

**WEED INFESTATION OF PLANTINGS AND YIELDING CAPACITY OF  
MAIZE DEPENDING ON CROPPING SEQUENCES IN ROTATION AND  
MAIN TILLAGE OPERATIONS**

**O.B. Karnaukh, Candidate of Agricultural Sciences**

*The article presents the results of the research into the influence of previous crops and main tillage operations on the level of weed infestation of plantings and yielding capacity of maize in the Right-bank Forest-Steppe of Ukraine*

Over the last years a considerable demand for maize has been established both on domestic and foreign market. This in its turn stimulates agricultural enterprises to expand areas under maize production. However their unreasonable expanding leads to undesirable consequences because of the failure to provide maize with the best previous crops which causes the increase of field infestation and hence the decrease of yielding capacity and the increase in production costs [1, 2].

The choice of the best previous crops and main tillage operations has been studied by many scientists but still this issue remains open to discussion. Thus, a considerable fluctuation of indexes for weed infestation of plantings and yielding capacity of maize resulted from the effect of the previous crops according to the research of M.S. Shewchenko, O.M. Shewchnko and M.S. Parlikokoshko [3]. Under the application of maize and sunflower as previous crops compared to winter wheat the level of infestation of maize plantings increased 1.8 – 2.4 times. In this case the yielding capacity in repeated plantings went down to 63 cwt/ha, after sunflower it fell to 57 cwt/ha whereas the yielding capacity of maize following winter wheat made up 103 cwt/ha.

The infestation of maize plantings depended on the previous crops and the main tillage operations in the research of W.I. Olesenko [4]. Thus, the lowest amount of weeds was recorded after sugar beets – 8.8 units/ m<sup>2</sup>, which is lower than after winter wheat by 13.7%, and after barley – by 27.9 % and almost 2.0 – 2.5 times lower than the amount of weeds after corn maize.

Winter wheat turned out to be the best previous crop for grain maize that was grown both on fertilized and unfertilized ground. The introduction of the minimal tillage operations resulted in a substantial increase of weeds in the plantings of the investigated crop.

According to the research of the Department of arable farming at Uman National University of Horticulture [5] in the plantings of maize in the cropping sequence pea – winter wheat – maize the amount of weeds was 29.8 units/ m<sup>2</sup>, and in the plantings of the third maize in the sequence maize – maize - maize the weed infestation over the period of four years was on the average more than 3 times higher and reached 94.2 units/ m<sup>2</sup>. Such considerable increase in the infestation of repeated plantings occurred due to millet like weeds – barnyard grass, yellow and green foxtail grasses.

That is why the important part of our research consisted in the determining the influence of the previous crops on the weed infestation and yielding capacity of maize under various tillage operations.

#### **Methods of the research.**

The study was carried out during the stationary experiment with five-field rotation including various crops using row and wide-row planting. This experiment was conducted on the podzolized black soil on the trial field of Uman National University of Horticulture.

The previous crops of maize were winter wheat, spring barley and the same maize. The tillage operations were traditional plowing and subsurface cultivating at the depth of 25 – 27 cm.

The level of weed infestation was evaluated using quantitative method at the beginning, in the middle and at the end of the vegetation period; the yield of maize on the investigated area was gathered manually.

#### **The results of the research.**

In our research (Table 1) the previous crops of maize exerted noticeable influence on the weed infestation of plantings of the researched crop.

Thus, at the beginning of vegetation over the years of the experiment the weed infestation of maize plantings under plowing fluctuated on average within 76.9 – 103 units/ m<sup>2</sup>. The lowest amount of weeds was recorded when maize followed winter wheat.

A slight increase (6.0 units/ m<sup>2</sup>) was detected when maize followed spring barley, and the greatest amount of weeds in the experiment at this time was observed when the maize was grown in repeated plantings. In this case the amount of weeds in relation to control increased by 26,1 units/ m<sup>2</sup>.

According to our point of view the main reason of such increase was the greater amount of weeds in the plantings of the previous crop and the fact that after the gathering of maize there was no time left to conduct the effective weed killing in the after-crop period.

**1. The amount of weeds in the plantings of maize after different previous crops under plowing, units/ m<sup>2</sup> (the average over the period of 2010 – 2013)**

Previous crops	Evaluated stage					
	the beginning of vegetation		the middle of vegetation		the end of vegetation	
	all	incl. perennials	all	incl. perennials	all	incl. perennials
<b>Plowing</b>						
Winter wheat	76,9	2,1	40,3	1,8	37,9	1,8
Spring barley	83,9	2,4	43,6	1,7	39,6	1,9
Maize	103	3,0	51,5	2,2	46,0	2,2
<b>Subsurface cultivating</b>						
Winter wheat	101	2,3	54,3	2,1	45,3	2,2
Spring barley	113	2,5	59,5	2,2	51,8	2,3
Maize	153	2,8	70,5	2,7	61,2	2,5

During the experiment we observed the increase of perennial weeds, in particular sow thistle when maize was placed in repeated plantings. In our opinion this was caused by vigorous growth and development of these weeds in the plantings of the previous crop.

By the middle of the vegetation period of maize the amount of weeds decreased approximately twice and depending on the variant of the experiment their amount was at the level of 40.3 – 51.5 units/ m<sup>2</sup>. This decline occurred due to inter-row tillage and enhancing of the phytocentric capability of maize during the later stages of its growth and development. In this case the same tendencies which were at the beginning of vegetation were observed when the greatest amount of weeds was recorded again in repeated plantings of maize, somewhat lower amount of weeds was registered when the studied crop followed spring barley and the lowest – in control.

At the end of vegetation of the investigated crop the weed infestation of maize plantings was on average almost the same as in the middle of vegetation after 3 years of the research. This was caused by the increase in the weed infestation at the end of vegetation in 2012 resulted from precipitation at that time.

Weed infestation of maize plantings after various previous crops under subsurface cultivating was somewhat different.

The common for all investigated variants was a considerable increase in the number of weeds in comparison with their amount under plowing caused by localization of ripe weed seeds in the 10 cm- layer of the soil. Thus, the amount of weeds after various previous crops under subsurface cultivating fluctuated at the beginning of vegetation during the experiment on average within 101-153 units/m<sup>2</sup>.

The lowest amount of weeds was recorded during the growth of maize after winter wheat.

Like in the case of subsurface cultivating we observed a considerable increase in the amount of annual weeds when maize was placed after spring barley and especially in repeated plantings.

According to our point of view the sharp increase can be explained by the fact that not all ripe weed seeds germinated in the after-crop period because of the dormant period of seeds of many types of weeds. On the other hand it germinated on a massive scale next year causing a considerable level of weed infestation of plantings at the beginning of its vegetation.

In the middle of vegetation the amount of weeds fell significantly in all variants of the experiment owing to tillage of plantings. Though in this period of evaluation the highest level of weed infestation was recorded during the growth of maize in the repeated plantings and the lowest one when it was planted after winter wheat. The variant with spring barley as a previous crop of maize occupied intermediate place. The same tendency in weed infestation was at the end of vegetation.

Thus, our research showed that the lowest amount of weeds in the plantings of maize in both cases of the experiment was determined when maize followed winter wheat. This fact was caused by phytocentric capability of the previous crop. A slight increase was observed when the investigated crop followed spring barley and considerable increase in the amount of weeds was determined in repeated plantings and especially in the case of subsurface cultivating which indicates the inexpediency of such sequence.

The level of yielding capacity of agricultural crop depends on many factors, the main of which are: weather conditions during the vegetation period of a crop, water and nutrients supply, the level of agricultural machinery.

Weeds in plantings have a negative effect on water and nutritive regimes and therefore in our experiment the yielding capacity of maize was noticeably influenced by the previous crops impacting its weed infestation in different ways (Table 2).

Thus over 3 years of the experiment the yielding capacity of maize under plowing was on average 55.6 – 64.5 cwt/ ha. A slight decrease after all previous crops was observed under the subsurface cultivating, in this case the yielding capacity depending on the variant was 51.9-61.4 cwt/ ha. According to our point of view the main reason for the decrease in the yielding capacity in the case of subsurface cultivating was a higher level of weed infestation during the whole vegetation period of maize.

A slight decrease in the yielding capacity of maize in our experiment in both cases was noted in the case with spring barley as the previous crop of maize compared to the control variant. In this case this decrease was very inconsiderable during the experiment.

## 2. Yielding capacity of maize after various previous crops

The year of the research	Previous crops			HIP <sub>05</sub>
	Winter wheat	Spring barley	Maize	
Plowing				
2011	70,8	68,1	61,3	5,8
2012	50,2	46,3	42,8	4,1
2013	72,4	70,3	62,8	5,3
average	64,5	61,6	55,6	
Subsurface cultivating				
2011	67,1	65,3	54,6	6,6
2012	48,4	45,2	40,4	4,8
2013	68,7	64,3	60,7	5,1
average	61,4	58,3	51,9	

During the growing of maize in repeated plantings over 3 experimental years a considerable decrease in the yielding capacity of maize was observed in both cases of the experiment and indicates inexpediency of such sequence.

Weather conditions had a great influence on the yielding capacity of maize. Thus, small precipitation and a high temperature in 2012 resulted in a considerable decrease of yielding capacity of the investigated crop in all variants compared to another 2 years of the experiment.

### **Conclusions.**

The findings of our research show that the best previous crops for grain maize in the south Forest-Steppe of Ukraine are spiked grains regardless of the main tillage operations of the soil.

The growing of maize in repeated plantings is accompanied by a considerable increase of weed infestation and as a result leads to the decrease in the yielding capacity of the investigated crop. That is why such sequence of crops in crop rotation is not expedient.

### **REFERENCES:**

1. Єщенко В.О. Сівозміни лісостепової зони / В.О.Єщенко, В.П. Опришко, П.Г. Копитко; За ред. В.О. Єщенка. – Умань, 2007. – 176 с.
2. Єщенко В.О. Умови вирощування і продуктивність кукурудзи залежно від попередників на півдні Лісостепової зони України // Степове землеробство. – Вип. 28. – К.: Урожай, 1994. – С. 42 – 46.
3. Шевченко М.С. Фактори контролювання забур'яненості і продуктивність гібридів кукурудзи / М.С.Шевченко, О.М.Шевченко, М.С.Парлікошко // Бюлетень Інституту зернового господарства. – Дніпропетровськ, 2006. – №29. – С. 19–21.
4. Олексенко В.І. Ефективність дії попередників, основного обробітку ґрунту та тривалого застосування добрив на урожайність кукурудзи у сівозмінах підзони північного Степу України. – Автореферат дисертації на здобуття наукового ступеня кандидата сільськогосподарських наук зі спеціальності 06.01.01 – загальне землеробство. – Дніпропетровськ, 2007. – 18 с.
5. Усик С.В. Урожайність зернових культур залежно від попередників та насичення ними п'ятипільних сівозмін / С.В.Усик, В.О.Єщенко,

### **Annotation**

The issues of the selection of the best previous crops and main tillage operations of the soil under maize are of current interest because there is no consensus among scholars and because of considerable expanding of areas under cultivation of this crop. This prompted us to undertake this research.

#### **Research methods.**

During the period of 2011-2013 the influence of various previous crops on the weed infestation of plantings of maize and its yielding capacity under various tillage methods was studied on the experimental field of Uman National University of Horticulture in the stationary experiment of the Department of arable farming.

The level of weed infestation was evaluated using quantitative method and yielding capacity was analyzed by weighing the ear mass from the investigated area.

#### **Results of the research.**

According to the results of three-year research it has been established that the lowest level of weed infestation of maize plantings was observed when it was placed after winter wheat in both cases of the experiment.

When the investigated crop followed spring barley under plowing there was inconsiderable amount of weeds and under the subsurface cultivating this increase was more significant that can be explained by the higher level of infestation of the previous crop plantings under the application of this tillage method.

The placement of maize in repeated plantings in both cases of the experiment was accompanied by significant increase in weed infestation of its plantings.

The yielding capacity of investigated crop in both cases of the experiment was almost the same after previous spiked grains and there was its considerable decrease in repeated plantings.

#### **Conclusions.**

The results of our research show that the best previous crops for grain maize in the Forest-Steppe of Ukraine are spiked grains regardless of the tillage method.

It should be noted that the amount of weeds under plowing was significantly lower than under subsurface cultivating of the soil.

The growing of maize in repeated plantings was accompanied by the increase in the weed infestation which resulted in a considerable decrease of yielding capacity.

Therefore such cropping sequence is inexpedient.