ACTUAL WEED INFESTATION AND SUSTAINABLE FARMING SYSTEMS IN WINTER WHEAT

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Abstract. *Actual status in relation to the possibilities of growing winter wheat in ecological and integrated farming systems is closely related to the current weed infestation and field crops. In the paper we observed two different farming systems. One of the mentioned is called integrated and the second one is called ecological. The research was focused on the actual weed infestation of winter wheat. Small-parcelled experiment was realized in Dolná Malanta near the Nitra in 2014 and 2015 years. The objective was to quantify and evaluate the actual weed infestation in the crop of summer wheat, winter form, in both management systems on land. We observed two different systems namely amended and unmanured, in ecological and integrated farming systems. In the integrated system was provided herbicidal protection by effective substance of appliance Mustang and fungicidal protection by effective substance of appliance Tango Super. In ecological system the chemical regulation wasn´t applied, we used mechanical regulation (harrowing) of weed infestation namely protection of bar shaped gates. The results were evaluated with two methods: a counting and combined counting and mass method. By counting method was evaluated a crop of winter wheat in the spring. By counting and mass method was evaluated a crop of weed infestation before harvest of summer wheat, winter form. The unmanured variant had less weed infestation than the amended variant. The weed infestation was higher in the ecological farming system. The integrated farming system has reached lower weed infestation, because of the absence of chemicals for regulation of weed infestation. Mechanical operations are not as effective, as herbicide. Important species in ecological farming system in the spring were, for example, weeds such as Capsela bursa pastoris, Thlaspi arvense, Cirsium arvense, Sonchus arvensis and others. In the integrated farming system has occurred several weed species in the spring such as Medicago sativa, Thlaspi arvense, Stellaria media, and Convolvulus arvensis. In the crops before harvest has occurred in ecological farming system species such as: Tripleurospermum perforatum, Cirsium arvense, Thlaspi arvense and Medicago sativa. In the integrated farming system before harvest has occurred weed species such as: Medicago sativa, Cirsium arvense and Convolvulus arvensis. In the crops of winter wheat was found a variant dependency. Based on the measured values and the observed results we dare to claim, that farming systems with fertilization have a significant effect on weed infestation of winter wheat crop.*

Key words: *winter wheat, weeds, weed control, sustainable systems*

INTRODUCTION

The aim of this study was to evaluate the heterogeneity of the incidence of individual weed species on a selected experimental field. This field was situated in the cadastre of the village Žabčice (South Moravian Region, Czech Republic). To evaluate the intensity of weed infestation, a field experiment was established. In 2011, altogether 33 weed species were identified in a stand of spring barley. In the next year, the total number of weeds in a stand of winter wheat was 22. Basing on results of the evaluation of infestation heterogeneity it was possible to detect the following trends: The first one concerned the incidence of significantly dominant species *Chenopodium album* and *Veronica hederifolia* in stands of spring barley and winter wheat, respectively. The second one expressed the incidence of the so-called sub-dominant species. Regarding the character of the incidence of these weed species it would be suitable to kill them by means of a targeted application of herbicides. Finally, the third trend concerned the incidence of that group of weeds that occurred in the major part of the

experimental plot but in low numbers only. The abundance of these species was minimal and the total number of weed plants did not exceed the limit of 100 specimens. This group of weeds involved also those species that were markedly more frequent on plots situated closer to the margin of the experimental field. The targeted application of herbicides can be performed on plots with a lower level of weed infestation; another possibility, however, seems to be a targeted intervention that helps to control the incidence of a certain weed species and/or that is performed along the margin of the field where the different weed species are more frequent (WINKLER, LUKAS, SMUTNÝ, 2015).

BUERKLE (2008) provides for increased production and an expansion in the cultivation of winter cereals and believes in a positive and prosperous cooperation in Europe and America. It has to think or weeds act to reduce harvest enough to be effective incur costs reduction. There aerates' the question of whether all the costs of regulating weed infestation stands exceed the deficit of income caused by lower quality and quantity of crops without regulated (van der SCHANS et al., 2010).

The degree of weed infestation in the crop of winter wheat is often determined already in the autumn so should be given a larger dose of attention inventory in the fall and early spring (TÝR, 2006).

Adds that in recent years the cereals, more infestation new species and also species composition corresponds to the quality of the crop rotation and soil preparation. When increased participation spring crops or cereals, there is the same situation, but they have superiority in this case spring weeds. Here you can see the merits of proper crops rotation (MIKULKA, KNEIFELOVÁ, 2005).

It disagrees TÝR, LACKO-BARTOŠOVÁ (2007) it also adds that after the previous crop of winter and also perennial forage in the soil are especially *Cirsium arvense*, *Sonchus arvensis* and *Elytrigia repens*.

Architecture and mechanical weed control soil and vegetation during the period of vegetation is the key to profitable growth. The mechanical treatment plant also includes weeding and total elimination of the soil surface network, whip and towed gates. We get the experience for one of the forms of mechanical weed control called defences, which is used mainly for annual weeds. The goal is fixed to the steel nails are at a depth of 20 - 40 mm, and its effects are very strong in the early stages of the growth of weeds 24. The efficiency by preventing and controlling is different for different types of weeds. Bedstraw we regulate better in the spring because its trailing stems are captured on metal door construction (TÓTHOVÁ et al., 2011).

MATERIAL AND METHODS

The aim of the study was to evaluate the occurrence and development of weed species current weed crops of winter wheat in sustainable farming systems. The work had provided several partial goals. Assess the dynamics of occurrences of each weed species in integrated and ecological farming systems. To assess the impact of factors such as system farming, manure and fertilizer year for the presence of weeds in crops of winter wheat for 2014 – 2015. To assess the effectiveness and propose regulatory measures undertaken against weeds. To evaluate the impact of the current crop of weed on the main product of winter wheat for 2014 – 2015.

In experimental plots was done in 2014 and 2015 years traditional preparation of land for the creation of favourable conditions for sowing, treatment and follow-emergence of the crop, in this case of winter wheat. After its emergence, the emergence of the plants to deduct an area of 1 m^2 in the reporting system management. After complete emergence of the weeds (for

densely sown cereals in the third leaf stage of FEKEES in TÝR et al., 2012) was calculated using the method determined by the weed infestation. The principle of this method consists of measuring the number of weed species on the area (1 m^2). This area counts all the weeds, regardless of the degree of development and determine the species represented. This procedure is performed on fertilized and non-fertilized variants in four replications (r1, r2, r3, r4).

We determined: 1. Status of the crop and weeds in spring (ecological network) and also before spraying herbicides in the spring (integrated system). 2. The status of the crop and weeds in the spring after spraying herbicides (integrated system). 3. The state of the crop and weeds before harvesting the crop has used the combined method (arithmetic-weight). 4. Weed infestation of crops was evaluated (HOSENDEL, 1979 in TÝR et al., 2012), the author states weed steps S1 - S6, but the implementation of experiments we used a modified scale S1 - S4, with respect to the functionality (TÝR, 1997 in TÝR et al., 2012). 5. The effect of herbicides was evaluated according to the international scale of EWRS, statistical evaluation of the data obtained was carried out of Excel. In addition to the effect of the herbicide on weeds it was assessed and their possible negative impact on winter wheat - fytotoxicity. The effect of herbicides on weeds was evaluated by calculation according to the ABOTT formula in TÝR et al. (2012).

$$U=\frac{C-T}{C}\ x\ 100$$

U - Efficiency herbicides and harrowing (%),
C - Number of weeds per m^2 in the no treatment area,
T - Number of weeds per m^2 in the treatment area.

RESULT AND DISCUSSIONS

The systems to be managed arable play an important role in influencing the properties of the soil as well as the extent of weed infestation of cultivated crop plants. Systems affect the course of the processes in the soil, and their functions are important points of intersection in the regulation of pathogens and pests on food crops. And also in the regulation of weed infestation, and elimination of weeds. They are negligible element in analysing the results achieved.

Elimination of undesirable weeds in densely sown cereals is mainly achieved right field conditions. It is therefore important for the careful establishment stand almost in the fall subject to proper fertilization and adequate nutrition. If conditions are ensured in an optimal way, the plant will provide high quality crop emergence and involved in good shape.

The crop of winter wheat, allowing the occurrence of mainly annual species weed community, but also and some perennial weed species. The types of one year, are mostly late spring species, early spring species and species winter of course, that did not manage to germinate in the fall. The group of perennial weeds include deeper reptans weed species.

Winter wheat has a good competitive against the weed species. Hair creates limited conditions for the development of weeds and a good anti emerged weeds.

In non-fertilized and integrated system management, we found an average incidence of weeds 15.75 plants per m^2. Among the most numerous types of farming system as advised kinds: *Thlaspi arvense*, *Cirsium arvense*, *Chenopodium album*, *Convolvulus arvensis*, *Tripleurospermum perforatum*, *and Capsela bursa pastoris*.

The integrated system management on arable land, where we fertilized, we found that the soil was more weeds than in unfertilized system management. There have been here species like: *Medicago sativa*, *Stellaria media*, *Cirsium arvense* and *Capsela bursa pastoris*. The number of weeds per m^2 was 19.75 plants. On 14.04.2014 it was applied herbicide called

Mustang at 0.6 l ha^{-1} and also fungicide Tango Super at a dose of 1.0 l ha^{-1} on 24.04.2014. By using the user EWRS scale, the effect of the herbicide used Mustang appraised value of 1-2, which means very good to excellent activity. These the values they pointed out that he used herbicide sufficient for occurring weed spectrum.

In ecological farming systems and non-fertilized was found to average incidence of weeds 23.75 per square meters. Among the most numerous species were: *Thlaspi arvense, Capsela bursa pastoris, Tripleurospermum perforatum, Cirsium arvense*, and *Medicago sativa*. The ecological farming system of land in which we were fertilized, were found to be located there more weeds than in unfertilized system management. There have been here as a weed species: shepherd's pouch, purple dead nettle, creeping thistle roe thistle, alfalfa and others. The determined number of weeds at per m^2 was 27.75. On 14.04.2014 weeders are used. In this system, herbicides or fungicides non treatments. Fertilized ecological system has been fertilizing only regenerative fertilizer N, P, K fertilizers. The ratio of N: P: K at 24:15:36.

In non-fertilized and integrated system management, we found an average incidence of weeds at 2.75 per m^2. Among the most abundant weed species were: *Medicago sativa, Cirsium arvense,* and *Convolvulus arvensis*.

The integrated system management fertilized arable we found that was more weeds than unfertilized system management. There have been here like weeds: *Medicago sativa, Cirsium arvense,* and *Convolvulus arvensis*. The number of weeds per m^2 was 4.75.

In ecological farming systems and non-fertilized, we found the average prevalence of weeds at 5.75 per m^2. Among the most numerous species of weeds were: *Tripleurospermum perforatum, Medicago sativa, Cirsium arvense, Sonchus arvensis, Thlapsi arvense, Lamium purpureum*, at cetera species.

In ecological and fertilization system, we found that there exists more than weed species in organic farming systems fertilized arable land. There have been here especially species such as: *Sonchus arvensis, Medicago sativa, Thlaspi arvense, Tripleurospermum perforatum, Cirsium arvense*, etc. Number of weeds per m^2 averaged 6.25 plants. On 04.14.2014 it was conducted harrowing. Ecological system was controlled without chemical treatment. Ecological system has been fertilized fertilizing only regenerative dose of N, P, K fertilizers. The ratio of 24:15:36.

In the years 2015, integrated system management on arable land, where we fertilized, we found that the soil was more weeds than in unfertilized system management. There have been here species like: *Stellaria media, Thlaspi arvense, Cirsium arvense,* and *Capsela bursa pastoris*. The number of weeds per m^2 was 17.50 plants. On 15.04.2015 it was applied herbicide called Mustang at 0.6 l ha^{-1} and also fungicide Tango Super at a dose of 1.01 l ha^{-1} on 25.04.2015. By using the user EWRS scale, the effect of the herbicide used Mustang appraised value of 1, which means to excellent activity. These the values they pointed out that he used herbicide sufficient for occurring weed spectrum.

In ecological farming systems and non-fertilized was found to average incidence of weeds 13.00 per square meters. Among the most numerous species were: *Thlaspi arvense, Capsela bursa pastoris, Cirsium arvense*, and *Medicago sativa*. The ecological farming system of land in which we were fertilized, were found to be located there more weeds than in unfertilized system management. There have been here as a weed species: shepherd's pouch, purple dead nettle, creeping thistle roe thistle, alfalfa and others. The determined number of weeds at per m^2 was 17.00. On 15.04.2015 harrowing are used. In this system, herbicides or fungicides non treatments. Fertilized ecological system has been fertilizing only regenerative fertilizer N, P, K fertilizers. The ratio of 24:15:36.

In non-fertilized and integrated system management, we found an average incidence of weeds at 0.55 per m^2. Among the most abundant weed species were: *Medicago sativa*, *Cirsium arvense*, and *Convolvulus arvensis*.

The integrated system management fertilized arable we found that was more weeds than unfertilized system management. There have been here like weeds: *Medicago sativa*, *Cirsium arvense*, and *Convolvulus arvensis*. The number of weeds per m^2 was 0.75.

In ecological farming systems and non-fertilized, we found the average prevalence of weeds at 1.75 per m^2. Among the most numerous species of weeds were: *Cirsium arvense*, *Sonchus arvensis, Thlapsi arvense, Lamium purpureum*.

In ecological and fertilization system, we found that there exists more than weed species in organic farming systems fertilized arable land. There have been here especially species such as: *Sonchus arvensis, Medicago sativa, Thlaspi arvense, Cirsium arvense*, etc. Number of weeds per m^2 averaged 2.25 plants. On 15.04.2015 it was conducted harrowing. Ecological system was controlled without chemical treatment. Ecological system has been fertilized fertilizing only regenerative dose of N, P, K fertilizers. The ratio of 24:15:36.

Efficiency of the herbicides is per two years 1-2 which means very good to excellent activity. These the values they pointed out that he used herbicide sufficient for occurring weed spectrum. Efficiency of the harrowing is per two years very different. In year 2014 is humidity vegetable periods. In year 2015 is very dry vegetable period from winter wheat. Comparison of ecological farming system with integrated farming system spring after the harvest in the same year 2014 only confirmed the results of previous years. The integrated system using herbicides and fungicides has a lower frequency than the weed ecological system, which was used only obstruction without chemical intervention. On weed infestation of winter wheat had more impact than the meteorological factors (temperature and rainfall) right management systems.

The integrated weed farming systems number of community greatly reduces herbicidal compositions therefore integrated system records a lower weed infestation than organic. We agree with the statement ČERNUŠKO et al., (1994), that the dynamics of weed infestation of winter wheat will vary depending on the degree of development of the crop, weather conditions, agroecological factors that make up crop culture. According to obtained and study of results and information, therefore I can say that systems of arable farming can significantly influence the weed infestation of crops. Cannot forget the other factors that influence the weed infestation. These include crop rotation and subsequent inclusion crops, seedbed preparation, weed infestation previous crops on the land, agro-technical term early sowing, the density and the Involvement of the crop and its condition's state and also the right choice date of application of the herbicidal compositions. Attention should be paid to preventive measures, the use of certified seed, cleanliness mechanisms, proper storage and treatment of manure, which is a source of seeds of undesirable plant species so-called weeds.

CONCLUSIONS

The most widespread species in the integrated farming system in the spring of 2014 and 2015 were: *Cirsium arvense*, *Convolvulus arvensis* and *Medicago sativa*. And in ecological farming systems, also in 2014 and 2015 there were: *Cirsium arvense, Medicago sativa, Convolvulus arvensis, Sonchus arvensis* and *Capsela bursa pastoris*.

Comparison of ecological system with integrated spring after the harvest in the same year 2014 only confirmed the results of previous years 2015. The integrated system using herbicides and fungicides has a lower frequency than the weed ecological system, which was used only obstruction without chemical intervention.

In both systems, management must control the weed out by taking into account the health status of crops a grower must possess the knowledge and information necessary to control weed species requires.

In keeping with the precautionary measures and indirect measures of so-called cultural weed infestation, the ecological system of farming systems carried out smoothly as a separate system of farming systems in the soil.

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