ACTA AGROBOTANICA
Vol. 61 (2): 229–238
2008

THE INFLUENCE OF DIFFERENT HERBICIDE DOSES ON WEED INFESTATION OF WINTER TRITICALE CULTIVATED IN MONOCULTURE

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Received: 27.11.2007

S u m m a r y

The study was carried out in 2003–2005 in the Bezek Experimental Farm (University of Life Sciences in Lublin). The experimental field was situated on light loamy sand soil. The phosphorus content in soil was high, in potassium medium, in magnesium low. The humus content was 1.2%. The experiment was carried out in randomized blocks in three replications. The aim of the investigation was to compare three doses of herbicides in winter triticale canopy (Janko cv., Woltario cv., Krakowiak cv.) cultivated in monoculture. The herbicides Atlantis 04 WG and Factor 365 EC were applied at full recommended doses (200 $g \times ha^{-1}$), at doses reduced to 75% and 50%. The control was not treated with the herbicides. The weed infestation level was determined by means of the quantitative-weighting method at two dates: the first one at the 6th week after herbicide application and the second one before harvest. The density of weed individuals was counted; the species composition and air–dry biomass of above-ground parts were estimated from the randomly selected areas of 1 m x 0.25 m at four sites of each plot. The density of weeds and weed air dry weight were statistically analysed by means of variance analysis, and the mean values were estimated with Tukey's confidence intervals (p=0.05).

It was found that the number of weeds and air dry mass of weeds in the control were significantly higher in comparison with the herbicide treated objects. The application of different doses of herbicides did not differentiate significantly the weed infestation level in the winter triticale canopy. *Viola arvensis, Matricaria maritima, Chenopodium album* and *Apera spica-venti* were dominant species of weeds in the winter triticale canopy. The selection of cultivars did not influence the canopy weed infestation level.

Key words: herbicide doses, cultivars, winter triticale, weed infestation

INTRODUCTION

Weeds significantly reduce yields of crop plants and affect yield quality. They compete with the crop plant for room, light, water and nutrients; they can even lead to complete choking of plants. For hundred of years, the fight against weeds has been mainly based on their control by using mechanical and agrotechnical methods. A breakthrough took place when chemical plant protection agents were discovered (A d a m c z e w s k i , 2000).

A reduction in herbicide doses allows to cut costs of weed control, to mitigate the risk of environmental contamination, as well as to reduce permissible levels of residues of biologically active substances in cereal products (R o l a et al. 1997; D o m a r a d z k i and R o l a , 2000; D o m a r a d z k i and S a d o w s k i , 2002). The application of a proper dose of a herbicide must take into account its weed-killing effectiveness in given conditions, the maintenance of selectivity for the protected plant and consumer safety (S t r e i b i g , 1989).

A reduction in herbicide doses also involves a change in the perception of the problem of weed control. The aim of this control should not be the total destruction of all weeds growing in a crop canopy but such reduction of their occurrence and weakening of the form so that they do not pose a threat to the crop plant (D o m a r a d z k i and R o l a , 1999). Proven et al. (1991) have found that the application of reduced herbicide rates is of special significance at a low level of cereal canopy weed infestation.

D a v i e s and W h i t i n g (1989), D o m a r a d z k i and R o l a (2001, 2004), D o m a r a d z k i (2006) and K r a s k a (2006) have demonstrated that it is possible to reduce herbicide doses from 20% to 50% without a significant reduction in yielding levels of winter and spring cereal crops, at the same time maintaining the required weed-killing effectiveness. They have also found that the application of herbicides at reduced doses gives the best effects in fields where weeds occur at early development stages. Very good results can be obtained on plantations with low weed intensity and in controlling weeds sensitive to a particular herbicide.

MATERIALS AND METHODS

The field experiment was carried out in the years 2003–2005 in the Bezek Experimental Farm near Chełm, Poland, owned by the University of Life Sciences in Lublin. In the two-factor experiment conducted in randomized blocks in three replications, the effect of three herbicide doses in the winter triticale *Tricicale rimpaui* Wittm. canopy (Janko cv., Woltario cv., Krakowiak cv.) was compared. The herbicides were applied at full recommended doses, reduced to 75% and at doses reduced by half. Herbicide untreated plots were the control. The plot size was 12 m^2. The results were presented as three-year means.

The experimental field was located on incomplete podzolic soil lying on marl substrate with the granulometric composition of light and strong loamy sand. This soil is classified as IVb evaluation class and good rye complex. Soil nutrient availability in terms of available phosphorus was high, in potassium medium, in magnesium low. Expressed in mg×kg^{-1}, it was as follows, respectively: P_2O_5 – 171; K_2O – 120; Mg – 22. The humus content was 1.2%. The soil reaction was slightly acid, and the pH in 1 mol KCl was 6.0.

Tillage was done following generally accepted agricultural practice recommendations. Winter triticale was a forecrop. After harvesting the forecrop, skimming and harrowing were performed. 3 weeks before sowing, pre-sowing ploughing was carried out. Before sowing, cultivator tillage with harrowing was performed. Seeds dressed with Panoctine 300 LS (a biologically active substance – guazatine in the form of acetate) were sown at an amount of 5 million seeds per ha^{-1} with the row spacing of 12 cm. Mineral fertiliser doses were as follows: N – 120 kg×ha^{-1}; P_2O_5 – 100 kg×ha^{-1}; K_2O – 120 kg×ha^{-1}. Phosphorus and potassium fertilisers as well as 30 kg N ha^{-1} were applied pre-sowing. The remaining part of the nitrogen dose was applied before vegetation start at the rate of 60 kg×ha^{-1} and 30 kg×ha^{-1} at the shooting stage. In addition, the following plant protection agents were used: Atlantis 04 WG 200 g×ha^{-1} – (23-29 BBCH development stages*) + Actirob 842 EC 1.0 l×ha^{-1}– basic dose, Factor 365 EC 1.0 l×ha^{-1} – (23-29*) – basic dose, Alert 375 SC 1.0 l×ha^{-1} – (26-29*), Tango 500 SC 0.8 l×ha^{-1} – (51-56*), Terpal C 460 SL 2.5 l×ha^{-1} – (32-39*). The herbicides Atlantis 04 WG (containing two active substances: mesosulfuron-methyl 30 g×kg^{-1} + iodosulfuron-methyl-sodium 6 g×kg^{-1} and as a safener mefenpyr-diethyl 90 g×kg^{-1}) and Factor 365 EC (containing 5 g×l^{-1} of metosulam and 360 g×l^{-1} 2.4 D) were applied jointly. In the experiment, the adjuvant Actirob 842 EC was applied (containing 842 g of rape oil methyl ester in 1 litre).

Canopy weed infestation was determined twice using the quantitative-weighting method. The first time was 6 weeks after herbicide treatment, the second time before winter triticale harvesting. The number of individuals, species composition and air–dry mass of above-ground parts of weeds were determined from the test areas surrounded by a frame of 1 m x 0.25 m in four randomly selected sites of each plot, in accordance with the recommendations given in the paper of B a d o w s k i et al. (2001).

The obtained results were statistically analysed by means of variance analysis. The mean values were compared by means of the least significant differences using the Tukey test.

RESULTS

The weed infestation level of winter triticale canopy was significantly modified by the application of herbicides. At both dates of weed infestation assessment, it was found that there was a significantly lower number of dicotyledonous and monocotyledonous weeds and their total number as well as smaller air-dry mass of weeds in the herbicide-treated plots compared to the control in which no herbicides were applied (Tab. 1).

The selection of triticale cultivars did not significantly change the canopy weed infestation level at both assessment dates. However, a tendency towards the occurrence of a larger total number of weeds in the canopy of 'Woltario' cv. was noticeable before the harvest (Tab. 2).

The largest number of weed species at both dates of weed infestation assessment was found in the control compared to the herbicide-treated plots (Tab. 3, Tab. 4). In the herbicide-treated plots, those in which a half of herbicide doses was applied were characterised by the greatest species diversity, whereas those where the full recommended dose was applied had the lowest species diversity. At the first date of weed infestation assessment, the applied herbicides completely eliminated the following weed species, compared to the herbicide untreated control: *Chenopodium album, Cerastium holosteoides, Conyza canadensis, Spergula arvensis, Sonchus arvensis, Anchusa arvensis and Raphanus raphanistrum*. At the same time, they reduced to a large extent the occurrence of *Matricaria maritima* and *Apera spica-venti* (Tab. 3). But before winter triticale harvest, the used herbicides eliminated *Spergula arvensis, Gypsophila muralis* and *Anchusa arvensis*. At the same time, out of the species occurring in great numbers, they markedly reduced the number of *Chenopodium album, Matricaria maritime* and in the first place *Apera spica-venti* (Tab. 4).

From the group of dicotyledonous species, *Viola arvensis, Matricaria maritima, Veronica arvensis and Chenopodium album* occurred most numerously in the

Table 1
Weed infestation elements in canopy of x *Triticale rimpaui* Wittm. per 1 m^2 in dependence on herbicide doses, mean figures in the years 2003-2005.

Number and dry matter of weeds	Herbicide doses				
	A*	B	C	D	$LSD_{0.05}$
	1st date				
Number of dicotyledonous weeds	52.0	13.2	13.7	19.5	9.9
Number of monocotyledonous weeds	19.7	1.1	2.4	3.0	6.0
Total weeds	71.7	14.3	16.1	22.5	11.3
Air dry matter of weed in $g \times m^{-2}$	53.0	4.4	3.7	8.5	9.9
	2nd date				
Number of dicotyledonous weeds	25.0	13.2	12.3	23.6	12.0
Number of monocotyledonous weeds	77.9	12.7	10.4	10.7	16.5
Total weeds	102.9	25.9	22.7	34.3	21.6
Air dry matter of weed in $g \times m^{-2}$	75.3	6.4	4.5	9.4	17.9

*A – control (without herbicides)
B – full dose of herbicides
C – 75% dose of herbicides
D – 50% dose of herbicides

Table 2
Weed infestation elements in canopy of x *Triticale rimpaui* Wittm. per 1 m^2 in dependence on cultivars, mean figures in the years 2003-2005.

Number and dry matter of weeds	Herbicide doses			
	Janko	Woltario	Krakowiak	$LSD_{0.05}$
	1st date			
Number of dicotyledonous weeds	23.9	25.0	24.5	ns*
Number of monocotyledonous weeds	8.1	5.0	6.7	ns*
Total weeds	32.0	30.0	31.2	ns*
Air dry matter of weed in $g \times m^{-2}$	19.9	15.8	16.6	ns*
	2nd date			
Number of dicotyledonous weeds	16.4	20.1	19.1	ns*
Number of monocotyledonous weeds	29.6	30.0	24.3	ns*
Total weeds	46.0	50.1	43.4	ns*
Air dry matter of weed in $g \times m^{-2}$	20.0	23.9	27.7	ns*

*ns – not significant

Table 3

Species composition and the number of weeds per 1 m^2 of x *Triticale rimpaui* Wittm. canopy at the first date weed infestation assessment in dependence on herbicide doses, mean figures in the years 2003-2005.

Species	Herbicide doses			
	*A	B	C	D
Dicotyledonous				
1. *Viola arvensis* Murray	13.1	7.6	8.4	11.9
2. *Matricaria maritima subsp. inodora* (L.) Dostál	12.6	0.7	0.5	0.9
3. *Veronica arvensis* L.	5.9	1.9	1.5	2.4
4. *Capsella bursa-pastoris* (L.) Medik.	4.3	0.1	0.1	0.1
5. *Geranium pusillum* Burm. f. ex L.	2.7	0.6	0.5	0.9
6. *Chenopodium album* L.	2.6	–	–	–
7. *Anthemis arvensis* L.	2.3	0.2	0.1	0.2
8. *Stellaria media* (L.) Vill.	1.6	0.1	0.1	0.3
9. *Galium aparine* L.	1.4	0.6	0.9	1.2
10. *Vicia hirsuta* (L.) Gray	1.2	0.1	0.2	0.1
11. *Myosotis arvensis* (L.) Hill	1.1	0.1	0.2	0.3
12. *Cerastium holosteoides* Fr. Emend. Hyl.	0.8	–	–	–
13. *Fallopia convolvulus* (L.) Á. Löve	0.6	1.0	0.9	0.6
14. *Conyza canadensis* (L.) Cronquist	0.4	–	–	0.1
15. *Spergula arvensis* L.	0.4	–	–	–
16. *Polygonum aviculare* L.	0.3	0.2	0.1	0.3
17. *Veronica persica* Poir.	0.3	0.0	0.1	0.1
18. *Lamium amplexicaule* L.	0.1	–	0.1	0.1
19. *Sonchus arvensis* L.	0.1	–	–	–
20. *Anchusa arvensis* (L.) M. Bieb.	0.1	–	–	–
21. *Raphanus raphanistrum* L.	0.1	–	–	–
22. *Gnaphalium uliginosum* L.	0.0	–	–	–
23. *Oxalis stricta* L.	0.0	–	–	–
24. *Anagallis arvensis* L.	–	–	–	0.0
Total dicotyledonous	52.0	13.2	13.7	19.5
Number of dicotyledonous species	23	13	14	17
Monocotyledonous**				
25. *Apera spica-venti* (L.) P. Beauv.	19.0	0.1	0.1	2.6
26. *Elymus repens* (L.) Gould	0.7	0.5	0.1	0.2
27. *Echinochloa crus-galli* (L.) P. Beauv.	0.0	0.3	1.9	0.0
28. *Poa annua* L.	0.0	0.2	0.3	0.2
29. *Equisetum arvense* L.	0.0	0.0	0.0	0.0
Total monocotyledonous	19.7	1.1	2.4	3.0
Number of monocotyledonous species	2	4	4	3
Total number of weeds	71.7	14.3	16.1	22.5
Number of species	25	17	18	20

0.0 – Species occurring in less than 0.1 per m^2

– Species not occurring

* explanation like in table 1

** with *Equisetum arvense* L.

Table 4
Species composition and the number of weeds per 1 m^2 of x *Triticale rimpaui* Wittm. canopy before harvest in dependence on herbicide doses, mean figures in the years 2003-2005.

Species	Herbicide doses			
	*A	B	C	D
Dicotyledonous				
1. *Chenopodium album* L.	7.1	0.0	0.0	0.4
2. *Matricaria maritima subsp. inodora* (L.) Dostál	6.4	0.7	1.0	2.0
3. *Viola arvensis* Murray	3.7	5.2	6.0	9.4
4. *Fallopia convolvulus* (L.) Á. Löve	1.1	1.3	1.1	1.3
5. *Myosotis arvensis* (L.) Hill	1,1	0.6	0.4	1.4
6. *Geranium pusillum* Burm. f. ex L.	1.0	1.0	0.9	2.7
7. *Polygonum aviculare* L.	0.7	1.6	0.9	1.4
8. *Stellaria media* (L.) Vill.	0.6	0.4	0.5	0.7
9. *Vicia hirsuta* (L.) Gray	0.6	0.1	0.1	0.4
10. *Conyza canadensis* (L.) Cronquist	0.6	0.3	0.0	0.2
11. *Galium aparine* L.	0.4	0.7	0.2	0.8
12. *Veronica arvensis* L.	0.4	0.3	0.3	0.4
13. *Capsella bursa-pastoris* (L.) Medik.	0.4	–	0.0	0.0
14. *Oxalis stricta* L.	0.2	0.3	0.3	1.2
15. *Anagallis arvensis* L.	0.2	0.0	0.3	0.7
16. *Spergula arvensis* L.	0.1	–	–	–
17. *Anthemis arvensis* L.	0.1	0.0	0.1	0.2
18. *Lamium amplexicaule* L.	0.0	–	–	–
19. *Gnaphalium uliginosum* L.	0.1	0.3	0.1	0.1
20. *Gypsophila muralis* L.	0.1	–	–	–
21. *Anchusa arvensis* (L.) M. Bieb.	0.1	–	–	–
22. *Cerastium holosteoides* Fr. Emend. Hyl.	0.0	0.0	0.0	0.1
23. *Papaver rhoeas* L.	0.0	–	–	0.1
24. *Trifolium arvense* L.	0.0	–	–	–
25. *Gnaphalium uliginosum* L.	0.0	–	–	–
26. *Artemisia vulgaris* L.	0.0	–	–	–
27. *Plantago major* L.	–	0.3	0.1	0.1
28. *Stachys palustris* L.	–	0.0	0.0	–
29. *Lapsana communis* L.s.str.	–	0.0	–	0.0
30. *Veronica persica* Poir.	–	–	–	0.0
31. *Centaurea cyanus* L.	–	–	–	0.0
Total dicotyledonous	25.0	13.2	12.3	23.6
Number of dicotyledonous species	25	20	20	23
Monocotyledonous				
32. *Apera spica-venti* (L.) P. Beauv.	74.2	0.7	0.2	2.5
33. *Elymus repens* (L.) Gould	2.8	1.3	1.1	0.9
34. *Echinochloa crus-galli* (L.) P. Beauv.	0.9	8.5	4.5	5.4
35. *Setaria pumila* (Poir.) Roem. & Schult.	0.0	2.2	4.6	1.8
36. *Poa annua* L.	–	0.0	–	–
37. *Avena fatua* L.	–	–	–	0.1
Total monocotyledonous	77.9	12.7	10.4	10.7
Number of monocotyledonous species	4	5	4	5
Total number of weeds	102.9	25.9	22.7	34.3
Number of species	29	25	24	28

0.0 – Species occurring in less than 0.1 per m^2
– Species not occurring; * explanation like in table 1

Table 5
Species composition and the number of weeds per 1 m^2 of x *Triticale rimpaui* Wittm. canopy at the first date weed infestation assessment in dependence on cultivars, mean figures in the years 2003-2005.

Species	Cultivar		
Dicotyledonous	Janko	Woltario	Krakowiak
1. *Viola arvensis* Murray	9.1	10.6	11.1
2. *Veronica arvensis* L.	3.6	2.7	2.5
3. *Matricaria maritima subsp. inodora* (L.) Dostál	3.1	4.1	3.7
4. *Galium aparine* L.	1.4	1.0	0.8
5. *Fallopia convolvulus* (L.) Á. Löve	1.2	0.6	0.6
6. *Capsella bursa-pastoris* (L.) Medik.	0.9	1.2	1.4
7. *Geranium pusillum* Burm. f. ex L.	0.9	1.5	1.2
8. *Chenopodium album* L.	0.9	0.5	0.5
9. *Polygonum aviculare* L.	0.5	0.1	0.1
10. *Anthemis arvensis* L.	0.6	0.7	0.7
11. *Vicia hirsuta* (L.) Gray	0.6	0.5	0.1
12. *Stellaria media* (L.) Vill.	0.4	0.5	0.5
13. *Myosotis arvensis* (L.) Hill	0.3	0.4	0.4
14. *Veronica persica* Poir.	0.1	0.1	0.1
15. *Cerastium holosteoides* Fr. Emend. Hyl.	0.1	0.2	0.2
16. *Lamium amplexicaule* L.	0.1	0.1	0.1
17. *Conyza canadensis* (L.) Cronquist	0.1	0.1	0.1
18. *Anchusa arvensis* (L.) M. Bieb.	–	0.0	0.1
19. *Spergula arvensis* L.	0.0	0.1	0.1
20. *Anagallis arvensis* L.	0.0	–	–
21. *Sonchus arvensis* L.	–	–	0.1
22. *Raphanus raphanistrum* L.	–	0.0	0.1
23. *Gnaphalium uliginosum* L.	–	0.0	–
24. *Oxalis stricta* L.	–	0.0	0.0
Total dicotyledonous	23.9	25.0	24.5
Number of dicotyledonous species	19	22	22
Monocotyledonous*			
25. *Apera spica-venti* (L.) P. Beauv.	6.1	4.6	5.8
26. *Echinochloa crus-galli* (L.) P. Beauv.	1.5	0.1	0.1
27. *Elymus repens* (L.) Gould.	0.3	0.2	0.6
28. *Poa annua* L.	0.2	0.1	0.2
29. *Equisetum arvense* L.	0.0	–	–
Total monocotyledonous	8.1	5.0	6.7
Number of monocotyledonous species	5	4	4
Total number of weeds	32.0	30.0	31.2
Number of species	24	26	26

0.0 – Species occurring in less than 0.1 per m^2
– Species not occurring
* with *Equisetum arvense* L.

Table 6
Species composition and the number of weeds per 1 m² of a x *Triticale rimpaui* Wittm. canopy before harvest in dependent on cultivars, mean figures in the years 2003-2005.

Gatunki – Species	Cultivar		
Dicotyledonous	Janko	Woltario	Krakowiak
1. *Viola arvensis* Murray	5.1	6.4	6.8
2. *Matricaria maritima subsp. inodora* (L.) Dostál	2.9	2.4	2.3
3. *Chenopodium album* L.	1.3	2.6	1.8
4. *Geranium pusillum* Burm. f. ex L.	1.1	1.5	1.6
5. *Fallopia convolvulus* (L.) Á. Löve	1.0	1.3	1.3
6. *Polygonum aviculare* L.	1.0	1.3	1.2
7. *Myosotis arvensis* (L.) Hill	0.7	1.1	0.8
8. *Stellaria media* (L.) Vill.	0.6	0.6	0.5
9. *Oxalis stricta* L.	0.6	0.3	0.4
10. *Galium aparine* L.	0.3	0.6	0.5
11. *Veronica arvensis* L.	0.3	0.3	0.4
12. *Conyza canadensis* (L.) Cronquist	0.3	0.3	0.2
13. *Vicia hirsuta* (L.) Gray	0.3	0.2	0.4
14. *Anagallis arvensis* L.	0.2	0.2	0.4
15. *Plantago major* L.	0.2	0.2	0.0
16. *Gnaphalium uliginosum* L.	0.1	0.3	0.1
17. *Capsella bursa-pastoris* (L.) Medik.	0.1	0.1	0.2
18. *Anthemis arvensis* L.	0.1	0.1	0.1
19. *Cerastium holosteoides* Fr. emend. Hyl.	0.1	0.0	0.1
20. *Gypsophila muralis* L.	0.1	–	0.0
21. *Lapsana communis* L.s.str.	0.0	0.0	–
22. *Stachys palustris* L.	0.0	–	0.0
23. *Anchusa arvensis* (L.) M. Bieb.	0.0	–	0.0
24. *Veronica persica* Poir.	0.0	–	–
25. *Spergula arvensis* L.	–	0.2	–
26. *Papaver rhoeas* L.	–	0.1	0.0
27. *Trifolium arvense* L.	–	0.0	–
28. *Artemisia vulgaris* L.	–	0.0	–
29. *Centaurea cyanus* L.	–	0.0	–
Total dicotyledonous	16.4	20.1	19.1
Number of dicotyledonous species	24	25	23
Monocotyledonous			
30. *Apera spica-venti* (L.) P. Beauv.	18.5	21.4	18.2
31. *Echinochloa crus-galli* (L.) P. Beauv.	5.3	5.4	3.9
32. *Setaria pumila* (Poir.) Roem. & Schult.	4.3	1.5	0.6
33. *Elymus repens* (L.) P. Beauv.	1.4	1.6	1.6
34. *Avena fatua* L.	–	0.1	–
35. *Poa annua* L.	–	–	0.0
Total monocotyledonous	29.6	30.0	24.3
Number of monocotyledonous species	4	5	5
Total number of weeds	46.0	50.1	43.4
Number of species	28	30	28

0.0 – Species occurring in less than 0.1 per m²
– Species not occurring

canopy of all winter triticale cultivars at both dates of weed infestation assessment. But among monocotyledonous species, the most numerous were *Apera spica-venti* and *Echinochloa crus-galli* (Tab. 5, Tab. 6). At the first assessment date, 24 weed species, including 19 dicotyledonous and 5 monocotyledonous ones, were found in the canopy of 'Janko' cv., whereas there were 22 dicotyledonous and 4 monocotyledonous species in the canopy of the other cultivars (Tab. 5). In the canopy of winter triticale 'Woltario' cv., 30 weed species, including 25 dicotyledonous ones, were found at the second assessment date, whereas in the canopy of the cultivars 'Janko' and 'Krakowiak' there were 28 species in each, including 24 and 23 dicotyledonous ones, respectively (Tab. 6).

DISCUSSION

At the first date of weed infestation assessment, the applied herbicides reduced the number of weeds from 68.6 to 80.1% and their air-dry mass from 84.0 to 93.0%, compared to the herbicide untreated control. The total number of weeds estimated before triticale harvest was smaller by 66.7 to 77.9% compared to the control, and air-dry mass of weeds from 87.5 to 94.0%. Worth noting is the fact that in the plot with the herbicide dose reduced to 75%, at the second assessment date, both the number and air-dry mass of weeds were slightly smaller than in the other herbicide treated plots (Tab. 1). Differences between the herbicide treated plots were within the statistical error. Research conducted by Starczewski and Żądełek (2000) has shown that full doses of preparations reduced air-dry mass of weeds, depending on the triticale cultivar, from 46% to 54% compared to the control.

The selection of winter triticale cultivars did not significantly affect the canopy weed infestation level. Feledyn-Szewczyk and Duer (2005), Parylak et al. (2006) and Kraska (2006) draw attention to the possibility of reducing the weed infestation level in cereals by selecting an appropriate cultivar.

At the first date of weed infestation assessment, the effectiveness of action of different herbicide doses, compared to the control, was from 9.2% to 42.0% in relation to *Viola arvensis, Veronica arvensis* from 59.3% to 74.6%, *Matricaria maritima* from 92.9% to 96.0%, Capsella bursa-pastoris 97.7% and *Apera spica-venti* from 86.3% to 99.5%. The efficacy of control of the most numerous weed species before triticale harvesting was 94.4% for *Chenopodium album*, *Matricaria maritima* from 89.1 to 68.8% and *Apera spica-venti* from 96.6% to 99.7%.

In their experiment, Romek and Dzienia (2000) confirm that decreased herbicide doses resulted in reduced effectiveness of control of *Apera spica-venti.* They found in their research that the application of a full dose of the herbicides Protugan 500 SC, Lentipur 80 WP and Chisel 75 DF reduced *Apera spica-venti*, on the average, by 71% to 77%. In turn, a reduction in the dose of the tested herbicides by 50% resulted in reduced effectiveness of control of the abovementioned weed by 16% to 31%. Higher effectiveness of *Apera spica-venti* reduction was noted by Domaradzki et al. (2003), when applying Arelon Dispersion 500 SC at a full dose and at doses reduced to 75%, 50% and 25%. The preparation applied at a full dose reduced to a high extent (99-100%) the occurrence of common windgrass, whereas lowered doses reduced *Apera spica-venti* to a slightly smaller extent (from 93% to 99%). Whiting et al. (1991) have found that it is possible to reduce the occurrence of dicotyledonous species and *Apera spica-venti* in cereals by the application of herbicides at reduced doses from 30 to 60%. Also Davies and Whiting (1989), when applying herbicides containing isoproturon, did not find any differences in the effectiveness of control of *Apera spica-venti* between the full dose and the dose reduced to 50%.

Adamczewski and Praczyk (1999) claim that *Apera spica-venti* poses the greatest risk to winter cereals among monocotyledonous weeds. It has found confirmation in the control of the experiment in question.

Domaradzki (2006) is of opinion that the main criterion deciding about the herbicide rate should be, in the first place, the condition and degree of weed infestation of a field. A weaker effect of reduced herbicide doses should be expected in winter cereals, in particular in triticale and barley, where these weeds are more advanced in development due to early sowing of these species. Moreover, lower doses have a weaker effect especially in cases of very high weed intensity in a crop canopy.

CONCLUSIONS

1. The weed infestation level of winter triticale canopy, measured both in terms of the number of individuals and air-dry mass of weeds, was not significantly differentiated by the applied doses of herbicides. It indicates the possibility of reducing herbicide doses in the winter triticale canopy without the risk of increasing the weed infestation level. A tendency towards the occurrence of a larger number of individuals and higher air-dry mass of weeds was only found in the plots with the herbicide dose reduced by half compared to the other herbicide treated plots.
2. Before winter triticale harvesting, a larger number of weed species was found in all the plots assessed. *Viola arvensis, Matricaria maritima, Chenopodium album* and *Apera spica-venti* were the dominant

species in the winter triticale canopy at both dates of weed infestation assessment.

3. At both dates of weed infestation assessment, the applied herbicides reduced the occurrence of *Matricaria maritima, Chenopodium album* and *Apera spica-venti* to the largest extent.
4. The selection of cultivars did not significantly affect the weed infestation level of winter triticale canopy.

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Wpływ zróżnicowanych dawek herbicydów na zachwaszczenie pszenżyta ozimego uprawianego w monokulturze

Streszczenie

Badania przeprowadzono w latach 2003-2005 w Gospodarstwie Doświadczalnym Bezek niedaleko Chełma. W dwuczynnikowym doświadczeniu przeprowadzonym w układzie bloków losowanych porównywano działanie trzech dawek herbicydów w pszenżycie ozimym odmian ‘Janko’, ‘Woltario’ i ‘Krakowiak’ uprawianych w monokulturze. Herbicydy były stosowane w pełnych zalecanych dawkach, zredukowanych do 75% i do 50%. Kontrolę stanowiły poletka na których nie stosowano herbicydów. W pracy oceniono poziom zachwaszczenia łanu (liczba osobników, skład gatunkowy i powietrznie sucha masa) pszenżyta ozimego w 6 tygodni po zastosowaniu herbicydów Atlantis 04 WG i Factor 365 EC oraz przed zbiorem.

Poziom zachwaszczenia łanu pszenżyta ozimego mierzony zarówno liczbą osobników jak i powietrznie suchą masą chwastów nie był istotnie różnicowany przez zastosowane dawki herbicydów. Uzyskane

wyniki wskazują na możliwość obniżenia dawek herbicydów w łanie pszenżyta ozimego bez ryzyka wzrostu poziomu zachwaszczenia. Dobór odmiany pszenżyta ozimego nie zmieniał poziomu zachwaszczenia łanu. Gatunkami dominującymi w łanie pszenżyta ozimego w obu terminach oceny zachwaszczenia były *Viola arvensis, Matricaria maritima, Chenopodium album* oraz *Apera spica-venti.*