FEATURES OF SPRING BARLEY WEEDINESS UNDER DIFFERENT FARMING AND SOIL TILLAGE SYSTEMS IN THE RIGHT BANK FOREST-STEPPE OF UKRAINE

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The results of research on the effect of different farming systems and ways of the basic soil cultivation on weeds were analyzed. The effectiveness of industrial farming system in the weed population control was revealed. The basic disadvantages of ecological and biological farming systems while growing spring barley in the Right Bank Forest-Steppe of Ukraine were illuminated.

***Key words**: spring barley, weeds, farming system, soil tillage, agrocoenosis.*

The agricultural crops weediness problem considered the greatest since the time of emergence of agriculture and today remains one of the most important limiting factors for a possible harvest crops.

The negative effect of weeds component in agrocenoses occurs in early stages of field crops development. During the competition between field crops and segetal plants, wild forms occupy most of the dominant positions, primarily due to their increased natural ability of active nutrients absorption, assimilation them out from the soil and fertilizers in quantities that are higher compared to field crops. In addition, during the early stages of development grows of wild species is far ahead compared to most crops especially in the beginning of vegetation season, which greatly reduces their competitive potential in the absence of human intervention [1,2].

Comprehensive control measure's rejection of weeds component presence level in field crop's agrocenoses leads to a decrease the yield because of competition from 15 to 40%. Furthermore, yield reduction can occur because of significant number of weeds with climbing stems growing in the crop, like a field bindweed (*Convolvulus arvensis* L.), for example. In addition, weeds can complicate the development and mechanization processes. In case of cereal's direct harvesting with presence of weeds in them, the harvester's total fuel consumption increases, the quality of details decreases due to use of more intensive working machine capacity.

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Later this grain mass has high humidity therefore, it needs a coarse separation, but in the absence of this possibility it requires additional costs for final drying, grain mass mixing in order to prevent its warming [4]. In particular, cleaver (Galium aparine L.), as well known weed species with tenacious and climbing stem, except competition with field crops for nutrients and water, complicates combine's work during the harvesting. Cleaver's green seeds, which got into the grain mass, increases its humidity and stimulates the development of pathogens and pests in granaries and silos. As a result, grain cannot be sold as certified seed through legal companies in the European Union. Increasing of losses related with weeds degrades the economic performance and efficiency in general. [3].

The reasons of the weed's constant presence in agrocenoses, despite the application of their prevention and control, are quite diverse. Firstly, focusing on market needs farmers use the same rotation type and technologies of growing crops, which prevents the possibility of specific measures application of individual dominant weed species' control. Furthermore, backwardness in terms of cultivation measures carrying, or its mismatch to the type of weediness in certain circumstances, the use of machines in bad mechanical condition, undermines their effectiveness against various types of weeds.

The aim of the research was to determine the impact of different types of cultivation and farming systems on weediness in agrocenosis of spring barley.

Material and methods of researches. Field's part of experimental research was conducted during the 2014-2015 biennium as a stationary experiment in "Agronomic Research Station" (Agriculture and herbology department, National university of life and environmental sciences of Ukraine), located in Pshenychne, Kyiv region.

Stationary research established in 2002. The scheme of crop rotation in the field's rotation corresponds zonal requirements of Forest-steppe: clover - winter wheat - sugar beets - corn silage - winter wheat - maize - peas - winter wheat - sugar beets - spring barley with overseeding clover.

The basis for grading factor A is a farming system, which provides different levels of resource support for the preservation of soil fertility:

- Industrial - to preserve soil fertility, preferred application is production of industrial origin, namely mineral fertilizers in quantities of 300 kg / ha a.i. NPK, organic fertilizers 12 tons / ha. To control pests, emphasis is placed on the use of synthetic pesticides;

- Ecological - in the soil fertility preservation involves the use of organic fertilizers - 24 t / ha (12 t / ha manure, 6 t / ha non-tradable crop products and 6 t/ha of green manure). As to fertilizers, application provides 150 kg per hectare a.i. NPK of crop rotation area. Pre-sowing seed preparation with use of biological agents. During the growing season, in case of exceeding crop's harmfulness threshold, pesticide use expected;

- Biological - a key element in maintaining the fertility is the use of resources only natural origin, namely 24 t / ha of organic matter. This system of agriculture excludes the use of industrial agrochemicals. Pre-sowing seed preparation is carried out with the use of natural origin preparations. During the crop's growing season, harmful objects control is provided by using biologics.

Graduation Factor B - system of main soil tillage in rotation:

- Nonmouldboard tillage - using tools without soil overturning at different depths, with leaving stubble on the surface of the field.

- Surface tillage - use disk tools for loosening soil at 8-10 cm for all crops in rotation.

Results. During the period of observation weed's synusia in conducted experiments varied considerably depending on the farming system. At the beginning of the growing season each variant had significant increase in the number of weeds with the lowest part of their presence in control experiment. For industrial farming system value reached 226 pcs. / m^2. Weed community in ecological system experiment was 2 times larger, compared to the industry. The largest number of segetal vegetation in spring barley crops was admitted for biological farming systems (an average of 584 pcs. / m^2 (Table)).

Table

Weediness of spring barley in the 10th field rotation during 2014-2015

Farming system (Facotr A)	System of main tillage (Factor B)	Weed's number, pcs./м²				Weed weight, g/м²
		Beginning of vegetation	At the time of harvest	In the phase of bearing	Finished bearing	
Biological	Nonmouldboard tillage	665	391	139	35	130
	Surface tillage	503	285	177	49	208
Ecological	Nonmouldboard tillage	261	78	67	19	58
	Surface tillage	252	115	88	15	99
Industrial (control)	Nonmouldboard tillage	209	58	53	13	34
	Surface tillage (control)	243	77	73	19	47
Index of correlation		-0,84	-0,88	0,85	0,81	-0,97
LSD	A	68,78	33	15,39	8,28	26,16
	B	56,16	$F_{calc}<F_{teor}$	12,56	$F_{calc}<F_{teor}$	21,36
	AB	97,27	47,04	21,76	$F_{calc}<F_{teor}$	37
Power of influence	A	94	94	93	71	81
	B	2	1	4	3	12
	AB	3	4	1	8	4
	Other factors	1	1	2	18	3

Comparing the main tillage's impact on weed community's quantitative index, the highest efficiency is marked while surface soil preparation, where the average number of weeds at the beginning of the growing season was 333 pcs. / m2, while for nonmouldboard tillage weediness was 14% higher (378 pcs. / m2).

At the end of the spring barley's growing season, the highest weed infestation was for biological farming system (338 pcs. / m^2), it is in 2.2 times lower compared with data at the beginning of the growing season. Reducing in the segetal vegetation number was due to competition for life factors and falling away some of plants as a result of pests damage in the early growth stages. In ecological farming system at the end of the growing season was admitted 96 pcs. / m^2 of weeds, that is 2.7 times lower than initial rate and 3.5 times, compared to biological system. The highest efficiency of the weed control had industrial farming system, where the average weediness amounted less than 67 pcs. / m^2, which is 5 and 1.4 times lower than the biological and ecological systems, respectively. This result was achieved by greater levels of using chemicals, which reduced the initial weediness in 3.4 times.

To forecast the possible weed community's species composition in the next years of crop rotation it is important to account weeds in the phase of bearing period at the harvesting time and those, which finished the growing season, and their numbers. In our case, the smallest number of weeds, which ended growing period, was admitted in industrial farming system (16 pcs. / m^2). The results obtained in the ecological system were not significantly different (17 pcs./ m^2). At the same time, in biological system the number of weeds, which ended the growing season up to the time of spring barley harvesting, was 42 pcs. / m^2, that exceeding the previous values in 2.5 times. Comparing the number of weeds that finished growing season with the number at the beginning of growing season, we got a close linear relationship (k = 0,81).

Within the tillage systems the weeds number that could give new a population was less in case of nonmouldboard tillage – 22 pc. / m^2. For surface tillage, this figure was 21% higher (28 pcs. / m^2).

It was established that the main source of weed seed stores replenishment in the soil is segetal vegetation, which reached the reproductive phase at the time of harvesting. Direct harvesting with chippering additionally promotes more even spread of mature seeds over the entire area of the field. In the absence of segetal vegetation community chemical control biological farming system characterized by the greatest number of weeds that reached the reproductive phase – 158 pcs. / m^2. Ecological farming system ensures reduction in the number of weeds in at least 2 times (78 pcs. / m^2). The industrial farming system characterized by the lowest number of segetal vegetation in the bearing phase – 63 pcs. / m^2. Between the weeds number in the reproductive phase and weediness at the beginning of the growing season there was a close linear relationship (k = 0,85).

To prevent the accumulation of weed's seed in the soil, an important element of growing technology is the early crops harvesting, which can reduce the segetal vegetation amount that reaches the reproductive phase at the time of threshing.

In realization of the potential spring barley's yield, an important limiting factor is the weeds weight, which determines its competitive potential. In our case, there is a close inverse relationship between spring barley's yield and weight of segetal

vegetation (the correlation coefficient is 0.97). The introduction of more intensive weed control system in the 10-fields crop rotation of industrial farming system allowed to reach the lowest segetal vegetation's weight in spring barley agrocenoses – 41 g / m^2. This data was 90% higher for the ecological farming system (78 g / m^2), and reached the highest level while biological farming system was used - 169 g / m^2.

Nonmouldboard tillage helped to decrease the average mass of weeds up to 74 g / m^2, and in case of the surface tillage weed's weight was 59% higher (118 g / m^2).

During the period of studies, the highest yield was obtained by industrial farming systems with nonmouldboard tillage that exceeded the control by 10%. The lowest yield rate was found in variant of using the biological systems with surface cultivation, 39% lower compared with a control variant.

To summarize, the main factor, which had influence on the weed's number and the level of its development was farming system. Comparing the factors influence strength, we examined that farming system had a very high impact on the number of weeds at the beginning and end of the growing season. Therefore, their number in the reproductive phase at the time of spring barley harvest was 94, 94 and 93%.

Conclusions. Application of only mechanical measures for weed control on biological farming systems leads to a significant increase in segetal vegetation populations.

The most effective is the ecological agriculture system. Despite the fact that the industrial system provided a lower number of weeds in spring barley crops and it had greater productivity, confirmation of its efficiency is not justified from economic point of view. An increase in crop productivity (0.4-0.5 t / ha) compared to the ecological system, will not compensate the additional costs incurred in growing.

It is important to consider the results while planning technology aspects and future costs of agrochemicals.

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