THE MOST HARMFUL WEED SPECIES OF CANOPY OF MAIZE IN MARGINAL GROWING REGIONS OF SLOVAKIA

NAJNEBEZPEČNEJŠIE BURINY V PORASTOCH KUKURICE PESTOVANEJ V MARGINÁLNYCH OBLASTIACH SLOVENSKA

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Abstract. *The results of the weed survey on arable land conducted in 1997-2005 in the Slovak Republic were applied to asses the distribution and occurrence of weed species with respect to their importance and harmfulness in maize fields situated in marginal production region. Four infestation levels from weak to heavy were used. One or two maize field on each 16 pilot farms situated in selected region according crop rotation and tillage and weed management has been evaluated. The most troublesome weeds were established late emerging spring weeds Atriplex spp. and Chenopodium spp. in sugar beet production region. Amaranthus retroflexus L., Atriplex spp., Chenopodium spp. dominated also in maize field in potato production region. The results are discussed in relation to harmfulness between production regions.*

Abstrakt*. Výsledky prieskumu zaburinenosti na ornej pôde uskutočnené v rokoch 1997-2005 na Slovensku boli použité na ohodnotenie výskytu a významu burin vo vzťahu k ich škodlivosti. Boli hodnotená zaburinenosť porastov kukurice pestovanej v repnej a zemikovej výrobnej oblasti. Boli využité 4 stupne hodnotenia na 16 vybraných podnikoch. Polia boli vybrané na základe osevných postupov, obrábania pôdy a manažmentu kontroly zaburinenosti. Najvážnejšie buriny v poraste kukurice boli zo skupiny jarné neskoré Atriplex spp., Chenopodium spp. v repnej výrobnej oblasti a Amaranthus retroflexus L., Atriplex spp., Chenopodium spp. taktiež v zemiakovej výrobnej oblasti. Diskusia sa dotýka škodlivosti hodnotených burín.*

Key words*: weed density, weed diversity, maize*
Cuvinte cheie: *diverzita burín, pokryvnosť burín, kukurica*

INTRODUCTION

The competitive threshold of weeds has been defined as the weed density above which crop yield is reduced beyond an acceptable amount. Weed surveys are useful for determining the occurrence and relative importance of weed species in crop production systems (Frick and Tomas, 1992). Determination of important weed species can help to establish priorities and strategies of weed control in maize field. The data about weed density and time of emergence are also use to predict loss of yields (Cousens et al., 1987). In agrophytocenosis, the environmental driving factors considered include not only soil and ambient temperature and humidity but also soil properties (Walter et al., 2002), management practices and crop rotation (Týr and Bartošová, 2006). At the regional level, weed diversity has been related to various factors such as area, altitude, productivity, landscape heterogeneity, successional status and disturbance (Swift and Anderson, 1994; Pyšek et al. 2005). These factors do not act separately but are to some extent mutually correlated, which makes it difficult to assess the role each plays in determining species richness (Pyšek et al., 2002).

The aim of the study was to find out the distribution and occurrence of weed species with respect to their importance and harmfulness in maize fields situated in sugar beat and potato production region of the Slovak Republic.

MATERIAL AND METHOD

The assessment of the most dangerous weed species in canopy of maize was conducted in frame of monitoring research conducted in Slovakia during 1997-2005. The large scale field of maize range from 30 to 70 ha. The fields of pilot farms were selected in sugar beat and potato growing region. One or two specific fields were selected in 6 farms in sugar beat production region and 10 farms in potato production region. Farms were selected with relation to crop rotation and tillage management. Common chemical weed control practices were used. Present study assessed the actual weed infestation of 4 the most dangerous weed species in canopy of maize in latest year of weed survey. The maize growing in monoculture is not included in present study.

An actual weed infestation was evaluated before 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 fields with same history were selected. After harvest of winter crops (winter wheat, winter barley, triticale, rye and winter rape) stubble cleaning followed by mouldboard ploughing and standard mechanical and chemical weed control have been used. 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

Group of weeds	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 received data from pilot farms were computed to whole area of growing crop in sugar beat and potato production region on the base of acreage of evaluated fields and share of maize in structure of growing crops and acreage of maize in particular production region. In 2005 the acreage of maize growing in sugar beat production region was 10 378 ha and in potato production region 3622 ha. For characteristic of production region see table 2.

Table 2

Characteristic of evaluated production region of the Slovak Republic

Characteristics	Sugar beat production region	Potato production region
Share of total arable land	16.2 %	18.9 %
Altitude	up to 350 m	350-500mnm
Average year temperature	8-9°C	6.5-8°C
Average year precipitation	550-650mm	700-800mm

The data of *Echinochloa crus-galli* (L.) P. BEAUV. and *Chenopodium* spp. (as *Chenopodium album* L., *Ch. hybridum* L., *Ch. polyspermum* L., *Ch. strictum* ROTH), *Amaranthus* spp. (*Amaranthus retroflexus* L., *Amaranthus powellii* S. Watson) and *Atriplex* spp. (*Atriplex patula* L., *Atriplex acuminata* WALDST. Et KIT.) were computed as a separate group and expressed in tables for two production region.

RESULTS AND DISCUSSIONS

In sugar beat growing region the 100% occurrence of *Echinochloa crus-galli* (L.) P.B., *Amaranthus* spp, *Atriplex* spp. and *Chenopodium* spp. were examined and one third of maize fields were heavy infested in 3rd level of infestation by these weeds. The less biodiversity of weed population in canopy of maize field was found out in sugar beat production region (10 species including pooled data).

In potato production region weed diversity of maize field was relatively high - 17 species including pooled data. The most troublesome weeds in maize field were *Amaranthus* spp., *Atriplex* spp., *Chenopodium* spp. and *Cirsium arvense*.

Colder (6.5-8°C) and partially more humid conditions (700-800 mm) on potato growing region are the relevant factors influenced the variability of weed flora composition in canopy of maize. Species composition differs according to production region (Tóth, 2006). 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.

Table 3

The actual weed infestation of maize field in sugar beat and potato production regions

Species	Infestation level									
	0		1		2		3		4	
	1000 ha	%	1000 ha	%	1000 ha	%	1000 ha	%	1000 ha	%
	sugar beat production region									
Echinochloa crus-galli	0.0	0.0	3.8	36.4	3.8	**36.4**	2.8	**27.3**	0.0	0.0
Amaranthus spp.	0.0	0.0	4.4	42.4	3.1	**30.3**	2.8	**27.3**	0.0	0.0
Atriplex spp.	0.0	0.0	3.8	36.4	3.5	**33.3**	3.1	**30.3**	0.0	0.0
Chenopodium spp	0.0	0.0	3.8	36.4	3.5	**33.3**	3.1	**30.3**	0.0	0.0
potato production region										
Echinochloa crus-galli	1.3	35.1	0.9	24.4	1.3	**34.9**	0.0	**0.0**	0.2	5.6
Amaranthus spp.	1.1	30.0	0.4	10.0	0.0	**0.3**	1.9	**51.7**	0.3	7.9
Atriplex spp.	0.4	11.3	0.7	18.2	1.1	**30.3**	1.1	**29.4**	0.4	10.8
Chenopodium spp.	0.4	11.3	0.7	18.2	1.1	**30.3**	1.1	**29.4**	0.4	10.8

On the base of analysed data from evaluated production regions (Table 3) the most spread and harmful weeds are *Echinochloa crus-galli*, *Amaranthus* spp., *Atriplex* spp., *Chenopodium* spp., *Cirsium arvense* weedy more than 60–100%% of maize fields in all production regions. *E. crus-galli*., *Amaranthus retroflexus* L. and Amaranthus *powellii* S. Watson are recorded as the most important and expanding weeds on arable land also in Czech Republic (Kneifelová, Mikulka, 2003). Harmfulness of this late spring emerging group of weeds, expressed as share of heavy infested fields, seriously overcome threshold of economic loses mainly in 3rd- 4th, grade. Barnyard grass (*E. crus-galli* (L.) BEAV.) density of 200 plants m^{-1} reduced maize yield in the range from 26-35% when the emergence of barnyard grass seedlings occurred between the 1- and 2-leaf stages of maize growth (Bosnic and Swanton, 1997). In our investigation Amaranthus *retroflexus* L. was prevalent in maize field situated in potato

production region. The higher occurrence of *Amaranthus powellii* S. Watson was noted in sugar beat production region.

CONCLUSIONS

The most troublesome weeds were established *Atriplex* spp. and *Chenopodium* spp. in sugar beat production region.

Amaranthus retroflexus L., *Atriplex* spp., *Chenopodium* spp. dominated also in maize field in potato production region.

Determined late emerging spring weeds are getting very important weed in row crops also in marginal maize growing region. For acceptable control the deep mouldboard ploughing and stubble cleaning practices must be maintained.

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