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DRESSER EFFECTS ON THE SPRING BARLEY GRAIN QUALITY

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The results of studying the spring barley grain quality depending on the pre-sowing treatment of seeds with systemic agents and a bioagent are presented. The contents of protein and starch in spring barley grain influenced by the pre-sowing treatment of seeds with various chemicals and the bioagent were analyzed.

***Key words**: spring barley, dresser, cultivar, protein, starch*

Introduction. The barley is primarily a forage crop, especially in areas where the oat is not grown [1]. When pigs are fattened with barley grits, lard and bacon are the most delicious one can ever have. Barley is a valuable food crop. Dietary fine-ground barley and pearl barley are made; they, due to triglycerides and tocotriethanol, help to lower blood cholesterol levels [2].

Brewing (malt production) was also based on barley grain. Previously, it was believed that brewing barley required cultivars with high starch content and low protein content and forage barley should be high-protein. It has recently been found that a high percentage of protein does not interfere with the production of excellent light beers, as the beer quality depends rather on decomposition products produced via fermentation during malting than on the protein amount in grain. The protein content in barley varies from 7% to 20.43% [1]. Grain should contain 60-70% of starch [2].

Literature review and problem articulation. The Plant Production Institute named after V.Ya. Yuriev fruitfully worked, studying the performance and quality of spring barley cultivars [3, 4].

Of several factors limiting barley yields in the country, insufficient attention of farmers to protection of crops against pests should be highlighted. There are quite a many harmful organisms causing damage to barley. The current phytosanitary condition of fields requires mandatory treatment of seeds with broad-spectrum dressers, acting both as fungicides and as insecticides. It is preferable to use two- or three-component agents, which protect against smut, root rot and leaf spot [2]. The pesticides in assortment suitable for barley are registered in "The Pesticides List" [5, 6].

Studies on the protection of crops against pests and diseases are described in [7, 8, 9, 10]. Issues of the impact of pre-sowing seed treatment on grain quality arise.

Purpose. To determine the spring barley grain quality depending on the pre-sowing treatment of seeds with systemic dressers and the bioagent.

Materials and methods. The study was carried out in a nine-field fallow-cereal-row crop rotation of the Department of Plant Production and Variety Investigation of the Plant Production Institute named after V.Ya. Yuriev of NAAS (Eastern Forest-Steppe of Ukraine) in 2017–2020. The soil was typical medium-humus chernozem on loess with a humus content in the arable layer of 5.4%.

To protect spring barley against pests and diseases, seeds were treated with systemic dressers belonging to different chemical groups and the bioagent prior to sowing (1–8 days before sowing) [5, 6, 11].

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The experiment design:

1. Control, water - 10.0 L/t;

Fungicidal agents:

2. Vitavax 200 FF, w.s.c. (carboxin 200 g/L + thiram 200 g/L), reference - 3.0 L/t;
3. Vincit Forte SC (flutriafol 37.5 g/L + imazalil 15 g/L + thiabendazole 25 g/L) - 1.25 L/t;
4. Insure Perform FS (triticonazole 80 g/L + pyraclostrobin 40 g/L) - 0.5 L/t;
5. Lamardor 400 FS (prothioconazole 250 g/L + tebuconazole 150 g/L) - 0.20–0.25 L/t;
6. Lamardor Pro 180 FS, TH (prothioconazole 100 g/L + tebuconazole 60 g/L + fluopyram 20 g/L) - 0.6 L/t;
7. Scenic 80 FS, TH (fluoxastrobin 37.5 g/L + prothioconazole 37.5 g/L + tebuconazole 5.0 g/L) - 1.6 L/t;
8. Supervin SC (flutriafol 30 g/L + thiabendazole 45 g/L) - 1.8 L/t;
9. Ultrasil Duo, TH (tebuconazole 60 g/L + imazalil 100 g/L) - 0.5 L/t;
10. Maxim Star 025 FS, TH (fludioxonil 18.7 g/L + cyproconazole 6.25 g/L) - 1.5 L/t;
11. Trichodermin BT (bioagent). Spores of the fungus *Trichoderma viride*, strain T-4, spore titer 5.0 billion CFU/cm^3 - 5.0 kg/t;

Insecticidal agents:

12. Cruiser 350 FS (thiamethoxam 350 g/L) - 0.5 L/t;
13. Taboo SC (imidacloprid 500 g/L) - 0.5 L/t;

Combined insecticides and fungicides:

14. Vibrance Integral 235 FS, TH (sedaxane 25 g/L + fludioxonil 25 g/L + tebuconazole 10 g/L + thiamethoxam 175 g/L) - 2.0 L/t;
15. Record Quadro, TH (carboxin 170 g/L + epoxiconazole 70 g/L + imidacloprid 100 g/L + acetamiprid 100 g/L) - 0.4 L/t;
16. Junta Quadro 373.4 FS. (prothioconazole 33.3 g/L + tebuconazole 6.7 g/L + imidacloprid 166.7 g/L + clothianidin 166.7 g/L) - 1.6 L/t.

Seeds were analyzed in accordance with the DSTU 4138: 2002 requirements [12]. Spring barley (brewing cultivars Parnas and Inkluziv in 2018 and 2019; grain cultivars Vzirets and Ahrarii in 2017 and 2020) were sown within the first 10 days of April at a sowing rate of 4.5 million germinable seeds per hectare after the soybean as a forecrop. Fertilization background was 6.6 tons of manure per hectare of the crop rotation area (aftereffect) plus $N_{30}P_{30}K_{30}$. The record area was 30 m^2 in three replications. The farming techniques were conventional for the growing location.

Laboratory and field tests were conducted. Grain was harvested with a Sampo-130 combine. Significance of the obtained data was assessed by analysis of variance [13].

Results and discussion. On average across 2018 and 2019, unfertilized control brewing barley cultivars Parnas and Inkluzive contained 12.46% of protein in grain (Table 1). After the pre-sowing treatment of seeds with Vincit Forte, Record Quadro, Insure Perform, Scenic, Taboo, Vibrance Integral, Lamardor 400, Supervin, or with Maxim Star, the values were slightly lower compared to the control: by 0.49, 0.47, 0.33, 0.19, 0.12, 0.12, 0.11, 0.07, and 0.01%, respectively. After the pre-sowing treatment of seeds with Junta Quadro, Lamardor Pro, Trichodermin, or with Ultrasil Duo, the protein content, on the contrary, was slightly higher: by 0.04, 0.21, 0.24, and 0.26%, respectively, compared to the control. After the pre-sowing treatment of seeds with Vitavax 200 FF or with Cruiser 350 FS, the protein content in grain was significantly lower: by 0.70% and 0.84%, respectively, compared to the control, which is considered to be positive for brewing cultivars. As to the output, the protein output from 1 ha was 0.36 tons in the control and it ranged from 0.30 tons (Vitavax 200 FF) to 0.39 tons (Taboo) after seed treatment.

Fertilizers ($N_{30}P_{30}K_{30}$) significantly increased the protein content in grain after seed treatment compared to no fertilizer variant: from 2.7% (Maxim Star) to 13.9% (Vitavax 200 FF). With fertilization, the protein content in grain was 12.48% in the control, which was very similar to no fertilizer control.

In the fertilization experiments, the protein content in grain increased significantly when seeds were treated with Scenic (by 0.84%), Lamardor Pro (by 0.88%), Trichodermin (by 0.94%), or with Vitavax 200 FF (by 0.91%) compared to the control (12.48%). After the pre-sowing treatment of seeds with Record Quadro, Maxim Star, Vincit Forte, Supervin, Insure Perform, Taboo, or with Vibrance Integral, the protein content in grain was within 12.77–13.02%, which was almost at the control level. In the pre-sowing seed treatment experiments, the protein output from 1 ha was within 0.56 (Vincit Forte, Insure Perform, Lamardor 400, Trichodermin) - 0.63 tons (Cruiser 350 FS) compared to the control (0.55 tons).

Table 1

The protein content in grain and protein and grain outputs in spring barley depending on the pre-sowing treatment of seeds with fungicides or insecticides-fungicides (cultivars Parnas and Inkluzyve), the average for 2018 and 2019.

Agent	Protein content in grain, %				Output from 1 ha, tons			
	No fertilizers		$N_{30}P_{30}K_{30}$		No fertilizers		$N_{30}P_{30}K_{30}$	
	%	+/- related to the control	%	+/- related to the control	Grain	Protein	Grain	Protein
Control	12.46	–	12.48	–	2.92	0.36	4.43	0.55
Vitavax 200 FF, w.s.c. 3.0 L/t	11.76	–0.70	13.39	+0.91	2.56	0.30	4.25	0.57
Vincit ForteSC 1.0 L/t	11.97	–0.49	12.87	+0.39	2.88	0.34	4.35	0.56
Insure Perform FS 0.5 L/t	12.13	–0.33	12.94	+0.46	2.79	0.34	4.33	0.56
Lamardor 400 FS 0.2 L/t	12.35	–0.11	13.04	+0.56	2.87	0.35	4.28	0.56
Lamardor Pro 180 FS, TH 0.5 L/t	12.67	+0.21	13.36	+0.88	2.85	0.36	4.47	0.59
Scenic 80 FS, TH 1.6 L/t	12.27	–0.19	13.32	+0.84	2.69	0.33	4.27	0.57
Maxim Star 025 FS, TH 1.5 L/t	12.39	–0.07	12.90	+0.42	2.96	0.36	4.41	0.57
Cruiser 350 FS 0.5 L/t	12.72	+0.26	13.24	+0.76	2.79	0.35	4.38	0.58
TabooSC 0.5 L/t	12.45	–0.01	12.79	+0.31	2.90	0.36	4.54	0.58
Supervin SC 1.8 L/t	12.70	+0.24	13.42	+0.94	2.73	0.34	4.20	0.56
Ultrasil Duo, TH 0.5 L/t	11.62	–0.84	13.18	+0.70	3.12	0.36	4.80	0.63
Trichodermin BT	12.34	–0.12	12.99	+0.51	3.13	0.39	4.70	0.61
Vibrance Integral 235 FS, TH 2.0 L/t	12.34	–0.12	13.02	+0.54	2.92	0.36	4.67	0.61
Record Quadro, TH 0.4 L/t	11.99	–0.47	12.77	+0.29	2.87	0.34	4.53	0.61
Junta Quadro 373.4 FS 1.6 L/t	12.50	+0.04	13.10	+0.62	3.06	0.38	4.66	0.61
LSD_{05}: factor A (pre-sowing treatment) – 0.57; factor B (fertilization) – 0.20; AB (interaction) – 0.80								

The starch content in grain was 61.03% in no fertilizer control (Table 2). There was a negative effect of some agents on this parameter. A significantly lower starch content in grain was recorded in the experiments with the pre-sowing treatment of seeds with Lamardor 400 (by 1.29%), Scenic (by 1.42%), Lamardor Pro (by 1.51%), Supervin (by 1.68%)), Vibrance

Integral (by 1.69%), and Ultrasil Duo (by 2.10%). When Junta Quadro, Record Quadro, Maxim Star, Insure Perform, Cruiser 350 FS, Trichodermin, Vincit Forte, or Taboo was used, the starch content in grain ranged 59.91 to 60.62%, which was almost at the control level. With Vitavax 200 FF (61.15%), this parameter was slightly higher than the control value.

Fertilization led to a reduction in the starch content in grain. The parameter was significantly lower in the experiments with the pre-sowing treatment of seeds with Supervin (58.55%), Lamardor Pro (58.51%), Taboo (58.46%), Insure Perform (58.42%), Ultrasil Duo 58.28%), Cruiser 350 FS (58.26%), Trichodermin (58.22%), Maxim Star (58.14%), or with Scenic (57.74%) compared to the control (59.76%), with LSD_{05} = 1.23%. There was a downward trend in the starch content in grain in the experiments with the pre-sowing treatment of seeds with Vincit Forte (0.30%), Vitavax 200 FF (0.40%), Vibrance Integral (0.70%), Lamardor 400 (0.77%), Record Quadro (0.90%), or with Junta Quadro (1.13%) compared to the control.

Table 2

The starch content in spring barley grain depending on the pre-sowing treatment of seeds with fungicides or insecticides-fungicides (cultivars Parnas and Inkluzyve), the average for 2018 and 2019.

Agent	Starch content in grain, %			
	No fertilizers		$N_{30}P_{30}K_{30}$	
	%	+/- related to the control	%	+/- related to the control
Control	61.03	–	59.76	–
Vitavax 200 FF, w.s.c. 3.0 L/t	61.15	+0.12	59.36	–0.40
Vincit ForteSC 1.0 L/t	59.92	–1.11	59.40	–0.30
Insure Perform FS 0.5 L/t	59.99	–1.04	58.42	–1.34
Lamardor 400 FS 0.2 L/t	59.74	–1.29	58.99	–0.77
Lamardor Pro 180 FS, TH 0.5 L/t	59.52	–1.51	58.51	–1.25
Scenic 80 FS, TH 1.6 L/t	59.31	–1.42	57.74	–2.02
Maxim Star 025 FS, TH 1.5 L/t	60.03	–1.00	58.14	–1.62
Cruiser 350 FS 0.5 L/t	59.95	–1.08	58.26	–1.50
TabooSC 0.5 L/t	59.91	–1.12	58.46	–1.30
Supervin SC 1.8 L/t	59.35	–1.68	58.55	–1.21
Ultrasil Duo, TH 0.5 L/t	58.93	–2.10	58.28	–1.48
Trichodermin BT	59.94	–1.09	58.22	–1.54
Vibrance Integral 235 FS, TH 2.0 L/t	59.34	–1.69	59.06	–0.70
Record Quadro, TH 0.4 L/t	60.16	–0.87	58.86	–0.90
Junta Quadro 373.4 FS 1.6 L/t	60.62	–0.41	58.63	–1.13
LSD_{05}: factor A (pre-sowing treatment) – 1.23; factor B (fertilixation) – 0.43; AB (interaction) – 1.70				

On average across 2017 and 2020, the grain cultivars, Vzirets and Ahrarii, contained 10.48% of protein in grain in no fertilizer control (Table 3). This parameter was slightly higher than in the control when Supervin (by 0.07%), Cruiser (by 0.15%), Maxim Star (by 0.22%), or Junta Quadro (0.46%) was used. When Vitavax was applied, there was an upward trend in the protein content in grain (by 0.70%) compared to the control. When seeds were treated with Lamardor Pro, Lamardor 400, Ultrasil Duo, Scenic, or with Taboo prior to sowing, the protein content in grain was slightly lower than in the control: by 0.08, 0.16, 0.18, 0.25, and 0.28%, respectively. With Vincit Forte, there was a downward trend in this parameter (by 0.71%) compared to

the control. With Insure Perform, the protein content in grain amounted to 9.70%, which was significantly lower than in the control.

Table 3

The protein content in grain and protein and grain outputs in spring barley depending on the pre-sowing treatment of seeds with fungicides or insecticides-fungicides (cultivars Vzirets and Ahrarii), the average for 2017 and 2020.

Agent	Protein content in grain, %				Output from 1 ha, tons			
	No fertilizers		$N_{30}P_{30}K_{30}$		No fertilizers		$N_{30}P_{30}K_{30}$	
	%	+/- related to the control	%	+/- related to the control	Grain	Protein	Grain	Protein
Control	10.48	-	11.04	-	3.81	0.40	5.96	0.65
Vitavax 200 FF, w.s.c. 3.0 L/t	10.98	+0.70	11.15	+0.11	3.31	0.37	5.57	0.62
Vincit ForteSC 1.0 L/t	9.77	–0.71	10.84	–0.20	3.55	0.36	5.68	0.61
Insure Perform FS 0.5 L/t	9.70	–0.78	10.87	–0.17	3.62	0.36	5.51	0.60
Lamardor 400 FS 0.2 L/t	10.32	–0.16	10.61	–0.43	3.56	0.36	5.75	0.61
Lamardor Pro 180 FS, TH 0.5 L/t	10.40	–0.08	10.72	–0.32	3.53	0.37	5.50	0.59
Scenic 80 FS, TH 1.6 L/t	10.23	–0.25	11.43	+0.39	3.54	0.36	5.69	0.65
Maxim Star 025 FS, TH 1.5 L/t	10.70	+0.22	11.02	–0.02	3.71	0.40	5.69	0.62
Cruiser 350 FS 0.5 L/t	10.63	+0.15	10.72	–0.32	3.87	0.41	6.02	0.64
TabooSC 0.5 L/t	10.20	–0.28	11.28	+0.24	3.91	0.41	6.07	0.68
Supervin SC 1.8 L/t	10.55	+0.07	10.44	–0.60	3.89	0.42	5.85	0.61
Ultrasil Duo, TH 0.5 L/t	10.30	–0.18	11.07	+0.03	3.66	0.38	5.59	0.62
Junta Quadro 373.4 FS 1.6 L/t	10.94	+0.46	10.83	–0.21	4.06	0.45	6.69	0.73
LSD_{05}: factor A (pre-sowing treatment) – 0.78; factor B (fertilization) – 0.30; AB (interaction) – 1.10.								

Fertilization ($N_{30}P_{30}K_{30}$) increased the protein content in grain in most experiments: from 0.09% (Cruiser) to 1.20% (Scenic), except for Supervin and Junta Quadro, where the protein content in grain was slightly lower (by 0.11%) compared to no fertilizer variant.

In the fertilization experiments, application of Ultrasil Duo, Vitavax 200 FF, Taboo, or Scenic slightly increased the protein content in grain compared to the control: by 0.03, 0.11, 0.24, and 0.39%, respectively. On the contrary, the values were slightly lower than in the control when seeds were treated with Maxim Star (by 0.02%), Insure Perform (by 0.17%), Vincit Forte (by 0.20%), Junta Quadro (by 0.21%), Lamardor Pro (by 0.32%), Cruiser (by 0.32%), Lamardor 400 (by 0.43%), or with Supervin (by 0.60%).

As to the output, the protein output from 1 ha without fertilizers was 0.40 tons in the control; when seeds were dressed, it ranged from 0.36 tons (Vincit Forte, Insure Perform, Lamardor 400, Scenic) to 0.45 tons (Junta Quadro). When fertilizers were applied in the dressing experiments, the protein output from 1 ha ranged from 0.59 tons (Lamardor Pro) to 0.73 tons (Yunta Quadro) compared to 0.65 tons in the control.

The starch content in grain in no fertilizer control was 62.83% (Table 4). It was slightly higher than in the control when Junta Quadro (by 0.09%), Taboo (by 0.29%), Scenic (by 0.45%), Supervin (by 0.53%), or Vincit Forte (1.04%) was used. In the experiments with pre-sowing treatment of seeds with Insure Perform, Maxim Star, Lamardor Pro, or with Ultrasil Duo, the starch content in grain was slightly lower: by 0.02, 0.29, 0.30 and 0.97%, respectively. The values were significantly lower in the experiments with the pre-sowing treatment of seeds with Vitavax 200 FF (by 1.25%), Lamardor 400 (by 1.41%), or with Cruiser 350 FS (by 1.37%), which is positive in terms of the grain quality for grain cultivars.

Fertilization slightly reduced the starch content in grain compared to no fertilizer control (by 0.9%). In the experiments with the pre-sowing treatment of seeds with Ultrasil Duo, Vitavax 200 FF, Maxim Star, or with Taboo, the starch content in grain was slightly lower: by 0.03, 0.8, 0.10, and 0.73%, respectively. With Scenic, this parameter was significantly lower than in the control (by 1.51%). The starch content in grain was slightly higher than in the control when seeds were dressed before sowing with Junta Quadro (by 0.03%), Cruiser (by 0.33%), Lamardor Pro (by 0.36%), Vincit Forte (by 0.49%) %), Lamardor 400 (by 0.67%), Supervin (by 1.04%), or with Insure Perform (by 1.21%).

Table 4

The starch content in spring barley grain depending on the pre-sowing treatment of seeds with fungicides or insecticides-fungicides (cultivars Vzirets and Ahrarii), the average for 2017 and 2020.

Agent	Starch content in grain, %			
	No fertilizers		$N_{30}P_{30}K_{30}$	
	%	+/- related to the control	%	+/- related to the control
Control	62.83	–	61.93	–
Vitavax 200 FF, w.s.c. 3.0 L/t	61.58	–1.25	61.13	–0.8
Vincit ForteSC 1.0 L/t	63.87	+1.04	62.42	+0.49
Insure Perform FS 0.5 L/t	62.81	–0.02	63.14	+1.21
Lamardor 400 FS 0.2 L/t	61.42	–1.41	62.60	+0.67
Lamardor Pro 180 FS, TH 0.5 L/t	62.53	–0.30	62.29	+0.36
Scenic 80 FS, TH 1.6 L/t	63.28	+0.45	60.42	–1.51
Maxim Star 025 FS, TH 1.5 L/t	62.54	–0.29	61.83	–0.10
Cruiser 350 FS 0.5 L/t	61.46	–1.37	62.26	+0.33
TabooSC 0.5 L/t	63.12	+0.29	61.20	–0.73
Supervin SC 1.8 L/t	63.36	+0.53	62.97	+1.04
Ultrasil Duo, TH 0.5 L/t	61.86	–0.97	61.90	–0.03
Junta Quadro 373.4 FS 1.6 L/t	62.92	+0.09	61.96	+0.03
LSD_{05}: factor A (pre-sowing treatment) – 1.30; factor B (fertilization) – 0.51; AB (interaction) – 1.83.				

Conclusions. The effects of agents (fungicides, insecticides, insecticides-fungicides and bacterial agent Trichodermin) on the contents of protein and starch in spring barley grain were shown to be ambiguous.

The brewing cultivars, Parnas and Inkluzive, produced 0.36 tons of protein from 1 hectare without fertilizers in the control; with the pre-sowing treatment of seeds with dressers, they gave from 0.30 tons (Vitavax 200 FF) to 0.39 tons (Taboo). In the fertilization ($N_{30}P_{30}K_{30}$) experiments, the protein output from 1 hectare after the pre-sowing treatment of seeds ranged from 0.56 tons (Vincit Forte, Insure Perform, Lamardor 400, Trichodermin) to 0.63 tons (Cruiser 350 FS) vs. 0.55 tons in the control.

As to the grain cultivars, Vzirets and Ahrarii, the protein output from 1 hectare was 0.40 tons without fertilizers in the control; after the pre-sowing seed treatment, it ranged from 0.36 tons (Vincit Forte, Insure Perform, Lamardor 400, Scenic) to 0.45 tons (Junta Quadro). In the fertilization experiments combined with pre-sowing seed dressing, the protein output from 1 hectare ranged from 0.59 tons (Lamardor Pro) to 0.73 tons (Junta Quadro) vs. 0.65 tons in the control.

The starch content in grain of the brewing cultivars was 61.03% without fertilizers in the control; in the fertilization experiments, it was 59.76%. After the fertilization-pre-sowing seed dressing combination, the starch content in grain was lower (significantly or a downward trend) than the control value. Vitavax 200 FF without fertilizers slightly increased this parameter (61.15%) compared to the control.

The starch content in grain cultivars 62.83% without fertilizers in the control. This parameter was significantly lower after the pre-sowing treatment of seeds with Vitavax 200 FF (by 1.25%), Cruiser 350 FS (by 1.37%), or with Lamardor 400 (by 1.41%). In the fertilization experiments, the starch content in grain was significantly lower (by 1.51%) than the control value (61.93%) when Scenic was used for dressing.

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ДІЯ ПРОТРУЙНИКІВ НА ЯКІСТЬ ЗЕРНА ЯЧМЕНЮ ЯРОГО

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Мета дослідження – визначити якість зерна ячменю ярого залежно від передпосівної обробки насіння протруйниками системної дії та біопрепаратом.

Матеріали і методи. Дослідження проводили протягом 2017–2020 рр. у дев'ятипільній паро-зерно-просапній сівозміні Інституту рослинництва імені В.Я. Юр'єва НААН. Ґрунт – чорнозем типовий середньогумусний. Для захисту ячменю ярого від шкідників та хвороб насіння перед сівбою (за 1–8 діб) протруювали системними протруйниками різних хімічних груп і біопрепаратом. Аналізування насіннєвого матеріалу сортів ячменю ярого пивоварного та зернового напрямку використання проводили згідно ДСТУ 4138:2002. Попередник − соя. Фон живлення – 6,6 т гною на 1 га сівозмінної площі (післядія) з внесенням $N_{30}P_{30}K_{30}$. Агротехніка – загальноприйнята для зони вирощування. Оцінку достовірності отриманих даних виконали методом дисперсійного аналізу.

Обговорення результатів. По сортах пивоварного напряму використання Парнас та Інклюзив у блоці без добрив уміст білка в зерні був суттєво меншим у варіантах із передпосівною обробкою насіння фунгіцидним протруйником Вітавакс 200 ФФ та інсек-

тицидним протруйником Круїзер 350 FS (на 0,70% і на 0,84% відповідно), порівняно із контролем (12,46%). У варіантах із застосуванням хімічних фунгіцидних препаратів Вінцит Форте, Іншур Перформ, Ламардор 400, Ламардор Про, Сценік, Максим Стар, Супервін, Ультрасил Дуо, бактеріального Триходермін, інсектицидного Табу, та інсектофунгіцидних Вайбранс Інтеграл, Рекорд Квадро і Юнта Квадро вміст білка в зерні варіював від 11,97% до 12,72%, тобто практично на рівні контролю. У блоці з добривами ($N_{30}P_{30}K_{30}$) уміст білка в зерні суттєво підвищився у варіантах із протруєнням насіння препаратами Сценік (на 0,84%), Ламардор Про (на 0,88%), Триходермін (на 0,94%) і Вітавакс 200 ФФ (на 0,91%), порівняно з контролем, 12,48%. У варіантах із передпосівною обробкою насіння препаратами Рекорд Квадро, Максим Стар, Вінцит Форте, Супервін, Іншур Перформ, Табуі Вайбранс Інтеграл уміст білка в зерні був у межах 12,77–13,02%, що практично на рівні контролю.У блоці без добрив збір білка з 1 га в контролі становив 0,36 т, по варіантах із передпосівною обробкою насіння препаратами – від 0,30 т (Вітавакс 200 ФФ) до 0,39 т (Табу). У блоці з добривами по варіантах із передпосівною обробкою насіння збір білка з 1 га був у межах 0,56 т (Вінцит Форте, Іншур Перформ, Ламардор 400, Триходермін) – 0,63 т (Круїзер 350 FS), порівняно з контролем, – 0,55 т.

Уміст крохмалю в зерні пивоварних сортів на контролі в блоці без добрив становив 61,03%, у блоці з внесенням добрив – 59,76%. Внесення добрив сприяло зменшенню вмісту крохмалю в зерні по варіантах досліду. У варіантах із передпосівною обробкою насіння по фонах уміст крохмалю в зерні був меншим (на суттєвому або на рівні тенденції), порівняно з контролями. У варіанті із застосуванням Вітавакс 200 ФФ у блоці без добрив відмічено незначно підвищений цей показник (61,15%), порівнюючи з контролем.

По сортах зернового напряму використання Взірець та Аграрій у варіантах із застосуванням протруйників у блоці без добрив уміст білка в зерні був у межах 9,77% (Вінцит Форте) – 10,98% (Вітавакс 200 ФФ), порівняно із контролем, 10,48%; у блоці з добривами – у межах 10,44% (Супервін) – 11,43% (Сценік), що практично на контрольному рівні – 11,04%. У варіанті із передпосівною обробкою насіння препаратом Іншур Перформ у блоці без добрив уміст білка в зерні становив 9,70%, що було суттєво меншим, порівняно із контролем. Збір білка з 1 га в блоці без добрив на контролі становив 0,40 т, по варіантах із передпосівною обробкою насіння – у межах 0,36 т (Вінцит Форте, Іншур Перформ, Ламардор 400, Сценік) – 0,45 т (Юнта Квадро). У блоці з добривами по варіантах із протруєнням насіння збір білка з 1 га був у межах 0,59 т (Ламардор Про) – 0,73 т (Юнта Квадро), порівняно з контролем, 0,65 т.

Уміст крохмалю в зерні сортів зернового напряму використання на контролі в блоці без добрив становив 62,83%. Суттєво меншим цей показник був у варіантах із передпосівною обробкою насіння протруйниками Вітавакс 200 ФФ (на 1,25%), Круїзер 350 FS (на 1,37%) і Ламардор 400 (на 1,41%). В удобреному блоці суттєво менший уміст крохмалю в зерні відмічено у варіанті із застосуванням препарата Сценік (на 1,51%), порівняно із контролем (61,93%).

Висновки.Встановлено неоднозначну дію препаратів (фунгіцидного, інсектицидного, інсекто-фунгіцидного спектру дії та бактеріального Триходермін) на вміст білка й крохмалю в зерні ячменю ярого.

Ключові слова: *ячмінь ярий, протруйники, сорти, білок, крохмаль*

DRESSER EFFECTS ON THE SPRING BARLEY GRAIN QUALITY

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Purpose. To determine the spring barley grain quality depending on the pre-sowing treatment of seeds with systemic dressers and the bioagent.

Materials and methods. The study was carried out in a nine-field fallow-cereal-row crop rotation of the Department of Plant Production and Variety Investigation of the Plant Production Institute named after V.Ya. Yuriev of NAAS in 2017–2020. To protect spring barley against pests and diseases, seeds were treated with systemic dressers belonging to different chemical groups and the bioagent prior to sowing (1–8 days before sowing).

The soybean was a forecrop. Fertilization background was 6.6 tons of manure per hectare of the crop rotation area (aftereffect) plus $N_{30}P_{30}K_{30}$. The farming techniques were conventional for the growing location. Significance of the obtained data was assessed by analysis of variance.

Results and discussion. As to the brewing cultivars, Parnas and Inkluzive, without fertilizers the protein content in their grain after the pre-sowing treatment of seeds with fungicide Vitavax 200 FF or with insecticide Cruiser 350 FS was significantly lower (by 0.40% and 0.8%, respectively) than the control value (12.46%). When fungicides Vincit Forte, Insure Perform, Lamardor 400, Lamardor Pro, Scenic, Maxim Star, Supervin, Ultrasil Duo, bacterial agent Trichodermin, insecticide Taboo, or insecticides-fungicides was used for seed dressing, the protein content was not different from the control. In the fertilization ($N_{30}P_{30}K_{30}$) experiments, the protein content in grain significantly increased when Scenic (by 0.84%), Lamardor Pro (by 0.88%), Trichodermin (by 0.94%), or Vitavax 200 FF (by 0.91%) was used. After the pre-sowing treatment of seeds with Record Quadro, Maxim Star, Vincit Forte, Supervin, Insure Perform, Taboo, or with Vibrance Integral, the protein content in grain was almost at the control level. In no fertilizer experiments, the protein output from 1 hectare in the control was 0.36 tons; after the pre-sowing seed dressing, it ranged from 0.30 tons (Vitavax 200 FF) to 0.39 tons (Taboo). In the fertilization experiments combined with pre-sowing seed dressing, the protein output from 1 hectare ranged from 0.56 tons (Vincit Forte, Insure Perform, Lamardor 400, Trichodermin) to 0.63 tons (Cruiser 350 FS) vs. 0.55 tons in the control.

The fertilization caused a decrease in the starch content in grain. In the experiments with pre-sowing seed dressing combined with fertilization, the starch content in grain was lower than the control value.

As to the grain cultivars, Vzirets and Ahrarii, after dressing without fertilizers the protein content in grain was within 9.77% (Vincit Forte) − 10.98% (Vitavax 200 FF) vs. 10.48% in control; after dressing combined with fertilization, it was − at the control level. When Insure Perform was applied for pre-sowing seed dressing without fertilizers, the protein content in grain was 9.70%, which was significantly lower than in the control. The protein output from 1 hectare without fertilizers was 0.40 tons in the control; after pre-sowing seed dressing, it was within 0.36 tons (Vincit Forte, Insure Perform, Lamardor 400, Scenic) − 0.45 tons (Junta Quadro). In the fertilization experiments combined with pre-sowing seed dressing, the protein output from 1 hectare was in the range of 0.59 tons (Lamardor Pro) − 0.73 tons (Junta Quadro) vs. 0.65 tons in the control.

The content of starch in the grain cultivars was 62.83% in the control without fertilizers. This figure was significantly lower in the experiments with pre-sowing treatment of seeds with Vitavax 200 FF (by 1.25%), Cruiser 350 FS (by 1.37%), or with Lamardor 400 (by 1.41%). In the fertilization experiments, a significant decrease in the starch content in comparison with the control (61.93%) was observed when Scenic (-1.51%) was used for dressing.

Conclusions. The effects of agents (fungicides, insecticides, insecticides-fungicides and bacterial agent Trichodermin) on the contents of protein and starch in spring barley grain were shown to be ambiguous.

Key words: *spring barley, dresser, cultivar, protein, starch*