RESEARCHES REGARDING TO CONTROL SPECIES CONVOLVULUS ARVENSIS L. ON RELATION WITH SOIL TILLAGE SYSTEMS

CERCETĂRI PRVIND COMBATEREA SPECIEI CONVOLVULUS ARVENSIS L. ÎN RELAȚIE CU SISTEMUL DE LUCRARE A SOLULUI

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ABSTRACT

The research paper presents the results obtained in the pedoclimatic conditions of Cluj-Napoca, Romania, concerning the control of Convolvulus arvensis L species. To determine or accomplish the relation with soil tillage systems and herbicides applied on soy-bean, wheat and maize crop. Minimum tillage systems determine an increasing percentage of Convolvulus arvensis species at weeding, different depending on experimental variant and on crop: 11.2-39.1% at soy-bean, 0.9-4.2% at wheat and 11.9-24.4% at maize crop. The number of Convolvulus arvensis seeds increases with 169% at tillage variant with disk + rotary harrow, 77% of these being located in the first 10 cm soil depth.

Key words: minimum tillage, weeds, Convolvulus arvensis L.

REZUMAT

Lucrarea prezintă rezultatele obținute, în condițiile pedoclimatice de la Cluj-Napoca, România, privind combaterea speciei Convolvulus arvensis L. Determinările efectuate sunt în relație cu sistemul de lucrare a solului şi erbicidele aplicate la culturile de soia, grâu şi porumb. Lucrările minime determină o creştere a ponderii speciei Convolvulus arvensis la îmburuienare, diferențiat în funcție de varianta experimentală şi cultură: 11.2-39.1% la soia, 0.9-4.2% la grâu şi 11.9-24.4% la porumb. Numărul semințelor de Convolvulus arvensis creşte cu 169% la varianta lucrată cu disc + grapă rotativă, 77% dintre acestea fiind localizate în primii 10 cm de sol.

Cuvinte cheie: lucrări minime, buruieni, Convolvulus arvensis L.

Introduction

Convolvulus arvensis L. because of its biological features and difficulties to control it, involves in a higher proportion to straw cereals, hoeing crops and in general, at all agricol crops in Romania. Literature in domain [2], [4], [5], [6], [7] quote the experimental results which show this species sensitively to active herbicides substances as: oxyfluorfen, MCPB-Na, 2.4D, clopyralid, metosulam, fluoroxypyr, chlorsulfuron, dicamba, MCPA, florosulam, glyphosate, and possibilities to control, with homologated herbicides in Romania [1], [3], from straw cereals crops, maize, pea, rape and sugar beet crop, but very hard to control at potatoes, sun flower bean, soy-bean crops (with the exception of genetically modified varieties) and chick pea crop. At these crops the only method of post emergent control for this weed is represented by mechanical hoeing.

Convolvulus arvensis integrated control is difficult to achieve because its vivacity and high ecological plasticity decreases the effect of control methods, being necessary adequate crop rotation and specific herbicide usage.

This paper presents determination regarding Convolvulus arvensis species control in relation with soil tillage system (conventional and minimum tillage) and control used methods, in soy-bean, wheat and maize crops.

MATERIAL AND METHOD

The tests took place during 2002-2005 at the University of Agricultural Sciences and Veterinary Medicine of Cluj-Napoca (46º46'N, 26º36'E), on a moderately inclined northern slope, on preluvosol vertic (SRTS, 2003) [8], a vertic luvisols (WRB-SR, 1998) [10], a vertic hapludalfs (USDA-ST, 1999) [9] with medium fertility, content of 2.7-3.29% humus, slightly-moderate acid reaction (pH = 5.17-6.06), clay texture (42-45% clay in arable stratum), medium content of nitrogen (0.245-0.268 % N total) and potassium (134-151 ppm), small content of phosphorus (16-17 ppm). The experimental field is characterized by a medium multi annual temperature of 8.2^{0}C and medium of multi annual rain drowns of 613 mm.

The treatments imposed were as follows:

A. Conventional tillage:

V_1 – classic plough (20-25 cm) + disc –2x (8 cm) (wt - witness).

B. Minimum tillage:

V_2 – disc harrow (6-8 cm) + rotary harrow (8 cm).

V_3 – rotary harrow – 2x (10-12 cm).

V_4 – paraplow (18-22 cm) + rotary harrow (8 cm).

V_5 – chisel plow (18-22 cm) + rotary harrow (8 cm).

The experimental design used in this study was a randomized complete block design with three replications. A plot dimension was 300 m^2. Except for the soil tillage, all the other technological sequences of sowing, fertilizing, weed control, tractors and equipment are identical in all the variants. Crop rotation was represented by: soy-bean (S0994RR), autumn wheat (Ariesan) and maize (Turda 200). Weed control was made using the following herbicides: soy-bean - post emergent with Roundup Ready (glyphosate acid 360 g/l) 5 l/ha (2.5+2.5); wheat - post emergent with Icedin Super (dicamba 100 g/l + 2.4D 280 g/l) 1.0 l/ha; maize - pre emergent with Guardian CE (acetochlor 820-860 g/l + antidote) 2.5 l/ha and post emergent with Icedin Super (dicamba 100 g/l + 2.4D 280 g/l) 1.0 l/ha.

The weeding degree was determined in 3 repetitions, on a 0.25 m^2 area, 2 weeks before harvesting. Weed seeds reserves from soil was determined at the end of crop rotation, up to 30 cm depth, by harvesting the samples from soil in cylinders of 100 cm^3 capacity, in 3 repetitions.

RESULTS AND DISCUSSION

Convolvulus arvensis is a perennial dicotyledonous weed which intestates all field agricol crops being a species with the highest ecological plasticity. In Romania Convolvulus arvensis creates special problems, specially generated by its capacity to reproduce, through seeds but especially vegetative, and also because its resistance to numerous herbicides. In pedo-climatic conditions from Cluj-Napoca a plant produces 500-600 seeds which maintain in soil their germinative capacity up to 15-20 years. The seeds germinate in soil at 2-8 cm depth, and these can germinate even immediately after shaking, at soil temperatures of over 2^{0}C. After 5-6 weeks from growing the little plant already have a revolving root which reach 40-60 cm depth, from which form other 4-6 lateral roots with 30-100 cm length. Convolvulus arvensis has a very profound root system which ca is up to 3-5 m depth. The main root has lateral ramification, all of them having radicular buds which will produce root sucker, especially those from the first 50-60 cm. The density of radicular buds is very high, a root fragment of 5 cm length could form up to 25 aerial springs. From radicular buds are formed the root sucker which draw out at the surface of the soil. Aerial stems can reach up to 1.5 m length, and die at the firs frost without the destruction of dormant buds. The stem is voluble, and without support is a procumbent one.

Vegetative propagation is stimulated through roots fragmentation from the surface of the soil and because of that controlling Convolvulus arvensis species through

Table 1. To control species *Convolvulus arvensis* on relation with soil tillage systems and herbicides applied on soy-bean, wheat and maize
Tabelul 1. Combaterea speciei *Convolvulus arvensis* în relație cu sistemul de lucrare a solului și erbicidele aplicate la soia, grâu și porumb

Cultivated plant	Biological group	Plough + disc - 2x	Disc + rotary harrow	Rotary harrow	Paraplow + rotary harrow	Chisel plow + rotary harrow
		No. /m^2				
Soy – bean (Roundup Ready)	Monocotyledonous	0.3	0.6	0.6	0.9	0.9
	Dicotyledonous	2.3	1.7	2.1	1.8	2.0
	TOTAL din care:	2.6	2.3	2.7	2.7	2.9
	Convolvulus arvensis	***0.5***	***0.9***	***0.6***	***0.3***	***0.3***
	% din total	**19.2**	**39.1**	**22.2**	**11.1**	**10.3**
	% toward control variant	**100 (wt.)**	**180**	**120**	**60**	**60**
Wheat (Icedin Super)	Monocotyledonous	-	-	-	-	-
	Dicotyledonous	31.0	32.2	34.7	31.6	33.2
	TOTAL from which:	31.0	32.2	34.7	31.6	33.2
	Convolvulus arvensis	***0.3***	***1.3***	***1.0***	***0.6***	***0.3***
	% from total	**0.9**	**4.2**	**2.9**	**1.9**	**0.9**
	% toward control variant	**100 (wt.)**	**433**	**333**	**200**	**100**
Maize (Guardian + Icedin Super)	Monocotyledonous	32.5	36.7	53.5	33.2	35.5
	Dicotyledonous	33.4	49.5	56.7	45.1	49.8
	TOTAL from which:	65.9	86.2	110.2	78.3	85.3
	Convolvulus arvensis	***2.5***	***12.0***	***12.1***	***11.2***	***10.2***
	% from total	**3.8**	**24.4**	**10.9**	**14.3**	**11.9**
	% toward control variant	**100 (wt.)**	**480**	**484**	**448**	**408**

soil tillage in more difficult compared to other perennial weeds control as Cirsium arvense and Agropyron repens.

The analyze of soy bean, wheat and maize crop weeding depending on soil tillage and in special on Convolvulus arvensis species percentage to weeding evidentiate the relation between this plant development an soil tillage system (table 1). Very significant appears the high gravity of this weed at the variant with disc + rotary harrow (39.1% at soy bean, 4.2% at wheat and 24.4% at corn), where because its root sucker fragmentation from the soil surface is practically stimulated its vegetative propagation. Further more, with the exception of soy bean crop, at all variants in which was used rotary harrow to prepare the germinative bed, by soil energetically mobilising at the surface and root sucker fragmentation, Convolvulus arvensis species weeding percentage has increased (even up to 484% at rotary harrow – corn crops. The Convolvulus arvensis species weeding percentage is higher at minimum tillage soil system application at corn crop (10.9-24.4% variants with minimal tillage and 3.8-6.1% at sowing variants) and wheat crop (0.9-4.2% at variants with minimal tillage system and 9-1.0% at sowing variants), and the influence of soil tillage system upon its appearance level is significantly decreased at soy bean crop where to control it was used 2 post emergent treatments with Roundup Ready (10.3-39.1% at minimal tillage systems variants and 19.2-23.1% at sowing variant). At soy-bean crop we mention a very low weeding level at harvest, of 2.3-2.9 weds /m^2 from which Convolvulus arvensis represent at average 0.3-0.6 weeds/m^2 (10.3-39.1%).

The research of weed seeds from soil at the end of a 3 years crop rotation, shows in the first place an increasing with 11% of total weed seeds numbers on 0-30 cm depth, from 22288 weed seeds /m^2 at conventional variant, to 24663 weed seeds /m^2 at disc + rotary harrow tillage system (table 2). So it can be seen that 91% from weed seeds from the minimum tillage variant are located on 0-10 cm depth, different from the variant where plough was used and where there are 71% from weed seeds. The number of Convolvulus arvensis seeds increased at minimum tillage system with about 169%, in the first 10 cm of soil where 77% of them are present.

At soy bean crop using a genetically modified variety weed control is much easier using Roundup Ready herbicide, he differences between minimum tillage variants being insignificant. In the variant worked with paraplow + rotary harrow, applying Roundup Ready herbicide 4 l/ha in two treatments (2+2) are controlled almost all weeds species and partial Convolvulus arvensis, Stachys palustris and Cirsium arvense species. To those species are destroyed

Table 3. The control of *Convolvulus arvensis* species in relation with Roundup Ready dozes on soy-bean crop (S0994RR)
Tabelul 3. Combaterea speciei *Convolvulus arvensis* în relație cu doza de erbicid Roundup Ready aplicată la cultura de soia (S0994RR)

Biological group	Untreated control variant	Roundup Ready 4 l/ha (2+2)	Roundup Ready 4.5 l/ha (2+2.5)	Roundup Ready 5 l/ha (2.5+2.5)
	No. / m^2			
Monocotyledonous	14.7	0.6	0.5	0.6
Dicotyledonous	60.4	6.2	4.0	2.1
TOTAL from which:	75.1	6.8	4.5	2.7
Convolvulus arvensis	**7.5**	**5.2**	**2.9**	**0.6**
% from total	**9.9**	**76.5**	**64.4**	**22.2**

aerial parts but through subterranean organs, root sucker and rhizomes, partial regenerate. The most resistant was proved to be Convolvulus arvensis which is capable to mantain an important percentage level to weeding, of 22.2-64.4% even at 4.5 (2+2.5) l/ha dozes and 5 (2.5+2.5) l/ha (table 3). We consider that at a strong infestation with Convolvulus arvensis, as Romanian agricol field are, the Roundup Ready necessary doze, in condition of soil minimum tillage appliance is of 4.5-5 l/ha. This way, Convolvulus arvensis weeding level is maintain under harming level and it is assured good conditions for the precursory plant for crops at which controlling this species is hard to be applied.

CONCLUSIONS

By applying minimum tillage soil systems it is stimulated the vegetative propagation of Convolvulus arvensis species. Its percentage level to weeding is what the highest at variant worked with disc + rotary harrow, with 39.1% at soy-bean, 4.2% at wheat and 24.4% at corn. At plough variant the percentage level of Convolvulus arvensis species is decreased at 19.2% at soy-bean, 0.9% at wheat and 3.8% at maize. At soy-bean crop weeding level is very low at all the variant experienced, 2.3-2.9 wed/m^2 from which Convolvulus arvensis represent 10.3-39.1%.

After three years of minimum soil tillage system with disc + rotary harrow it can be noticed an 11% increase of weed seeds reserve on 0-30 cm depth. In the first 10 cm of soil are found 91% of weed seeds determined at disc + rotary harrow variant and 71% in the case of the variant worked with plough + disc 2x. The number of Convolvulus arvensis seeds increased at minimum soil tillage system with about 169%, in the first 10 cm f soil being found 77% of these.

At soy bean crop, with the help of genetically modified varieties which are resistant to Roundup Ready herbicide it is assured an efficient Convolvulus arvensis control measure. The recommended doze to maintain weeding level under harming level and in the same time to reduce the potential for Convolvulus arvensis rhizomes regeneration is 4.5-5 l/ha Roundup Ready.

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