UDC: 633.111:632.951:631.8 https://doi.org/10.53040/gppb8.2024.106

GRAIN YIELD AND QUALITY OF WINTER BREAD WHEAT DEPENDING ON CROP PROCESSING

Kalitsinska Olesia, Zaima Oleksii
The V. M Remeslo Myronivka Institute of Wheat of National Academy of Agrarian Sciences of Ukraine, Tsentralne, Kyiv region, Ukraine
e-mail: ekonomistmip@ukr.net, oleksii.zaima@ukr.net

Summary. Winter wheat is one of the most common field crops both in Ukraine and abroad. An important factor in protecting plants from pests and preserving the harvest is the use of plant protection products. We investigated the influence of insecticides and microfertilizers on grain yield of winter bread wheat varieties. There was found a positive effect and generally increased results compared to the control. We obtained the best grain quality indicators of winter bread wheat when using insecticides in variants with complex treatment with insecticides and microfertilizer.

Keywords*:* winter bread wheat, yield, protection, insecticide application, microfertilizer.

Introduction

World agriculture cannot be imagined without such a crop as winter wheat. This crop was one of the main grain crops both in Ukraine and throughout the world. Now winter wheat is sown on more than 40% of arable land under grain crops in our country.

The modern trend of integrated plant protection is determined by the management of the dynamics of the population of harmful and beneficial organisms based on phytosanitary forecasts of various orientations and the purposeful application of modern methods and means of plant protection, taking into account environmental protection. Based on international experience in the future, the phytosanitary importance of plant protection, primarily its effective methods and means and their ecological orientation and nature protection, will steadily grow [1].

In the works of many Ukrainian and foreign scientists A. A. Morshchatskyi, V. P. Kavunets, H. M. Kovalyshyna, S. V. Retman, H. P. Zhemela, T. M. Pedash, H. E. Creissen, J. M. Nicol and others, it has been proven that non-compliance of winter wheat crop management system leads to significant yield losses (20–50%) due to damage of plants with diseases and pests [2, 3]. The elements of improving the phytosanitary condition of winter wheat crops include pre-sowing seed treatment and crop processing, which is the subject of the works of scientists such as V. I. Tanasevych, S. M. Kalenska, M. M. Marenych, L. I. Ulich [4, 5] and others. However, in the conditions of climate change, in order to obtain stable yields of winter wheat and high-quality grain, when growing varieties with high potential, there is a need to study the mechanism of action of preparations for pre-sowing seed treatment on the characteristics of its germination and preparations for crop processing on the characteristics of plant development and the subsequent production process.

The most important component of the agro-industrial complex of Ukraine is the grain industry. The constant demand for grain products encourages the production of more grain, which allows to increase the volume of its export. Increasing the volume of crop production becomes possible due to the use of intensive technologies that involve the use of modern high-yielding varieties of winter wheat, which will allow reaching a new level of yield and grain quality [6].

Harmful fauna of cereal grain crops is characterized by a significant diversity of species composition. Significant damage to grain crops is caused by omnivorous species of insects (click beetles, darkling beetles, armyworms, cutworms, etc.), as well as rodents. Pests damage various parts of cereal plants: seeds sown in the soil, seedlings, roots, stems, leaves and generative organs (ovaries, anthers, stamens, spikelet scales, and seeds). Crop losses due to damage to generative organs by such pests as thrips, grain aphids, leafhoppers, bugs, scarab beetles, cereal ground beetles

and yellow poplar weevilis, caterpillars of rustic shoulder-knot can be particularly significant. In the presence of even a small amount of impurities of grains damaged by the bugs (2-3%), the baking qualities of the flour are sharply reduced [7, 8].

Our research was aimed to increasing the yield of winter wheat varieties and checking the effect of the insecticide application combined with microfertilizer on grain yield and quality.

Materials and methods

The research was carried out at the Department of Seed Growing and Agrotechnologies of the V.M. Remeslo Myronivka Institute of Wheat, NAAS of Ukraine.

The formation of winter wheat seed yield was studied depending on the treatment of crops with insecticides at the VIII (heading) and the X (milk ripeness) stages of organogenesis. Scheme of the experiment includes factor A – varieties: MIP Fortuna, MIP Vidznaka; factor B – insecticides Green Fort IL 200, SC (a.s. imidacloprid 150 g/l, lambda-cyhalothrin 50 g/l), 0.5 l/ha); Kanonir Duo, SC (a.s. imidacloprid 300 g/l, lambda-cyhalothrin 100 g/l), 0.1 l/ha; factor C – microfertilizer "5 Element", 25 g/ha. Crops treated with microfetilizer were also treated with fungicides Vareon 520 EC (1.0 l/ha) and Abrusta EC (1.0 l/ha) at booting stage. To achieve the goal was used conventional methods of research: field (determination of yield, biometric records and measurements), laboratory (determination of yield increase); calculation and analytical (estimation of economic efficiency when using complex preparations on winter wheat crops [9].

Results and discussions

The research was conducted in 2022–23 on the experimental fields of the V. M. Remeslo Myronivka Institute of Wheat. Analyzing the indicators of yield growth according to the Table 1, it can be concluded that when processing with the combination of Vareon (booting) + Green Fort IL 200 (heading) + Green Fort IL 200 + "5 Element" (milk ripeness) there is a significant effect of insecticides and microfertilizers on the grain yield of all studied winter wheat varieties.

Table 1

The influence of insecticides and microfertilizers on grain yield of winter wheat varieties, t/ha

Variant of processing, stage of wheat development	Variety			
	MIP Vidznaka		MIP Fortuna	
	Yield	Yield increase	Yield	Yield increase
Control, no processing	5.63	–	4.52	–
Green Fort IL 200, 0.5 l/ha, heading	5.81	0.37	4.70	0.18
Kanonir Duo, 0.1 l/ha, heading	5.75	0.31	4.79	0.27
Green Fort IL 200, 0.5 l/ha, milk ripeness	5.85	0.40	4.99	0.47
Kanonir Duo, 0.1 l/ha, milk ripeness	5.82	0.38	5.06	0.54
Vareon, booting + Green Fort IL 200, heading + Green Fort IL 200 + "5 Element", milk ripeness	6.01	0.56	5.67	1.15
Abrusta, booting + Kanonir Duo, heading + Kanonir Duo + "5 Element", milk ripeness	6.26	0.82	5.62	1.10

In general, in the variants with the application of insecticides the yield of winter wheat was 0.18–1.15 t/ha higher than the control. The most indicators of yield increase were in the variants of crop processing during the period of milk ripeness and in the same period with the addition of microfertilizer and ranged from 0.40 to 1.15 t/ha.

A healthy plant is the key to the potential of a crop. Therefore, its protection and nutrition is a primary task for obtaining maximum harvest volumes. The agrarian complex of Ukraine faces the task of increasing both the quantity and quality of winter wheat grain.

According to the Table 2, it can be noted that the most effect of insecticides and microfertilizers on grain quality of all winter wheat varieties was caused by the Kanonir Duo preparation for processing during heading stage and for processing during milk ripeness stage.

Table 2

Impact of insecticides and microfertilizers on grain quality of winter wheat varieties

Variant of processing, stage of wheat development	Variety					
	MIP Vidznaka			MIP Fortuna		
	Protein content, %	Sedimentation value, ml	Wet gluten content, %	Protein content, %	Sedimentation value, ml	Wet gluten content, %
Control, no processing	11.3	47	21.6	11.0	37	21.0
Green Fort IL 200, SC, 0.5 l/ha, heading	12.2	53	23.5	11.5	46	21.7
Kanonir Duo, 0.1 l/ha, heading	11.9	65	22.6	11.1	48	20.6
Green Fort IL 200, 0.5 l/ha, milk ripeness	11.4	47	22.1	10.7	46	20.2
Kanonir Duo, 0.1 l/ha, milk ripeness	12.4	57	23.7	12.5	47	23.7
Vareon, booting + Green Fort IL 200, heading + Green Fort IL 200 + "5 Element", milk ripeness	11.9	54	22.4	11.5	46	22.5
Abrusta, booting + Kanonir Duo, heading + Kanonir Duo + "5 Element", milk ripeness	11.5	57	22.0	11.4	46	22.0

Conclusions

The effect of insecticides and microfertilizers on grain yield of winter wheat varieties turned out to be positive and generally improved the result as compared to the control.

We obtained the positive effect of insecticides on the quality of winter bread wheat grain in variants with insecticide treatment and in combination them with microfertilizer. Insecticides Green Fort IL 200 and Kanonir Duo and microfertilizer "5 Element" contribute to higher productivity and quality of winter bread wheat grain.

References

1. Pysarenko, V .M., Pishchalenko, M. A., Pospielova, H. D. Horb, O. O., Kovalenko, N. P., & Sherstiuk, O. L. (2020). Integrated plant protection. Poltava: N.p. [in Ukrainian]
2. Retman, S. V., & Shevchuk, O. V. (2006). The seeds should be treated. *Seed Production, 3*, 22–24. [in Ukrainian]
3. Kavunets, V. P. Kovalyshyna, H. M., & Kochmarskyi, V. S. (2002). Influence of fungicides on sowing qualities and yielding properties of winter wheat seeds. *Bulletin of Bila Tserkva State Agrarian University*, *24*, 116–121. [in Ukrainian]
4. Marenych, M. M. (2018). Factors limiting grain production under climate change conditions. In *Climate change and agriculture. Challenges for agricultural science and education* : Proceedings of Int.scientific and practical conference (pp. 117–120). Kyiv: State University "SMC Agro-education". [in Ukrainian]
5. Ulich, L. I. (2006). Yield and adaptive properties of new varieties of winter wheat. *Bulletin of the Bila Tserkva State Agrarian University, 37*, 30–37. [in Ukrainian
6. Hrytsiuk, P. M. (2013). Prospects of grain production and grain export from Ukraine in the conditions of the world food crisis. *Problems of rational use of socio-economic and natural resource potential of the region: financial policy and investments*, *19*(4), 87–97. [Ukrainian]
7. Liskovsky, S., Demidov, A., Siroshtan, A., et al. Influence of spring wheat treatment by insecticides and fungicides on yield and seed sowing qualities. *Agriculture and Plant Protection, 5*, 54–56. [in Rusian]
8. Morhun, V. V., Sanin, Ye. Yu., & Schwartau, V. V. (2014). Club of 100 centners. Modern varieties and systems of nutrition and protection of winter wheat. Kyiv: Lohos. [in Ukrainian]
9. Rozhkov, A.O., Puzik,V.K., Kalenska, S. et al. (2016). Experimenting in agronomy. Book 1. Theoretical aspects of experimenting. Kharkiv: Maidan [in Ukrainian]