RESISTANCE OF TRITICALE VARIETIES AND SAMPLES TO ENVIRONMENTAL FACTORS IN A CONTROL NURSERY

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Abstract: This article presents the results of experiments conducted in a control nursery during the breeding process, focusing on the resistance of triticale varieties and samples to environmental factors, namely yellow rust disease, winter conditions, and lodging resistance.

Keywords: Breeding, control, triticale, rust disease, variety, lodging resistance, sample, result.

Introduction

Triticale, a cultivated crop species created through synthetic breeding methods, despite being evolutionarily younger than its parental forms, is capable of competing with other cereal crops in cultivated areas. Over the past twenty years, the global cultivation area of triticale has tripled, reaching approximately 3.5 million hectares.

Triticale, a hybrid obtained from wheat and rye, was first developed at the end of the 19th century, and its first commercial varieties were released in 1969. Today, this crop is cultivated in many European countries, as well as in Russia and Belarus. Poland is the leading country in triticale production worldwide, where about 10% of total grain acreage is allocated to this crop. Interest in triticale is increasing both globally and in our country, as it demonstrates great potential under conditions of climate warming and increasing drought.

Triticale is a synthetic cereal crop created by crossing wheat and rye. Its name reflects its origin, being derived from parts of the Latin names *Triticum* (wheat) and *Secale* (rye). Scientists assigned it the Latin name *Triticosecale Wittm. & A. Camus*.

According to O. Kasynkina [1; pp. 20–23], studies on triticale varieties and samples have shown that this crop contains high levels of protein, fiber, and fat, making it suitable for both grain and fodder purposes. The Rondo variety and Line 14, which demonstrated superior performance across all traits, were recommended for future breeding programs.

T. Dyachuk, V. Akinina, O. Khomyakova, and A. Pominov [2; pp. 25–29] emphasized that developing biotechnology at the cellular level and transferring the genetic traits of the D-genome of soft wheat into the hexaploid triticale genome is one of the promising directions in creating triticale-wheat hybrids.

According to A. Grabovets [3; pp. 6–12], breeding work aimed at improving grain quality indicators of triticale, including baking quality, is mainly conducted at the Krasnodar National Grain Center named after P.P. Lukyanenko in the Russian Federation. Researchers at this institute have developed several new high-quality triticale varieties, such as TI-17, Kapriz, Kornet, and Tribun.

Materials and Methods

The percentage of plant infection with diseases was assessed using the Modified Cobb scale. The resistance of varieties and samples in the nursery to winter conditions and lodging was evaluated using a 9-point scoring system.

Results and Discussion

The analysis of triticale varieties and samples in the control variety testing nursery showed the following results regarding resistance to environmental factors, namely yellow rust disease, winter hardiness, and lodging resistance.

The incidence of yellow rust infection in varieties and samples was observed between April 10–15. The percentage of disease infection in plants was evaluated using the Modified Cobb scale.

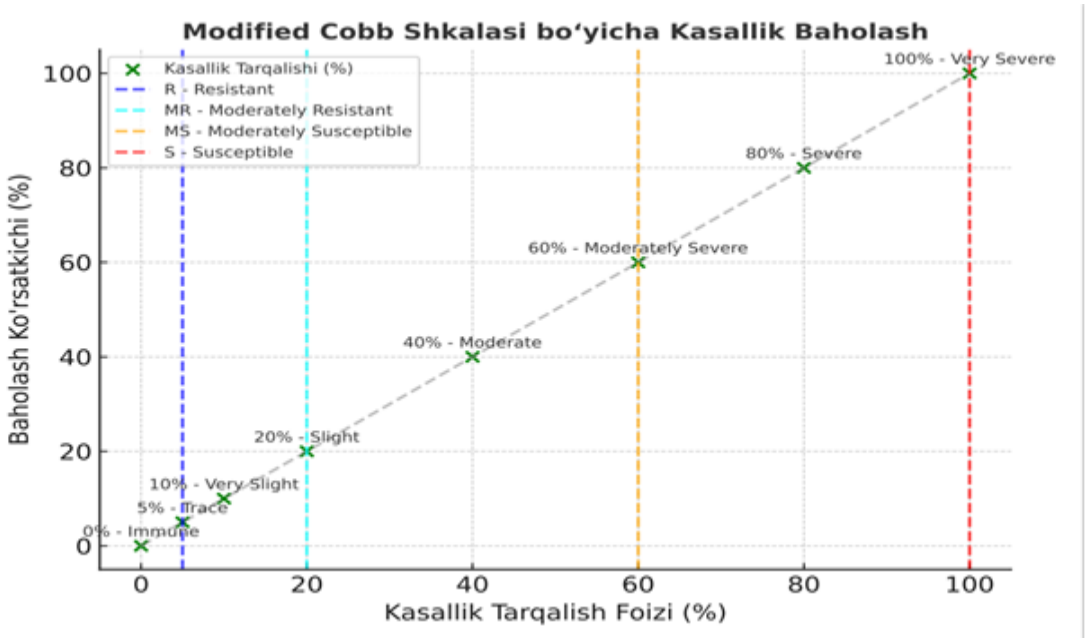

Figure 1. Evaluation Procedure According to the Modified Cobb Scale

The Modified Cobb scale is a standard method used to assess the level of rust diseases (such as yellow rust, brown rust, and black rust) in cereal crops. This method is an updated version of the Cobb scale and helps to evaluate both the percentage of infected leaf area and the intensity of the disease. It is mainly applied in selecting and identifying resistant and susceptible varieties to yellow rust disease.

The main purpose of using this scale is to assess the degree of infection in different varieties and samples, as well as to determine their safety and resistance levels.

In the varieties and samples, yellow rust infection was observed at 10% in the standard variety Sergiy, while no disease symptoms were detected in the standard variety Yarilo. In the nursery, the level of yellow rust infection among varieties and samples ranged from 10% to 20%.

Among the introduced varieties, the variety Sotnik and samples ERIZO-6, RANV-17, HIPPO-4, SITER-77-170, 578884, 100-519, 100-557, 114-216, 117-429, 118-198, and 118-947 showed the same infection level (10%) as the standard Sergiy variety.

The variety Brat and samples POLMER-17 and Sloser-49 showed 15% infection. A 20% infection level was recorded only in the sample PoP-tsaz-44, where disease symptoms were observed on 20% of the leaf surface.

Similar to the standard variety Yarilo, the variety Romes and samples KNIISKH-6, KNIISKH-70, ERIZO-49, PASSI-8-60, 578894, 100-597, 118-156, and 118-759 demonstrated resistance to yellow rust during the experiment.

During the experiment, the general condition of the varieties and samples after overwintering, i.e., their winter hardiness, was evaluated using a 9-point scale.

Evaluation of winter hardiness using a scale is one of the important methods for determining the resistance of cereal crops to winter conditions. Through this method, it is possible to assess each crop's tolerance to cold and winter stress. This approach combines visual inspection with statistical evaluation.

Table 1. Resistance of Triticale Varieties and Samples to Environmental Factors in the Control Nursery (2019–2021)

No	Varieties and Samples	Resistance to Yellow Rust (%)	Winter Hardiness (score)	Lodging Resistance (score)
1	Sergiy (St)	10MR	8	7
2	PoP-tsaz-44	20MR	6	5
3	Yarilo (St)	R	7	7
4	Romes	R	8	7
5	Sotnik	10MR	7	7
6	Brat	15MR	8	7
7	KNIISKH-6	R	7	7
8	KNIISKH-70 (Nixol)	R	9	9

No	Varieties and Samples	Resistance to Yellow Rust (%)	Winter Hardiness (score)	Lodging Resistance (score)
9	ERIZO-6	10MR	6	7
10	ERIZO-49	R	6	7
11	RANV-17	10MR	5	5
12	POLMER-17	15MR	6	7
13	PASSI-8-60	R	5	7
14	HIPPO-4	10MR	6	7
15	SITER-77-170	10MR	5	7
16	Sloser-49	15MR	6	7
17	578884	10MR	4	7
18	578894	R	5	9
19	100-519	10MR	5	9
20	100-557	10MR	4	7
21	100-597	R	5	9
22	114-216	10MR	4	7
23	117-429	10MR	5	7
24	118-156	R	4	7
25	118-198	10MR	5	7
26	118-759	R	4	7
27	118-947	10MR	4	7

Minimum value: 20MR | 4 | 5
Average value: 15MR | 6 | 7
Maximum value: 10MR | 9 | 9

The winter hardiness of the varieties and samples in the experimental field was evaluated based on visual assessment, considering symptoms such as yellowing, drying, and other visible signs in plants, and scored according to a standardized scale. Among the standard varieties, *Sergiy* demonstrated very high winter hardiness with a score of 8 points, while *Yarilo* showed high winter hardiness with a score of 7 points, as confirmed by the trial results.

Among the tested varieties and samples, the sample **KNIISH-70** exhibited the highest level of winter hardiness (9 points), indicating that all plants in this experimental variant survived the winter in a healthy condition.

The varieties *Romes* and *Brat* under testing showed results similar to the standard variety *Sergiy*, scoring 8 points (very high winter hardiness). Meanwhile, the variety *Sotnik* and the sample **KNIISH-6** demonstrated results comparable to the standard variety *Yarilo*, scoring 7 points (high winter hardiness).

The samples **PoP-tsaz-44, ERIZO-6, ERIZO-49, POLMER-17, HIPPO-4, Sloser-49** showed high winter hardiness with a score of 6 points. The samples **RANV-17, PASSI-8-60, SITER-77-170, 578884, 578894, 100-519, 100-557, 100-597, 114-216, 117-429, 118-156, 118-198, 118-759, 118-947** demonstrated medium winter hardiness, scoring 4–5 points.

In agriculture, resistance to lodging is an important trait, as it directly affects crop productivity and yield potential. Lodging resistance is a key characteristic that determines the plant's response to various factors such as temperature, moisture, precipitation, and other environmental stresses.

In the breeding of cereal crops, selecting and introducing lodging-resistant varieties into production is of great importance. These varieties are better adapted to winter conditions and are less susceptible to damage from low temperatures, water deficiency, or other stress factors, thereby ensuring yield stability under adverse conditions.

According to the analysis of lodging resistance, the standard varieties *Sergiy* and *Yarilo* were both evaluated at 7 points. Similarly, the varieties *Romes* and *Brat*, as well as the samples **ERIZO-6, ERIZO-49, POLMER-17, PASSI-8-60, 578884, 100-557, 117-429, 118-156, 118-198, 118-759, 118-947**, showed results equal to the standard varieties.

Higher performance compared to the standard varieties was recorded in the samples **KNIISH-70 (Nihol), 578894, 100-519, 100-597**, each scoring 9 points. In contrast, the samples **PoP-tsaz-44** and **RANV-17** showed lower results than the standard varieties, with a score of 5 points.

Conclusion. The results of the winter hardiness assessment indicate that no varieties or samples with very low winter resistance were identified. It is noteworthy that the varieties and samples introduced from Russia demonstrated higher winter hardiness compared to those obtained from the CIMMYT organization.

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