UDC 633.11:631.53.027.2:632.95:631.86
DOI: https://doi.org/10.36495/2312-0614.2025.1.29-33

THE INFLUENCE OF SEED TREATMENT

by protectants and microfertilizer on sowing qualities and biological indicators of winter bread wheat

O.A. ZAIMA,
Candidate of Agricultural Sciences,
ORCID: 0000-0001-5714-6308

O.B. KALITSINSKA,
ORCID: 0009-0000-1661-3838
The V. M. Remeslo Myronivka Institute of Wheat of the NAAS, 68 Tsentralna st., Tsentralne village, Obukhiv district, Kyiv region, 08853, Ukraine
e-mail: oleksii.zaima@ukr.net; ekonomistmip@ukr.net

Goal. To determine the effect of various protectants and microfertilizer on sowing qualities and biological parameters of winter bread wheat seeds. **Methods.** There were studied winter bread wheat varieties MIP Valensiia, MIP Vidznaka, MIP Aelita, MIP Fortuna. The influence of the protectants GreenFort Star, Yunta Quattro 373.4 FS, Cruiser 350 FS and their combinations with microfertilizer «5 Element» was investigated. **Results.** When treating seeds with protectants and their combination with microfertilizer «5 Element» sprouting seed activity increased by 0.3—9.0%, seed vigor by 0.5—6.3%, laboratory germination by 0.3—2.0% compared to the control variants. The higher seed vigor for the varieties MIP Valensiia (96.5%) and MIP Aelita (94.5%) was obtained in variants of treatment by Cruiser 350 FS, MIP Vidznaka (95.8%) by GreenFort Star, MIP Fortuna (96.0%) by Yunta Quattro 373.4 FS. In the varieties MIP Aelita and MIP Fortuna the highest laboratory germination was obtained in the variants of treatment by Cruiser 350 FS and its combination with the microfertilizer, in the varieties MIP Vidznaka and MIP Valensiia by GreenFort Star and its combination with the microfertilizer. In the varieties MIP Aelita and MIP Fortuna the higher field germination was obtained when treating seeds by the preparation Cruiser 350 FS in combination with the microfertilizer «5 Element», while in the varieties MIP Vidznaka and MIP Valensiia by Yunta Quattro 373.4 FS in combination with the preparation «5 Element». **Conclusions.** It has been determined that treatment of winter bread wheat seeds with preparations under study improved sprouting activity, seed vigor, laboratory and field germination. Preparations of fungicidal and insect-fungicidal action mainly caused shortening of the coleoptile, and the protectant of insecticidal action Cruiser 350 did its lengthening. By complex treatment of seeds by protectants and microfertilizer, more length of coleoptile and the number of primary roots were noted compared with the use of only preparations of protection against diseases and pests. Consequently, the protectants and microfertilizer we studied contributed to the improvement of most of the sowing qualities and biological indicators of the treated seeds.

seeds of winter bread wheat; treatment; preparations; complex microfertilizer; indicators of seed quality

Winter wheat has the largest crop areas and occupies a leading place among grain crops in Ukraine. So, the main problem is to obtain high yields and quality grain. For its solution, the quality of seed material of winter wheat is important: seed vigor, germinating power, grain size, varietal purity, grain uniformity, disease and pest infestation, as well as yield properties. A significant role in seed processing technologies belongs to modern protectant and growth regulators containing a complex of biologically active micro-, macro- and mesoelements that enhance metabolic processes in plant organisms, increase their resistance to adverse weather conditions, contribute to the additional use of their full potential, and improve the quality of yield [1].

One of the ways to maximize the productivity potential of winter wheat varieties is the introduction of optimal and adapted crop management systems. According to the modern intensive crop management practice of winter wheat, it is necessary to carry out seed dressing before sowing [2]. The factor of presowing treatment of seeds is quite important and affects the course of the initial stages of plant development, makes it impossible to infect seeds and seedlings, which ultimately impacts on productivity.

Crop management practices involve the use of an effective system for protecting plants from harmful organisms, the main task of which is to destroy the sources of primary and secondary infection of phytopathogens, as well as to prevent damage to plants by phytophages [3, 4]. Among the methods that are used in plant protection, preference is given to chemical one, which involves the use of pesticides for dressing seeds before sowing and for spraying plants during the growing season. In the integrated system of wheat protection from harmful organisms, one of the important elements is the use of innovative chemicals [5, 6].

Seed treatment before sowing contribute to increase sustainability and seed vigor, increases protective functions to pathogens, resistance to drought and frost, ensures the rapid and uniform seedling emergence in field, improves yield indicators and product quality in general [7, 8]. Seed treatment is aimed at protecting plants from diseases caused by affected seeds or soil, as well as protecting shoots and shoots of plants from soil pests [9].

Treatment makes it possible to disinfect seeds, protect them and seedlings from mold, and reduce the damage of seedlings by root rot and pests [10—13]. Treating is the most cost-effective and environmentally safe measure to protect crops from diseases and pests [13, 14]. Pre-

sowing treatment of wheat seeds with protectants not only disinfects the seeds, but also protects young shoots from soil pests [15].

Cultivation of varieties being resistant to pests and pathogens allows without additional costs to minimize crop losses from harmful organisms and to reduce energy consumption by 25—30%, as well as to create a new ecological niche in agrobiocenoses [16].

The experiments of many scientists confirm that chemical and biological protectants not only provide protection against pests and diseases, but also strengthen their resistance to stresses and significantly increase the productivity of grain crops [17—20]. One of the main ways to improve grain quality is to use biologically active substances that contribute to increasing the yield of various varieties of cereals (from 6 to 16%) [21].

In the presence on the market of a large number of preparations of various effects for pre-sowing treatment of seeds, the mechanism of their action and effect in the complex on seed germination, formation of shoots, vegetative and reproductive spheres of plants have not been fully clarified. All this prompted us to conduct relevant research in our climate zone.

Materials and methods. The research was carried out on winter bread wheat varieties MIP Valensiia, MIP Vidznaka, MIP Aelita, MIP Fortuna. Untreated seeds of the above-mentioned winter wheat varieties were as control. Seeds before sowing were treated with microfertilizer «5 Element» (80 g/t) and insecticidal, fungicidal and insecto-fungicidal protectants. «5 Element» is a complex of salts of macro- and mocroelements specially selected to stimulate the development of fungi-endophytes in the basal zone and directly in the plant itself, which provide a powerful development of useful soil microorganisms, primarily various bacteria and rhizospheric exobacteria. As a result, there is a process identical to the applying high norms of mineral (from 0.1 to 0.4 t/ha) and organic (5—10 t/ha) fertilizers.

There were studied protectants of insecticidal action Cruiser 350 FS (thiamethoxam, 350 g/l), 0.5 l/t, fungicidal action GreenFort Star, FS, (fludioxonil, 18.75 g/l; cyproconazole, 6.25 g/l), 1.2 l/t, and insecto-fungicidal action Yunta Quattro 373.4 FS, (imidacloprid, 166.7 g/l; clothianidin, 166.7 g/l; prothioconazole, 33.3 g/l; tebuconazole, 6.7 g/l), 1.2 l/t. The norms of the protectants for the variants of the experiment were calculated according to the recommended doses. Field experiments were laid after the preceding crop soybean according to the State variety testing method [22].

Sowing was carried out with a seeder SN-10 Ts, the seeding rate was 5 million viable seeds per 1 ha. Sample area is 10 m^2 with four replications. Agricultural practices in the experiments are common for the conditions of the Forest-Steppe of Ukraine. The crop was direct harvested with the «Hege 125» (Germany) and transferred to standard (14%) grain moisture. Statistical processing of the results was carried out using the programs «Statistica 6.0» and «Excel 2003».

Under laboratory conditions, in the treated seeds there were determined activity of sprouting by the method of M.M. Makrushyn, Ye.M. Makrushyna [23], seed vigor, laboratory germination according to State Standard of Ukraine 4138—2002 [24], coleoptile length and number of embryonic roots by the method of morphological assessment of seedlings. Field germination was calculated as the ratio of the number of shoots to the total number of seeds sown.

The purpose of the study is determine the impact of seed treatment with modern protectants and microfertilizer on sowing qualities and biological indicators of winter bread wheat seeds in unvironments of the Forest-Steppe of Ukraine.

Research results and discussion. On average, over the years of the research (2022—2023) when treating seeds of winter bread wheat varieties with protectants and their combination with microfertilizer «5 Element»|, the activity of sprouting in seeds increased by 0.3—9.0%, seed vigor by 0.5—6.3%, laboratory germination by 0.3—2.0% compared to the control variants (Table 1). The best indicators of sprouting activity in seeds of the varieties MIP Valensiia and MIP Aelita were obtained in the variants of seed treatment with protectants Yunta Quattro 373.4 FS (1.2 l/t) and Cruiser 350 FS (0.5 l/t), in the variety MIP Fortuna with GreenFort Star (1.2 l/t) and Yunta Quattro 373.4 FS (1.2 l/t), MIP Vidznaka with GreenFort Star (1.2 l/t) and Yunta Quattro 373.4 FS (1.2 l/t) in combination with the microfertilizer «5 Element» (80 g/t).

The higher seed vigor in the varieties MIP Valensiia (96.5%) and MIP Aelita (94.5%) was obtained in variant with the treatment of Cruiser 350 FS, MIP Vidznaka (95.8%) with GreenFort Star, MIP Fortuna (96.0%) with Yunta Quattro 373.4 FS. Thus, with the parameters of untreated seeds at the level of 89.8—95.0%, the seed vigor in treated seeds was 90.8—96.5%.

Laboratory germination of seeds, which was treated, was in the range of 96.8—98.8%, with indicators of untreated seeds of 96.0—97.8%. In the variety MIP Aelita, the highest laboratory germination was obtained in the variants of treatment with Cruiser 350 FS and its combination with the microfertilizer «5 Element», in the variety MIP Vidznaka with GreenFort Star, in the variety MIP Valensiia with GreenFort Star in combination with the microfertilizer, in the variety MIP Fortuna with Cruiser 350 FS plus «5 Element».

The combination of protectants and microfertilizer did not guarantee an increase in the sowing qualities of seeds in proportion compared to the treatment with only one of these preparations. Only on some varieties there was such a trend.

Field germination of treated seeds was in the range of 85.5—92.9%, while in the untreated seeds it was 88.1—84.8% (Table 2). In the varieties MIP Aelita and MIP Fortuna higher field germination was obtained by treating the seeds with the preparation Cruiser 350 FS in combination with the microfertilizer «5 Element», in the varieties MIP Vidznaka and MIP Valensiia with Yunta Quattro 373.4 FS in combination with the preparation «5 Element».

1. Seeding qualities of seeds after treatment, 2022—2023

Variety	Variant	Sprouting activity, %	Seed vigor, %	Laboratory germination, %
MIP Fortuna	Control	78.8	89.8	96.5
	GreenFort Star FS 1.2 l/t	86.0	92.8	97.3
	Yunta Quattro 373.4 FS, 1.2 l/t	85.5	96.0	97.5
	Cruiser 350 FS, 0.5 l/t	83.0	94.8	97.5
	GreenFort Star FS, 1.2 l/t + «5 Element», 80 g/t	79.5	94.0	97.0
	Yunta Quattro 373.4 FS + «5 Element», 80 g/t	82.0	94.0	97.5
	Cruiser 350 FS + «5 Element», 80 g/t	84.0	95.0	98.0
MIP Valencia	Control	90.3	95.0	96.0
	GreenFort Star FS 1.2 l/t	92.3	95.5	97.0
	Yunta Quattro 373.4 FS, 1.2 l/t	93.5	95.8	96.8
	Cruiser 350 FS, 0.5 l/t	94.3	96.5	97.5
	GreenFort Star FS, 1.2 l/t + «5 Element», 80 g/t	92.0	96.0	98.0
	Yunta Quattro 373.4 FS + «5 Element», 80 g/t	91.5	95.0	97.0
	Cruiser 350 FS + «5 Element», 80 g/t	90.5	96.0	97.0
MIP Aelita	Control	85.5	91.3	96.8
	GreenFort Star FS 1.2 l/t	89.3	90.8	97.0
	Yunta Quattro 373.4 FS, 1.2 l/t	93.0	94.0	97.5
	Cruiser 350 FS, 0.5 l/t	93.0	94.5	98.5
	GreenFort Star FS, 1.2 l/t + «5 Element» 80 g/t	91.0	93.0	97.5
	Yunta Quattro 373.4 FS + «5 Element», 80 g/t	92.0	92.5	97.0
	Cruiser 350 FS + «5 Element», 80 g/t	91.0	92.0	98.0
MIP Vidznaka	Control	69.0	92.8	97.8
	GreenFort Star FS 1.2 l/t	69.5	95.8	98.8
	Yunta Quattro 373,4 FS, 1.2 l/t	71.3	95.0	98.5
	Cruiser 350 FS, 0.5 l/t	75.8	94.5	98.3
	GreenFort Star FS, 1.2 l/t + «5 Element», 80 g/t	78.0	94.5	97.5
	Yunta Quattro 373.4 FS + "5 Element» 80 g/t	78.0	95.5	98.5
	Cruiser 350 FS + «5 Element», 80 g/t	77.5	95.0	98.5
LSD_{05}		**5.1**	**3.5**	**2.1**

2. Field germination and biological indicators of plants after seed treatment, 2022—2023

Variety	Variant	Field germination, %	Coleoptile length, cm	Number of roots, pcs
MIP Fortuna	Control	84.8	5.2	3.8
	GreenFort Star FS 1.2 l/t	86.0	3.6	3.8
	Yunta Quattro 373.4 FS, 1.2 l/t	85.5	4.2	3.9
	Cruiser 350 FS, 0.5 l/t	90.9	5.3	3.8
	GreenFort Star FS, 1.2 l/t + «5 Element», 80 g/t	86.1	4.2	3.9
	Yunta Quattro 373,4 FS + «5 Element», 80 g/t	87.0	4.7	4.1
	Cruiser 350 FS + «5 Element», 80 g/t	92.2	5.4	4.2
MIP Valencia	Control	*83.2*	*3.2*	*4.1*
	GreenFort Star FS 1.2 l/t	89.6	2.3	4.0
	Yunta Quattro 373.4 FS, 1.2 l/t	89.4	3.7	4.2
	Cruiser 350 FS, 0.5 l/t	90.7	4.0	4.1
	GreenFort Star FS, 1.2 l/t + «5 Element», 80 g/t	89.6	3.0	4.2
	Yunta Quattro 373.4 FS + «5 Element», 80 g/t	93.0	3.6	4.2
	Cruiser 350 FS + «5 Element», 80 g/t	92.4	3.8	4.2
MIP Aelita	Control	*84.0*	*4.6*	*4.0*
	GreenFort Star FS 1.2 l/t	85.8	3.4	3.9
	Yunta Quattro 373.4 FS, 1.2 l/t	90.7	4.5	3.7
	Cruiser 350 FS, 0.5 l/t	90.6	5.3	4.1
	GreenFort Star FS, 1,2 l/t + «5 Element», 80 g/t	88.2	5.0	4.0
	Yunta Quattro 373.4 FS + «5 Element», 80 g/t	90.9	4.4	4.2
	Cruiser 350 FS + «5 Element», 80 g/t	92.9	5.7	4.0
MIP Vidznaka	Control	*88.1*	*4.4*	*3.6*
	GreenFort Star FS 1.2 l/t	90.0	3.2	3.7
	Yunta Quattro 373.4 FS, 1.2 l/t	90.5	3.6	3.7
	Cruiser 350 FS, 0.5 l/t	91.7	4.6	3.5
	GreenFort Star FS, 1.2 l/t + «5 Element», 80 g/t	88.8	4.1	3.8
	Yunta Quattro 373.4 FS + «5 Element», 80 g/t	92.8	4.6	3.9
	Cruiser 350 FS + «5 Element», 80 g/t	92.2	5.5	3.8
LSD_{05}		**2.9**	**2.1**	**0.9**

Treatment of seeds with protectants had a different effect on the coleoptile length of winter bread wheat seedlings. In control variants the coleoptile length was 5.2 cm in the variety MIP Fortuna, 3.2 cm in MIP Valensiia, 4.6 cm in MIP Aelita, and 4.4 cm in MIP Vidznaka. When treating seeds with test preparations, these indicators were 3.6—5.4; 2.3—4.0; 3.4—5.7 and 3.2—5.5 cm, respectively. It is noted that preparations of fungicidal and insecto-fungicidal action mainly caused shortening of coleoptile, and preparation of insecticidal action Cruiser 350 FS caused its lengthening. Complex treatment of seeds with protectants and microfertilizer contributed to the lengthening of coleoptile compared to the use of only preparations for protection against diseases and pests.

Seed treatment with test preparations had no negative effect on the number of embryonic roots in winter wheat seedlings, and in some variants a tendency to increase it was observed. More embryonic roots (3.8—4.2 pcs depending on the variety and variant) was formed in seedlings resulted from treatment of seeds with protectants and microfertilizer, at indicators in the control of 3.6—4.1 pcs.

CONCLUSIONS

It has been established that by treatment of winter bread wheat seeds with the investigational preparations the higher sprouting activity and seed vigor in seeds of the varieties MIP Valensiia and MIP Aelita was obtained in variants of Yunta Quattro 373.4 FS (1.2 l/t) and Cruiser 350 FS (0.5 l/t); in the varieties MIP Fortuna — Yunta Quattro 373.4 FS (1.2 l/t); MIP Vidznaka — GreenFort Star (1.2 l/t). In the variety MIP Aelita, the most laboratory germination was obtained in the variants of treatment with the preparation Cruiser 350 FS and its combination with microfertilizer «5 Element», in the variety MIP Vidznaka — GreenFort Star, in the variety MIP Valensiia — GreenFort Star combined with micronutrient, in the variety MIP Fortuna — Cruiser 350 plus «5 Element». Preparations of fungicidal and insecto-fungicidal action mainly caused shortening of coleoptil, but preparation insecticidal action Cruizer 350 FS did its lengthening. Complex treatment of seeds with protectants and microfertilizer had a positive effect on the coleoptile length and the number of embrional roots compared to the use of only preparations for protection against diseases and pests. In the varieties MIP Aelita and MIP Fortuna, the higher field germination was noted when treating the seeds with the preparation Cruiser 350 FS in combination with the microfertilizer «5 Element»; in the varieties MIP Vidznaka and MIP Valensiia with Yunta Quattro 373.4 FS in combination with the microfertilizer «5 Element». Consequently, the protectants and microfertilizer we studied contributed to the improvement of most biological indicators and sowing qualities of the treated seeds.

Financing. The research was carried out within the framework of task 13.00.14.04.P «Improvement of seed technology for growing new varieties of winter wheat under the conditions of the Right-Bank Forest-Steppe of Ukraine». No. SR 0121U100436.

Conflict of interest. The authors declare no conflict of interest.

REFERENCES

1. Havryliuk M.M. (2004). Osnovy suchasnoho nasinnytstva. [Fundamentals of modern seed production]. Kyiv: NNTs IAE, 256 s. (in Ukrainian).

2. DeVuyst E.A., Edwards J., Hunger B., Weaver L. (2014). Insecticide and fungicide wheat seed treatment improves wheat grain yields in the US southern plains. Crop Management, *13*(1), 1–5. DOI: https://doi.org/10.2134/CM-2013-0039-RS

3. Kuzmenko N.V., Avramenko S.V., Hlubokyi O.M. (2021). Khimichnyi zakhyst pshenytsi miakoi ozymoi vid korenevykh hnylei. [Chemical protection of soft winter wheat against root rot]. Zernovi kultury, [Cereal Crops], *5*(2), 383–389. DOI: https://doi.org/10.31867/2523-4544/0199 (in Ukrainian).

4. Bezpalko V.V., Stankevych S.V., Zhukova L., Zabrodina V., Turenko V.P., Horyainova V.V., …, Matsyura A.V. (2020). Presowing seed treatment in winter wheat and spring barley cultivation. Ukrainian Journal of Ecology, *10*(6), 255–268. DOI: https://doi.org/10.15421/2020_291

5. Kovalyshyna H.M., Mukha T.I., Murashko L.A., Kryvoviaz I.Z., Zaima O.A. (2012). Nasinnieva infektsiia zerna pshenytsi ozymoi ta zakhyst vid nei. [Seed infection on winter wheat grain and protection from it]. Zakhyst i karantyn roslyn. [Plant Protection and Quarantine], (58), 74–81. (in Ukrainian).

6. Kalenych P.Ye. (2017). Ekonomichni pokaznyky vyroshchuvannia nasinnia novykh sortiv pshenytsi ozymoi (*Triticum aestivum* L.) v umovakh Pivdennoho Lisostepu Ukrainy. [Economic indicators of growing seeds of new winter wheat varieties (*Triticum aestivum* L.) in the conditions of the Southern Forest-steppe of Ukraine]. Zbirnyk naukovykh prats NNTs «Instytut zemlerobstva NAAN». [Collection of scientific works of the NSC «Institute of Agriculture of NAAS»], (4), 188–199. (in Ukrainian).

7. Pyroh T.P., Paliichuk O.I., Iutynska H.O., Shevchuk T.A. (2018). Perspektyvy vykorystannia mikrobnykh poverkhnevo-aktyvnykh rechovyn u roslynnytstvi. [Prospects of using microbial surfactants in plant growing]. Mikrobiolohichnyi zhurnal. [Microbiological Journal], *80*(3), 115–134. DOI: https://doi.org/10.15407/microbiolj80.03.115 (in Ukrainian).

8. Siroshtan A.A., Zaima O.A., Kavunets V.P., Dubovyk D.Yu. (2021). Vplyv obrobky nasinnia protruinykamy i mikrodobryvamy na posivni yakosti ta vrozhainist pshenytsi ozymoi. [Influence of seed treatment with protectors and microfertilizers on sowing qualities and yield of winter wheat]. Peredhirne ta hirske zemlerobstvo i tvarynnytstvo. [Foothill and Mountain Agriculture and Stockbreeding], *70*(1), 150–165. DOI: https://doi.org/10.32636/01308521.2021-70-1-11 (in Ukrainian).

9. Kosylovych H., Holiachuk Yu. (2023). Efektyvnist novoho protruiuvalnyka nasinnia Vibrans Intehral proty khvorob ta shkidnykiv na yaromu yachmeni. [Efficiency of the new seed treatment preparation Vibrance Integral against diseases and pests on spring barley]. Visnyk Lvivskoho natsionalnoho universytetu pryrodokorystuvannia. Seriia Ahronomiia [Bulletin of Lviv National Environmental University. Series Agronomy], (27), 129–132. DOI: https://doi.org/10.31734/agronomy2023.27.129 (in Ukrainian).

10. Voloshchuk O., Voloshchuk I., Hlyva V., Hereshko H., Zapisotska M. (2020). Bakterialni preparaty v tekhnolohii vyroshchuvannia nasinnia pshenytsi ozymoi v zakhidnomu lisostepu Ukrainy. [Bacterial preparations in the technology of growing winter wheat seeds in the western Forest-Steppe of Ukraine]. Peredhirne ta hirske zemlerobstvo i tvarynnytstvo. [Foothill and Mountain Agriculture and Stockbreeding], *67*(1), 26–38. DOI: https://www.doi.org/10.32636/01308521.2020-(67)-1-2 (in Ukrainian).

11. Mehra L.K., Cowger C., Ojiambo P.S. (2017). A model for predicting onset of *Stagonospora nodorum* blotch in winter wheat based on preplanting and weather factors. Phytopathology, *107*(6), 635–644. DOI: https://doi.org/10.1094/PHYTO-03-16-0133-R

12. Chornomorets V.S. (2020). Zalezhnist yakosti ta vrozhainosti pshenytsi ozymoi vid peredposivnoho protruiuvannia nasinnia. [Dependence of quality and yield of winter wheat on pre-sowing seed treatment]. Tavriiskyi naukovyi visnyk. [Taurida Scientific Herald], (112), 161–165. DOI: https://doi.org/10.32851/2226-0099.2020.112.23 (in Ukrainian).

13. Marenych M.M. (2017). Peredposivna obrobka nasinnia yak element upravlinnia produktyvnym potentsialom pshenytsi ozymoi. [Presowing treatment of seeds as an element of management of the productive potential of winter wheat]. Visnyk Poltavskoi derzhavnoi ahrarnoi akademii. [Bulletin of Poltava State Agrarian Academy], (4), 42–46. (in Ukrainian).

14. Klipakova Yu.O., Priss O.P., Bilousova Z.V, Yeremenko O.A. (2019). Urozhainist pshenytsi ozymoi zalezhno vid peredposivnoi obrobky nasinnia. [Productivity of winter wheat depending on presowing cultivation of seeds]. Visnyk ahrarnoi nauky. [Bulletin of Agricultural Science], (4), 16–23. DOI: https://doi.org/10.31073/agrovisnyk201904-03 (in Ukrainian).

15. Markovska O., Biliaieva I. (2015). Shliakhy znyzhennia shkodochynnosti zlakovykh mukh na zroshuvanykh posivakh pshenytsi ozymoi. [Ways to reduce the harmfulness of cereal flies on irrigated winter wheat crops]. Propozytsiia, (12), 100–102. (in Ukrainian).

16. Morhun V.V., Topchii T.V. (2018). Znachennia stiikykh sortiv ozymoi pshenytsi, vyvchennia dzherel i donoriv stiikosti do shkidnykiv ta osnovnykh zbudnykiv khvorob. [The importance of resistant varieties of winter wheat, the study of sources and donors of resistance to pests and main pathogens]. Fiziolohiia roslyn i henetyka. [Plant Physiology and Genetics], *50*(3), 218–240. (in Ukrainian).

17. Anishyn L.A. (2002). Rehuliatory rostu roslyn: sumnivy i fakty. [Plant growth regulators: doubts and facts]. Propozytsiia, (5), 64–65. (in Ukrainian).

18. Volkohon V.V, Nadkernychna O.V., Kovalevska T.M., Tokmakova L.M., Kopylov Ye.P. (Volkohon V.V. Ed.). (2006). Mikrobni preparaty v zemlerobstvi. Teoriia i praktyka. [Microbial preparations in agriculture. Theory and practice]. Kyiv: Ahrarna nauka, 312 s. (in Ukrainian).

19. Hrytsaienko Z.M., Ponomarenko S.P., Karpenko V.P., Leontiuk I.B. (2008). Biolohichno aktyvni rechovyny v roslynnytstvi. [Biologically active substances in crop production]. Kyiv: Nichlava, 352 s. (in Ukrainian).

20. Cherenkov A.V., Hruzinov S.K., Kobos I.O. (2018). Vplyv peredposivnoi obrobky nasinnia na morozo- ta zymostiikist pshenytsi ozymoi pislia riznykh poperednykiv. [Influence of pre-seed treatment of seeds on frost and winter resistance of winter wheat after various predecessors]. Zernovi kultury. [Cereal crops], *2*(1), 53–60. DOI: https://doi.org/10.31867/2523-4544/0007 (in Ukrainian).

21. Herman M.M., Mishchenko O.V. (2013). Vplyv obrobky nasinnia protruinykamy i mikrodobryvamy na posivni yakosti ta vrozhainist pshenytsi ozymoi. [Effect of protectant of sowing seed treatment on seed quality and yield of soft winter wheat grain]. Visnyk Poltavskoi derzhavnoi ahrarnoi akademii. [Bulletin of Poltava State Agrarian Academy], (3), 78–80. (in Ukrainian).

22. Volkodav V.V. (Ed.). (2000). Metodyka derzhavnoho sortovyprobuvannia silskohospodarskykh kultur. Vyp. 1. Zahalna chastyna. [Methods of state variety testing of crops. Issue 1. General part]. Kyiv, 100 s. (in Ukrainian).

23. Makrushyn M.M., Makrushyna Ye.V. (2011). Nasinnytstvo. [Seed production]. Simferopol: VD «Arial». 476 s. (in Ukrainian).

24. Derzhspozhyvstandart Ukrainy. (2003). Nasinnia silskohospodarskykh kultur. Metody vyznachennia yakosti: DSTU-4138-2002. (Chynnyi vid 2004-01-01, Natsionalnyi standart Ukrainy). [Seeds of agricultural crops. Methods for seed testing: DSTU 4138-2002 (Effective from 2004-01-01, National Standard of Ukraine)]. Kyiv. 173 s. (in Ukrainian).

О.А. Заїма,
кандидат сільськогосподарських наук,
ORCID: 0000-0001-5714-6308

О.Б. Каліцінська,
ORCID: 0009-0000-1661-3838

Миронівський інститут пшениці імені В.М. Ремесла НААН,
с. Центральне, Обухівський р-н,
Київська обл., 08853, Україна,
e-mail: oleksii.zaima@ukr.net;
ekonomistmip@ukr.net

Вплив обробки насіння протруйниками і мікродобривом на посівні якості та біологічні показники пшениці м'якої озимої

Мета. Визначити вплив протруйників різної дії та мікродобрива на посівні якості й біологічні показники насіння пшениці м'якої озимої. **Методи.** Польові та лабораторні. Вивчали сорти пшениці м'якої озимої МІП Валенсія, МІП Відзнака, МІП Аеліта, МІП Фортуна. Досліджували вплив протруйників інсектицидної дії Круїзер 350 FS, ТН (тіаметоксам, 350 г/л), фунгіцидної дії Грінфорт Стар, ТН, (флудіоксоніл, 18,75 г/л + ципроконазол, 6,25 г/л) та інсектофунгіцидної дії Юнта Квадро 373,4 FS, ТН (імідаклоприд, 166,7 г/л + клотіанідин, 166,7 г/л + протіоконазол, 33,3 г/л + тебуконазол, 6,7 г/л), також їхні комбінації з мікродобривом «5 елемент». **Результати.** За обробки насіння протруйниками та комбінаціями із мікродобривом «5 елемент» активність наклювування насіння підвищувалася на 0,3—9,0%, енергія проростання — на 0,5—6,3%, лабораторна схожість — на 0,3—2,0% порівняно з контрольними варіантами. Вищу енергію проростання насіння у сортів МІП Валенсія (96,5%) і МІП Аеліта (94,5%) отримано у варіантах із обробкою протруйником Круїзер 350 FS, ТН, у сорту МІП Відзнака (95,8%) — Грінфорт Стар, ТН, МІП Фортуна (96,0%) — Юнта Квадро 373,4 FS, ТН. У сортів МІП Аеліта і МІП Фортуна вищу лабораторну схожість отримано у варіантах обробки препаратом Круїзер 350 FS, ТН із мікродобривом, у сортів МІП Відзнака і МІП Валенсія — Грінфорт Стар, ТН із мікродобривом. У сортів МІП Аеліта та МІП Фортуна вищу польову схожість отримано за обробки насіння препаратом Круїзер 350 FS, ТН в комбінації із мікродобривом «5 елемент», у сортів МІП Відзнака і МІП Валенсія — Юнта Квадро 373,4 FS, ТН з препаратом «5 елемент». **Висновки.** Встановлено, що за обробки насіння пшениці м'якої озимої досліджуваними препаратами підвищувались активність наклювування, енергія проростання, лабораторна та польова схожість. Препарати фунгіцидної та інсекто-фунгіцидної дій переважно спричиняли вкорочення колеоптиля, а протруйник інсектицидної дії Круїзер 350 FS, ТН — подовження. За комплексної обробки насіння протруйниками і мікродобривом відзначали більшу довжину колеоптиля і кількість первинних корінців порівняно із застосуванням лише препаратів захисту від хвороб та шкідників. Досліджувані протруйники і мікродобриво сприяли покращенню більшості посівних якостей та біологічних показників обробленого насіння.

насіння пшениці м'якої озимої; протруювання; препарати; комплексне мікродобриво; показники якості насіння

Received by the editorial office: *November 7, 2024*
Accepted for publication: *November 14, 2024*
Printed and published online: *March 2025*