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WEED CONTROL EFFICACY OF PROPISOCHLOR IN WHEAT, BARLEY, MAIZE, ROOT CROPS AND PEA

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Abstract: The aim of the field experiments was to evaluate the effect of herbicide Proponit 720 EC used commercially (which content in 1 l – 720 g of propisochlor) for grass- and dicotyledonous weed control in winter wheat, winter barley, sugar beet, pea, potato and maize. The field trials were conducted over period 1995–1998 in experimental stations, which belong to the Institute of Plant Protection. Proponit 720 EC effectively controls *Apera spica-venti* and *Echinochloa crus-galli*. In winter cereals dicotyledonous weed control was satisfactory but at other tested crops better weed control was obtained while Proponit 720 EC application with other herbicide. The yield of crops was increased after Proponit 720 application. Proponit 720 EC was not enough safe for sugar beet but was selective for other tested crops.

Key words: propisochlor, weed control, wheat, barley, maize, pea, root crops

I. INTRODUCTION

Propisochlor is an active ingredient produced by Nitrokemia from Hungary and known as herbicide Proponit 720 EC. This herbicide controls monocotyledonous and some dicotyledonous weeds in winter cereals, maize, sunflower (Sebestyen et al. 1997), soybean, potato, pea (Anyszka et al. 1998), lupine, onion from sets (Dobrzański et al. 1998) and kidney bean. First experiments in Poland with this active ingredient were done by Adamczewski et al. (1999) and Rola and Gołębiowska (1998). Propisochlor is a structural isomer of metalachlor. Used pre-emergence and early post-emergence is taken by short shoots and rootlet of germinated weeds and caused damages in plant growth by inhibition of protein synthesis.

Monocotyledonous weed species the most susceptible to propisochlor are: *Apera spica-venti, Echinochloa crus-galli, Setaria viridis, Setaria glauca, Digitaria sanguinalis, Poa annua, Alopecurus mysuroides.* From dicotyledonous weeds susceptible to this products are following: *Sinapis arvensis, Papaver rhoeas, Matricaria inodora, Urtica urens, Capsella bursa-pastoris, Thlaspi arvense* and *Galinsoga parviflora.*

The aim of field trials was biological evaluation of Proponit 720 EC used in winter barley, winter wheat, sugar beet, potato, pea and maize to control both: mono- and dicotyledonous weeds.

II. MATERIALS AND METHODS

Experiments were carried out in Experimental Stations of Plant Protection Institute Winna Góra, Sośnicowice and Trzebnica within the period 1995–1998. All field experiments were designed in the randomized blocks in four replications on pseudopodsolic soil based on loamy sand. The plot size was 16.5 m^2. Cultivation and fertilization were done according to the best agronomic practices for these commercial crops.

In sugar beet experiments were done in two growing seasons. Proponit 720 EC was used at rates 2.5 and 3.0 l/ha alone and in mixtures: Proponit 720 EC 2.5 l/ha + Venzar 80 WP (lenacil) 0.5 and 0.75 l/ha; Proponit 720 EC 1.0 and 1.5 l/ha + Burex 430 SC (chloridazone) 4.0 kg/ha. All experimental treatments used in sugar beet were not enough safe for sugar beet plants.

In winter cereals field trials were conducted during three seasons. The herbicide was applied in two terms: pre- emergence after sowing and post-emergence at 1–2 leaf stage of cereals. In both terms Proponit 720 EC was used at three doses: 0.5; 0.75 and 1.0 l/ha. As a standard Stomp 330 EC at dose 4.0 l/ha was used.

Within the period 1995–1996 experiments on pea were carried out. Proponit 720 EC was applied pre-emergence, after sowing at doses: 2.5 and 3.0 l/ha. In mixtures with herbicides Command 480 EC (chlomazone), Sencor 70 WG (metribuzine) and Gesagard 50 WP (prometryne) the dose at 2.5 l/ha of Proponit 720 EC was used.

Proponit 720 EC was used in maize at dose 2.5 l/ha alone and at doses 1.0 and 2.5 l/ha in mixtures with Azoprim 500 FW (atrazine) at doses 2.0 and 1.0 l/ha. The experiments were done in the years 1996–1998.

From 1995 to 1996 three doses: 2.0; 2.5; 3.0 l/ha of Proponit 720 EC alone and the dose 2.0 l/ha in mixtures with Sencor 70 WG (0.3 and 0.4 kg/ha) and Command 480 EC (0.15 and 0.2 l/ha) were applied in potato.

The herbicides were applied with a small plot sprayer Gloria type using a spray volume 300 l/ha and a pressure of 3 bars. On the treated plots weed control was rated on the scale 0 to 100% (where 0 = no control and 100 = complete control). On untreated plot weeds counts were carried out using 4x0.25 m^2. Efficacy assessments were done 2–3 weeks after post-emergence treatment. *Apera spica-venti* control in winter cereals was observed after heading.

In all crops the yield was determined. The LSD method was used to process data statistically. Standard error = 0.05.

III. RESULTS

Sugar beet. Proponit 720 EC showed very high activity against many weed species, but had negative influence on young beet plants damaging them very hard.

Proponit 720 EC used alone and at the lowest dose with Venzar 80 WP and Burex 430 SC was not satisfactory safe for crop and after two years the experiments were abandoned.

Winter wheat (Tab. 1). On 1 m^2 of untreated plots 92 dicotyledonous weeds and 87 panicles of *Apera spica-venti* were present. Data collected from four-year experiments shows very high efficacy of Proponit 720 EC (used in both terms) against *Apera spica-venti*. Level of dicotyledonous weed control was high and correlated with dose of Proponit 720 EC. Better effect was observed when herbicide was applied pre-emergence after winter wheat sowing.

Stomp 330 EC used as a standard controlled dicotyledonous weeds and *Apera spica-venti* in high percentage but not as high as Proponit 720 EC. No phytotoxic effect of used herbicides was observed. The average yield of winter wheat harvested from untreated plots was 6.51 t/ha. Application of Proponit 720 EC increased yield of winter wheat. Statistically processed data showed that after using Proponit 720 EC pre-emergence yield was higher than used post-emergence. The higher yield of winter wheat was obtained after using experimental herbicide pre-emergence at doses 0.75 and 1.0 l/ha. No differences between yield obtained on post-emergence treatments were observed. After pre-emergence using of Proponit 720 EC higher weight of 1000 grains and average number of grains in the ear were recorded.

Winter barley (Tab. 2). The most numerous weeds in winter barley were *Viola arvensis, Veronica arvensis, Thlaspi arvense* and *Galium aparine*. On 1 m^2 of untreated plots 73 dicotyledonous weeds and 96 panicles of *Apera spica-venti* were present. The level of *Apera spica-venti* control was very high in both times of application. Dicotyledonous weeds were controlled from 69 to 93% and better effect was obtained after pre-emergence application. The efficacy of Proponit 720 EC was correlated with doses. Yield of winter barley grains was higher on all treated plots than on untreated. The higher yield was obtained after pre-emergence application of Proponit 720 EC. The differences obtained between

Table 1

Influence of Proponit 720 EC on weed control and yield in winter wheat
Average from 3 years (1995–1998 Winna Góra)

Treatment	Dose l/ha	APESV	Dicot.	VIOAR	ANTAR	THLAR	No. of grains in the ear	Weight of 1000 grains	Yield t/ha
1. Proponit 720 EC	0.5	97	79	78	85	81	43.6	44.1	7.31
2. Proponit 720 EC	0.75	100	86	79	93	90	44.8	45.2	7.64
3. Proponit 720 EC	1.0	100	89	85	96	93	45.5	45.7	7.57
4. Stomp 330 EC	4.0	92	92	85	81	96	44.6	46.0	7.27
5. Proponit 720 EC	0.5	95	75	74	82	75	44.4	46.3	7.26
6. Proponit 720 EC	0.75	100	87	85	98	84	45.1	46.5	7.35
7. Proponit 720 EC	1.0	100	93	90	99	92	46.2	45.9	7.26
8. Stomp 330 EC	4.0	83	88	98	99	99	44.5	46.3	7.10
9. Untreated (no./sq.m)	–	(87)	(92)	(68)	(11)	(6)	42.1	42.4	6.51

Time of application: LSD (0.05) 0.327
1–4: pre-emergence, after sowing;
5–8: autumn, post emergence, 1–2 leaves stage of winter wheat

Table 2

Influence of Proponit 720 EC on weed control and yield in winter barly Average from 3 years (1995–1998 Winna Góra)

Treatment	Dose l/ha	APESV	Dicot.	VIOAR	ANTAR	THLAR	GALAP	No. of grains in the ear	Weight of 1000 grains	Yield t/ha
1. Proponit 720 EC	0.5	97	76	65	92	80	86	43.6	44.1	7.31
2. Proponit 720 EC	0.75	99	88	77	92	99	90	44.8	45.2	7.64
3. Proponit 720 EC	1.0	99	93	84	100	96	95	45.5	45.7	7.57
4. Stomp 330 EC	4.0	90	81	78	77	98	87	44.6	46.0	7.27
5. Proponit 720 EC	0.5	95	69	60	82	71	68	44.4	46.3	7.26
6. Proponit 720 EC	0.75	99	77	76	98	78	77	45.1	46.5	7.35
7. Proponit 720 EC	1.0	100	85	80	99	93	92	46.2	45.9	7.26
8. Stomp 330 EC	4.0	84	79	75	74	90	88	44.5	46.3	7.10
9. Untreated (no./sq.m)	–	(96)	(73)	(42)	(11)	(8)	(7)	42.1	42.4	6.51

Time of application: LSD (0.05) 0.262
1–4: pre-emergence, after sowing;
5–8: autumn, post emergence, 1–2 leaves stage of winter barly

times of application were statistically proved. Yield of winter barley was higher after pre-emergence Proponit 720 EC application than after post-emergence. Higher yield was correlated with higher weight of 1000 grains and number of grains in the ear. Proponit 720 EC is safe for winter barley plants.

Pea (Tab. 3). The experiments were carried out within the period 1995–1996. On the untreated plots the most numerous weeds were *Viola arvensis, Chenopodium album, Anthemis arvensis* and *Sinapis arvensis*. Total number of dicotyledonous weeds was 71 per 1 square meter of untreated plot. Higher dose of Proponit 720 EC controlled weeds better than lower dose. The best results of weed control were obtained when Proponit 720 EC was used in mixture with Command 480 EC or Sencor 70 WG. Especially it was visible in case of *Viola arvensis, Chenopodium album* and *Anthemis arvensis.* Weed infestation before harvest was higher on plots on which weed control was poor and not satisfactory.

Only in one experiment the yield of pea was determined. On all treated plots it was higher than on untreated. Differences between treated plots were very low. Only after using Proponit 720 EC at dose 2.5 l/ha the yield was statistically different. At the beginning of vegetation the phytotoxic effect on pea plants was observed, but it was gone very fast and had no influence on yield of pea.

Maize (Tab. 4). During three years of experiments on 1 m^2 of untreated plots 225 dicotyledonous weeds and 25 *Echinochloa crus-galli* were presented. The most numerous dicotyledonous weeds were *Chenopodium album, Sinapis arvensis, Thlaspi arvense.* Proponit 720 EC used alone controlled those species very poor (except *Thlaspi arvense*). Better effect was achieved when Proponit 720 EC was used in mixture with Azoprim

Table 3

Influence of Proponit 720 EC (alone and in mixtures) on weed control and yield in pea Average from 2 years (1995–1996 Trzebnica, Sośnicowice)

Proponit 720 EC	Dose l,kg/ha	Weed control in %					Weed infestation before harvest in scale 1–9	Weight* of 1000 seeds(g)	Yield* t/ha
		Dicot	VIOAR	CHEAL	ANTAR	SINAR			
Alone	2.5	75	58	58	69	98	5	253	3.92
Alone	3.0	89	67	68	78	100	4–5	254	4.24
+ Command 480 EC	2.5 + 0.2	93	73	92	96	96	2–3	258	4.42
+ Command 480 EC	2.5 + 0.3	96	85	94	97	97	2	261	4.51
+ Sencor 70 WG	2.5 + 0.2	95	94	96	98	99	3	262	4.48
+ Sencor 70 WG	2.5 + 0.3	98	95	97	99	99	2	261	4.51
+ Gesagard 50 WP	2.5 + 2.0	86	81	96	100	97	3	259	4.38
Untreated (no./sq.m)	–	(71)	(21)	(20)	(17)	(13)	9	249	3.63

Time of application: pre-emergence LSD (0.05) 0.248
* Only from Sośnicowice experiment

Table 4

Influence of Proponit 720 EC (alone and with Azoprim 500 FW) on weed control and yield in maize Average from 3 years (1996–1998 Trzebnica, Sośnicowice)

Proponit 720 EC	Dose l,kg/ha	Weed control in %					Weed infestation before harvest in scale 1–9	Yield* t/ha
		Dicot	CHEAL	SINAR	THLAR	ECHCG		
Alone	2.5	68	60	72	99	95	5–6	42.46
+ Azoprim 500 FW	1.0 + 2.0	88	91	95	99	95	2–3	53.55
+ Azoprim 500 FW	2.5 + 1.0	98	99	98	100	100	2	55.56
Untreated (no./sq.m)	–	(225)	(76)	(18)	(17)	(25)	9	18.22

Time of application: pre-emergence LSD (0.05) 0.278
* Only from Sośnicowice experiment

500 EC. Also after using this mixture the yield of maize was higher comparing to yield from untreated plots. Proponit 720 EC is not phytotoxic for maize plants. Weed infestation before harvest was very high after using Proponit 720 EC alone.

Potato (Tab. 5). During two years Proponit 720 EC was applied in potato pre-emergence. Three doses of the herbicide were used: 2.0; 2.5 and 3.0 l/ha. At dose 2.0 l/ha was used also in mixtures with Sencor 70 WG and Command 480 EC. The most numerous weeds on the untreated plots were: *Chenopodium album, Viola arvensis, Anthemis arvensis* and *Echinochloa crus-galli.* Weed control after using Proponit 720 EC was not satisfactory, higher doses improved efficacy of compound. The best effect was achieved after application of mixtures with other herbicides. *Echinochloa crus-galli* control was very high on all

Table 5

Influence of Proponit 720 EC (alone and in mixtures) on weed control and yield in potatoes Average from 2 years (1995–1996 Winna Góra, Trzebnica)

Proponit 720 EC	Dose l,kg/ha	Weed control in %					Weed infestation before harvest in scale 1–9	Yield* t/ha
		Dicot	CHEAL	VIOAR	ANTAR	ECHCG		
Alone	2.0	54	44	52	67	91	5–6	16.95
Alone	2.5	80	75	74	77	99	4	17.82
Alone	3.0	91	85	88	87	100	3–4	18.35
+ Command 480 EC	2.0 + 0.15	93	92	96	95	97	2	20.56
+ Command 480 EC	2.0 + 0.2	95	96	98	97	99	1–2	22.89
+ Sencor 70 WG	2.0 + 0.3	96	98	99	98	100	1–2	21.58
+ Sencor 70 WG	2.0 + 0.4	99	99	98	99	100	1	23.59
Untreated (no./sq.m)	–	(76)	(32)	(28)	(8)	(14)	9	12.23

Time of application: pre-emergence LSD (0.05) 1.528

* Only from Sośnicowice experiment

treated plots. Secondary weed infestation before harvest was higher on plots on which Proponit 720 EC was used alone.

Because of potato blight the yield of potato tuber was very low. Yield was correlated with weed control level. Proponit 720 EC used alone and in mixtures with other herbicides Sencor 70 WG and Command 480 EC was safe for potato plants.

All presented in this paper data are according to experiments conducted by other authors (Adamczewski et al.1999; Balint et al.1993; Rola and Gołębiowska 1998; Sebestyen 1996; Varga et al. 2000; Anyszka et al.1998).

IV. CONCLUSIONS

Proponit 720 EC can be useful herbicide for pre-emergence weed control in many crops.

In potato, pea and maize better weed control effect can be reached by using Proponit 720 EC in tank mixtures with other herbicides. In winter cereals (wheat and barley) Proponit 720 EC controlled many species of dicotyledonous weeds and *Apera spica-venti* as well. Treatment can be done pre-emergence and early post-emergence. Better effect gave pre-emergence using Proponit 720 EC. Experimental herbicide Proponit 720 EC is not suitable in sugar beet because caused many damages in this crop.

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VI. POLISH SUMMARY

OCENA PRZYDATNOŚCI PROPIZOCHLORU DO ZWALCZANIA CHWASTÓW W ZBOŻACH OZIMYCH, ROŚLINACH OKOPOWYCH, GROCHU I KUKURYDZY

Badania polowe nad biologiczną oceną propizochloru przeprowadzono w latach 1995–1998 w Rolniczym Zakładzie Doświadczalnym w Winnej Górze, Terenowej Stacji Doświadczalnej w Trzebnicy i Oddziale IOR w Sośnicowicach. Herbicyd Proponit 720 EC produkcji węgierskiej firmy Nitrokemia jako substancję biologicznie czynną zawiera w 1 litrze 720 g propizochloru. W uprawie pszenicy ozimej i jęczmienia ozimego oraz buraku cukrowym, grochu, ziemniakach i kukurydzy sprawdzano skuteczność chwastobójczą herbicydu Proponit 720 EC. W zbożach ozimych preparat stosowano w dawkach 0,5; 0,75 i 1,0 l/ha po zasiewie i jesienią w fazie 1–3 liści zbóż. W roślinach okopowych, grochu i kukurydzy Proponit 720 EC stosowano w dawkach od 2,0 do 3,0 l/ha sam lub w mieszance z innymi herbicydami. Proponit 720 EC dobrze zwalczał miotłę zbożową, chwastnicę jednostronną i niektóre gatunki chwastów dwuliściennych. Uzyskane z doświadczeń wyniki badań wskazują, że Proponit 720 EC może być przydatnym herbicydem do zwalczania chwastów w zabiegu doglebowym w wielu uprawach. W ziemniakach, grochu i kukurydzy lepiej jest go stosować w mieszance z innymi preparatami. W uprawie zbóż ozimych: pszenicy ozimej i jęczmieniu ozimym zabieg zwalczania chwastów może być wykonany przedwschodowo lub wcześnie nalistnie. Zabieg przedwschodowy należy uznać za bardziej korzystny. W buraku cukrowym Proponit 720 EC nie może być stosowany do zwalczania chwastów, gdyż spowodował znaczne uszkodzenia rośliny uprawnej.