IMPACT OF WEED CONTROL ON POTATO INFESTATION AND YIELD

VPLYV REGULÁCIE BURÍN NA ZABURINENOST ZEMIAKOV A ICH ÚRODU

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Abstract: *Weed control is one of the most important factors for a successful crop production and therefore the prevention of weed–crop competition at an early stage plays a very important role. From the beginning of the growing season until a plant height of 25–30 cm potato is very susceptible to weed infestation.Results of the three–year herbicide efficacy investigation Dual 960EC + Prometrin SC 500; Basagran 600 SL + Prometrin SC 500 and Sencor WP 70 + Fusilade super combined with mechanical weed control on the potato yield have presented. Investigated herbicide combinations have influenced weed species and number decrease. Regarding control plot without herbicide application, all investigated combinations have shown significant increase of potato yield. The highest average yields in three years period have achieved by the combination Sencor WP 70 0.8 kg ha^{-1} + Fusilade super 2.5 l ha^{-1} (28.2 t ha^{-1}), that represented significant increase regarding most of the investigated variants.Statistical significance of herbicide efficacy and investigated year interaction have affected by the different effects of applied herbicide combination on potato yield, depending various meteorological conditions.*

Rezime: *U usevu krompira korovi se javljaju kao stalna komponenta biocenoze i u manjem ili većem stepenu dovode do smanjenja prinosa. radu su prikazani trogodišnji rezultati ispitivanja efikasnosti nekih herbicida u suzbijanju korova u usevu krompira: Dual 960EC + Prometrin SC 500; Basagran 600 SL + Prometrin SC 500; Sencor WP 70 + Fusilade super u kombinaciji sa mehaničkim merama nege.Ispitivane kombinacije herbicida delovale su na smanjenje broja vrsta i jedinki korova po jedinici površine. U odnosu na kontrolnu varijantu bez primene herbicida sve ispitivane kombinacije ispoljile su statistički značajno povećanje prinosa krompira. Najveći prosečni prinos za trogodišnji period ostvaren je na varijanti primene herbicida Sencor WP 70 0.8 kg ha^{-1} + Fusilade super 2.5 l ha^{-1} (28.2 t ha^{-1}) što je u odnosu na većinu varijanti u ispitivanju signifikantno povećanje. Statistička opravdanost interakcije: efikasnost herbicida x godina uslovljena je različitim delovanjem primenjenih kombinacija na zakorovljenost i prinos krompira u zavisnosti od meteoroloških uslova.*

Key words: *weeds, herbicides, potato, yield.*
Ključne reči: *korovi, herbicidi, krompir, prinos.*

INTRODUCTION

Weed control is one of the most important factors for a successful crop production and therefore the prevention of weed–crop competition at an early stage plays a very important role. From the beginning of the growing season until a plant height of 25–30 cm potato is very susceptible to weed infestation.

Characteristics for the weed populations of potato field in Serbia are annual weeds like for example: *Amaranthus* spp., *Chenopodium album*, *Echinochloa crus–galli*, *Stellaria* spp., *Ambrosia artemisiifolia* L. and many other weeds (JANJIĆ ET AL., 2006). From among perennial plants *Cirsium arvense* L. Scop. and *Convolvulus arvensis* L. can cause problems (MIŠOVIĆ et al., 1996). Weed control in potatoes is critical to maximize yield and tuber quality (ROBINSON et al., 1996). While effective weed control is important, herbicide injury can reduce

potato yield and quality. Numerous authors observed a favourable impact of herbicides on the potato tuber yields as a result of eliminating weed competition (JAISWAL AND LAL., 1996; ACKLEY et al., 1996; EBERLEIN et al., 1997; JANJIĆ et al., 2006).

The present research aimed at defining the impact of mechanical treatment combined with herbicide application on the number and species composition of weeds and the yielding of two cultivars of potato.

MATERIAL AND METHODS

The 2004–2006 experiment was conducted in the experimental field of the Agricultural Experiment Station of the Guča on pseudogley soil type of pH 5.1 and low contents available phosphorus and potassium. The experiment was set in a randomised sub–block design in three replications and included, as follows:

- Factor A: Weed control methods;
- Factor B: Potato cultivars: *Desiree* and *Liseta*;

Potato weed control methods employed:

1. Mechanical weed control;
2. Mechanical weed control + Dual 960EC 1.5 l ha^{-1} + Prometrin SC 500 1.0 l ha^{-1};
3. Basagran 600 SL 3 l ha^{-1} + Prometrin 500 SC 1.0 l ha^{-1};
4. Sencor WP 70 0.8 kg ha^{-1} + Fusilade super 2.5 l ha^{-1};

Cereals (winter triticale) acted as a potato fore crop. Each year, organic fertilization has been used with manure (30 t ha^{-1}) and mineral one in the following quantities: 100 kg N, 100 kg P_2O_5 and 150 kg K_2O per 1 ha. Phosphorus and potassium fertilizers were fed with in autumn and nitrogen fertilisers in spring. Potatoes were planted in the third decade of April at the furrow spacing of 70 cm and a 35–cm distance in furrow. Weed infestation was determined with the square frame and gravimetric method defining the number of weeds and species composition. The results obtained were analysed statistically and the significance of the differences obtained was verified with the Tukey test (MEAD et al., 1996).

RESULTS AND DISCUSSION

Weed infestation

Weed infestation determined prior to potato plant showed a total of 17 species, including 15 dicotyledonous (Table 1).

The monocotyledonous weeds were represented by 2 species only, yet they were observed only in big numbers in the treatment with Mechanical weed control + Dual 960 EC + Prometrin SC 500 (7.2 items/sq. m amounting for 75.0%) and with the combination of Basagran 600 SL + Prometrin 500 SC (3.7 items/sq. m accounting for 57%). The species most represented were *Chenopodium album, Polygonum convolvulus, Stellaria media* and *Raphanus raphanistrum* which amounted to, on average, 75% of the total weed number per 1 sq. m. Analysing the impact of weed control methods on the number of weeds, it was noted that the highest percentage of plant damage was obtained for the treatment exposed to mechanical and chemical control with the Sencor WP 70 + Fusilade super–variant 4.

There were also observed significant differences in weed infestation of the cultivars researched (tab. 2). A considerably fewer dicotyledonous species were found in the fields with "*Desiree*" than with"*Liseta*".

Potato yield

Weed control methods showed a significant impact on yielding of potato cultivars (Table 3).

Table 1.

Impact of potato weed control methods on the number and species composition of weeds per sq.m (mean for cultivars and the years 2004–2006)

Weed species	Mechanical weed control	Mechanical weed ontrol + Dual 960 EC 1.5 ha^{-1} + Prometrin SC 500 1.0 l ha^{-1}	Basagran 600 SL 3 l ha^{-1} + rometrin SC 500 1.0 l ha^{-1}	Sencor WP 70 0.8 kg ha^{-1} + Fusilade super 2.5 l ha^{-1}	Mean	Percentage of species (%)
Elymus repens	0.9	4.2	2.5	1.2	2.2	16.8
Echinochloa crus-galli	1.2	3.0	1.2	0.1	1.4	10.7
Total of monocotyledon.	2.1	7.2	3.7	1.3	3.6	27.5
Chenopodium album	17.1	1.5	1.5	2.0	5.5	42.0
Polygonum convolvulus	2.5	0.1	0.1	0.3	0.8	6.1
Polygonum nodosum	1.0	0.1	0.2	0.1	0.4	3.1
Stellaria media	1.7	0.1	0.1	0.5	0.6	4.6
Raphanus raphanistrum	1.5	0.2	0.1	0.7	0.6	4.6
Capsella bursa–pastoris	1.0	–	0.1	0.1	0.3	2.3
Viola arvensis	0.7	0.1	0.2	0.1	0.3	2.3
Matricaria inodora	0.5	0.1	0.1	0.2	0.2	1.5
Galeopsis tetrahit	0.8	0.1	0.3	0.2	0.4	3.1
Total of dicotyledonous	26.8	2.3	2.7	4.2	9.0	69.6
Other species (12–17)	1.5	0.1	0.1	0.3	0.5	3.8
Total number of weeds	30.4	9.6	6.5	5.8	13.1	–

$LSD_{0,05}$ FOR METHODS OF WEED CONTROL: FOR THE MONOCOTYLEDONOUS: 1.9
FOR THE DICOTYLEDONOUS: 3.6

Table 2.

Number and weed species composition per sq. m, depending on weed control methods and cultivars (mean for 2004–2006)

Weed control method	Monocotyledonous			Dicotyledonous		
	Desiree	Liseta	Mean	Desiree	Liseta	Mean
Mechanical weed control	1.2	1.6	1.4	19.8	20.6	20.2
Mechanical weed control + Dual 960EC 1.5 l ha^{-1} + Prometrin SC 500 1.0 l ha^{-1}	11.8	13.2	12.5	1.8	4.4	3.1
Basagran 600 SL 3 l ha^{-1} + Prometrin SC 500 1.0 l ha^{-1}	9.0	10.2	9.6	2.1	4.5	3.3
Sencor WP 70 0.8 kg ha^{-1} + Fusilade super 2.5 l ha^{-1}	1.2	1.4	1.3	5.1	4.3	4.7
Mean	5.8	6.6	–	7.2	8.5	–

$LSD_{0,05}$ FOR WEED CONTROL METHODS: 1.9 3.6
FOR CULTIVARS: 2.2 1.8

Table 3.

Impact of weed control methods on yield, mean tuber weight and number of tubers per plant of potato cultivars (mean for 2004–2006)

Weed control method	Cultivar	Mean weight of tuber (g)	No of tubers per plant	Yield of tubers	
				t ha^{-1}	%
Mechanical weed control	Desiree	76.0	11.2	20.1	100.0
	Liseta	68.5	10.0	18.5	100.0
	Mean	–	–	19.3	100.0
Mechanical weed control + Dual 960EC 1.5 l ha^{-1} + Prometrin SC 500 1.0 l ha^{-1}	Desiree	85.3	11.8	23.5	116.9
	Liseta	70.5	10.3	21.1	114.1
	Mean	–	–	22.3	115.5
Basagran 600 SL 3 l ha^{-1} + Prometrin SC 500 1.0 l ha^{-1}	Desiree	98.6	11.9	25.4	126.4
	Liseta	85.3	11.2	23.8	128.7
	Mean	–	–	24.6	127.5
Sencor WP 70 0.8 kg ha^{-1} + Fusilade super 2.5 l ha^{-1}	Desiree	117.1	12.5	29.3	145.8
	Liseta	93.5	10.6	27.1	146.5
	Mean	–	–	28.2	146.1
Mean	Desiree	94.3	11.9	24.6	–
	Liseta	79.5	10.5	22.6	–

$LSD_{0,05}$
FOR WEED CONTROL METHODS: 0.9 – 0.9
FOR CULTIVARS: 1.1 1.0 1.1
FOR INTERACTION OF WEED CONTROL METHODS X CULTIVARS 0.7 – 0.7

The plots treated with herbicides gave an increase in tuber yield as compared with the variant exposed to mechanical control by an average ranging from 3.0 to 8.9 t ha^{-1} (by 15.5%–46.1%). The highest yields were obtained from the treatment weed–infested due to chemical treatment applied with Sencor WP 70 + Fusilade super. Mean potato tuber yield increases ranged, depending on the cultivar, from 8.6 to 9.2 t ha^{-1}. The highest mean tuber weight and the greatest number of tubers per one plant were obtained from the treatment 4 with the lowest weed–infestation. The values defined for the cultivars researched differed significantly. "*Desiree*" produced more robust tubers than "*Liseta*" similarly the number of tubers per 1 plant was higher.

MIŠOVIĆ et al. (1996) observed that the potato in its initial vegetation period is not a highly competitive crop to weeds and requires a continuous weed control. Mechanical and chemical weed control reducing weed infestation, affected potato tuber yields considerably. Out of all the weed control methods researched, the mechanical and chemical method, the Sencor WP 70 and Fusilade super, showed most effective. Similar results on weed control with herbicides were reported by CEGLAREK AND KSIĘŻAK (1992); ACKLEY et al. (1996); EBERLEIN et al. (1997); ZARESKA (1997); JANJIĆ et al. (2006). The present results also show significant differences in the weed infestation of the cultivars investigated. Both at the beginning of the vegetation period, higher infestation was observed in the plots with „*Liseta*"which has fewer leaves –than „*Desiree*". The present research showed a correlation between the weed control methods and the conditions in research years.

CONCLUSIONS

In the potato crops, weeds appear as a constant component of biocenosis and, in small or great degree, they lead to the decrease of return.

Weed infestation determined prior to potato plant showed a total of 17 species, including 15 dicotyledonous. The greatest weed control effectiveness was observed for the mechanical and chemical method with the application of Sencor WP 70 + Fusilade super, which reduced the number of weeds, as compared with the number obtained for mechanical control. Potato weed control with herbicides gave a higher tuber yield than the yield obtained with the mechanical method by an average of 15.5–46.1%. Statistical significance of herbicide efficacy and investigated year interaction have affected by the different effects of applied herbicide combination on potato yield, depending various meteorological conditions.

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