CONTROLLING THE PERENNIAL SPECIES *CONVOLVULUS ARVENSIS* L., A PROBLEM-WEED IN WINTER WHEAT

Claudia CULHAVI, Dan MANEA

Banat's University of Agricultural Sciences and Veterinary Medicine, Faculty of Agricultural Sciences, Timisoara, Calea Aradului no. 119, RO-300645, Romania
Corresponding author: manea_dn@yahoo.com

Abstract: *Research presented in this paper aimed at establishing the most efficient modern ways of chemical control of the problem-species Convolvulus arvensis L. in winter wheat, with direct effects on yield results. Research was carried out during the agricultural year 2008-2009 on the experimental field of the Plant Protection Department of the Didactic Station in Timişoara, on a cambic chernozem, where we tested 11 post-emergent herbicides. The winter wheat cultivar we used in our trial was Lovrin 50, developed at the S.C.A. Lovrin. In the control variant, we inventoried 77.00 weeds/m^2 (belonging to 11 distinct species), of which Convolvulus arvensis L. represented 13.83 plants/m^2 with a share of 17.80%. The most efficient decrease of the number of field bindweed shoots was ensured by the herbicide Buctril Universal, with a control rate of 95.87%. There was also weed control above 90% in the variants treated with Aril Super, Banvel 480 S, and Dialen Super 464 SL. As a result of the studies and research carried out, we could see that the herbicide Tomigan 250 EC had no visible effect in controlling field bindweed, which makes us not recommend it for the control of fields weeded by this plant. In all treated variants, 30 days after application and particularly 60 days after application, the plants of Convolvulus arvensis L. tended to regenerate by sprouting new shoots that could not be a real challenge for the almost mature wheat plants. The highest wheat yields obtained in 2009 were in the variants treated with Aril Super (1 l/ha), Banvel 480 S (1 l/ha), and Dialen Super 464 SL (0.9 l/ha), with yields of 53.01 q/ha, 52.43 q/ha and 51.08 q/ha, respectively, with very significant positive differences compared to the average of the field. All the tested herbicides were very selective for the winter wheat cultivar we cultivated (Lovrin 50), with no visible symptoms of phyto-toxicity.*

Keywords: *winter wheat, weed control, Convolvulus arvensis L., herbicides, yields*

INTRODUCTION

Wheat is among the oldest cultivated plants: it is used by more than half of the globe's population in the making of "our daily bread". It has the most favourable carbohydrates: proteins ratio (6: 1). It is also used in industrial processing to get starch, dextrins, alcohol, or animal feed, and it is important from an agrotechnical point of view.

Wheat shares the largest cultivated area worldwide – about 220 million ha – with an average production of 3,000 t/ha. In Romania, wheat has been cultivated lately on areas ranging between 2 and 3 million ha, with production largely impacted by climate conditions.

The particular importance of wheat and its distribution worldwide in over 100 countries determined numerous researches to be carried out in time and all over the world.

One of the most important steps in cultivating wheat is weed control, and particularly problem-species.

Research presented in this paper aimed mainly at establishing the most efficient modern ways of chemically controlling the problem-species *Convolvulus arvensis* L. in winter wheat, with direct effects on production results.

Convolvulus arvensis L. is a species native from Europe and Asia; it is a member of the Family Convolvulaceae (NAGY *et al*. 2002, CIOCÂRLAN *et al*. 2004). The Family Convolvulaceae contains plants with voluble grassy stems or woody lianas, often with tuberised radices. The leaves – simple, whole, or lobate – with no stipels are alternate. The

flowers, solitary or grouped into cymous or racemous inflorescences, are bisexuate, actinomorphous, and of the type 5. The perianth is formed of 5 sepals free or united and a corolla of 5 united petals. The androecium has 5 stamens inserted on the corolla with an intrastaminal nectariferous disc. The higher gynaecium sincarpous comes from 2-5 carpels. The fruit is a capsule (SARPE *et al*. 1998). It is an invasive species. The vegetal covers invade crops and diminish yield; they estimate that losses caused by this weed in the U.S.A. alone were above 377 million US dollars in 1998 alone (BERCA 2004). Though its flowers are attractive, it is considered a weed because of its quick growth and because it suffocates the crops.

In Romania, it grows everywhere, on all soils, and particularly on warm, drier soils, aerated and permeable, on road banks, in vegetable gardens, where it suffocates the young seedlings, in nurseries and on plantations, where it clings on the shrubs.

In ornamental gardens, it clings on the roses and on other decorative plants. On weeded soles, it clings on graminaceae and hinders their growth (IONESCU-SISEŞTI 1955).

It is a mesofilous plant that resists drought due to its deep root system, but it cannot stand frost. It is a very damaging weed for crops.

Field bindweed is a perennial parasitic plant with strong vegetative reproduction.

The rhizome and aerial parts of the field bindweed, also called *Herba convolvuli*, have medicinal properties (BERCA 2004).

MATERIAL AND METHODS

Research was carried out during the agricultural year 2008-2009 on the experimental field of the Department of Plant Protection of the Didactic Station in Timişoara, on a cambic chernozem; a number of 11 post-emergent herbicides were tested to control field bindweed in winter wheat. The setting of the trial field to control field bindweed in winter wheat was done after the Latin rectangle method, a mono-factorial trial with 12 replications, covering a harvestable area of 50 m^2.

The winter wheat cultivar we used in the trial was Lovrin 50, developed at the S.C.A. Lovrin, a cultivar homologated in the year 1996 to be cultivated in the Romanian Western Plain and in Southern Romania.

The post-emergent herbicides were applied during vegetation, when field bindweed was in the rosette phase, and winter wheat was growing shoots, at an air temperature reaching 15˚C.

Experimental variants were as follows:

V_1 – Not treated
V_2 – Rival Star 75 PU (Tribenuron – methyl: 75%) – 20 g/ha.
V_3 – Damine (Acid 2,4D from the salt of dimethyl amine: 600 g/l) – 1 l/ha.
V_4 – Lintur 70WG (Triasulfuron: 4.1% + Dicamba: 65.9%) – 150 g/ha.
V_5 – Sekator (Amidosulfuron: 5% + Iodosulfuron-methyl Na: 1.25%) – 300 g/ha.
V_6 – Buctril Universal (Bomoxinil: 280 g/l + Acid 2,4D: 280 g/l) – 1 l/ha.
V_7 – Aril super (Acid 2,4D: 28% + Dicamba: 10%) – 1 l/ha.
V_8 – Tomigan 250 EC (Fluroxipin: 250 g/l) – 0.5 l/ha.
V_9 – Banvel 480 S (Dicamba 480gr/l) – 0.6 l/ha.
V_{10} – Mustang (Florasulam: 6.25 g/l + Acid 2,4D: 300 g/l) – 0.5 l/ha.
V_{11} – Lancet RV (Fluroxipir: 80 g/l + Acid 2,4D: 450 g/l) – 1 l/ha.
V_{12} – Dialen super 464 SL (Dicamba 120 g/l + 344 g/l acid 2,4D) – 0.9 l/ha.

We monitored the following:

- total weed control degree and particularly the species *Convolvulus arvensis* L. in % (readings were done 15 days after application and were followed by grades according to the EWRS scale concerning weed control);
- winter wheat yield in q/ha in the control variant and in the variants treated;
- herbicide selectivity of the tested herbicides on the cultivated winter wheat cultivar.
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RESULTS AND DISCUSSION

Table 1 shows weed species in the control variant (not treated) in winter wheat.

Table 1.

Weed species in the control variant (not treated) in winter wheat

No.	Weed species	Weeds/m^2	Share (%)	Botanical class
1.	*Stellaria media*	17.43	24.10	D.a.
2.	*Veronica hederifolia*	14.24	19.30	D.a.
3.	***Convolvulus arvensis* L.**	**13.83**	**17.80**	**D.a.**
4.	*Lamium purpureum*	11.13	14.60	D.p.
5.	*Polygonum convolvulus*	7.44	10.20	D.a.
6.	*Cirsium arvense*	4.65	5.50	D.p.
7.	*Stachys annua*	3.47	4.10	D.a.
8.	*Galium aparine*	2.80	2.30	D.a.
9.	*Rubus caesius*	1.55	1.20	D.a
10.	*Papaver rhoeas*	0.30	0.70	D.a.
11.	*Viola arvensis*	0.16	0.20	D.p.
Total		77.00	100	

Results show that in the year 2009, there were, in the control variant, 77.00 weeds/m^2 of which 13.83 plants/m^2 were represented by the species *Convolvulus arvensis* L., with a share of 17.80%.

Annual dicot species such as *Stellaria media*, *Veronica hederifolia*, *Lamium purpureum*, *Polygonum convolvulus*, *Stachys annua*, *Galium aparine*, *Papaver rhoeas*, and *Viola arvensis* shared 75.50%, while perennial dicots such as *Convolvulus arvensis* L., *Cirsium arvense*, and *Rubus caesius* shared 24.50%.

Compared to the number of weeds in the control variant (77.00 weeds/m²), the number of weeds after herbicide application diminished with 44.17 weeds/m² in the variant treated with Tomigan 250 EC (0.5 l/ha), and up to 74.55 weeds/m² in the variant treated with Dialen Super 464 SL (0.9 l/ha).

The total control percentage ranged between 57.36% in the variants treated with Tomigan 250 EC (0.5 l/ha) and 96.81% in the variants treated with Dialen Super 464 SL (0.9 l/ha). The variants in which weed control was above 90% are as follows: Dialen Super 464 SL (0.9 l/ha) – 96.81%, Banvel 480 S (1 l/ha) – 96.54%, Aril Super (1 l/ha) – 96.40%, Lancet RV (1 l/ha) – 92.44%, Rival Star 75PU (20 g/ha) – 91.85%, and Bucril Universal (1 l/ha) – 91.25%. The lowest weed control was in the variants treated with Mustang (0.1 l/ha) – 65.75%, Damine (1 l/ha) – 64.01%, and Tomigan 250 EC (0.5 l/ha) – 57.36% (Table 2).

Table 2.

Diminution of the number of weeds in winter wheat

Herbicide	Rate	Weed control EWRS grades	Number of weeds controlled	Control percentage		Significance of the difference
				Total	*Convolvulus arvensis* L.	
v_{12} - Dialen Super 464 SL	0.9 l/ha	3	74.55	96.81	91.90	***
v_9 - Banvel 480 S	1 l/ha	3	74.34	96.54	91.25	***
v_7 - Aril Super	1 l/ha	3	74.23	96.40	93.52	***
v_{11} - Lancet RV	1 l/ha	4	71.18	92.44	76.60	***
v_2 - Rival Star 75PU	20 g/ha	4	70.73	91.85	22.31	***
v_6 - Buctril Universal	1 l/ha	4	70.27	91.25	95.87	***
v_5 - Sekator	300 g/ha	5	65.13	84.58	25.73	***
v_4 - Lintur 70WG	150 g/ha	6	59.72	77.55	61.70	***
v_{10} - Mustang	0.5 l/ha	7	50.32	65.35	63.23	***
v_3 - Damine	1 l/ha	7	49.29	64.01	57.51	***
v_8 - Tomigan 250 EC	0.5 l/ha	7	44.17	57.36	0.00	***
v_1 - control (not treated)	-	9	**Mt**	0.00	0.00	-

$DL_{5\%}$= 2.56 weeds/m²; $DL_{1\%}$ = 4.16 weeds/m²; $DL_{0.1\%}$= 6.35 weeds/m²

As for the exclusive control of the species *Convolvulus arvensis* L., the best results were in the variants treated with Bucril Universal (85.87%), Aril Super (93.25%), Dialen Super 464 SL (91.90%), and Banvel 480 S (91.25%). To note that the herbicide Tomigan 250 EC had no visible effect in the control of field bindweed, reason for which we do not recommend it for the treatment of the field weeded by it.

In all the variants treated, 30 days after treatment and particularly 60 days after treatment, plants of *Convolvulus arvensis* L. tended to regenerate by sprouting new shoots, but they could not really challenge the almost mature winter wheat plants.

All tested herbicides were very selective for the cultivated winter wheat cultivar (Lovrin 50), with no visible signs of phyto-toxicity.

Data presented in Table 3 show that the largest winter wheat yields in the year 2009 were in the variants treated with Aril Super (1 l/ha), Banvel 480 S (1 l/ha), and Dialen Super 464 SL (0.9 l/ha), with yields reaching 53.01 q/ha, 52.43 q/ha, and 51.08 q/ha, respectively, with very significant positive differences compared to the average of the field. Distinctly significant positive differences compared to the average of the field were also in the variant treated with Lancet RV (1 l/ha), while in the variant treated with Buctril Universal (1 l/ha) the difference was significantly positive.

Yields in which the difference to the average of the field was not significant were in the variants treated with Rival Star 75PU (20 g/ha) and Sekator (300 g/ha). The variants treated with Lintur 70WG (150 g/ha), Mustang (0.5 l/ha), Damine (1 l/ha), or Tomigan 250 EC (0.5 l/ha) ensured lower yields compared to the average of the field.

Table 3.

Experimental results in winter wheat

Herbicide	Rate	Absolute yield (q/ha)	Relative yield (%)	Difference in yield (q/ha)	Significance of the difference
v_7 - Aril Super	1 l/ha	53.01	120.8	+9.13	xxx
v_9 - Banvel 480 S	1 l/ha	52.43	119.4	+8.55	xxx
v_{12} - Dialen Super 464 SL	0.9 l/ha	51.08	116.4	+7.20	xxx
v_{11} - Lancet RV	1 l/ha	48.54	110.6	+4.66	xx
v_6 - Buctril Universal	1 l/ha	46.70	106.4	+2.82	x
v_2 - Rival Star 75 PU	20 g/ha	45.05	102.6	+1.17	-
Media	-	**43.88**	**100.0**	**Mt**	-
v_5 - Sekator	300 g/ha	42.60	97.0	-1.82	-
v_4 - Lintur 70WG	150 g/ha	40.16	91.5	-3.72	0
v_{10} - Mustang	0.5 l/ha	39.88	86.3	-4.00	00
v_3 - Damine	1 l/ha	37.65	85.8	-6.23	000
v_8 - Tomigan 250 EC	0.5 l/ha	37.44	85.3	-6.44	000
v_1 - control (not treated)	-	32.00	72.92	-11.88	000

$DL_{5\%}$ = 2.60 q/ha; $DL_{1\%}$= 3.90 q/ha; $DL_{0.1\%}$ = 5.47 q/ha

The lowest yield was in the control variant (not treated), where yield reached 32.00 q/ha, with a very significant negative difference compared to the average of the field.

CONCLUSIONS

1. Field bindweed is a ruderal, segetal weed resistant to drought and with a wide ecological amplitude. In Romania, it can be found practically in any crop, year after year, in all areas, and is considered a problem-weed, one of the most damaging of the weed species.

2. The soil, a cambic chernozem, on which we set our trials, has good fertility but it also supplies very good conditions for the spread and growth of field bindweed.

3. We identified initially in the control variant a total number of weeds of 77.00 weeds/m^2, of which *Convolvulus arvensis* L. shared 17.80%, i.e. 13.83 plants/m^2.

4. The most efficient diminution of field bindweed shoots was ensured using the herbicide Buctril Universal, with a control degree of 95.87%. There was also weed control above 90% in the variants treated with Aril Super, Banvel 480 S, and Dialen Super 464 SL.

5. The herbicide Tomigan 250 EC had no visible effect in the control of field bindweed, reason for which we do not recommend it to control weeds in fields weeded by it.

6. In all the variants treated, 30 days after application and particularly 60 days after application, plants of *Convolvulus arvensis* L. tended to regenerate by shooting new shoots, but the latter were no challenge for the almost mature winter wheat plantlets.

7. All tested herbicides were very selective for the cultivated winter wheat cultivar (Lovrin 50), with no visible symptoms of phyto-toxicity whatsoever.

8. Winter wheat yields from our experimental field were impacted, on one hand, by the climate conditions of the year 2009 and, on the other hand, they correlated positively with the performances of the herbicides in the control of total weeding by field bindweed.

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