 true leaves unfolded
	4th assessment 21	First side shoots visible
Matricaria spp.	1st assessment 12	2 true leaves unfolded
	2nd assessment 14	4 true leaves unfolded
	3rd assessment 19	9 true leaves unfolded
	4th assessment 21	First side shoots visible
	5th assessment 12/16	2 and 6 true leaves unfolded
Convolvulus arvensis	1st assessment 13	3 true leaves unfolded
	2nd assessment 16	6 true leaves unfolded
	3rd assessment 19	9 true leaves unfolded
	4th assessment 21	First side shoots visible

The predominant weeds present were: *Veronica* spp. 18.8 plants/m^2, *Setaria* spp. 12 plants/m^2, *Echinochloa crus-galli* 9.5 plants/m^2, *Lamium purpureum* 9.8 plants/m^2 and *Galium aparine* 7.0 plants/m^2 at 42 days of treatment.

In these conditions of weed infestation, the tested herbicides have a good efficacy in weed control at winter oil seed rape.

The herbicide metazachlor applied at the dose of 2 l/ha has a good efficacy in control of annual monocotyledonous and dicotyledonous weeds (Figure 1).

Figure 1. Issues on the effectiveness of herbicides at 14 days after treatment application

At pre-emergence application, the metazachlor herbicide is absorbed by germinating weed seeds and as a consequence the new weed plants are destroyed immediately after emergence. Good seedbed preparation and sufficient soil moisture favours taking over the active substance and increases effectiveness. If the soil is dry, the effect is felt after the first rain. At 14 days of treatment metazachlor has a very good efficacy in control of *E. crus-galli* (94%), *Setaria* spp. (100%), *C. album* (92%). For species present in greater numbers efficacy rate was 85 % for *Matricaria* spp. 81% for *Veronica* spp. and 76% for *L. purpureum*. The lowest percentage of efficacy, namely 74%, was in the case of the weed *G. aparine*, a weed species very difficult to control.

The herbicide with two active substances (dimetachlor + clomazone) provided a better control of annual weeds in rape crop, after 14 days of treatment: *E. crus-galli* (96 %), *Setaria* spp. (100%), *C. album* (96%), *Matricaria* spp. (90%), *Veronica* spp. (84%), *L. purpureum* (87%) and *G. aparine* (74%) at 14 days after the treatment (Table 2).

Table 2. The efficacy of herbicides in oilseed rape crop, at 14 days after treatment

Treatment	Weeds													
	E. crus-galli		*Setaria* spp.		*C. album*		*Matricaria* spp.		*Veronica* spp.		*L. purpureum*		*G. aparine*	
	D	E	D	E	D	E	D	E	D	E	D	E	D	E
Untreated	6.0 a	0.0 b	7.5 a	0.0 b	4.0 a	0.0 b	4.3 a	0.0 b	8.5 a	0.0 b	7.3 a	0.0 b	5.0 a	0.0 b
Metazachlor 2 l/ha	0.5 b	94 a	0.0 b	100 a	0.5 b	92 a	0.8 b	85 a	1.8 b	81 a	1.8 b	76 a	1.3 b	74 a
Dimetachlor + Clomazone 2l/ha	0.3 b	96 a	0.0 b	100 a	0.3 b	96 a	0.5 b	90 a	1.5 b	84 a	0.8 b	87 a	0.5 b	87 a
LSD (P=.05)	2.40	41.19	1.88	24.28	1.09	12.26	0.83	13.97	1.37	15.2	1.75	17.96	1.36	26.92
Standard Deviation	1.62	27.72	1.26	16.34	0.73	8.25	0.56	9.45	0.92	10.2	1.18	12.09	0.92	18.12

D = density (plants/m²) E = efficacy (%)

The control of *Veronica* spp. weeds was reaches a value of 84% because this specie is present in large numbers, in the spring season this exceeded 30 plants/m^2. Some species in the genus Veronica are considered invasive species, out of these, the most important two species being *Veronica hederifolia L.* subsp. *Hederifolia* and *Veronica persica* Poir which (Dihoru, 2004).

Besides the high number of weeds/m², they are difficult to distinguish in the phase of cotyledons. The *V. hederifolia* species has large cotyledons, elliptical or oval, slightly narrowed towards the tip, petiole with numerous long hairs or hairless, whereas the *V. persica* species has cotyledons shaped spatula, simple, elliptical or oval, toothed regularly (Figure 2).

Figure 2. *Veronica hederifolia* and *Veronica persica*

No phytotoxicity symptoms have been shown in experimental plots. No symptoms such as chlorosis, necrosis and deformation of leaves as well as reduction of height plants, distortion and delay of the flowering were observed in plots treated with herbicides metazachlor and dimetachlor + clomazone.

Subsequent observations (28 and 42 days after treatment), confirm the good results in control of the annual monocotyledonous and annual dicotyledonous in winter oil seed rape (Table 3 and Table 4).

At 42 days of treatment metazachlor has a good efficacy in control of *Echinochloa. crus-galli* (83%), *Setaria* spp. (86%), *Chenopodium album* (82%). For species present in greater numbers efficacy rate was 66 % for *Matricaria* spp., and 65% for *Veronica* spp.

The two active substances (dimetachlor + clomazone) provided a better control of annual weeds in rape crop, after 42 days of treatment: *Echinochloa crus-galli* (87%), *Setaria* spp. (84%), *Chenopodium album* (91%), *Matricaria* spp. (78%), *Veronica* spp. (70%), *Lamium purpureum* (85%) and *Galium aparine* (86%) (Table 4).

Table 3. Efficacy of herbicides in oilseed rape, after 28 days of treatment

Treatment	Weeds													
	E. crus-galli		*Setaria* spp.		*C. album*		*Matricaria* spp.		*Veronica* spp.		*L. purpureum*		*G. aparine*	
	D	E	D	E	D	E	D	E	D	E	D	E	D	E
Untreated	7.3 a	0.0 b	10.0 a	0,0 b	5.0 a	0.0 b	5.0 a	0.0 b	12.8 a	0.0 c	7.8 a	0.0 b	6.0 a	0.0 b
Metzachlor 2 l/ha	0.8 b	91 a	1.5 b	86 a	0.5 b	92 a	1.0 b	83 a	3.3 c	75 a	1.3 b	84 a	0.8 b	90 a
Dimetachlor + Clomazone 2 l/ha	0.3 b	96 a	1.3 b	90 a	0.3 b	96 a	0.8 b	87 a	3.0 c	78 a	1.0 b	87 a	0.5 b	94 a
LSD (P=.05)	2.08	25.56	2.34	26.2	1.15	11.07	1.06	17.69	2.47	18.11	1.16	14.08	1.27	14.48
Standard Deviation	1.40	17.20	1.57	17.6	0.77	7.45	0.72	11.91	1.66	12.19	0.78	9.47	0.86	9.73

D = density (plants/m²) E = efficacy (%)

Table 4. Efficacy of herbicides in oilseed rape, after 42 days of treatment

Treatment	Weeds													
	E. crus-galli		*Setaria* spp.		*C. album*		*Matricaria* spp.		*Veronica* spp.		*L. purpureum*		*G. aparine*	
	D	E	D	E	D	E	D	E	D	E	D	E	D	E
Untreated	9.5 a	0.0 b	13.5 a	0.0 b	5.5 a	0.0 b	6.3 a	0.0 b	18.8 a	0.0 c	9.8 a	0.0 c	7.0 a	0.0 b
Metzachlor 2 l/ha	1.8 b	83 a	2.0 b	86 a	0.8 b	82 a	2.0 b	66 b	6.8 bc	65 ab	2.8 b	73 a	1.5 b	80 a
Dimetachlor + Clomazone 2 l/ha	1.0 b	87 a	1.8 b	84 a	0.5 b	91 a	1.3 b	78 ab	5.5 bc	70 ab	1.5 b	85 a	1.3 b	86 a
LSD (P=.05)	2.66	24.47	3.72	28.49	1.14	17.84	1.50	20.68	4.17	19.67	1.67	14.03	1.50	14.44
Standard Deviation	1.79	18.49	2.50	19.18	0.77	12.01	1.01	13.92	2.81	13.24	1.13	9.44	1.01	9.72

D = density (plants/m²) E = efficacy (%)

In the treated plots, the rape plants were more vigorous and in a high density comparatively with the untreated plots (Figure 3).

Figure 3. Issues on the effectiveness of herbicides at 28 days after treatment application

The density of weeds per square meter was determined also in the spring season when the vegetation starts. Besides the weeds present in the autumn, a new species of weed has emerged, namely *C. bursa pastoris*, but the weeds from *Veronica* spp. has continued to be the dominant species (Table 5).

Table 5. The weeds present in the experimental plots spring regrowth

Treatment	Weeds							
	E. crus-galli	*Setaria* spp.	*Matricaria* spp.	*Veronica* spp.	*G. aparine*	*C. album*	*L. purpureum*	*C. bursa pastoris*
	Density (plants/m^2)							
Untreated	11.5 a	14.0 ab	7.8 a	32.0 a	9.3 a	4.8 a	9.8 a	4.0 a
Metzachlor 2 l/ha	11.8 a	15.8 a	3.0 b	9.5 b	3.5 b	1.8 b	4.3 b	1.8 b
Dimetachlor + Clomazone 2 l/ha	9.8 a	13.5 ab	2.0 b	7.5 b	2.8 b	1.5 b	3.5 bc	1.3 b
LSD (P=.05)	4.04	4.75	1.54	4.02	1.61	3.78	1.69	1.08
Standard Deviation	2.72	3.20	1.04	2.71	1.08	2.54	1.14	0.73

CONCLUSIONS

The degree of weed infestation was very high, the weed species present were: *E. crus-galli*, *Setaria* spp., *Matricaria* spp., *G. aparine, C. album*, *L. purpureum*.

The dominant species belonged to *Veronica* spp. The number of weeds per square meter in the spring regrowth was > 30 plants/ m^2.

The herbicides metazachlor and dimetachlor + clomazone applied at the dose of 2.0 l/ha had a good efficacy in control of annual monocotyledonous and annual dicotyledonous weeds in the crops of winter oil seed rape.

Pre-emergence herbicides are an important link for obtaining safe, stable crops because they can eliminate the competition between rape crops and weeds for reserves of water, light and nutrients. Reducing the weed density facilitates seed harvesting and reduces seed moisture.

No phytotoxicity symptoms have been shown in experimental plot.

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