ACTUAL WEED INFESTATION AND SUSTAINABLE FARMING SYSTEMS IN SPRING BARLEY

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Abstract. *Weeds are not desirable for arable occurrence significantly compete with agricultural crops in claims for nutrients, soil moisture, sunlight and space. The present paper was to evaluate the impact of integrated and ecological farming system and the actual weed infestation spring barley at two variants of fertilization (without fertilization and fertilization) in 2014 and 2015 years. The management had an impact on the occurrence of weed species before regulation. The objective was to quantify and evaluate the actual weed infestation in the crop of spring barley form, in both farming systems on soil. 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 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 spring barley in the spring. By counting and mass method was evaluated a crop of weed infestation before harvest of spring barley. The integrated farming system unfertilized occurring weed Chenopodium album, Convolvulus arvensis, Polygonum aviculare, Stellaria media, Chenopodium hybridum and others. The integrated system fertilized occurring weeds: Chenopodium album, Atriplex patula, Thlaspi arvense and others. The organic unfertilized system, we recorded the occurrence of weed species Chenopodium album, Atriplex patula, Convolvulus arvensis, Polygonum aviculare, Avena fatua and others. In ecological system that has been fertilized species Chenopodium album, Atriplex patula, Convolvulus arvensis, Polygonum aviculare, Sonchus arvensis and others. The use of fertilizers variant the occurrence of weed species in the monitored repetitions spring barley crops. Use harrowing in ecological farming systems were not sufficient to regulate occurring perennial weed species. The use of herbicide Mustang in the integrated farming systems had a positive effect on the frequency and weight of weed species before harvest. In keeping with all cultural and direct measures of weed control is an ecological farming system is fully viable as a standalone - sustainable farming systems.*

Key words*: spring barley, weeds, weed control, sustainable farming systems*

INTRODUCTION

Weeds are not desirable on arable land, as proof of his experience significant agricultural crops in competing claims for nutrients, soil moisture, sunlight and space. They were seen as a fast-growing unwanted and harmful plants growing with seasonal produce. These plants cause large losses for crops and are responsible for smaller production. Weeds can have a positive character with proper use. Can be used as animal feed, in the treatment of many diseases, they are used in medicine and for the presence of certain chemical substances such as alkaloids, glycosides, and have therapeutic effects (PAWAR, PATIL, 2011; PATAL, 2014).

Understanding the mechanisms shall be an ecological and economic importance. Dormancy and germination of weed seeds are controlled by the interaction of environmental complexes, edaphic, physiological and genetic factors. Weed seed dormancy is an important feature that contributes to their survival as one of the ways plants have been adapted to the dynamically changing conditions. After the regulation of weed herbicides thus can outlast unfavorable conditions. The relationship between

dormanciou seed and plant as successful crop is important. The existence of large reserves of weed seeds with different degrees of dormancy state and is the basis for annual weed problem in regulating. Land over the years may have a large number of seeds in a resting stage, so that weeds appear in the field and after years during which pursue the implementation of weed management system (ALI et al., 2011).

Weed competition and nutrient scarcity often restrict organic cereal production, especially where the availability of livestock manure is limited. While harrowing of annual weeds and legume cover crops can be used, these methods are both executed in early spring and may hinder each other (STENERUD et al., 2015). The effect of the WHCC (with weed harrowing and under sown cover crops) treatments was measured by weed density and species, weed biomass, changes in weed seedbank and grain yield. The weed density depended on the interaction between WHCC, fertiliser and year. On average, preemergence weed harrowing reduced weed density by 32% and weed biomass by 49%, while pre- and post-emergence weed harrowing reduced weed density by 59% and weed biomass by 67% compared with the untreated control. More research is required into improving the efficacy of mechanical and cultural weed suppression methods that organic systems rely on.

A functional approach to predicting shifts in weed floras in response to management or environmental change requires the combination of data on weed traits with analytical frameworks that capture the filtering effect of selection pressures on traits (STORKEY et al., 2015).

AMARE et al. (2016) from the results of the field experiment it cloud be inferred that, among the weed management practices, post emergence application of 2,4-D at 2.0 $kg.ha^{-1}$ at 25 days after sowing, supplemented with hand weeding at 40 days after sowing reduced weed density and dry biomass of weeds significantly, closely followed by hand weeding. These treatments also enhanced yield and yield components significantly and reduced relative yield loss of cereals. Application of 2,4-D alone cloud not prove effective in controlling weeds, thereby resulting in more yield loss in comparison with hand weeding and integrated approach. Uncontrolled weed growth throughout the crop growth period caused a yield reduction of 72.0% and 72.5%.

Chemical control is usually used only as a short-term solution to the problem of weeds. For annual use of the same herbicide, in some cases, it may develop in some species of weeds resistance - complete tolerance to the herbicide dose or the total destruction of the active, or the tolerance of - natural resistance to the herbicide active ingredient. In this case the application will not help on a large scale, it would be unnecessarily expensive and harmful to the environment. If herbicides are used in the context of good agricultural practice as part of the integrated protection against weeds, herbicides become a useful tool for managing the problem of weeds (TÝR, VEREŠ, 2012).

Development and implementation of an integrated weed management system offering control weeds while reducing dependence on herbicides, without adverse consequences on the overall economic performance of the system (VASILEIADISA et al., 2015).

Implementation of stubble is limited to one to three times, and the effectiveness of weed control depends on the date of execution and the species composition of weeds and vases development. But generally the plots where stubble was carried out on a regular basis there are fewer weeds than on land non stubble (GLOWACKA, 2012).

The spring barley (*Hordeum vulgare* L.) is one of the most important cereals, today is the fourth most important cereal and reigns supreme in the world. Within the structure of plant production The Slovak Republic barley important position. After the wheat it is third in the most widespread cereals and commercial commodities (ŠÚ SR, 2014).

Cereals are generally very popular crop for growers because they help maintain soil structure and coupled with appropriate measures to successfully suppress weed species However, if the weed plant species are not adequately controlled, it can result in substantial economic losses (SOLTANI et al., 2014).

Unless the barley crop is well connected and has favorable conditions for their growth, characterized by a very good ability to suppress weeds mainly a one. The improperly connected stand a great risk of outbreaks early spring weeds, which include, for example: *Avena fatua*, *Fallopia convolvulus*, *Galium aparine*, *Cirsium arvense*, *Anthemis* sp., *Convolvulus arvensis* (TÝR, DJALOVIĆ, 2008).

Spring cereals characterize its rapid growth, so it is time for the application of the herbicide relatively short. It is very important to capture the correct term in which the crop cereals approximate coverage of 50% and when resistant weeds have not yet moved into the extension growth (SOUKUP, 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 to 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 to 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) 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 (HOSNEDL, 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.

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

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

Spring barley allows the development of particular species of annual weeds which germinate the seeds in early spring at lower temperatures. It is species belonging to the one-early spring. It also may occur and weeds from the group of one-winter that no emergence in the autumn and also destroy seedbed preparation. From weeds belonging to the late spring, weeds can be significant in the case where the spring barley stands incomplete, late and poor condition. Perhaps it is the occurrence of species of perennial weeds deeper rotting.

Weather conditions in 2014 were to yield a crop of spring barley quite appropriate. At the time of fertilization and sowing in the month of March, it prevailed very hot and dry weather. The vegetation period in 2014 can be considered rather warm almost all year remained normal rainfall conditions. Weather conditions in 2015 year were to dry and minimum rainfall conditions.

The integrated system management was not fertilized weed infestation in the spring strong, averaging 19.25 weeds per m2, with the appearance of eight kinds of weeds. Most are represented by the weeds: *Chenopodium album* L., *Atriplex patula* L., *Convolvulus arvensis* L. and other species. Integrated

system, the status of fertilized weed vegetation in spring is higher than in non-fertilized system. Occurred here a total of six species of weeds: *Chenopodium album* L., *Atriplex patula* L. and *Convolvulus arvensis* L. and others. The average number of weed plants accounted for 24.75 per m^2, was therefore a strong degree of weed. One of most dangerous in this system was a *Chenopodium album* L. and others species.

The ecological farming system of non-fertilized averaged 13.50 number of weed plants per m^2, representing a moderate degree of weed. The most represented in this type of system include: *Chenopodium album* L., *Atriplex patula* L., and others. To ecological farming systems fertilized plants the average was 26.75 per m^2, representing a strong weed infestation. For this system, occurred with nine kinds of weeds, most of which are represented by *Chenopodium album* L., *Amaranthus retroflexus* L., and *Atriplex patula* L., and others species.

Using chemicals for weed control was carried out as follows: 23.4.2014 herbicide Mustang applied at 0.5 l ha^{-1}, fungicide Tango Super 22. 5. 2014 applied at 1.0 l.ha^{-1}, insecticide Vaztak EC 10, 22.05.2014 at a rate of 0.15 l.ha^{-1}.

Prior to harvest crops we use an integrated system of state management of weeds significantly reduced. The integrated system state not fertilized weeds. On average, the weeds to 2.00 m^2, the average weight of dry matter of 8.09 $g.m^{-2}$. From this finding, we concluded that the state of weed before the collection was unique. Present was only one species, field *Convolvulus arvensis* L. Other occurring weed species have been successfully regulated the use of herbicides Mustang. The fertilized integrated farming system, the average state of weeds 3.00 per m^2, with an average weight of weeds in dry matter 24.14 $g.m^{-2}$. There have been this kind of field *Convolvulus arvensis* L., and *Polygonum aviculare* L. Status weed before harvest we evaluated as weak. Other occurring weed species have been successfully regulated the use of herbicides Mustang. We assume that this outcome had the largest share using chemicals.

To ecological farming systems before harvest also reduced the state of weeds compared to the situation in the spring. Ecological unfertilized variant despite a decrease in the average number of 10 weeds per m^2 remains weak weed infestation of weeds in dry matter weight 46.83 $g.m^{-2}$. There have been here species: *Chenopodium album* L., *Atriplex patula* L., *Avena fatua* L., *Convolvulus arvensis*, *Sonchus arvensis* L. and *Cirsium arvense* and others. To ecological farming systems fertilized before harvesting system we have also seen a decline in the average number of weeds per m^2 at 19.75 with a mass of weeds in dry matter 86.73 $g.m^{-2}$, but continues to provide a strong level of weed infestation in the species represented here, to be part *Chenopodium album* L., *Atriplex patula* L., *Polygonum aviculare* L., *Avena fatua* L., *Sonchus arvensis* L., and others.

Weed infestation of spring barley crops in the spring in the integrated management system at an average grade of weed strong, with the number of weeds 22.00 per m^2. The most frequent weed species were: *Chenopodium album* L., *Atriplex patula* L., *Convolvulus arvensis* L., *Polygonum aviculare* L., and others. Similar results come to understand being pursued VEREŠ, SMATANA, MACÁK, 2010 and TÝR, VEREŠ, 2012.

To ecological farming system was on average weed infestation strong spring with the number of weeds on 20,125 m^2. Most occurring species were: *Chenopodium album* L., *Atriplex patula* L., *Convolvulus arvensis* L., *Polygonum aviculare* L., and *Stellaria media* L. Used successfully regulate chemicals harmful factors, mainly weeds in the integrated farming systems, as well as weeders used in ecological farming systems on the occurring of annual weeds. Effectiveness weeders were mild to perennial species: *Convolvulus arvensis* L., *Sonchus arvensis* L., *Cirsium arvense* L., *Plantago media* L., similar claims came L.-BARTOŠOVÁ et al. (2005); TÝR, VEREŠ, L.-BARTOŠOVÁ (2012).

Before harvest crops in different management systems were in the stands of spring barley the differences found in the weed. The integrated farming system has a unique weed infestation in crop occurred just kind of *Convolvulus arvensis* and *Polygonum aviculare*. The environmental management system prior to harvesting the crop was fertilized system strong weed infestation and the system was not fertilized weed infestation medium. Fertilizing system had the largest share of the weight of the weed species: *Chenopodium album*, *Atriplex patula*, *Convolvulus arvensis*, *Polygonum aviculare, Avena fatua* weed weighing 86.73 g m^{-2}.

We agree with the TÝR (2004), that the integrated management system will greatly reduce the number of weeds using herbicides. Some weed species for habitat and continue to persist, but the effect of the herbicide is both limited their growth and reproduction. Our results are consistent with the results GLOWACKA (2013), by which the control of weeds in the integrated management of chemical substances is not a complete destruction occurring weed species, ensuring a significant reduction in their number and dry weight loss. As submitted SOUKUP (2011), our results also confirmed that the spectrum of weeds in the spring and the harmful, not in spite of the shorter growing period and rapid engagement end stand so high. Most occurring weeds in our experimental systems with spring barley were species belonging typical from seedling springers cereals, especially *Chenopodium album* L., and *Polygonum aviculare* L. We note also the occurrence of the feared weed species from a number of monocotyledonous species *Avena fatua* L., which is relevant in terms of their harmful effects, but also costly, requiring protection in certain cases, especially herbicides.

According to the findings of our results and their comparison with other authors we would argue that systems of land management can greatly affect the status of crops of spring barley and weed infestation. It is very important to create crops of spring barley in the spring of complete emergence of the crop that will be competitive against weeds. Among the findings we monitor in 2014 and 2015, is in the integrated management of weeds number drastically decreased use of chemical plant protection products. Ecological farming system using weeders did not bring significant changes in weed (mostly perennial), but it is evident that hustosiate cereals can be grown without the use of herbicides. Crops in organic farming systems with lower weed can be maintained only if the crop is in good fitness condition and provided that the land will be against weeds control from perennial weed species.

CONCLUSIONS

In the present work we focused on theoretical and practical assessment of the possibilities and ways to reduce weed infestation in spring barley crop. Based on the stated objectives of work carried out evaluations and measurements can be submitted to the following conclusions in the years 2014 to 2015:

1) Soil and weather conditions were for the establishment of plantations and their relatively favorable development.

2) Fertilization affected the actual weed infestation stands spring barley before making weed control systems both in land management. The use of fertilizers promote the occurrence of the other for reps spring barley crops.

3) The management had an impact on the occurrence of weed species before regulation.

4) The integrated farming system is not fertilized occurred eight kinds of weeds: *Chenopodium album* L., *Convolvulus arvensis* L., *Polygonum aviculare* L., *Stellaria media* VILL., *Chenopodium hybridum* L., and others. Fertilized integrated farming system with the appearance of six kinds of weeds: *Chenopodium album* L., *Atriplex patula* L., *Thlaspi arvense* L., and others. In ecological farming system unfertilized we recorded the occurrence of nine kinds of weeds: *Chenopodium album* L., *Atriplex patula* L., *Convolvulus arvensis* L., *Polygonum aviculare* L., *Avena fatua* L., and others. In ecological farming system that was fertilized 10 species: *Chenopodium album* L., *Atriplex patula* L., *Convolvulus arvensi*s L., *Polygonum aviculare* L., *Sonchus arvensis* SCOP., and others.

5) Mustang herbicide use in the integrated land management had a positive impact on the frequency and weight of weed species before harvest. In the integrated system, not fertilized, the average number of weeds to 19.25 m^2, the number of eight kinds of weeds, reduce the occurrence of only one type - *Convolvulus arvensis* L., with the average of weeds at 2.00 m^2. In an integrated system there was fertilized significantly reduce the frequency of occurrence of weeds. From the initial average number of weeds to 24.75 m^2, and initially 6 weed species, the reduction occurred two species: *Convolvulus arvensis* L., *Polygonum aviculare* L., with an average number of weeds at 3.00 m^2.

6) Use weeders in ecological farming systems were not sufficient to regulate occurring perennial weed species: *Convolvulus arvensis* L., *Sonchus arvensis* SCOP., *Cirsium arvense* L., *Plantago media* L., which is also reflected in weight per m^2 weeds before harvesting spring barley, we have had no fall by half compared to the weight of the spring.

7) In keeping with all cultural (preventive and indirect), and direct measures of weed control is an ecological farming system is fully viable as a standalone - sustainable farming system.

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