

WEED INFESTATION OF PLANTINGS AND YIELDING CAPACITY OF SPRING BARLEY UNDER VARIOUS TILLAGE METHODS

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The article presents the data about the influence of different tillage practices on the level of weed infestation of plantings and yielding capacity of spring barley in the Right-bank Forest-Steppe of Ukraine.

Spring barley belongs to the most wide-spread crops in the world arable farming, in Ukraine it is cultivated every year on the area of 3 – 4 million hectares [1]. However the yielding capacity of this crop in our country remains low. One of the main reasons of this is a high weed infestation of spring barley plantings. Weeds in plantings worsen growth conditions and development of crops, foster the spread of pest, diseases and make difficult the tillage of soil, deteriorate the quality of yield and decrease yielding capacity by 40-45% [2].

A great number of investigations established that the main tillage is the most effective measure for controlling weed infestation in the structure of agrophytocenosis. According to S.P. Tanchyk investigations, specific contribution of the main tillage makes up about 60% in the cumulative anti-weed effect [3]. Though there is no agreement among scholars as to the choice of the depth and the method of tillage. The majority of researchers notice that weed infestation increases during tillage without turning over the soil [4, 5], but some researchers emphasize on the advantage of partial or complete replacement of mouldboard plowing with soil loosening without mould board plowing at different depth in crop rotation.

Methods of the research. To study the influence of various tillage methods on weed infestation of plantings and yielding capacity of spring barley the stationary experiment was carried out. The trial was conducted in five-field crop rotation with different crops under drill sowing and wide-row sowing on the podzolized black soil on the field of Uman National University of Horticulture.

During the period of 2010-2012 we studied the effectiveness of replacement of autumn plowing at the depth of 20-22cm with soil loosening at the same depth using blade cultivator or with disk plowing at the depth of 10-12cm. In this case spring barley was planted after maize. Quantitative-gravimetric method was used to evaluate weed infestation. The experiment was conducted with application of Grodil Maxi (0,11/ha) and without herbicide application.

The results of the research. In our study (Table 1) weed infestation of barley plantings depended to some extent on the main tillage methods. At the beginning of its vegetation three-year average of weed infestation fluctuated from 56,4 to 81,9 units/m² within the limits of the experiment.

The smallest amount of weeds was detected in the variant with plowing at the depth of 20-22cm, and the greatest number of weeds — in the variant with disc plowing at the depth of 10-12cm as the main tillage operation. The variant with soil loosening using blade cultivator took an intermediary position. It is obvious that the

1. Weed quantity in spring barley plantings without herbicide application under various tillage methods, units/m²

Tillage method	Period of determination					
	Initial stage of vegetation		Middle stage of vegetation		Final stage of vegetation	
	all	incl. perennials	all	incl. perennials	all	incl. perennials
No herbicide application						
Plowing at 20-22cm	56,4	1,5	29,5	1,8	22,8	1,5
Loosening with blade cultivator at 20-22cm	71,2	1,7	34,6	1,9	26,4	1,5
Disc plowing at 10-12cm	81,9	2,4	40,9	2,3	32,3	2,0
Herbicide application						
Plowing at 20-22cm	-	-	5,6	0,4	6,5	0,5
Loosening with blade cultivator at 20-22cm	-	-	6,7	0,4	7,9	0,5
Disc plowing at 10-12cm	-	-	8,1	0,5	9,1	0,7

main reason of such increase in weed infestation of plantings of the researched plant was placement of weed seeds in the top soil with blade cultivator and disc plow, where it germinated on a massive scale under favourable conditions.

A considerable increase of perennial weeds is worth noticing in the variant with disc plowing. Thus, in comparison with control variant the number of perennial weeds increased by 0,9 units/m² or almost by 80% in the variant with disc plowing, which was caused by impossibility of cutting the root system of perennial weeds in a proper way with the help of disc implements because of shallow depth of tillage.

To the middle stage of vegetation of spring barley the number of weeds in its plantations went down to the level of 29,5-40,0 units/m² or in fact reduced by half. The main reason for this decrease was enhancing of phytocentric ability of spring barley in the competition with weeds at further stages of growth and development. At the period of evaluation it is necessary to mention that the difference in the number of young weeds reduced between researched variants. In other words in our study at the period of evaluation we didn't observe considerable increase in the number of weeds in case of refusal of plowing. Though the number of perennial weeds in the variant with disc plowing was noticeably higher.

At the end of vegetation of spring barley the number of weeds decreased even more in comparison with preceding periods of 2010 and 2011 and increased slightly in 2012. In our opinion the decrease of weed infestation was caused by a certain

suppression of weeds by a researched plant, and the increase in 2012 can be explained by the precipitation in that period. At that time the tendencies in the number of young and perennial weeds remained the same as in the middle of vegetation period.

In the case of herbicide application the number of weeds decreased considerably in all variants of the experiment. On average over the years of our experiment the number of weeds decreased almost by 5 times in comparison with variants without herbicide application, which indicates the efficiency of the chemical method. In this case depending on the variant of the experiment, weeds were recorded from 5,6 to 8,1 units/m² in the plantings of the researched plant, and the difference between researched variants was minimal. That is why under the application of herbicides weed infestation of plantings of spring barley at that period couldn't influence conditions of growth and development of the researched plant. Similar situation was in the case with perennial weeds, where we observe the tendency of increasing their number under the minimum use of mechanical tillage.

At the end of vegetation of spring barley the number of weeds in its plantings under the application of herbicides was almost the same as at the middle stage of vegetation, the preceding trends remained.

Thus, conducted research showed that under the introducing tillage methods alternative to plowing there was a considerable increase in weed infestation of plantings of spring barley at the initial stage of vegetation. At later periods of evaluation the difference between variants was reduced to the minimal values, and under the application of herbicides it leveled up completely, which indicates almost the same anti-weed efficiency of the researched methods of tillage during the growing of spring barley under herbicide application.

Along with the main indices of weed harmfulness such as their occurrence, species composition, the number and duration of competitive relations with crops there is the mass which they form per unit area. This particular index characterizes consumption of humidity and nutrients by weeds, and as a result – their harmfulness. As we can see from Table 2, on average over the years of our experiment we observed increase in the mass of weeds under soil loosening with blade cultivator and disc plowing compared to plowing. It is necessary to mention that we didn't observe a considerable difference in indices of mass of weeds in our experiment. This index was rather influenced by weather conditions during the experiment than by tillage methods. Thus, the mass of weeds in the plantings of spring barley was the same during vegetation periods in 2010 and in 2011 and because of dry conditions during vegetation period in 2012 it decreased considerably.

The application of herbicides in the plantings of spring barley resulted in the decrease of the weed mass by 3,5-4,6 times which indicates their efficiency. At the same time slightly higher mass of weeds in the plantings of spring barley was formed while applying herbicides under tillage methods alternative to plowing, though the difference between researched variants wasn't significant and that is why it could influence the productivity of the investigated crop.

Weeds in the plantings of crops lead to the competition with the last for the main factors of life, thus they have a negative impact on growing conditions, growth and

productivity of crops. In our research (Table 3) the yielding capacity of spring barley grains fluctuated from 32,8-38,2 cwt/ha over a period of 3 years without application of herbicides. It was relatively higher in the variants where plowing and soil loosening with blade cultivator were applied at the depth of 20-22cm.

2. The mass of weeds in spring barley plantings in the middle stage of vegetation under the application of various tillage methods, g/m² (average for 2010-2012)

Tillage method	Weed mass	
	wet	dry
Application of herbicides		
Plowing at 20-22cm	20,9	5,7
Loosening of soil with blade cultivator at 20-22cm	23,5	6,9
Disc plowing at 10-12cm	26,9	7,4
Without herbicide application		
Plowing at 20-22cm	9,3	3,2
Loosening of soil with blade cultivator at 20-22cm	9,1	3,0
Disc plowing at 10-12cm	11,7	3,8

In this case insignificant difference between indicated variants was not valid during the experiment. To our opinion almost the same level of yielding capacity in the indicated variants despite significant infestation of plantings is explained by the fact that at the time of harvesting, density of plants was higher in the variant with soil loosening using blade cultivator. This enhanced both competitive ability of plantings and allowed to get a certain compensation of harvest shortage caused by weeds.

The lowest level of yielding capacity was detected in the variant with disc plowing at the depth of 10-12cm, which was caused by the high level of infestation of plantings of the investigated crop. It is necessary to mention that in that variant there was the greatest number of perennial weeds that are the most harmful. It is worth noting that the reliable decrease of the barley harvest during the experiment was in the variant with disc plowing.

Herbicide application had a positive influence on the yielding capacity of spring barley. Thus, the increase of yield capacity accounted for 3,3-4,8 cwt/ha in different variants. Cited data prove the expediency of the chemical method application especially under the minimal use of mechanical tillage operations. Having analyzed the data of three-year period it is necessary to mention that yielding capacity in the variant with disc plowing at the depth of 10-12cm under herbicide application was almost the same as in the variant with plowing and loosening of soil by blade cultivator without herbicide application. On average during the years of the experiment the yielding capacity of spring barley was the same in the variants with herbicide application under plowing and loosening of soil with blade cultivator, and the use of disc plowing as the main tillage operation led to the reliable decrease of

yielding capacity in each year of our experiment and on average it accounted for 3,9cwt/ha.

3. Yielding capacity of spring barley grain under various tillage methods cwt/ha

Tillage method	Year of experiment			Average for the period of 2010-2011
	2010	2011	2012	
Without herbicide application				
Plowing at 20-22cm (control)	38,2	42,9	33,4	38,2
Soil loosening with blade cultivator at 20-22cm	37,4	43,2	32,2	37,6
Disc plowing at 10-12cm	32,1	37,0	29,3	32,8
<i>HIP</i> _{0,5}	2,2	3,2	2,6	
Herbicide application				
Plowing at 20-22cm (control)	42,3	46,2	36,2	41,5
Soil loosening with blade cultivator at 20-22cm	41,9	47,4	35,3	41,5
Disc plowing at 10-12cm	38,4	41,1	33,2	37,6
<i>HIP</i> _{0,5}	2,9	4,2	2,8	

Conclusions. The results of our research showed that replacement of plowing at the depth of 20-22cm with soil loosening using blade cultivator at the same depth was accompanied with insignificant increase of infestation of spring barley plantings. Though it doesn't effect its yielding capacity in both cases of the experiment with or without herbicide application and that is why there is a possibility of such replacement. The use of disc plowing at the depth of 10-12 cm as the main tillage method leads to considerable infestation of plantings. Therefore this method is impossible to use even under the application of herbicides.

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Карнаух О.Б.

Засоренность посевов и урожайность ячменя ярового при различных мероприятиях обработки почвы

Присутствие сорняков в посевах ячменя ярового существенно влияет на его продуктивность. Вследствие этого главной задачей зяблевой обработки почвы является эффективная борьба с сорняками. Вместе с тем, среди ученых отсутствует единая позиция относительно оптимального варианта обработки почвы, что и подтолкнуло нас к проведению этих исследований.

На протяжении 2010 – 2012 г. На опытном поле Уманского национального университета садоводства в стационарном опыте изучалась возможность замены вспашки плоскорезным рыхлением почвы либо дискованием. Учет сорняков проводили количественно-весовым способом. Исследования проводили на гербицидном и безгербицидном фонах.

За результатами трехлетних исследований было установлено, что замена вспашки на глубину 20 – 22 см плоскорезным рыхлением почвы при проведении зяблевой обработки под ячмень яровой сопровождалось незначительным увеличением засоренности посевов исследуемой культуры. Вместе с тем, это увеличение засоренности практически повлияло на урожайность ячменя на гербицидном и безгербицидном фонах исследований. Использование в качестве

зяблевой обработки под ячмень дискового луцения почвы на глубину 10 – 12 см сопровождалось значительным увеличением засоренности посевов исследуемой культуры и существенным снижением ее урожайности.

Установлена возможность и целесообразность замены вспашки на глубину 20 – 22 см плоскорезным рыхлением почвы под ячмень яровой на обоих фонах исследований.

Ключевые слова: ячмень, засоренность, основная обработка почвы, урожайность.

Karnaikh O.V.

Weed infestation of plantings and yielding capacity of spring barley under various tillage operations

Weeds in the spring barley plantings influence substantially its productivity. As a result the main task of fall tillage lies in the effective weed control. At the same time there is no consensus among scholars about ideal tillage method and this prompted us to undertake this research.

During the period of 2010 – 2012 the possibility to replace plowing with disc plowing or soil loosening with blade cultivator was researched on the trial field of Uman National University of Horticulture in the stationary experiment. The record of weeds was performed with the help of quantitative-gravimetric method. The research was conducted in 2 variants: with and without herbicide application.

The results of three-year experiment established that the replacement of plowing at the depth of 20 – 22cm with soil loosening using blade cultivator during the fall plowing of spring barley plantings was accompanied by insignificant increase in weed infestation of the investigated crop. At the same time this increase in infestation influenced the yielding capacity of spring barley while applying herbicides and without herbicide application. The usage of disc plowing as fall plowing at the depth of 10 – 12cm led to significant increase in infestation of the researched plant and considerable decline of its yielding capacity.

Possibility and expediency of the replacement of plowing at the depth of 20 – 22cm with soil loosening using blade cultivator was established in both cases: while applying herbicides and without herbicide application.

Key words: *spring barley, weed infestation, primary tillage, crop.*