UDC 633.16: 631.5:581.16

DOI: https://doi.org/10.36495/2312-0614.2022.4.15-20

THE INFLUENCE OF FERTILIZERS
on the damage of spring barley plants by intrastalk pests and grain yield

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Goal. *To study the population and harmfulness of intrastalk pests in the agrocenosis of spring barley depending on the use of fertilizers.* ***Methods.*** *The investigations was carried out in a stationary field, fixed nine-course-fallow-grain-row crop rotation at the Department for Plant Production and Cultivar Investigations of the Plant Production Institute named after V.Ya. Yuriev of the National Academy of Sciences (Eastern Forest-Steppe of Ukraine) during 2011—20.* ***Results.*** *During the years of research, the species composition of intrastalk pests was represented by: Oscinella pusilla Mg., O. frit L., Chaetocnema hortensis Geoffr., and Mayetiola destructor Say. Oscinella pusilla Mg. and O. frit L. dominated, damage to shoots by their larvae varied from 1.9% (2016) to 61.1% (2013). Damage to shoots by Chaetocnema hortensis Geoffr. larvae ranged from 0.4% (2015) to 35.5% (2011). The greatest damage to shoots by the larvae of Mayetiola destructor Say. was registered in 2018 — 5.7%. Application of fertilizers (manure 6.6 t/ha of the crop rotation area, aftereffect, and mineral fertilizers in the norm* $N_{30}P_{30}K_{30}$ *or* $N_{45}P_{45}K_{45}$*) provided increased resistance of spring barley plants to damage by pests. On the average over 2011...2020 year period, in the block without fertilizers, damage to shoots by Oscinella pusilla Mg. and O. frit L. larvae was 21.6%, in the fertilized block — 19.3% (decrease at the tendency level). At the tillering stage, the undamaged shoots on the background without fertilizers was 72.5%, on the fertilized background — 76.1% (difference at the tendency level). A reliable inverse average correlation was established between the damage of shoots by intrastalk pests and the grain yield of spring barley (r = −0.5). Averaged over ten years, the grain yield in the block without fertilizers was 3.25 t/ha, with the application of fertilizers — 4.69 t/ha, there was a difference of 30.7%.* ***Conclusions.*** *The positive role of fertilizers in regulating the number of intrastalk pests of spring barley and increasing grain yield was established.*

spring barley; fertilizers; intrastalk pests; grain yield

Spring barley (*Hordeum vulgare L.*) is a perspective grain crop that is important for the full food security of Ukraine, as it belongs to crops of universal use [1]. Spring barley is a valuable food, fodder and technical crop [2].

Barley responds very well to fertilization. The yield increase from mineral fertilizers can reach 1.5—2.0 t/ha and more [3]. According to the authors V.A. Ishchenko and others, obtaining high yields is impossible without providing crops with mineral fertilizers. In the years of research, spring barley productivity depended on the background of mineral nutrition by 33.6—46.5% [4].

According to the research of O.O. Vinyukov, the highest yield and increase were in the variant where the mineral nutrition system $N_{30}P_{30}K_{30}$ was used [5].

Agrotechnical solutions, such as applying nitrogen after the emergence of shoots, can increase the yield of fodder barley grain. Grain yield, nitrogen content in grain, and protein, as a rule, increased with an increase in the nitrogen rate after emergence [6].

The role of fertilizers in regulating the number of harmful insects has been established. The research was carried out on grain crops (in the agrocenosis of winter wheat [7], spring triticale [8]); on technical ones (in rapeseed agrocenosis [9]); on vegetable crops (in the agrocenosis of cabbage [10]); in fruit and berry plantations (in black currants [11]); in evergreen plantations (on the tropical shrub plant cassava, etc. [12)]. The analysis of literary sources showed that the effect of fertilizers in protecting plants against pests or the content of nutrients (mineral elements) in plants, in terms of increasing their tolerance, have different effects, both positive and negative.

A scientifically based fertilization system makes it possible to reduce the impact of negative factors on plants, ensuring high productivity and quality management of spring barley grain [13].

Barley has a large number of harmful organisms. Significant damage is caused by intrastalk pests:

- *Chaetocnema hortensis* Geoffr. In the tube-earing stage, the larvae move in the stems, the central leaves wither, dry up, and the stems die. They reduce the density of the productive stem, grain yield;
- *Oscinella pusilla* Mg. and *O. frit* L. damage the soots-grain formation stage. Larvae eat out the growth cone, base of the central leaf and grains. They thin out the density of the stem, cause uneven ripening of the grain;
- *Mayetiola destructor* Say. causes damage during tillering and grain formation. Larvae

damage stems and grains. They thin out the stem density, increase the intensity of tillering, contribute to the uneven ripening of grain, reduce the yield and quality of seeds [14].

The purpose of the research was to study the population and harmfulness of intrastalk pests in the agrocenosis of spring barley depending on the use of fertilizers.

Research materials and methods. The investigations were conducted in the field experiments of the Department for Plant Production and Cultivar Investigations of the Plant Production Institute named after V.Ya. Yuriev of the National Academy of Sciences (Eastern Forest-Steppe of Ukraine). The soil was a typical medium-humus black earth soil on loess with up to 5.4% humus in the plowing layer.

Spring barley was grown in 2011—20 according to conventional technology (without the use of insecticides and fungicides) in a stationary field, fixed nine-course-fallow-grain-row crop rotation. Agrotechniques were general use for growing area.

Sowing was carried out at the optimal time with a sowing rate of 4.5 million similar seeds per 1 ha. Varieties: Parnas (2011, 2013, 2014, 2015, 2016, 2018); Vyklyk (2012); Vzirets (2017); Inclusive (2019); Agrariy (2020). Forecrops of spring barley were: sugar beet (2011; 2016—18), peas for grain (2012—15), soybeans (2019—20). The sowing area was 34 m^2, the accounting area was 25 m^2. Experiments were replicated three times.

The block without fertilizers (control) was compared with the organo-mineral block (application of manure 6.6 t/ha of crop rotation area, aftereffect, and mineral fertilizers in the norm $N_{30}P_{30}K_{30}$ and $N_{45}P_{45}K_{45}$ (2014)).

The research method was laboratory-field. Counting of pests was carried out according to the general use method [15].

The grain harvest was harvested with a Sampo—130 combine.

Statistical analysis of the results of experimental studies was carried out by correlation and dispersion methods using Microsoft Office Excel and Statistica 6 licensed computer programs [16].

In 2011, during the germination–blooming period of spring barley, there were quite favorable meteorological conditions for the growth and development of plants: the average monthly air temperature exceeded the norm by 1.3°C; the amount of precipitation was 190.6% of the climatic norm. However, in the stage of milky grain maturity, the crops were badly damaged by hail, as a result of which the grain yield decreased by more than 50%. The meteorological conditions of 2014—17 and 2020 were also favorable for the formation of the spring barley harvest. The years 2012, 2013, 2018, and 2019 were characterized as unfavorable for the growth and development of spring barley, namely, dry conditions and a rise in temperature.

Results and discussion. During the years of research, the species composition of intrastalk pests was represented by *Oscinella pusilla* Mg. and *O. frit* L., *Chaetocnema hortensis* Geoffr., and *Mayetiola destructor* Say. *Oscinella pusilla* Mg. and *O. frit* L. dominated. Damage to shoots by their larvae ranged from 1.9% (2016, fertilized block) to 61.1% (2013, block without fertilizers). According to long-term data of researchers, in the eastern part of the Forest-Steppe of Ukraine, the number of *Oscinella pusilla* Mg. and *O. frit* L. was mainly at a significant level (up to 100%); only in the conditions of 2016, the decline of the pest was established up to 39% [17]. Damage to shoots by the larvae of *Chaetocnema hortensis* Geoffr. ranged from 0.4% (2015, block without fertilizers) to 35.5% (2011, block without fertilizers); in 2016, *Chaetocnema hortensis* Geoffr. was not observed. The greatest damage to shoots by *Mayetiola destructor* Say. larvae was recorded in 2018, on a fertilized background — 5.7%; in 2016—17 there was no fly (Table 1).

Damage to spring barley plants by intrastalk pests varied significantly over the years. The least damage to plants and shoots, respectively, was found in 2016: in the block without fertilizers — 5.4 and 4.9%; in the block with fertilizers — 3.0 and 1.9%, the maximum — in 2013: in the block without fertilizers — 79.1 and 64.8%; in the block with fertilizers — 84.8 and 53.9%.

In almost all years (with the exception of 2016 and 2019), damage to plants by intrastalk pests was less in the block without fertilizers compared to the fertilized block, at both the statistically significant level and the tendency level. Pests preferred more developed crops in their population.

Studies conducted in vegetable agrocenosis also showed that the application of manure, namely bird excrements together with mineral fertilizers (NPK), increased the attack of harmful insects on cabbage plants, compared to the control [10]. Shoot damage, on the contrary, was less on the fertilized background, compared to the background without fertilizers (with the exception of 2012).

Authors V.V. Gamayunova and A.V. Panfilova claim that the overground mass is important in the life of plants. They mobilize carbohydrates, nitrogenous and other substances from it to form a productive part of the harvest. Therefore, starting from the first stages of development, the accumulation of a large vegetative mass of plants is an important condition for the formation of a high yield [18]. It is known that the application of fertilizers, directly phosphorus, contributes to the increase of tillering of spring barley plants [3]. According to our data, on average over ten years, at the tillering stage, the total tillering was: on an unfertilized background, 2.5 shoots per 1 plant, on a fertilized background — 2.9 shoots per 1 plant, which was a difference of 13.8% (Table 2). As a result, a larger number of shoots (by 13.6%) was formed on the fertilized background. This explains the ratio of the population of plants and shoots with larvae of intrastalk pests on unfertilized and fertilized crops. On average during 2011—20, the total damage of plants by intrastalk pests in blocks ranged between 42.0—46.7%, shoots — 25.1—27.3%.

Shoot damage by *Oscinella* larvae was less, mainly with nutrition, *1. Damage to spring barley by intrastalk pests, %*

Year	Variant	Damage by intrastalk pests, %		Including shoots damaged by larvae, %		
		plants	shoots	*Mayetiola destructor* Say.	*Oscinella pusilla* Mg. and *O. frit* L.	*Chaetocnema hortensis* Geoffr.
2011	Control, without fertilizers	70.5	43.5	2.5	5.4	35.5
	Manure, 30 t/ha (aftereffect) with $N_{30}P_{30}K_{30}$	70.3	39.2	0.8	3.3	35.1
	LSD_{05}	8.0	4.1	1.1	1.1	2.7
2012	Control, without fertilizers	24.7	13.4	0.0	11.6	1.8
	Manure, 30 t/ha (aftereffect) with $N_{30}P_{30}K_{30}$	34.5	17.0	0.2	16.2	0.6
	LSD_{05}	10.2	3.4	1.1	2.8	1.2
2013	Control, without fertilizers	79.1	64.8	1.1	61.1	0.9
	Manure, 30 t/ha (aftereffect) with $N_{30}P_{30}K_{30}$	84.8	53.9	0.2	51.4	2.2
	LSD_{05}	9.3	4.7	1.2	3.9	0.9
2014	Control, without fertilizers	58.4	25.0	0.5	23.5	0.9
	Manure, 30 t/ha (aftereffect) with $N_{45}P_{45}K_{45}$	76.0	30.1	2.0	26.6	1.5
	LSD_{05}	10.5	9.5	2.8	3.2	1.4
2015	Control, without fertilizers	46.1	28.4	0.0	27.9	0.4
	Manure, 30 t/ha (aftereffect) with $N_{30}P_{30}K_{30}$	63.6	33.2	0.6	31.4	0.5
	LSD_{05}	9.8	1.9	0.7	2.3	1.2
2016	Control, without fertilizers	5.4	4.9	0.0	4.5	0.0
	Manure, 30 t/ha (aftereffect) with $N_{30}P_{30}K_{30}$	3.0	1.9	0.0	1.9	0.0
	LSD_{05}	8.4	2.6	–	2.8	–
2017	Control, without fertilizers	52.0	29.4	0.0	23.4	3.1
	Manure, 30 t/ha (aftereffect) with $N_{30}P_{30}K_{30}$	53.2	27.6	0.0	25.9	0.5
	LSD_{05}	5.1	1.40	–	2.0	0.4
2018	Control, without fertilizers	23.3	15.0	2.0	11.3	1.7
	Manure, 30 t/ha (aftereffect) with $N_{30}P_{30}K_{30}$	26.2	13.5	5.7	7.1	0.7
	LSD_{05}	8.3	4.1	1.3	1.7	1.0
2019	Control, without fertilizers	46.2	35.6	0.6	34.9	0.0
	Manure, 30 t/ha (aftereffect) with $N_{30}P_{30}K_{30}$	29.7	19.5	1.5	17.9	0.0
	LSD_{05}	13.9	6.4	–	8.0	–
2020	Control, without fertilizers	14.5	13.2	0.5	12.7	0.0
	Manure, 30 t/ha (aftereffect) with $N_{30}P_{30}K_{30}$	25.9	15.3	4.1	11.4	0.0
	LSD_{05}	10.9	2.8	1.3	3.0	–
Average						
Control, without fertilizers		42.0	27.3	0.7	21.6	4.4
Fertilized block		46.7	25.1	1.5	19.3	4.1
LSD_{05}		9.4	4.1	0.9	3.1	0.9

compared to the unfertilized background. This was recorded in 2011, 2013, 2018 and 2019 at the evidential level (the difference in damage was 1.6, 1.2, 1.6 and 1.9 times, respectively); in 2016 and 2020 — the difference is at the tendency level. In 2014; 2015 and 2017, the damage of shoots on the backgrounds varied between 23.5—26.6%; 27.9—31.4; 23.4—25.9%, respectively. Only in 2012, statistically greater shoot damage (16.2%) was found in the variant with nutrition compared to the background without fertilizers (11.6%), at LSD_{05}=2.8%. On average, in the block without fertilizers, shoot damage was 21.6%, in the fertilized block — 19.3% (decrease at the tendency level).

In 2011; 2013; 2018 and 2019, a greater number of shoots remained undamaged by intrastlk pests (mainly *Oscinella* larvae) at the tillering stage on the fertilized background, compared to the control. In 2011, the percentage of undamaged shoots in the version with nutrition was 70.1 versus 56.0 in the block without fertilizers; in 2013 — 46.9% versus 35.0%; in 2019 — 80.5 versus 64.1%; in 2018 — 87.0 versus 83.6%, respectively. In other years, the difference in the number of undamaged shoots was: in 2012 — 83.2—85.7%; in 2014 — 70.7—75.7%; 2015 — 67.1—71.9%; 2016 — 95.3—97.9%; 2017 — 70.4—72.7%; in 2020 — 85.4—87.3%. On average during 2011—20, on the background without fertilizers, undamaged shoots were 72.5%, on the fertilized background — 76.1%.

At the stage of waxy grain maturity, productive tillering ranged between: on a background without fertilizers, 1.0—2.6 stems per 1 plant, on a fertilized background — 1.3—2.5 stems per 1 plant. On average, for ten years, the index was: on the background without fertilizers — 1.6 stems per 1 plant, on the fertilized background — 1.9 stems on 1 plant, which is greater by 15.8% (Table 3). The number of spike-bearing stems was: on the background without fertilizers, 662 pcs./m^2, on the fertilized background — 779 pcs./m^2, which was a difference of 15.0%.

Under meteorological and phytosanitary conditions during the years of research, the spring barley grain yield ranged from 1.85 t/ha (2011) to 4.68 t/ha (2014 and 2020) (Table 4). In the block with fertilizer application, the index was from 2.57 t/ha (2011) to 6.33 t/ha (2014). On average over ten years in the block without fertilizers, the grain yield was 3.25 t/ha, with the application of fertilizers — 4.69 t/ha, which is significantly higher, at LSD_{05} = 0.25 t/ha. A reliable inverse average correlation was established between shoot damage and spring barley grain yield (r=–0.5).

2. Spring barley stem at the tillering stage

Year	Variant	Total tillering, shoots/plant	Number of shoots/m²		
			total	undamaged by intrastalk pests	
				number	%
2011	Control, without fertilizers	3.0	1.160	650	56.0
	Manure, 30 t/ha (aftereffect) with $N_{30}P_{30}K_{30}$	3.8	1.370	960	70.1
	LSD_{05}	0.8	190	150	–
2012	Control, without fertilizers	2.3	1.260	1.080	85.7
	Manure, 30 t/ha (aftereffect) with $N_{30}P_{30}K_{30}$	2.7	1.190	990	83.2
	LSD_{05}	0.6	261	223	–
2013	Control, without fertilizers	3.5	1.200	420	35.0
	Manure, 30 t/ha (aftereffect) with $N_{30}P_{30}K_{30}$	4.6	1.640	770	46.9
	LSD_{05}	1.3	450	290	–
2014	Control, without fertilizers	4.1	1.520	1.150	75.7
	Manure, 30 t/ha (aftereffect) with $N_{45}P_{45}K_{45}$	4.1	1.500	1.060	70.7
	LSD_{05}	1.1	354	375	–
2015	Control, without fertilizers	2.5	1.280	920	71.9
	Manure, 30 t/ha (aftereffect) with $N_{30}P_{30}K_{30}$	3.5	1.490	1.000	67.1
	LSD_{05}	1.1	166	165	–
2016	Control, without fertilizers	1.2	850	810	95.3
	Manure, 30 t/ha (aftereffect) with $N_{30}P_{30}K_{30}$	1.7	1.400	1.370	97.9
	LSD_{05}	0.9	267	376	–
2017	Control, without fertilizers	2.3	980	690	70.4
	Manure, 30 t/ha (aftereffect) with $N_{30}P_{30}K_{30}$	2.6	1.390	1.010	72.7
	LSD_{05}	0.7	62	156	–
2018	Control, without fertilizers	1.7	730	610	83.6
	Manure, 30 t/ha (aftereffect) with $N_{30}P_{30}K_{30}$	2.2	920	800	87.0
	LSD_{05}	1.0	190	184	–
2019	Control, without fertilizers	2.6	1.170	750	64.1
	Manure, 30 t/ha (aftereffect) with $N_{30}P_{30}K_{30}$	2.0	870	700	80.5
	LSD_{05}	1.0	246	190	–
2020	Control, without fertilizers	1.5	790	690	87.3
	Manure, 30 t/ha (aftereffect) with $N_{30}P_{30}K_{30}$	1.9	890	760	85.4
	LSD_{05}	0.5	203	267	–
Average					
Control, without fertilizers		2.5	1.090	780	72.5
Fertilized block		2.9	1.270	940	76.1
LSD_{05}		0.9	239	238	–

Thus, the application of mineral fertilizers against the background of the effects of organic fertilizers in spring barley crops, where less damage to shoots by intrastalk pests was noted, contributed to an increase in grain yield by 30.7%.

Averaged over the years (2011—20), on the background without fertilizers, the 1,000-kernel weight was 46.81 g, on the fertilized background — 48.87 g, which is 2.06 g more, that is, statistically reliable, at LSD_{05} = 0.51 g.

CONCLUSIONS

Under conditions of the eastern part of the Forest-Steppe of Ukraine during 2011—20, in the agrocenosis of spring barley, among the intrastalk pests, *Oscinella* spp. were the most harmful. In 2013, which was favorable for their reproduction, damage to shoots by their larvae reached 61.1%. The maximum damage to shoots by *Chaetocnema hortensis* Geoffr. larvae was 35.5% (2011), by the *Mayetiola destructor* Say. larvae was 5.7% (2018).

Application of fertilizers (manure 6.6 t/ha of crop rotation area, aftereffect, and mineral fertilizers in the norm $N_{30}P_{30}K_{30}$ or $N_{45}P_{45}K_{45}$) provided increased resistance of spring barley plants to damage by pests. On average, during 2011—20, damage to shoots by larvae of intrastalk pests was: 27.3% on the background without fertilizers, 25.1% on the fertilized background; including larvae of *Oscinella* spp., 21.6% and 19.3%, respectively, by backgrounds (decrease at the tendency level). Under the influence of fertilizers, an increase in the total tillering of plants by 13.8% was established, compared to the block without fertilizers, 2.5 shoots per plant; productive tillering by 15.8%, compared to the block without fertilizers, 1.6 stems per plant. At the tillering stage, the percentage of shoots undamaged by intrastalk pests on the background without fertilizers was 72.5, on the fertilized background — 76.1 (from the total number of shoots).

A reliable inverse average correlation was established between the damage of shoots by intrastalk pests and the yield of spring barley grain (r=–0.5).

On average, over ten years, the 1,000-kernel weight on the background without fertilizers was 46.81 g, on the fertilized background — 48.87 g (difference 2.06 g), at LSD_{05} = 0.51 g. The grain yield in the block without fertilizers was 3.25 t/ha, with fertilizer application — 4.69 t/ha, which is 30.7% greater.

We believe that the improvement of technological techniques for the cultivation of spring barley requires research in terms the assessment of the number and harmfulness of the

3. Stem density of spring barley at the stage of waxy grain ripeness

Year	Variant	Productive tillering, spike-bearing stems/plant	Number of stems/m²	
			total	including spike-bearing ones
2011	Control, without fertilizers	2.1	1.210	640
	Manure, 30 t/ha (aftereffect) with $N_{30}P_{30}K_{30}$	2.4	1.230	730
	LSD_{05}	0.8	254	121
2012	Control, without fertilizers	1.7	1.000	700
	Manure, 30 t/ha (aftereffect) with $N_{30}P_{30}K_{30}$	2.1	1.090	820
	LSD_{05}	0.4	206	133
2013	Control, without fertilizers	1.2	1.230	570
	Manure, 30 t/ha (aftereffect) with $N_{30}P_{30}K_{30}$	2.1	1.280	670
	LSD_{05}	0.4	300	170
2014	Control, without fertilizers	2.6	1.340	870
	Manure, 30 t/ha (aftereffect) with $N_{45}P_{45}K_{45}$	2.5	1.310	870
	LSD_{05}	0.8	321	212
2015	Control, without fertilizers	1.7	990	710
	Manure, 30 t/ha (aftereffect) with $N_{30}P_{30}K_{30}$	2.0	1.190	890
	LSD_{05}	0.9	190	130
2016	Control, without fertilizers	1.0	730	640
	Manure, 30 t/ha (aftereffect) with $N_{30}P_{30}K_{30}$	1.3	1.180	950
	LSD_{05}	0.8	219	170
2017	Control, without fertilizers	1.8	1.499	813
	Manure, 30 t/ha (aftereffect) with $N_{30}P_{30}K_{30}$	2.1	1.727	926
	LSD_{05}	0.6	93	42
2018	Control, without fertilizers	1.3	720	500
	Manure, 30 t/ha (aftereffect) with $N_{30}P_{30}K_{30}$	1.4	640	460
	LSD_{05}	0.8	131	92
2019	Control, without fertilizers	1.2	870	500
	Manure, 30 t/ha (aftereffect) with $N_{30}P_{30}K_{30}$	1.6	1.050	680
	LSD_{05}	0.8	178	138
2020	Control, without fertilizers	1.3	780	680
	Manure, 30 t/ha (aftereffect) with $N_{30}P_{30}K_{30}$	1.8	940	790
	LSD_{05}	0.7	131	119
Average				
Control, without fertilizers		1.6	1.037	662
Fertilized block		1.9	1.164	779
LSD_{05}		0.7	202	133

4. 1.000-kernel weight and spring barley grain yield

Year	Variant	1.000-kernel weight, g	Grain yield, t/ha
2011	Control, without fertilizers	46.97	1.85
	Manure, 30 t/ha (aftereffect) with $N_{30}P_{30}K_{30}$	49.71	2.57
	LSD_{05}	1.06	0.21
2012	Control, without fertilizers	48.77	4.57
	Manure, 30 t/ha (aftereffect) with $N_{30}P_{30}K_{30}$	51.61	5.29
	LSD_{05}	1.11	0.67
2013	Control, without fertilizers	44.22	2.02
	Manure, 30 t/ha (aftereffect) with $N_{30}P_{30}K_{30}$	47.75	3.14
	LSD_{05}	0.66	0.40
2014	Control, without fertilizers	52.04	4.68
	Manure, 30 t/ha (aftereffect) with $N_{45}P_{45}K_{45}$	53.85	6.33
	LSD_{05}	0.32	0.25
2015	Control, without fertilizers	45.03	3.16
	Manure, 30 t/ha (aftereffect) with $N_{30}P_{30}K_{30}$	44.54	3.95
	LSD_{05}	0.31	0.10
2016	Control, without fertilizers	42.13	2.71
	Manure, 30 t/ha (aftereffect) with $N_{30}P_{30}K_{30}$	46.36	4.83
	LSD_{05}	0.28	0.14
2017	Control, without fertilizers	48.45	2.95
	Manure, 30 t/ha (aftereffect) with $N_{30}P_{30}K_{30}$	50.10	6.03
	LSD_{05}	0.37	0.28
2018	Control, without fertilizers	50.37	2.55
	Manure, 30 t/ha (aftereffect) with $N_{30}P_{30}K_{30}$	54.00	4.36
	LSD_{05}	0.29	0.20
2019	Control, without fertilizers	47.48	3.30
	Manure, 30 t/ha (aftereffect) with $N_{30}P_{30}K_{30}$	47.72	4.51
	LSD_{05}	0.34	0.12
2020	Control, without fertilizers	42.60	4.68
	Manure, 30 t/ha (aftereffect) with $N_{30}P_{30}K_{30}$	43.08	5.89
	LSD_{05}	0.18	0.17
Average			
Control, without fertilizers		46.81	3.25
Fertilized block		48.87	4.69
LSD_{05}		0.52	0.25

main pests for the development of protective measures at the regional level.

Financing: Fundamental research was carried out according to the topics «To ground zonal ecologically safe management systems for the phytosanitary state of agrocenoses of grain crops in the Eastern Forest Steppe of Ukraine» (state registration number 0111U003395) in 2011—15, «To develop theoretical foundations and ensure reliable protection of field crops against harmful organisms under conditions of the Eastern Forest Steppe of Ukraine» (state registration number 0116U001040) in 2016—20.

Conflict of interest: the author declares no conflict of interest.

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Вплив добрив на пошкодженість рослин ячменю ярого внутрішньостебловими шкідниками та урожайність зерна

Мета. *Вивчити заселеність та шкідливість внутрішньостеблових шкідників у агроценозі ячменю ярого залежно від застосування добрив.* **Методи.** *Дослідження проведено в польових дослідах, у дев'ятипільному паро-зерно-просапному стаціонарі відділу рослинництва та сортовивчення Інституту рослинництва імені В.Я. Юр'єва НААН (східний Лісостеп України) протягом 2011—2020 рр.* **Результати.** *У роки досліджень видовий склад внутрішньостеблових шкідників представляли: шведські мухи — ячмінна (Oscinella pusilla Mg.) і вівсяна (O. frit L.), стеблові блішки, в основному, звичайна стеблова блішка (Chaetocnema hortensis Geoffr.) і гессенська муха (Mayetiola destructor Say.). Домінували шведські мухи, пошкодженість пагонів їх личинками варіювала від 1,9% (2016 р.) до 61,1% (2013 р.). Пошкодженість пагонів личинками стеблових блішок становила від 0,4% (2015 р.) до 35,5% (2011 р.). Найбільшу пошкодженість пагонів личинками гессенської мухи зареєстровано в 2018 р. — 5,7%. Застосування добрив (гній 6,6 т/га сівозмінної площі, післядія, та мінеральні добрива в нормі* $N_{30}P_{30}K_{30}$ *або* $N_{45}P_{45}K_{45}$*) забезпечувало підвищення стійкості рослин ячменю ярого до пошкоджень шкідниками. У середньому за 2011—2020 рр. досліджень, у блоці без добрив, пошкодженість пагонів личинками шведських мух становила 21,6%, в удобреному блоці — 19,3% (зменшення на рівні тенденції). У фазі кущіння відсоток непошкоджених пагонів на фоні без добрив становив 72,5%, на удобреному фоні — 76,1% (різниця на рівні тенденції). Між пошкодженістю пагонів внутрішньостебловими шкідниками і урожайністю зерна ячменю ярого було встановлено достовірний обернений середній кореляційний зв'язок (r = –0,5). У середньому за десять років урожайність зерна становила у блоці без добрив 3,25 т/га, із внесенням добрив — 4,69 т/га, що склало різницю 30,7%.* **Висновки.** *Встановлено позитивну роль добрив у регулюванні чисельності внутрішньостеблових шкідників ячменю ярого та підвищенні урожайності зерна.*

ячмінь ярий; добрива; внутрішньостеблові шкідники; урожайність

Received by the editors: 09/15/2022.
Accepted for printing: 07.11.2022.
Printed and published online: December 2022.