WEED CONTROL OF SUGAR BEET IN INTEGRATED FARMING SYSTEM

INTEGROVANÁ REGULÁCIA ZABURINENOSTI V PORASTOCH REPY CUKROVEJ

JOZEF SMATANA*, M. MACÁK*, E.DEMJANOVÁ*, I. DJALOVIĆ**

**Slovak University of Agriculture in Nitra, Faculty of Agrobiology and Food Resources, Nitra, Slovak Republic*
*** University in Kragujevac, Faculty of Agronomy, Čačak, Serbia*

Corresponding author: Milan Macák, e-mail:milan.macak@uniag.sk

Abstract: *A three year field study (2004-2006) was conducted in south-western Slovakia to investigate the effect of herbicides control on weed density, diversity and herbicide efficiency in sugar beet fields. An actual weed infestation was evaluated before herbicides application and 3-4 week after application of herbicides with concordance to International scales of EWRS. Screening of each field was made on the quadrant of 1 m^2 area with four replications. Weed diversity varied from 19 to 23 species each year of evaluation. On the base of three years field assessment we can conclude: The evaluated herbicides control is very effective strategy for weed control in sugar beet. After herbicides control the significant changes in weed flora were noted in term of abundance and share of some weed species on total weed community. After herbicide control Polygonum spp., Chenopodium spp. and Echinochloa crus-galli remained the dominant weed species in canopy of sugar beet. In late summer and autumn Amaranthus retroflexus, Cirsium arvense and Atriplex spp. also rise as a problem weeds.*

Rezumat: *V trojročných poľných pokusoch (2004-2006) v regióne juhozápadného Slovenska sme sledovali vplyv aplikácie herbicídov na početnosť, druhové zloženie a efektivitu účinnosti herbicídov v porastoch repy cukrovej. Aktuálna zaburinenosť bola hodnotená pred aplikáciou a 3-4 týždne po aplikácii herbicídov podľa EWRS. Hodnotenie bolo robené na snímke 1 m^2 v štyroch opakovaniach Diverzita burín bola v rozpätí od 19 do 23 druhov. Na základe trojročných výsledkov sme urobili nasledovné závery: hodnotená skladba herbicídov zabezpečila efektívnu reguláciu zaburinenosti repy cukrovej. Po aplikácii herbicídov boli zistené preukazné zmeny burinového spoločenstva v početnosti burín a v zmene podielov burín na celkovom zložení spoločenstva. Polygonum spp., Chenopodium spp. a Echinochloa crus-galli zostali dominantnými burinovými druhmi aj po aplikácii herbicídov v poraste repy cukrovej. V neskoršom lete a na jeseň Amaranthus retroflexus, Cirsium arvense a Atriplex spp. sa prejavili ako problémové buriny.*

Key words: *sugar beet, weed density, diversity, herbicides control*
Cuvinte cheie: *repa cukrová, početnosť burín, diverzita, herbicídna regulácia zaburinenosti*

INTRODUCTION

Sugar beet is important crop in arable industry. Research worker everywhere are attempting to improve sustainability of beet growing, minimize any threat posed to the environment (DRAYCOTT, 2006). Sugar beet has much more specific production then the other cultivated plants (MARINKOVIĆ, 2007). Top sugar beet yields require effective weed control.The weed control in canopy of sugar beet is getting more difficult in Slovak agri-environmental conditions. The main objective of the researches is to improve the cost-effectiveness of weed control in sugar beet whilst enhancing the environmental benefits that can accrue from weed control practices (ŠIMURKOVÁ, 2002; URBAN, 2006). The sugar beet as a row crop creates condition for development of weed population mainly *Chenopodium* spp., *Atriplex* spp., *Persicaria* spp. and other vigorous and height stature weeds (SMATANA et al.,

2006). HUNKOVÁ (2006a) presented *Cirsium arvense* as the most harmful weed in sugar beet stands (at the experimental farm in Kolíňany), with low biodiversity (3.32 species per square meter in average).

The aim of this work was to evaluate the spray strategy of sugar beet weed control on experimental farm Kolíňany.

MATERIALS AND METHOD

The field trial was conducted at the experimental farm Kolíňany (south-west Slovakia) in 2004-2006. Experimental farm is situated in warm and moderate arid climatic region with altitude of field from 180 to 310 m. The average annual rainfall is 539.0 mm. The average annual rainfall during the growing season is 320.3 mm. The mean annual temperature is 10.2˚C. The mean temperature during growing season is 16.3˚C. The soil is Orthic Luvisol with loamy texture. Sugar beet was growing on one or two large scale field range from 30 to 50 ha. An actual weed infestation was evaluated before application of herbicides and 3-4 week after application of herbicides with concordance to International scales of EWRS (Anonymous, 1988). Screening of each field was made on the quadrant of 1 m^2 area with four replications. One quadrant on each replication (0.7m by 1.5m) covers rows and inter-rows cultivation. The four randomly established sample quadrants were situated minimally 20 m from field margin and apart each other, respectively. The forecrop of sugar beet were cereals. After harvest of forecrop (winter wheat, spring barley) stubble cleaning followed by mouldboard ploughing and standard mechanical weed control have been used. Chemical weed control was used in three applications term T1-T3 as follows:

T1 and T2 applications: Betanal Expert (1 L ha^{-1}, desmedipham 71 g L^{-1}, phenmedipham 91 g L^{-1}, ethofumesate 112 g L^{-1}) and Safari 50 WG (30 g ha^{-1}, triflusulfuron-methyl 500g kg^{-1}) and Lontrel 300 (0.2 L ha^{-1}, clopyralid 300 g L^{-1}); T3 application- Betanal Expert (1.5 L ha^{-1}) and Safari 50 WG (30 g ha^{-1} a.i.) and Lontrel 300 (0.3 L ha^{-1}) and Gallant Super (0.6 L ha^{-1}, haloxyfop-methyl 108 g L^{-1}).

The level of infestation was evaluated according to average density of weeds per square meter (table 1).

Table 1

Evaluation scale of actual weed infestation for excessively dangerous and less dangerous weeds

Weed group	Actual weed infestation				
	none	weak	low	medium	heavy
	infestation level				
	0	1	2	3	4
	number of weeds per m^2				
Excessively dangerous	-	≤ 2	3-5	6-15	≥ 16
Less dangerous	-	≤ 4	5-8	9-20	≥ 21

The efficacy of herbicides was assessed according changes of weed population before and after herbicides application.

Present study assessed the actual weed infestation of dominant weed species in canopy of sugar beet in 2004-2006.

RESULTS AND DISCUSSION

The assessment of weed control strategy, weed population density, diversity and changes in weed flora in canopy of sugar beet are documented in table 2. Weed diversity varied from 19-23 species each year of evaluation. Tyšer and Nováková (2006) quoted that worse environmental conditions decreased the total number of weed species, mainly the number of thermophilous late spring annual weeds. In evaluated fields weather conditions and herbicides control were dominant factors influencing the weed community of experimental site.

Table 2

The weed infestation of prevalent weed species in canopy of sugar beet in 2004-2006 (number of weed pieces per square meter)

Weed species	2004		2005		2006		Average 2004-2006	
	N	H	N		H	N	N	H
1 *Persicaria* spp.	24	1.5	30	3.0	28	2.5	27.3	2.3
2 *Chenopodium* spp.	26	1.0	9	2.0	21	2.5	18.7	1.8
3 *Amaranthus retroflexus*	12	1.5	2	0.5	5	1.0	6.3	1.0
4 *Echinochloa crus-galli*	14	0.5	15	3.0	23	1.0	17.3	1.5
5 *Cirsium arvense*	6	0.5	9	1.0	12	0.5	9.0	0.7
6 *Tripleurospermum inodorum*	6	0.5	5	1.0	2	0.1	4.3	0.5
7 *Galium aparine*	4	0.1	4	0.3	1	0.1	3.0	0.2
8 *Atriplex* spp.	7	0.5	5	1.0	6	1.0	6.0	0.8
9 *Avena fatua*	8	0.2	1	0.7	1	0.1	3.3	0.3
10 *Polygonum aviculare*	3	0.3	5	1.5	7	0.5	5.0	0.8

N- before application of herbicides, H- 3-4 week after herbicides application

The efficiency of herbicides control is evaluated on the base of two evaluation term before and after post emergency application. Heavy infestation of *Persicaria* spp., *Chenopodium* spp. and *Echinochloa crus-galli* and medium infestation of perennial weed *Cirsium arvense* and late spring annual weeds *Amaranthus retroflexus* and *Atriplex* spp. was noted. After herbicides control the significant changes in weed flora were noted in term of abundance and share of some weed species on total weed community. In spite of low abundance of *Polygonum aviculare* in herbicides free field it becomes the important part of weed community after herbicides application in. Significant and very strong eradication of weeds is very clear documented in table 2. In both evaluations terms with herbicides free field and after herbicide application *Persicaria* spp., *Chenopodium* spp. and *Echinochloa crus-galli* remained the dominant weed species in canopy of sugar beet. In late summer and autumn *Amaranthus retroflexus*, *Cirsium arvense* and *Atriplex* spp. also rise as a problem weeds. Similarly Tóth (2004) stated *Echinochloa crus-galli*, *Amaranthus* spp, *Chenopodium* spp., *Cirsium arvense* and *Persicaria* spp. as the most abundant weed species in sugar beet fields. According Hunková (2006b) the dominant weed species in sugar beet fields in experimental farm Kolíňany were *Cirsium arvense*, *Helianthus annuus* – volunteer crop, *Persicaria lapathifolia*, *Amaranthus retroflexus*, *Chenopodium album* and *Avena fatua.* The pesticides weed control strategy very effectively decreased the weed population in sugar beet field. Safari with effect to leaves and roots of difficult control weeds was effective also in dry wetter.

CONCLUSIONS

On the base of three years field assessment we can conclude:

The evaluated herbicides control is very effective strategy for weed control in sugar beet.

After herbicides control the significant changes in weed flora were noted in term of abundance and share of some wed species on total weed community.

Polygonum spp., *Chenopodium* spp. and *Echinochloa crus-galli* remained the dominant weed species in canopy of sugar beet.

In late summer and autumn *Amaranthus retroflexus*, *Cirsium arvense* and *Atriplex* spp. also rise as a problem weeds.

ACKNOWLEDGEMENT

The paper has been supported by VEGA Project 1/4441/07 "Ecologization of Agricultural Practices and the Environmental Function of Agriculture on the Intensive Farmland".

LITERATURE

1. ANONYMOUS, *Guidance for the use and presentation of statistics in weed researching*. Weed Research, 1988, 28, pg. 139-144.
2. DRAYCOTT, A.P. *Sugar Beet*. Blackwell Publishing, 2006. 474 pg.
3. HUNKOVÁ, E., *Diverzita burín na demonštračnej báze SPU v Nitre – Kolíňanoch (Weed Diversity on Experimental Station SAU in Nitra – Kolíňany)*. In: Aktuálne problémy riešené v agrokomplexe, CD ROM. Nitra, VES SPU v Nitre, 2006 a, ISBN 80-8069-799-X, pg. 17-24.
4. HUNKOVÁ, E., *Burinová flóra v porastoch repy cukrovej v podmienkach rôzneho hnojenia (Weed Flora in Sugar Beet Stands under Various Fertilisation Conditions)*. In: Aktuálne problémy riešené v agrokomplexe, CD ROM. Nitra, VES SPU v Nitre, 2006 b, ISBN 80-8069-799-X, pg. 25-28.
5. MARINKOVIĆ, B., CRNOBARAĆ, J., JAĆIMOVIĆ, G., LATKOVIĆ, D., MRDA, J., HABÁN, M., *Effect of fertilizing systems on sugar beet yield and quality.* Scientifical papers agriculture XXXIX, Part I, Timişoara, Agroprint, 2007, pg. 3-6.
6. SMATANA, J., MACÁK, M., DEMJANOVÁ, E., *Aktuálna zaburinenosť v porastoch repy cukrovej na VVP v Kolíňanoch.* International scientific seminar, Nitra, Slovenská poľnohospodárska univerzita, 2006, ISBN 80-8069-799-X, pg. 202-206.
7. ŠIMURKOVÁ, J., *Najdôležitejšie problémy s burinami v porastoch repy cukrovej*, Naše pole, 7/2003, pg.17.
8. TÓTH, Š., *Cukrová repa versus buriny*. Listy cukrovarnické a řepařské, 4/2004, pg. 130-131.
9. TYŠER, L., NOVÁKOVÁ, K., *Weed vegetation of agrophytocenoses in selected regions of the Czech Republic*. Herbologia, 2/2006, pg. 9-19.
10. URBAN, J., PULKRÁBEK, J., BEČKOVÁ, L., *Vliv nižších dávek herbicidů s jejich častejší aplikací na výnos a kvalitu cukrovky*. Listy cukrovarnické a řepařské, 4/2006, pg. 122-125.