
INFLUENCE OF SOIL TILLAGE ON WEEDS IN MAIZE

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ABSTRACT

This thesis is focused on detection effect of tillage on weeds in maize. The attempt was carried out on farm lands of agricultural enterprise Agroservis 1. Zemědělská, Plc. in Višňové. The different ways of tillage were conducted in the individual attempt variants – plowing, minimization and no-tillage. The occurrence of weeds was observed on each individual variations in these types of tillage. The numbers of weeds were statistically evaluated and it is possible to derive from them, which species mostly occur on the particular variants of tillage. *Lathyrus tuberosus*, *Veronica polita*, *Conyza canadensis*, *Urtica dioica*, *Convolvulus arvensis*, *Cirsium arvense* a *Amaranthus* sp., appear most frequently on variant with plowing. *Polygonum aviculare*, *Chenopodium album*, *Persicaria lapathifolia*, *Anagallis arvensis* most often occur on variant with minimazing soil tillage and *Echinochloa crus-galli*, *Fallopia convolvulus* and *Viola arvensis* on variant of non-tillage.

Key words: weeds, maize, soil tillage

Acknowledgments: The results in paper are output of project of Internal Grant Agency, AF MENDELU, No. TP 10/2013 “Study of some factors affecting implementation of the biological potential of agricultural crops”.

INTRODUCTION

Traditional soil tillage means annual re-turning of topsoil with using of plow or aeration. The time lag is necessary between each soil tillage operations (basic and pre-sowing) in this type of cultivation. Agrotechnical functions fulfill these time intervals, which are eg a natural soil lying and control of weeds. In addition, here are more traditional procedures with separate operations, namely a stubble tillage, dragging, harrowing, aeration, rolling (HŮLA J., MAYER V. 1999).

Minimum tillage reduces the number of passes through the field, the influence of the cultivation on the soil and reduces the costs. This system of soil tillage is not defined only by reducing number of activities, but also by depth of tillage and amount of remaining crop residues on the soil surface. The application of these simplified methods of vegetation establishment is used mainly in enterprises without livestock production. This prevents the reduction of the fertility of agricultural soils (VACH M., JAVŮREK M. 2010).

For this reason, more economically and ecologically advantageous so called minimization simplified processes with soil-protective elements are increasingly used than the energy and labor demanding traditional methods. Opinions on reduction of soil tillage are however very different. Currently the simplified tillage systems are used in cereals, oilseed rape and legumes in our country. Recently they start to be used in some of wide-row crops, especially in maize, where they should mainly contribute to protect the soil from water and wind erosion (HŮLA J. *et al.* 2008).

The method of soil tillage can influence the occurrence, development and species spectrum of weed associations. My final thesis will be dedicate to the topic, how can the soil tillage affect the weeds in maize.

MATERIAL AND METHODS

Field pilot plant experiment was focused on the monitoring the impact of different tillage on corn grain yields, which was established on lands of the agricultural enterprise Agroservis 1. Zemědělská, Plc. in Višňové, in 2001. This company manages in corn production area whose lands are located largely in the northwestern part of Znojmo district, less of it in Brno-venkov district.

The entire planting area is situated in the lowlands of Dyje-Svratka river valley. Altitude of this area is 230 m asl. The average annual temperature reaches 8,5°C and annual precipitation is 470 mm.

Field trial is designed as long-term, where maize is consecutively grown on the same land. The experimental plot was divided into three parts, where the three different technological methods of soil tillage were used. The impact of different tillage on weed infestation of grain maize was evaluated. The weed infestation was assessed by a numerical method. Weeds were counted on 1 m², always in 30 repetitions for each variant of soil tillage. The evaluation took place in July 2012.

Names of individual weed species were used according to Kubat (KUBÁT K. 2002).

Kinds of soil tillage and ways of vegetation establishment of maize are shown in each variant of attempt. Here it should be emphasized that method of tillage is the only one agrotechnical intervention, which stayed unchanged for whole duration of experiment.

Variants of attempt:

1. Soil tillage - plowing

- Harvesting is followed by stubble-tillage and medium-deep plowing on 0,22 m.
- Dragging diagonally is done in spring, followed by tillage with blade loosener at depth 0,10 m.
- Precision seeder with fertilizer application under the heel is used for corn sowing.
- Eventual surface finish by rolling

2. Shallow tillage - aeration

- Stubble-tillage with disc cultivator to a depth of 0,12 m after harvesting of maize
- Shallow aeration on seedbed depth before sowing in spring
- Precision seeder with fertilizer application under the heel is used for corn sowing.
- Eventual surface finish by rolling

3. Direct sowing in untreated soil

- Sowing by seed drill with fertilization under the heel

Multivariate analysis of ecological data were used to determine the effect of tillage on weed in maize. Selection of the optimal analysis was conformed to the length of gradient (*Lengths of Gradient*), detected by segment analysis DCA (*Detrended Correspondence Analysis*). Canonical correspondence analysis CCA was also used (*Canonical Correspondence Analysis*). Exactly 499 permutations were calculated during testing of conclusiveness with a test of Monte-Carlo. Data were processed by the computer program CANOCO 4.0. (TER BRAAK C. J. F. 1998).

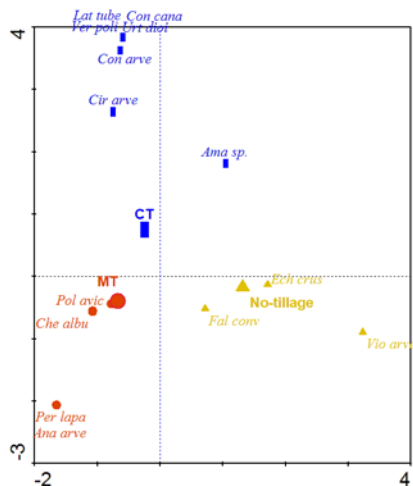
RESULT AND DISCUSSION

There were found 14 species of weed in total. Numbers of individuals are given in Tab. 1.

Results of CCA analysis that evaluated the effect of tillage on weeds is significant at the significance level $\alpha = 0.002$, for all canonical axes (Fig. 1). Based on the analysis of CCA it is possible to divide found weeds into 3 groups.

Table 1 . Sum of weed individuals found on variants of soil tillage

Weed species	Soil tillage - plowing (CT)	Shallow tillage - aeration (MT)	Direct sowing in untreated soil (No-tillage)
<i>Amaranthus</i> sp.	4	0	3
<i>Anagallis arvensis</i>	0	2	0
<i>Cirsium arvense</i>	58	14	1
<i>Convolvulus arvensis</i>	27	1	0
<i>Conyza canadensis</i>	1	0	0
<i>Echinochloa crus-galli</i>	66	51	214
<i>Fallopia convolvulus</i>	5	11	13
<i>Chenopodium album</i>	115	328	31
<i>Lathyrus tuberosus</i>	1	0	0
<i>Persicaria lapathifolia</i>	0	2	0
<i>Polygonum aviculare</i>	2	5	1
<i>Urtica dioica</i>	5	0	0
<i>Veronica polita</i>	1	0	0
<i>Viola arvensis</i>	0	0	1



Explanation of abbreviations used in the ordination diagram: Variants of soil tillage: CT – soil tillage - plowing, MT - shallow tillage - aeration, No-tillage - direct sowind in untreated soil; *Ama sp.* – *Amaranthus sp.*, *Ana arve* – *Anagallis arvensis*, *Cir arve* – *Cirsium arvense*, *Con arve* – *Convolvulus arvensis*, *Con cana* – *Conyza canadensis*, *Ech crus* – *Echinochloa crus-galli*, *Fal conv* – *Fallopia convolvulus*, *Che albu* – *Chenopodium album*, *Lat tube* – *Lathyrus tuberosus*, *Per lapa* – *Persicaria lapathifolia*, *Pol avic* – *Polygonum aviculare*, *Urt dioi* – *Urtica dioica*, *Ver poli* – *Veronica polita*, *Vio arve* – *Viola arvensis*.

Fig. 1. Ordination diagram expressing the realtion of weeds occurence variants of tillage

The first group of weeds primarily occurred in the variant with plowing: *Lathyrus tuberosus*, *Veronica polita*, *Conyza canadensis*, *Urtica dioica*, *Convolvulus arvensis*, *Cirsium arvense* and *Amaranthus sp.* The second group of weeds was found mainly in variants of minimum tillage: *Polygonum aviculare*, *Chenopodium album*, *Persicaria lapathifolia* and *Anagallis arvensis*. The third group of weeds occurred in variants with no-tillage and these species are: *Echinochloa crus-galli*, *Fallopia convolvulus* and *Viola arvensis*. The results of this work show that the plot, where the plowing was carried out, both kinds of annual (early spring, late spring, over-wintering) and perennial species were observed. On the plot with minimum tillage occurs spring species only. Most authors of literature focusing on the influence of tillage and weeds states, that using of minimization tillage decreases the number of weed species and increases theirs quantity (BALL D.A., MILLER S.D. 1990; TIAN X. *et al.* 2011). Compared to the traditional tillage, when the number of individuals in the area decreases (BLACKSHAW R.E. *et al.* 2001). For more precise formulation of the conclusion from our experiment would be necessary to collect more evaluations of weed infestation from more years of observation.

CONCLUSIONS

According to the evaluation of the experiment, which should determine the influence of tillage on occurrence of weeds in maize, we can say that method of tillage has a significant effect on representation of individual weed species in maize. It can be concluded that the species spectrum is the lowest one in variant with no-tillage and is increasing with the depth of tillage. Distribution of weed fruits and seeds in soil is influenced by the method of soil tillage, which has also significant effect on germination of weeds and theirs life time. The results suggest that the different types of tillage affect the intensity of weed infestation and spectrum of weed species in maize. From the perspective of short-time monitoring of the occurrence of weeds and its subsequent evaluation would be more advantageous the long-term observation, due to possible influence of meteorological conditions of the year.

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