TEMPORAL DYNAMICS OF ACTUAL WEED INFESTATION IN SUNFLOWER CANOPIES

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Abstract: *In the years 1994 – 2009 (15 years) was conducted weed survey on the farms in conventional farming system. The aim was to detect the most harmful weeds, as important biotic, environmental stress factor, on the farms in the canopies of sunflower in mays and sugar beet production region of the Slovak Republic. The actual weed infestation was evaluated by standard methods common used by a counting method per square. The four randomly established sample quadrants were situated minimally 20 m from field margin and apart each other, respectively. In the sunflower 34 weed species were detected, the most problematic were: perennial weed Cirsium arvense, Elytrigia repens, Convolvulus arvensis, annual weeds Chenopodium spp., Echinochloa crus galli, Persicaria spp., Amaranthus spp., Abutilon theophrasti, Ambrosia artemisiifolia, and cultural crops winter wheat, winter raps. Temporal dynamics in actual weed infestation depend on production region, early crops and canopy of sunflower in the last 15 years. 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 sunflower in 1994 – 2009, presentation in graphic and statistic results. 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. Contamination of live environment in integrated agricultural system and herbicide costs lead as to idea to grow agricultural crops by using only cultural, preventive and mechanical weed regulation methods, the same as in conventional system. This claim is feasibly only in sunflower crops infested level. The originality of result is mappings weeds species.*

Key words**:** *temporal dynamics, actual weed infestation, mapping, sunflower*

INTRODUCTION

Sunflower (*Helianthus annuus* L.) is one of the most important oil crops in the world, because it offers advantages in crop rotation systems, such as high adaptation capability, suitability to mechanization and low labor needs. Plant density is one of the most important cultural practices determining grain yield, as well as other important agronomic attributes of crop. Stand density affects plant architecture and alters growth and development pattern (SEDGHI et al., 2008). Significant yield loss in oil crops is mainly due to weed competition, alelopathic effects and contamination of harvested products. Weed competition is the greatest early in the seson, because weeds have a tendency of out growing the crops if they are not controlled early in the growth period (GESIMBA and LANGAT, 2005). Weed density, type of the weeds, their persistence and crop management practices determine the magnitude of yield loss (RAIZ et al., 2006).

Weeds infestation of sunflower depend on many factor (e.g. weed seed bank, weather condition, soil cultivation, fore crop, date and quality of sowing, canopy conduction a.o.). In the canopy of sunflower can weeds germinate from early spring to early autumn. Main weed species are: *Sinapis arvensis, Raphanus raphanistrum, Fallopia convolvulus, Iva xanthiifolia, Avena fatua, Tripleurospermum perforatum, Galium aparine, Viola arvensis, Stellaria media, Lamium spp., Thlaspi arvense, Capsella bursa pastoris, Veronica spp., Chenopodium spp.,* *Atriplex spp., Amaranthus retroflexus, Echinochloa crus galli, Datura stramonium, Galinsoga parviflora, Cirsium arvense, Elytrigia repens* and *Convolvulus arvensis* (KOHOUT, 1993). Schroeder et al., 1993 presented Rank importance of the 15 most important weed species found in each crop systems in the survey areas next weed: *Echinochloa crus galli, Chenopodium album, Amaranthus retroflexus, Solanum nigrum, Setaria pumila, Convolvulus arvensis, Atriplex patula, Sonchus arvensis, Polygonum persicaria, Polygonum aviculare, Cirsium arvense, Sonchus oleraceus, Fallopia convolvulus, Capsella bursa pastoris, Sorghum halepense.*

It is essential that sunflower seed be planted into a seedbed free of growing weeds. Weed control before planting can be accomplished with tillage, herbicides, or a combination of both. If tillage is predominate weed control method, implements such as the V-blade, tandem disc, or field cultivator may be used before planting sunflower. Soil that is warm and dry on the surface, and moist below, encourages rapid sunflower development and will delay weed seed germination. In double –cropped sunflower, good weed control also must be practiced in the small grain crop first. To the flush of new weed seedlings that usually follows tillage and rainfall, few weeds germinate following use of preplant burn down herbicides, because there is no tillage to bring a new supply of weed seed into germination position near the soil surface and weed seeds lying on the surface are not buried into moist soil. In crops such as sunflower, where there are few herbicide options, alternative techniques such as the seedbed method may be utilized. Alternatives may be utilized in any situation, but they gain in importance when traditional techniques (herbicides) are not available. Another alternative to tillage for weed control in double crop sunflower is to burn the small grain stubble ahead of sunflower planting (MAYER et al., 1999).

Weed control as a crop, sunflower yields are reduced, but rarely eliminated by weeds which compete within sunflower for moisture and nutrients and occasionally for light. Sunflower is a strong competitor with weeds, especially for light, but does not cover the ground early enough to prevent weed establishment. Therefore, early season weed control is essential for good yield. Annual weeds have been the primary focus of weed control research. Perennial weeds can also present problems but are usually not specific to sunflower (PUTMAN, 2010).

A major concern in landscape management and precision agriculture is the variable-rate application of herbicides in order to reduce herbicide treatment load. These applications require a correct assessment and knowledge of the density and potential spatial variability of weed species within fields. The best prediction method for mapping most of the weed species was kriging with an external drift, with the smallest mean squared error, indicating the highest accuracy. The result showed that kriging with an external drift with elevation reduced the prediction variance compared with ordinary kriging (JURADO-EXPOSITO et al., 2009).

MATERIAL AND METHODS

The assessment of the five most dangerous weed species and their dynamic in canopy of sunflower was conducted at the Slovakia in 1994 - 2009. The fields of farm were selected in maize production region and sugar beet production region. Common chemical weed practices were used. Present study assessed the actual weed infestation of weed species in canopy of sunflower and their dynamic during the years 1994 - 2009.

An actual weed infestation was evaluated before application of herbicides with concordance to modified international scale. Screening of each field was made on the quadrant of 1 m^2 area with four replications. One quadrant on each replication (0.7 m by 1.5 m) 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. 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). Received data from farm were computed to whole area of growing crop and statistically analyses.

Table 1

Evaluation scale of actual weed infestation

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
Less important	-	≤ 8	9-15	16-30	≥ 31

* - weed species checklist Hron-Vodák, 1959, modified by authors

Table 2

Characteristic of evaluated production region of the Slovak Republic

Characteristics	Maize production region (MPR)	Sugar beat production region (SBPR)
Share of total arable land	50,7 %	16.2 %
Altitude	up to 250 m	up to 350 m
Average year temperature	Above 9°C	8-9°C
Average year precipitation	Below 600mm	550-650mm

RESULTS AND DISCUSSIONS

On the base of analyses data from evaluated production regions (Table 2) the most spread and harmful weeds were: *Ambrosia artemisiifolia, Mercurialis annua, Conium maculatum, Datura stramonium, Viola* spp., *Persicaria* spp., *Sinapis arvensis, Hibiscus trionum, Iva xanthiifolia, Echinochloa crus galli, Capsella bursa pastoris, Brasica napus, Synphytum officinale, Amaranthus* spp., *Galium aparine, Atriplex* spp., *Setaria* spp., *Chenopodium* spp., *Avena fatua, Tripleurospermum perforatum, Thlaspi arvense, Cirsium arvense, Abutilon theophrasti, Fallopia convolvulus, Equisetum arvense, Panicum mileaceum, Convolvulus arvensis, Elytrigia repens, Raphanus raphanistrum, Anthemis* spp., *Polygonum aviculare, Xanthium strumarium.* The weed infestation of sunflower in maize and sugar beet production region of Slovak Republic during 1994-2009 is documented on figures 1-22. Only four weed species in sunflower canopy have significantly increasing tendency in the last 15 years.

Weed communities become more diverse in cropping systems, thus minimalizing the predominance of any one weed (MACÁK, 2005) and long term research is required to fully understand weed community dynamics and this research will continue.

Long term survey relevated the tendency of the 34 species in canopy of sunflower under cease of cropping intensity.

Increasing tendency of infestation was noted by *Iva xanthiifolia, Abutilon theophrasti, Atriplex spp., Cirsium arvense, Datura stramonium, and Chenopodium spp.*: Decreasing tendency has *Echinochloa crus galli, Elytrigia repens, Convolvulus arvensis, Amaranthus spp., and Xanthium strumarium.* Weed species like *Fallopia convolvulus* and *Polygonum aviculare, Persicaria maculosa* and *Persicaria lapathifolia* occurred only at the last years of weed survey.

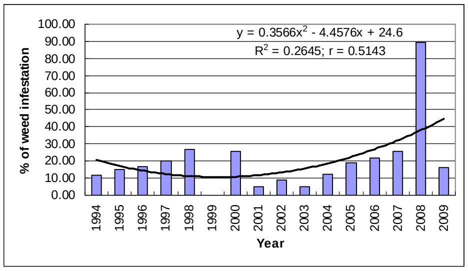

Fig. 1: *Iva xanthiifolia* in maize production region (MPR)

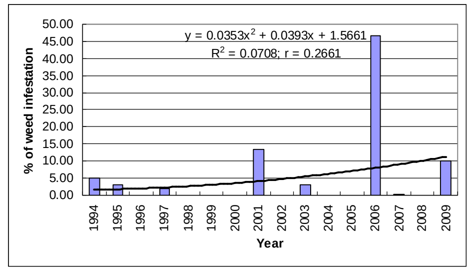

Fig. 2: *Iva xanthiifolia* in sugar beat production region (SBPR)

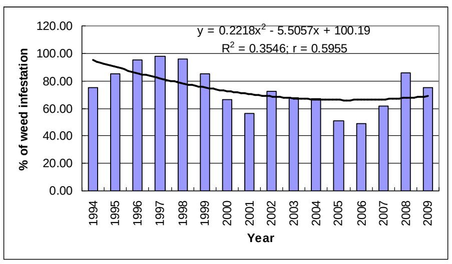

Fig. 3: *Echinochloa crus-galli* in MPR

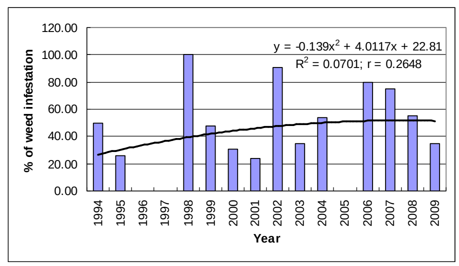

Fig. 4: *Echinochloa crus galli* in SBPR

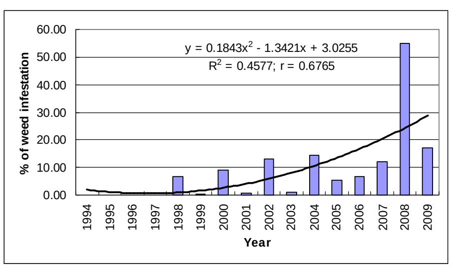

Fig. 5: *Abutilon theophrasti* in MPR

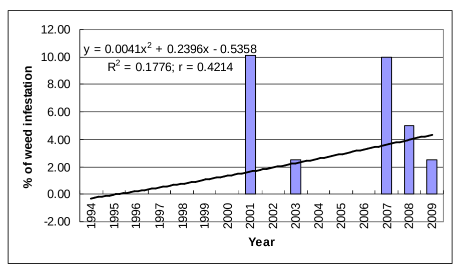

Fig. 6: *Abutilon theophrasti* in SBPR

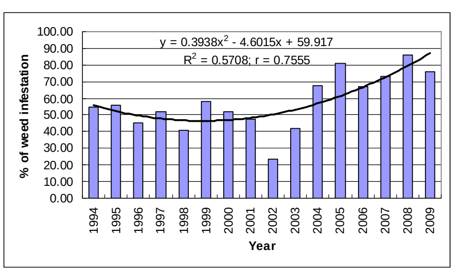

Fig. 7: *Atriplex spp.* in MPR

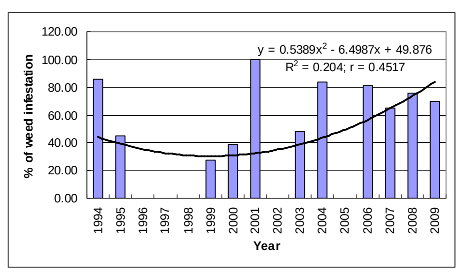

Fig. 8: *Atriplex spp.* in SBPR

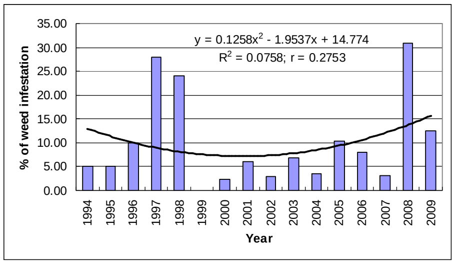

Fig. 9: *Elytrigia repens* in MPR

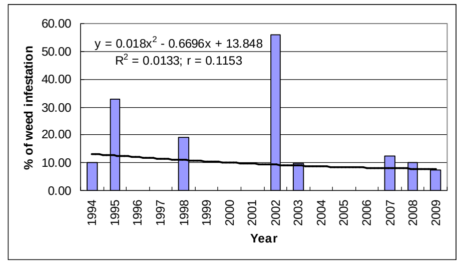

Fig. 10: *Elytrigia repens* in SBPR

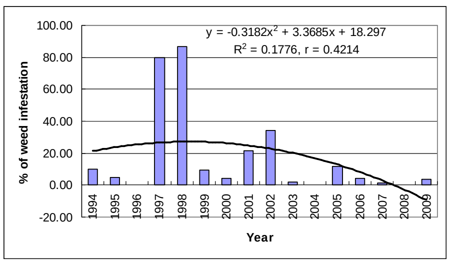

Fig. 11: *Convolvulus arvensis* in MPR

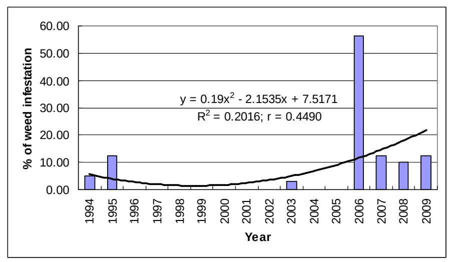

Fig. 12: *Convolvulus arvensis* in SBPR

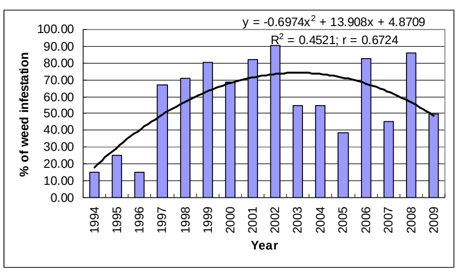

Fig. 13: *Cirsium arvense* in MPR

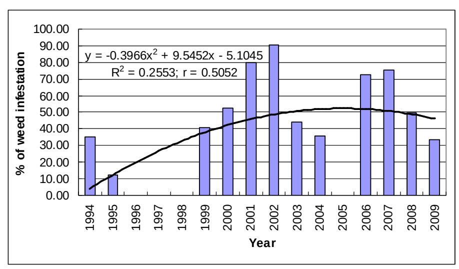

Fig. 14: *Cirsium arvense* in SBPR

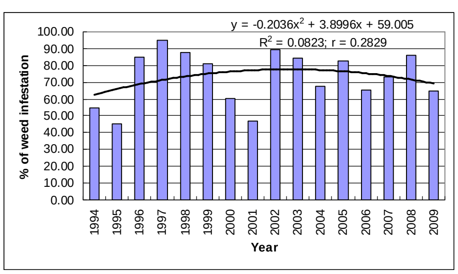

Fig. 15: *Chenopodium spp.* in MPR

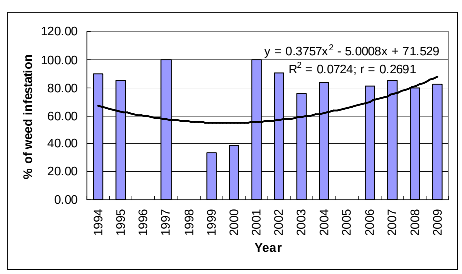

Fig. 16: *Chenopodium spp.* in SBPR

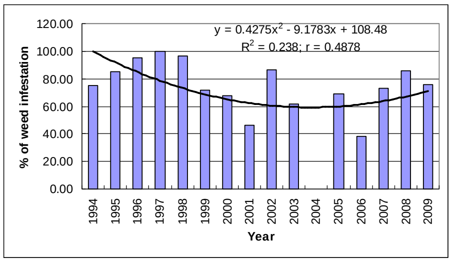

Fig. 17: *Amaranthus spp.* in MPR

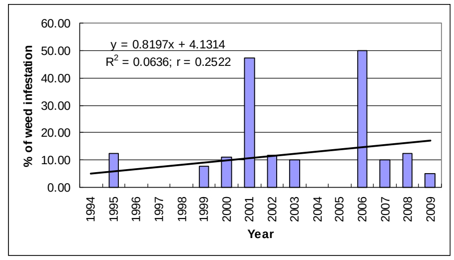

Fig. 18: *Datura stramonium* in SBPR

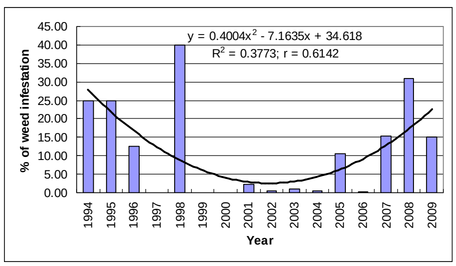

Fig. 19: *Fallopia convolvulus* in MPR

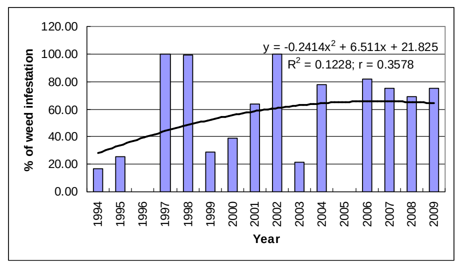

Fig. 20: *Persicaria spp.* in SBPR

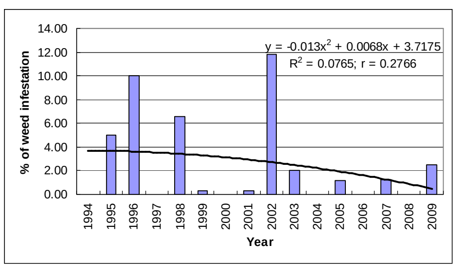

Fig. 21: *Xanthium strumarium* in MPR

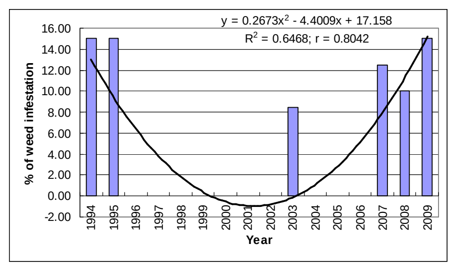

Fig. 22: *Polygonum spp.*in SBPR

According to SMATANA et al. (2008) weak weed infestation was detected by species *Abutilon theophrasti, Ambrosia artemisiifolia, Thlaspi arvense, Capsella bursa-pastoris, Stellaria media, Anagalis arvensis, Veronica spp., Viola arvensis, Panicum mileaceum, Atriplex spp., Lamium spp., Setaria spp.*.

CONCLUSIONS

The most troublesome weeds in sunflower were: *Iva xanthiifolia, Abutilon theophrasti*, *Atriplex spp*., *Cirsium arvense*, *Chenopodium spp.* in maize and sugar beat production region of Slovakia and *Datura stramonium, Cirsium arvense, Fallopia convolvulus, Convolvulus arvensis*, *Polygonum spp.* in sugar beat production region of Slovakia.

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