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PHYTOSANITARY STATUS OF WINTER WHEAT CROPS DEPENDING ON TILLAGE AND SOWING SYSTEMS

A. D. Gyrka, *doctor of agricultural sciences*
T. V. Gyrka, I. O. Kulyk, O. O. Viniukov, V. A. Ischenko, *candidates of agricultural sciences*
Institute of Grain Crops of NAAS Ukraine

За результатами виробничої перевірки впровадження систем обробітку ґрунту та сівби пшениці озимої визначено особливості розвитку і поширення шкідливих організмів у посівах культури під впливом досліджуваних факторів.

Ключові слова: *пшениця озима, обробіток ґрунту, сівба, бур'яни, шкідники, хвороби.*

Winter wheat along with high crop yield ability and grain quality, also characterized by increased resistance to stressful environmental conditions, makes it possible to significantly reduce the production costs of labor and resources at its growing and increase the sustainability of grain production. Growing highly well-adapted varieties is one of the cheapest ways to meet the challenges of saving as well as provides an opportunity to increase crop yield and improve its quality with little additional cost. Important in such event is high environmental requirements to soil structure and to predecessors [1, 2].

Growing winter wheat according to its biological requirements always increases productivity. When implementing scientifically based soil tillage made the rotation factor as element of biological agriculture. It stabilizes productivity level even without fertilization. Soil tillage and sowing systems of winter wheat has a positive effect on water and nutrient regimes of the soil, and in combination with fertilizers and other means of growing technology yields increased by 35–50 % at stable indicators of soil fertility. In the current socio-economic farming conditions, aggravated by climate change, the development and implementation a varietal agro technology of most adapted grain crops in specific soil and climatic conditions and the development of resource-saving technology elements based on the fullest possible use of plants biological potential has a practical interest and is an actual problem for modern plant growing [3, 4].

Production testing the feasibility of using surface and no tillage and sowing of winter wheat was carried out in SE EF "Dnipro" IGC NAAS Soloniansky district, Dnipropetrovs'k region (field № 7, division № 2) during 2008–2010 in crop rotation link: pea - winter wheat - sunflower.

In field experiment were studied the effectiveness of these technological schemes of winter wheat growing: 1 – no-tillage, seeding with sowing machine ATD-6.35; 2 – surface tillage, seeding with sowing machine ATD-6.35; 3 – surface tillage, seeding with SZ-3,6. In variant 1 after harvesting predecessor and regrowth of weeds (on August) used a herbicide mixture (vulkan, 4 l/ha + esteron, 1 l/ha). Technology of surface tillage (variant 2 and 3) included soil disking with BDT-7 at a depth of 8–10 cm, subsurface loosening with combined aggregate KR-4,5 at a depth of 10–12 cm, pre-sowing cultivation with KPS-4 at a depth of 6–8 cm. Other agro-technical elements – were generally accepted for Steppe zone [5, 6].

Seeding of winter wheat variety Kuial'nyk at rate of 5 million pcs. of germinated seeds/ha held on the 1st of October. At the end of tillering phase of plants in spring the sowings were locally dressed by ammonium nitrate (N_{30}).

Weather conditions during 2008–2009 were favorable for winter wheat growing. Abundant rains in the second half of September have created good prerequisites for obtaining even sprouts and plant establishment. In October and November observed elevated air temperature conditions at ceasing of autumn vegetation (CAV) of winter wheat was marked only on December, 8. Wintering of crops was successful. Early spring was cool, April was dry, but due to rain fall in May, the winter wheat is well developed and has formed a relatively high grain yield.

As a result of study the effect of minimum tillage on the development and spread of weeds in winter wheat crops established, that at first accounting of weeds (during late tillering and early stem elongation phases) in winter wheat crops were found 19 species of weeds at economic and environmental contamination threshold, which formed six species (Tab. 1).

1. Weediness of winter wheat crops in the tillering stage

Weed	Weeds amount (pcs./m²) on variants		
	No-tillage (seeding ATD-6.35)	Surface tillage (seeding ATD-6.35)	Surface tillage (seeding SZ-3,6)
Common ragweed	0,3	0,7	3,9
Knotgrass	20,7	27,7	21,6
Shepherd's purse	2,0	1,4	5,3
Flixweed	4,8	8,1	6,0
Horseweed	1,3	0,2	0,7
Common dandelion	1,3	2,2	1,8
Blue lettuce, Field bindweed, Creeping thistle	1,1	1,0	2,2
Cleavers	0,1	0,2	0,0
Forking larkspur	0,2	0,1	0,1
Drooping brome	1,1	0,1	0,2
Field pennycress	2,1	4,0	3,3
Amaranth	10,2	2,7	4,5
Other (Field gromwell, Henbit dead-nettle)	0,3	0,0	0,1
Altogether	45,5	48,4	49,7

Extermination these weed species must be economically recover the expenses of chemical crop protection. At the same time, it should be noted, that in variations of experience weed abundance was almost identical (45,5–49,7 pcs./m²). This indicates that it was formed mainly under the potential contamination of soil and weather conditions in spring this year (lack of active air temperatures, especially at night time, and productive moisture in the soil due to the absence of precipitation in April). In the ensuing time (first third of May) heavy rains fell. They were instrumental for growth and tillering of winter wheat plants. Its crops at this time had optically thick stand (500-600 productive stems per 1m² of field with energy-output ratio of illumination of bottom layer of crops at the level of 0,25–0,30 calories per 1cm²).

At these lighting conditions and following drought during May – June the majority of weeds which germinated in spring were died, due to drying up the upper soil layer (0–10 cm) and lack of PAR. Minority of them were in a depressed state: did not start to bloom and did not form viable seeds.

Having regard, to the above circumstances, it was unanimously resolved not to apply chemical protection of crops from weeds. In 2009 the studied tillage methods (surface, No-tillage), and sowing (ADT-6.35; SZ-3,6) had almost the same effect on weediness of culture. Of the 19 species of weeds that infested the wheat crops during the late tillering and early stem elongation phases the most withstanding (resistant), according to the second accounting, held before harvest, were six: Field bindweed – 0,8 pcs./m², Drooping brome – 0,1; Flixweed – 0,2; Horseweed – 0,7; Prickly lettuce – 0,4 Creeping thistle – 0,2 pcs./m² (Tab. 2).

Only a few plants on plots of the experiment (Field bindweed, Prickly lettuce, Horseweed) came to the middle and upper layer of wheat stand. They formed very little above-ground biomass and number of seeds. Under these conditions, the crop yield of winter wheat in experiment variants differed from control for only 0,07–0,16 t/ha, in other words the discrepancy was within the experimental error.

Obtained experiment data for the study of quantitative-species composition and harmfulness of weeds provides a basis for following conclusions. At incoming the atmospheric resources (moisture, light, heat) during the growing season for winter wheat in 2008–2009. at an approximate level to the multiyear norms, plants formed well bush and optically dense stands, which provided during the stem elongation and heading phases of crops sufficiently effective shading and biological suppression of weeds in plots both in surface and no-tillage tilling methods without application of herbicides.

2. Weediness of winter wheat crops before harvesting

Tilling and seeding methods	Parameters	
	pcs./m²	g/m² (kg/ha)
No-tillage (seeding ATD-6.35)	2,6	8,8 (88)
Surface tillage (seeding ATD-6.35)	2,5	7,7 (77)
Surface tillage (seeding SZ-3,6)	3,4	8,2 (82)

Winter wheat sowings in 2009 damaged mainly by the corn flies, plants infected by the Powdery mildew, Leaf blotch and Root rots (Tab. 3).

3. Infestation of winter wheat by the pests and damaging by diseases

Phase of development	Diseases, pests	Subject of registration, %	Tilling and seeding methods		
			No-tillage (seeding ATD-6.35)	Surface tillage (seeding ATD-6.35)	Surface tillage (seeding C3-3,6)
Tillering	Corn flies	Plant damage	1,4	1,9	6,3
Flowering	Powdery mildew	Infected plants	6,8	6,7	8,1
		Degree of injury	0,1	0,1	0,3
Soft dough	Root rots	Infected plants	28,7	30,2	33,7
		Degree of injury	8,3	8,2	9,3
	Leaf blotch	Degree of injury	4,4	4,2	5,4

It is established that the damage of the plants in tillering phase by corn flies at surface tilling and sowing with SZ-3,6 was for 4,4–4,9 % higher than at use of minimum-tillage planter ADT-6.35, due to lower depth of seed covering and more attractiveness of plants for pest settlement. The trend to increased infestation of crops by Powdery mildew and root rots in control (surface breaking up of soil, sowing with conventional sowing machine SZ-3,6) can be attributed to thicker placing plants in rows and greater damaging by corn flies.

In general, in conditions of 2009 the development and spreading of diseases and pests in winter wheat crops was not rampancy, revealed differences in terms of their harmfulness for different tilling and sowing technologies were non-substantial and could not be considered as a determining factor in terms of the possible impact on the formation of winter wheat productivity.

Thus, by the results of research was not installed the significant changes between the variants of experiment on the influence of tilling technologies on effective soil fertility and chemical composition of plants. Some trends that determined were of a general character.

Transferring the obtained indexes of yield structural elements of winter wheat into the program of mathematical processing we got a graphical model in which the corresponding parameters are displayed in each of the three lines – variants of tilling and sowing methods, wherein: the thin continuous line shows the no-tillage, seeding with sowing machine ATD-6.35; heavy continuous line – surface tillage, seeding with sowing machine ATD-6.35 and hatched line – surface tillage, seeding with SZ-3,6. The value of each of 8 variables laid off by one of the radiuses in order to better compare cases with multi-dimensional view (Fig.).

Analyzing the graphical model, it should be noted that at no-tillage and sowing with ATD-6.35 observed the highest manifestation of the 3 elements of the structure (amount of productive tillers per unit area, coefficient of productive tillering and the length of the head), and at the surface tillage and sowing with SZ-3,6 – of 4 other (plant height, amount and weight of grains per head, 1000 grains weight).

Only at the surface tilling and sowing method (with ATD 6.35), we noted the almost equal expression of the 5 structure elements, which, even at a significant reduction in plant height and reducing the number of grains per head, have provided formation the largest grain yield in experiment – 5,62 t/ha.

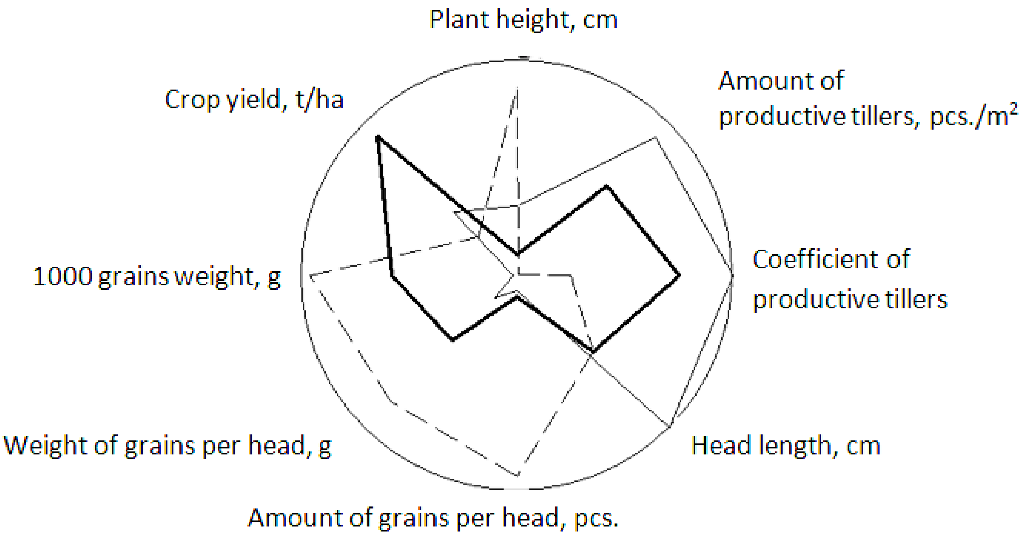

Fig. Graphical display of structure elements and grain yield of winter wheat depending on the tilling and seeding systems.

Conclusions. Under favourable hydrothermal conditions, regardless of technological schemes of tilling and sowing, the winter wheat formed optically dense stand even without applying insurance herbicides and provided effective shading and weed suppression.

The development and spreading of diseases and pests in winter wheat crops did not become rampancy, differences in terms of their harmfulness for different technologies of tilling and sowing were not significant and not a determining factor in terms of the possible impact on crop yield formation in variants of experiment.

It is established the tendency to increasing a crop yields and improving grain quality of winter wheat on a background of using the complex ADT-6.35 by uniform (in area and depth) covering of seeds in moist soil, higher stand density and optimal combination and ratio of structural elements of plant productivity.

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