CONTROLLING THE PERENNIAL SPECIES *RUBUS CAESIUS* L. – A PROBLEM WEED IN WINTER WHEAT AND GRAIN MAIZE IN THE TIMIŞOARA AREA

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Abstract: *In this paper, we present a few aspects concerning the control of weeds in winter wheat and grain maize, among which Rubus caesius L., a problem species popularly called dewberry. We describe materials and methods used in the control of problem weeds, that helped us monitor the control degree in percentage of dicot weeds, in general, and of the species Rubus caesius L., in particular, as well as winter wheat and grain maize yields in q/ha in both treated and not treated variants in the years 2008-2009 and 2009-2010. We present research results concerning the total number of weeds/m^2 in the control variant in winter wheat and in grain maize as well as the participation share. In winter wheat, we observed in the years 2008-2009 and 2009-2010 a number of 11 weed species, the total number of weeds per m^2 being 77, with a participation share of 100%, and in grain maize in the years 2009 and 2010, 11 weed species, the total number of weeds per m^2 being 282, with a participation share of100%. Dewberry was present in winter wheat with a number of 4.65 weeds/m^2 with a participation share of 5.5%, while in grain maize there were 24.2 weeds/m^2 with a participation share of 8.58%. The most efficient diminution of dewberry shoots in winter wheat was ensured by the herbicide Dialen Super 464 SL (0.9 l/ha), with a control degree of 93.70%. A weed control above 90% was also in the variants treated with Premiant (1 l/ha) 93.46% and Ceredin Super (1 l/ha) 93.31%, Lancelot 450 WG (30 g/ha) and Buctril Universal (1 l/ha) 90.84%. The most efficient diminution of dewberry shoots in grain maize was ensured by the herbicide Dialen Super 464 SL (0.9 l/ha), with a control degree of 85.97%.*

Key words: *herbicide, Rubus caesius L., weed, winter wheat, grain maize*

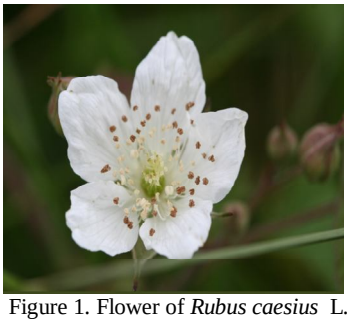

Figure 1. Flower of *Rubus caesius* L.

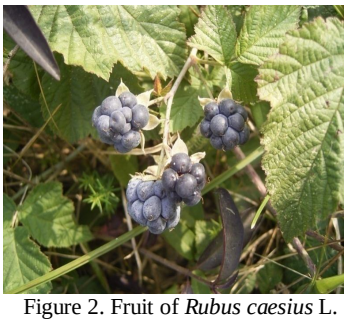

Figure 2. Fruit of *Rubus caesius* L.

INTRODUCTION

Winter wheat is one of the most important food crops worldwide. This is due particularly to the high content of carbohydrates and proteins of the grains, with the most favourable ratio carbohydrates proteins, i.e. 6: 1.

Wheat grains are used to produce flour and pasta. They are also used in industrial processing, to produce starch, dextrins, alcohol, or as feed, and it is very important from an agricultural point of view (MANEA 2006).

In general, winter wheat grains contain 62-75.7% non-nitrate extractive substances, 8-

24% protein, 1.5-2% fats, 2-3% cellulose, 1.5-2% mineral substances.

Non-nitrate extractive substances contain over 90% starch, 2.7% sugar and 2.3% dextrin.

Protein substances are the most important part of the wheat grain from the point of view of its nutritious values and of its bread-making quality (DAVID 2003).

The particular importance of wheat as well as its spread in over 100 countries of the world has resulted in numerous research carried out in time and worldwide.

One of the most important steps in cultivating wheat is weed control, in general, and problem weed species, in particular (LĂZUREANU, MANEA, CÂRCIU & ALDA 2002).

Maize ranks third in importance among worldwide cultivated crops.

Together with wheat and barley, it is a staple food in most countries of the world, consumed as such or turned into animal food.

One hundred kilos of wheat can give 77 kg of flour, 63 kg of starch, 44 l of alcohol, 71 kg of glucose, 1.8-2.7 l of oil, or 3.6 kg of cakes.

Wheat grains contain, on the average, 13.5% water, 10.0% proteins, 70.7% sugars, 4% fats, 1.4% mineral salts, and 0.4% acid organic substances.

In this paper we present a programme of weed control in winter wheat and grain maize, among which *Rubus caesius* L., popularly called dewberry.

The research presented in this paper aimed at establishing the most efficient present ways of controlling chemically perennial dicots, in general, and the problem weed species *Rubus caesius* L., in particular, in winter wheat and grain maize, with direct effects on yield results.

Among weeds, soil type, pre-emergent crop, climate, water table, and level of cultivation technology, there are certain relationships that, due to their cumulated influence, determine the level and quality of agricultural production (CHIRILĂ et al. 2001).

One of the main problem-weeds in winter wheat is *Rubus caesius* L. (Family Rosaceae), a species with a high variability (BERCA 2004).

Rubus caesius L. is a perennial dicot weed, semi-woody, polycarpous, with mainly vegetative multiplication from buds sprouting from the roots and on the creeping stems and less from seeds (COUSENS & CROFT 2000).

Creeping branches of the stems lay down on the soil and, in contact with it, they shoot. The branches have small, uneven thorns.

The plant spreads quickly in the field and is very rebel to control works, because it sprouts quickly from its vegetative organs left in the soil.

In time, the strategy of controlling weeds in winter wheat there has been significant progress determined mainly by the synthesis and use of new herbicide substances (HELDT 2000).

Research presented in this paper aimed mainly at establishing the most efficient present ways of controlling chemically the problem weed species *Rubus caesius* L. in winter wheat and grain maize, with direct effects on yield results.

MATERIALS AND METHODS

Research was carried out during the agricultural years 2008-2009 and 2009-2010 on an experimental field near Sacoşu-Turcesc (Timiş County), where we tested 9 post-emergent herbicides to control dewberry in winter wheat and grain maize. The setting of the experimental field to control dewberry in winter wheat was done after the Latin rectangle method, a monofactorial experiment with 10 variants, on a harvestable area per variant of 48 m^2. In order to establish the efficacy of controlling dewberry in grain maize, we set in the field a monofactorial experiment set after the randomised block method with four replicates, each

harvestable variant measuring 105 m^2, with a total area of 4200 m^2.

The winter wheat cultivar we used in the experiment was Lovrin 50 developed at the SC Lovrin and homologated in 1996 to be cultivated in the plain area of western and southern Romania, and the grain maize cultivar used in the experiment was DKC-5143, a hybrid developed by Monsanto, a semi-late grain maize hybrid homologated in 2005 and recommended for cultivation particularly in the Western Plain, in southern and south-eastern Romania, where they obtained good results. With a wide genetic base and a high ecological plasticity, it yields high, constant yield (11-14 t/ha), even in particular climate conditions.

Post-emergent herbicides were applied during vegetation, when dewberry was 10-15 cm long, and winter wheat was jointing at an air temperature of 15˚C.

The experimental variants in winter wheat were as follows:

V_1 – not treated

V_2 – Rival Star 75 PU (Tribenuron – methyl: 75%) – 20 g/ha.

V_3 – SDMA (600 g/l acid 2,4 D as dimethyl amine salt) – 1 l/ha

V_4 – Dialen Super 464 SL (120 g/l dicamba + 344 g/l acid 2,4-D) – 0.9 l/ha

V_5 – Lancelot 450 WG (30% aminopiralidin acid from potassium salt + 15% florasulam) – 30 g/ha

V_6 – Buctril Universal (Bomoxinil: 280 g/l + Acid 2,4D: 280 g/l) – 1 l/ha.

V_7 – Ceredin Super (300 g/l acid 2,4 –D + 100 g/l dicamba) – 1 l/ha

V_8 – Premiant (300 g/l acid 2,4 D +100 g/l dicamba as diemthyl amine) – 1 l/ha

V_9 – Banvel 480 S (Dicamba 480 g/l) – 0.6 l/ha.

V_{10} – Mustang (Florasulam: 6.25 g/l + Acid 2,4D: 300 g/l) – 0.5 l/ha.

The experimental variants in grain maize were as follows:

V_1 – not treated

V_2 – Buctril Universal (Bromoxinil 280 g/l + acid 2,4D (ester) 280 g/l) – 1 l/ha

V_3 – SDMA Super (Acid 2,4 -D 600 g/l) – 1 l/ha

V_4 – Dialen super (Dicamba 120 g/l + 2,4 D 344 g/l) – 0.9 l/ha

V_5 – Premiant (Dicamba 100 g/l + 2,4D 300 g/l) – 1 l/ha

V_6 – Excalibur (Bentazona 300 g/l +dicamba 90 g/l) – 2.5 l/ha

V_7 – Banvel 480 S (Dicamba 480 g/l) – 0.6 l/ha

V_8 – Merlin Duo (Isoxaflutol 37.5 g/l + terbutilazin 375 g/l) – 2 l/ha

V_9 – Callisto 480 SC (Mesotrione 480 g/l) – 0.3 l/ha

V_{10} – Cambio (Bentazon 320 g/l + dicamba 90 g/l) - 2-2.25 l/ha

We monitored the following:

- The degree of weed control in the species *Rubus caesius* L. in %: the readings were made 15 days after application of the herbicide and we assessed weed control in winter wheat and grain maize according to the EWRS scale;
- Winter wheat and grain maize in q/ha in the variants treated and not treated.

RESULTS AND DISCUSSIONS

Table 1 shows the weed species in the control variant in winter wheat and grain maize.

Results show that, in the control variant, there were 282.0 weeds/m^2 in grain maize of which 24.2 plants/m^2 were represented by *Rubus caesius* L., with a participation share of 8.58% and in the control variant in winter wheat there were 77.00 weeds/m^2 of which 4.65 plants/m^2 were represented by *Rubus caesius* L., with a participation share of 6.03%.

In winter wheat, compared to the number of weeds in the control variant of 77.00 weeds/m², after application of herbicides, the number of weeds decreased to 50.32 weeds/m² in the variant treated with Mustang (0.5 l/ha), up to 74.55 weeds/m² in the variant treated with

Dialen Super 464 SL (0.9 l/ha) (Table 2).

Table 1.

Mean of the number of weeds per species in the control variant in winter wheat and grain maize (2008-2009 and 2009-2010)

Weed species	Mean of the number of weeds/m^2		% share		Botanical class
	grain maize	winter wheat	grain maize	winter wheat	
Amaranthus retroflexus	29.4	-	10.43	-	A.d.
Chenopodium album	32.0	-	11.35		A.d.
Cirsium arvense	10.07	1.55	3.79	2.01	P.d.
Convolvulus arvensis	3.3	13.83	1.17	17.96	P.d.
Cynodon dactylon	2.6	-	0.92	-	P.m.
Echinochloa crus-gali	27.8	-	9.86	-	A.m.
Galium aparine	-	2.80	-	3.63	A.d.
Hibiscus trionum	12.0	-	4.25	-	A.d.
Lamium purpureum	-	11.13	-	15.90	A.d.
Papaver rhoeas	-	0.30	-	0.38	A.d.
Polygonum convolvulus	8.4	7.44	2.98	9.66	A.d.
Rubus caesius	**24.2**	**4.65**	**8.58**	**6.03**	**P.d.**
Setaria glauca	86.4	-	30.64	-	A.m.
Sorghum halepense	45.2	-	16.02	-	P.m.
Stachys annua	-	3.47	-	4.50	A.d.
Stellaria media	-	17.43	-	22.63	A.d.
Veronica hederifolia	-	14.24	-	18.49	A.d.
Viola arvensis	0.45	0.14	0.5	0.20	P.d.
	282.0	**77.00**	**100**	**100**	

A.d. = annual dicots; P.d. = perennial dicots; A.m. = annual monocots; P.m. = perennial monocots

Table 2.

Decrease of weed number in winter wheat

Herbicide	Rate	Weed control EWRS grades	Number of weeds controlled	Control percentage	
				Total	*Rubus caesius* L.
V_4-Dialen Super 464 SL	0.9 l/ha	4	84.33	93.70	92.14
V_8 .Premiant	1 l/ha	4	84.12	93.46	91.65
V_7-Ceredin Super	1 l/ha	4	83.84	93.31	90.57
V_5-Lancelot 450 WG	30 g/ha	4	82.10	91.22	86.60
V_6-Buctril Universal	1 l/ha	4	81.76	90.84	72.31
V_9-Banvel 480 S	1 l/ha	5	80.45	89.38	20.88
V_2-Rival Super Star 75PU	20 g/ha	5	75.12	83.46	19.73
V_3-S.D.M.A.	1 l/ha	6	68.72	76.35	22.70
V_{10}-Mustang	0.5 l/ha	7	60.52	67.24	56.24
V_1-control (not treated)	-	9	**Mt**		0.00

In winter wheat, the total weed control percentage ranged between 67.24% in the variants treated with Mustang (0.5 l/ha) and 93.70% in the variants treated with Dialen Super 464 SL (0.9 l/ha). The variants in which the weed control was above 90% are as follows: Dialen Super 464 SL (0.9 l/ha) 93.70%, Premiant (1 l/ha) 93.46%, Ceredin Super (1 l/ha) 93.31%, Lancelot 450 WG (30 g/ha) 91.22% and Buctril Universal (1 l/ha) 90.84%. The lowest weed control degree was in the variants treated with Mustang (0.1 l/ha) 67.24%, S.D.M.A. (1 l/ha) 76.35% and Rival Super Star 75PU (20 g/ha) 83.46% (Table 3).

Compared to the number of weeds in the control variant, 282.00 weeds/m², after application of the treatment, the number of weeds decreased to 141.5 weeds/m² in the variant treated with Cambio (2.5 l/ha), down to 274.3 weeds/m² in the variant treated with Dialen Super 464 SL (0.9 l/ha) in grain maize.

Table 3.

Decrease of weed number in grain maize in 2009 and 2010

Herbicide	Rate	Weed control EWRS grades	Number of weeds controlled	Control percentage	
				Total	*Rubus caesius* L.
V_4-Dialen Super 464 SL	0.9 l/ha	3	274.3	97.27	85.97
V_7-Bnavel 480 S	0.6 l/ha	3	273.4	96.95	71.65
V_6-Excalibur	2.5 l/ha	3	271.2	96.17	63.52
V_9-Callisto 480 SC	2.5 l/ha	3	270.0	95.74	42.60
V_5-Premiant	1 l/ha	4	268.4	95.17	50.31
V_2-Buctril Universal	1 l/ha	5	253.6	89.93	35.67
V_3-SDMA Super	1 l/ha	6	212.7	75.42	55.73
V_8-Merlin Duo	2 l/ha	7	186.3	66.06	51.50
v_{10}-Cambio	2.5 l/ha	8	141.5	50.17	42.63
v_1-control (not treated)	-	9	**Mt**	0.00	0.00

In maize, the total weed control percentage was between 50.17% in the variants treated with Cambio (2.5 l/ha) and 97.27% in the variants treated with Dialen Super 464 SL (0.9 l/ha) (Table 4).

Table 4.

Experimental results concerning mean yield in winter wheat in 2008-2009 and 2009-2010

Herbicide	Rate	Absolute yield (q/ha)	Relative yield (%)	Difference in yield (q/ha)	Significance of the difference
V_4-Dialen Super 464 SL	0.9 l/ha	53.02	115.56	+7.14	XXX
V_8-Premiant	1 l/ha	52.48	114.38	+6.60	XXX
V_7-Ceredin Super	1 l/ha	51.34	111.90	+5.46	X
V_5-Lancelot 450 WG	30 g/ha	49.15	107.12	+3.27	X
V_6-Buctril Universal	1 l/ha	47.45	103.42	+1.57	X
V_9-Banvel 480 S	1 l/ha	46.80	99.82	+0.92	-
Mean	-	**45.88**	**100.0**	**Mt**	-
V_2-Rival Super Star 75PU	20g/ha	42.75	93.17	-3.13	0
V_3-S.D.M.A.	1 l/ha	41.14	89.66	-4.74	0
V_{10}-Mustang	0.5 l/ha	38.42	83.74	-7.46	00
V_1-control (not treated)	-	37.32	81.34	-8.56	000

$D.L._{.5\%}$ = 3.27 q/ha ; $D.L._{.1\%}$ = 5.80 q/ha; $D.L._{.0,1\%}$ = 9.27q/ha

As far as the exclusive control of the species *Rubus caesius* L. in maize, the best results were in the variants treated with Dialen Super 464 SL, 85.97% .

Data in Table 5 show that the highest yields in winter wheat were in the variants treated with Dialen Super 464 SL (0.9 l/ha), Premiat (1 l/ha) and Ceredin Super (1 l/ha), with yields of 53.02 q/ha, 52.48 q/ha and 51.34 q/ha, respectively, the differences compared to the mean of the field being significantly positive. The significantly positive difference compared to the mean of the field was in the variants treated with Lancelot 450 WG (30 g/ha) and Buctril Universal (1 l/ha).

The yields in which the difference compared to the mean of the field was insignificant were in the variants treated with Banvel 480 S (1 l/ha). The variants treated with Mustang (0.5 l/ha), S.D.M.A. (1 l/ha) and Rival Super Star 75PU (20 g/ha) ensured lower yields compared to the mean of the field.

The lowest yield was in the control (not treated) variant, where the yield reached 37.32 q/ha, with a very significantly negative difference compared to the mean of the field.

Table 5.

Experimental results concerning mean yield in grain maize in 2009 and 2010

Herbicide	Rate	Absolute yield (q/ha)	Relative yield (%)	Difference in yield (q/ha)	Significance of the difference
V_4-Dialen Super 464 SL	0.9 l/ha	68.24	142.02	+20.36	Xxx
V_9-Callisto 480 SC	2.5 l/ha	66.45	138.78	+18.57	Xxx
V_7-Bavel 480 S	0.6 l/ha	62.78	131.11	+14.90	Xxx
V_6-Excalibur	2.5 l/ha	54.26	113.32	+6.38	X
V_2-Buctril Universal	1 l/ha	48.21	100.68	+0.33	-
Mean	-	**47.88**	**100.0**	**Mt**	-
V_5-Premiant	1 l/ha	45.05	94.24	-2.83	-
v_{10}-Cambio	2.5 l/ha	42.87	89.53	-5.01	0
V_8-Merlin Duo	2 l/ha	40.12	83.79	-7.76	0
V_3-SDMA Super	1 l/ha	32.34	67.54	-15.54	0
v_1-control (not treated)	-	18.48	38.60	-29.4	000

Data in Table 5 show that the highest yields in grain maize were in the variants treated with Dialen Super 464 SL (0.9 l/ha), Callisto 480 SC (2.5 l/ha) and Bavel 480 S (0.6 l/ha), with yields of 68.24 q/ha, 66.45 q/ha and 62.78 q/ha, respectively, with very significantly negative differences compared to the mean of the field. There was also a significantly positive difference compared to the mean of the field in the variant treated with Excalibur (2.5 l/ha).

There were insignificant differences compared to the mean of the field in the variants treated with Buctril Universal (1 l/ha) and Premiant (1 l/ha). The variants treated with Cambio (2.5 l/ha), Merlin Duo (2 l/ha), SDMA Super (1 l/ha) ensured lower yields compared to the mean of the field.

The lowest yield was in the control variant (not treated), where yield was 18.48 q/ha, the difference compared to the mean of the field being very significantly negative.

CONCLUSIONS

Rubus caesius L. is a problem-weed in winter wheat and grain maize, with great variability.

The soil, a cambic chernozem, on which we set the experiments, has good fertility but it also supplies good conditions for the growth and spread of dewberry.

We initially identified in grain maize a total number of weeds of 282.0 weeds/m^2 in the control variant, of which *Rubus caesius* L. shared 8.58%, i.e. 24.2 plants/m^2, while in winter wheat we initially identified, in the control variant, a total number of weeds of 77.0 weeds/m^2, of which *Rubus caesius* L. shared 5.50%, i.e. 4.65 plants/m^2.

The most efficient diminution of the dewberry shoots both in winter wheat and grain maize was ensured by the herbicide Dialen Super 464 SL.

The herbicide Mustang had no visible effect in controlling dewberry in winter wheat: this is why we do not recommend it in the treatment of the fields weedened by this species.

In all the variants treated, 30 days after treatment, and particularly 60 days after treatment, the plants of *Rubus caesius* L. tended to regenerate sprouting new shoots, but they did not represent a real threat for the winter wheat plants that were almost mature.

All tested herbicides were very selective for the winter wheat cultivar (Lovrin 50) and for the grain maize hybrid, with no visible phytotoxicity effects whatsoever.

Winter wheat and grain maize yields were impacted by climate conditions in the two agricultural years, and they correlated well with the performances of the herbicides in decreasing total and dewberry weeding.

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