
WEED INFESTATION OF WINTER WHEAT AT DIFFERENT SOIL TILLAGE

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ABSTRACT

This thesis focuses on the influence of tillage on the current weed infestation of winter wheat. An attempt was made in 2011 on experimental plots in Žabčice, in corn production area. Individual variations are distributed according to the method of tillage and previous crop. Previous crop was winter wheat grown in monoculture, red clover in Norfolk crop rotation, alfalfa and silage maize as previous crop. In the minimization method of tillage depth to 5 cm there was no difference from the traditional method of tillage. Greater effect was found in previous crop, when the data were evaluated by multivariate analysis of ecological data. The results indicated that the percentage of weed infestation in method of minimization tillage was slightly bigger than in conventional tillage.

Key words: tillage, previous crop, winter wheat, weeds

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INTRODUCTION

The choice of the tillage technology in certain conditions has an effect on an overall state of soil. Reducing costs of the soil cultivation due to using minimization tillage have also an influence of weed infestation on field. Competitiveness of our agriculture is based on the reduction of production inputs, but which do not reduce the profitability of crop and soil fertility. One of the options is the choice of appropriate tillage technology (Hůla J. et al. 1997).

Minimum soil tillage decreases numbers of passes over the field, reduces costs and effect of cultivation on the field. Minimum soil tillage is not defined just by reducing the number of activities, but also by depth of tillage and the amount of crop residues on the soil surface (Vach M., Javůrek M. 2010). Tillage without using a plough is a system requiring special equipment for soil cultivation, targeted agrotechnical operations carried out according to the area and crop sequence (Koller K., Linke Ch. 2006).

This work focuses on the effect of different tillage affecting the intensity of weed infestation and species spectrum of weeds in winter wheat.

MATERIAL AND METHODS

Experimental field plot 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 experimental plot is located in the cadastral municipality Žabčice. This region is part of the geomorphological area of Dyje-Svratka river valley. This area is reckoned as a very hot and dry. The average annual temperature for this climate region is 9.2 °C and average annual rainfall 483.3 mm.

Observed cover of winter wheat grown in three field attempt with different soil tillage and crop sequence. The tillage variants were two in all three field experiment. First variant is a typical conventional soil tillage (in further text marked as **plowing**), second variant is minimum shallow tillage (marked as **minimization**).

Description of individual attempt variants

1. **Plowing** – first working operations after crop harvest is a stubble-tillage made with chisel cultivator Kverneland, to an approximately depth of 0,1 m. In case of dry summer is the cover flat-rolled and if the second growth is extreme, the stubble-tillage is repeated for better ploughing of crop residues into the soil. Plowing is carried out to a depth of 0,2 to 0,24 m (medium-deep) with double-sided rotatable plough Lemken. Followed by seed drill combination Accord.
2. **Minimization** – stubble-cultivation with chisel cultivator Kverneland to an approximately depth of 0,1 m is carried out after harvest. Currently the manure is ploughed into the soil with maize and sugar beet. Chisel cultivator Kverneland for shallow tillage to a depth of 0,1 m is used again instead of conventional tillage. Sowing follows with the seed drill combination Accord.

First field attempt is monoculture of winter wheat, which is cultivated here in monoculture since 2002. The size of one plot is 5,3 m x 7,0 m.

Crop sequence in **second attempt** is arranged according to the Norfolk crop rotation, which was founded in 1970 and partially changed in 2002. The size of one plot is 5,3 m x 7,0 m. Crop sequence is as follows: red clover, **winter wheat**, grain maize, spring barley.

Third field attempt was based as „model example“ of farming with livestock production in drier climatic conditions, in **2004**. The size of individual plots is 10 x 20 m. In this field experiment is used **seven surface soil units** of crop rotation. Crop sequence is as follows: alfalfa - the first utility year, alfalfa - the second utility year, **winter wheat**, maize (for silage), **winter wheat**, sugar beet, spring barley.

The weed infestation of winter wheat was evaluated before herbicidal application in the period between 1.4. – 4.4. 2011. Counting method was used, the numbers of weeds were examined on the area of 1 m², on every variant of soil tillage and crop sequence with 24 repetitions. Czech and Latin names of individual weed species were used according to Kubát K. (2002).

The obtained data were processed by multivariate analysis of ecological data segment analysis DCA (Detrended Correspondence Analysis) and redundancy analysis (redundancy analysis, RDA), which is based on the model of linear response (Linear Response). There were 499 permutations calculated during testing of conclusiveness with a test of Monte-Carlo. Data were analyzed using the computer program CANOCO 4.0. (Ter Braak C.J.F. 1998). Using these analyzes was investigated the different effect of tillage on weeds.

RESULT AND DISCUSSION

Monoculture of winter wheat: 6 weed species were found on this variant of attempt, when the field was cultivated in conventional way of tillage. *Galium aparine* and *Consolida regalis* appeared the most in number of repetitions. In case of minimization tillage, 8 weed species were found in monoculture of winter wheat. There has been considerable represented more weeds compared to conventional technology. *Galium aparine* participated the most on the weed infestation, *Veronica persica* and *Veronica agrestis* on significance of weed infestation.

Norfolk crop rotation: Conventional soil tillage – the number of occurring species was 10 in this variant of experiment. The total number of weeds was determined 120 in all 24 repetitions. *Lamium amplexicaule*, *Lamium purpureum*, *Cirsium arvense* and *Tripleurospermum maritimum* occurred the most often from weed species. Minimization technology – 10 weed species was found in case of tillage without plowing. *Galium aparine* and *Stellaria media* had the largest representation. Some of species had higher representation as well, but their occurrence in numerical representation was dependent on the location of repetition.

Previous crop – silage maize: *Veronica persica* and *Veronica agrestis* were represented the most from occurring 11 species in traditional soil tillage. The dominant species were *Veronica agrestis* and *Capsella bursa-pastoris* in this variant of minimization technology.

Previous crop – alfalfa: 8 weed species were occurred in total in variant with plowing and alfalfa as a previous crop. *Veronica* sp. was represented in all 24 repetitions. Tillage without plowing – minimization technology showed the following results: 11 species. *Veronica agrestis* and *Capsella bursa-pastoris* had the largest representation.

Results of the analysis RDA are significant at the significance level $\alpha = 0.06$ for all canonical axes and explain 33.2% of the total variability in the data, which means the results are statistically significant. According to the ordination diagram (Fig. 1), plant species can be divided into several groups, although the most of the species were affected by other factors, which are not captured in this analysis. We can say that the presence of species eg *Galium aparine* and *Veronica agrestis* had not been influenced by the method of soil tillage.

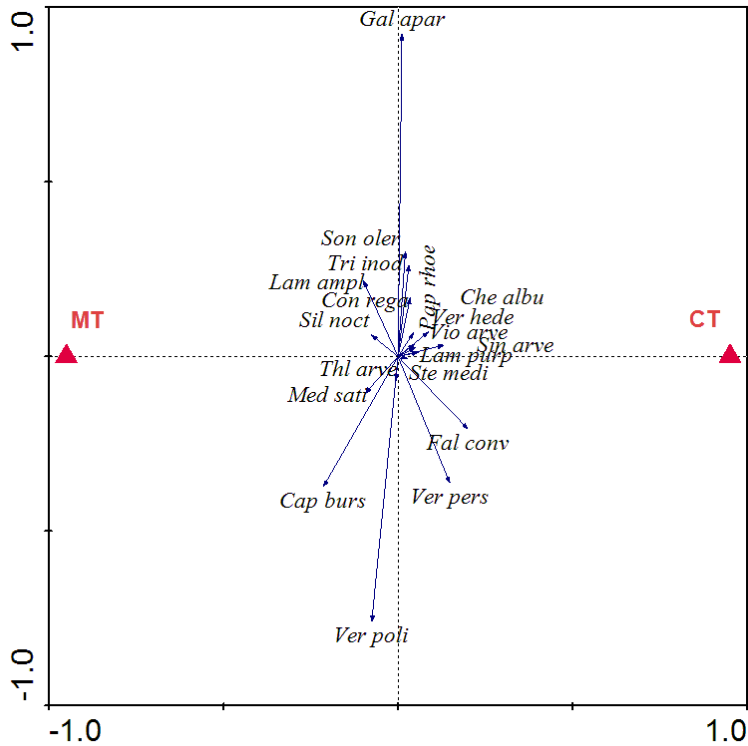


Fig. 1. Ordination diagram expressing the effect of tillage on weeds in winter wheat

Explanation of abbreviations used in the ordination diagram: CT – conventional method of tillage, MT – minimization method of tillage

Weeds: *Cap burs* - *Capsella bursa-pastoris*, *Cir arv* - *Cirsium arvense*, *Con rega* - *Consolida regalis*, *Fal cno* - *Fallopia convolvulus*, *Gal apar* - *Galium aparine*, *Che albu* - *Chenopodium album*, *Lac serr* - *Lactuca serriola*, *Lam ampl* - *Lamium amplexicaule*, *Lam purp* - *Lamium purpureum*, *Med sati* - *Medicago sativa*, *Pap rhoe* - *Papaver rhoeas*, *Sil noct* - *Silene noctiflora*, *Sin arve* - *Sinapis arvensis*, *Son olera* - *Sonchus oleraceus*, *Ste medi* - *Stellaria media*, *Thl arve* - *Thlaspi arvense*, *Tri inod* - *Tripleurospermum inodorum*, *Ver hede* - *Veronica hederifolia*, *Ver pers* - *Veronica persica*, *Ver poli* - *Veronica polita*, *Vio arve* - *Viola arvensis*

The experimental results showed that tillage systems have most likely a significant effect on weed species composition and numbers of individuals. The determined values still may not correspond to reality and conditions of practise. Effect of tillage technology can not be unequivocally excluded, because the attempt of bachelor work took place just one year and factor of the tillage should not occur in a given year.

From the perspective of long-term observation of the influence of tillage technology states Hůla J. a Procházková B. (2008), that the minimization technology contributes on higher weed infestation of

the soil in the early stages of use. Besides the annual weeds starting to occur also perennial weeds on lands, which tend to be suppressed due to plowing in systems of conventional tillage. In the longer term, however the species spectrum and the number of individuals decreases. This is due to the concentration of weed seeds and fruits in the upper horizon of topsoil. These conditions are created by use of machines vertically processing land.

CONCLUSIONS

In evaluation of conducted experiment about influence of soil tillage on current weed infestation in winter wheat was found, that methods of tillage should not have a strong impact on the representation of weeds in winter wheat. The percentage of weed infestation in method of minimization tillage was slightly bigger than in conventional tillage. But this are only a one-year results, which can be burdened by weather conditions.

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