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RESULTS OF BREAD WHEAT BREEDING FOR DEVELOPING NEW VARIETIES IN RAINFED LANDS

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Abstract:

In the context of ongoing global climate change, scientific research is being conducted at the Research Institute of Rainfed Agriculture on the developing of Bread wheat varieties resistant to stress factors of climatic and weather conditions in the rainfed lands of Uzbekistan. During the research, new varieties and lines of spring and facultative bread wheat adapted to climate change, resistant to abnormal heat and drought, ultra-early ripening, with a short growing season, intensive and efficient use of soil moisture, were evaluated.

In the experiments, it was observed that the varieties and lines of the heading period were heading on 24.04.2025, i.e., 12 days earlier than the standard Tezpishar variety, the Tagob variety on 30.04.25, 4 days earlier, and also the new varieties and lines SP-1/448/2021, SP-1-382/2021 (earlyripe) were heading 1-2 days earlier, and these varieties and lines were selected for early maturity due to earlier heading compared to the standard Tezpishar variety.

The germination-ripening phase of wheat lines was determined, and lines were isolated 2-3 days earlier than the standard variety Tezpishar. Tezpishar is early-ripening variety, the total growing season was 108 days, and new early-ripening lines were selected. Compared to the early-ripening variety, the new variety Eritrospermum-2020 (SP-2/21/2023) had a germination-ripening phase of 100 days and was 8 days earlier than the standard. This new variety, according to its biological lifestyle, is spring and was selected as a variety with ultra-early ripeness of bread wheat on rainfed lands. Also, according to the research results, it was established that new lines SP-1/602/2021 (Erytrospermum), SP-1/744/2021 (albidum) possess high economically valuable traits and properties.

Keywords: Bread wheat, variety, line, drought resistance, heat resistance, vegetation period, climate change, early maturity, growth, development, initial material, selection

INTRODUCTION. Today, as a result of global warming, during the most important stages of the growth and development of agricultural crops, including soft wheat, in rainfed areas (flowering-milk-wax ripening), a sharp increase in air temperature and a decrease in relative air humidity lead to a slowdown in physiological and biochemical processes in plants. This leads to a decrease in the yield and quality indicators of wheat grain.

Climate change has a strong impact on plant productivity elements, which threatens food security with extreme weather conditions and increased abiotic stresses (drought and heat stress), leading to increased losses in agricultural production. [1]. In general, it was assumed that an increase in average temperature by 2.0 °C could lead to a decrease in grain production by more than 20-40%[2]. This latter trend is expected to intensify in the future, accompanied by frequent dry weather. According to climate change data, corn and wheat are the most affected crops, with a sharp decrease in yields of 20-43% for corn and 25-50% for wheat [3]. High temperatures are a limiting factor for plant growth, ultimately affecting grain quality and wheat yields [4]. Heat stress has become the main limiting factor in wheat cultivation, as wheat is highly sensitive to heat stress, particularly during the reproductive and early grain-filling stages [5].

Heat resistance is a polygenic property, there is no direct method for selecting heat-resistant plants, but some properties, such as the thermal stability of the membrane, are effective indicators of the heat resistance of plants and can be used in their regular cultivation [6].

Due to the high content of bound water in drought-resistant plants, the protein in their composition does not coagulate quickly in hot conditions. Many organic acids are formed during the respiration of these plants. These acids react with ammonia to form amino acids such as asparagine and glutamine. As a result, ammonia is neutralized, and its harmful effects are reduced [7].

Heat resistance is defined as the ability of a plant to grow and develop normally under stress conditions and yield a harvest. Protection from antioxidants, the formation of proteins under the influence of heat, and the preservation of the green color are the main mechanisms of heat resistance of wheat [8].

In recent years, it has been observed that wheat varieties grown on more than 280 thousand hectares of rainfed land in Uzbekistan have been affected by global climate change. In April-May 2025, severe drought and high temperatures occurred in the grain formation and filling phase of wheat, which negatively affected plant growth and development. As a result, the yield and quality of wheat grain on rainfed lands decreased significantly.

As a result of scientific research, it was established that wheat varieties with valuable economic traits and properties lose their traits and properties over the years under the influence of climate change, unfavorable environmental conditions, and diseases. It has been proven that the continuation of work on the developing of new varieties, the phased implementation of varietal replacement over the years, ensures high yields. Therefore, the developing of early-ripening, ultra-early Bread wheat varieties with a short grain filling phase ensures an increase in grain yield on rainfed lands and a stable grain yield even under unfavorable weather conditions, such as abnormal heat and drought, occurring in different years.

MATERIALS AND METHODS. In the studies, 30 varieties and lines were sown in 3 replications on the competitive variety testing experimental plot and evaluated according to economically valuable traits and characteristics. The state of germination, tillering, heading and wax ripeness, days of full ripeness, resistance to diseases, plant height, and other morphological characteristics of the plants were assessed. Scientific research on the creation of soft wheat varieties with high grain quality and bread quality for rainfed lands was conducted in 2024 in the fields of the central experimental farm of the Research Institute of Rainfed Agriculture. Soft wheat varieties and lines were studied in collection, hybrid, breeding, control, preliminary, and competitive variety testing experimental plots. The degree of incidence of wheat variety samples and lines with rust diseases was determined by the method developed according to the genus Tritisum of the International Classifier CEF and the ICARDA International Scientific Center.

(1996), the "twell method" of A.F.Merezhko, L.M.Yezrokhin, A.E.Yudin was used in the hybridization of plants. Mathematical and statistical processing of the obtained data was carried out according to the method of B.A.Dospekhov and the GenStat (ANOVA) program.

RESULTS AND DISCUSSIONS. In the studies, when assessing the state of plants of soft wheat after germination on a scale of 1-5 points, the state of the standard Early-ripening variety was assessed at 4 points, and in 10 new lines, such as Nushkent, Bakhmal-97, Tagob, Zartepa, Eritrospermum-2020, KSI-2020/16 KP-2016/58, Sp-1/448/2021, Sp-1-382/2021 (earlyripe), the level of plant development and growth was assessed at 5 points.11 lines with poorly developed plants were marked with a score of 3, and the results of the experiments showed that such new varietal lines as KP-26/2020, KP-2021/82 (Semrug x Ok bug), KP-2020/98 goodtillyer, SP-1/872/2021 had weak growth and development characteristics under unfavorable winter and early spring weather conditions. In the variety samples and lines, tillering occurred on March 15-18, with a difference in tillering days of 1-4 days. In early-ripening varieties and lines, tillering occurred 4 days earlier than in other lines. During the studies, the heading date was determined in the varieties and lines, and it was noted that the Erythrospermum-2020 line eats on 24.04.2025, 12 days earlier than the Tezpishar variety, the Tagob variety eats on 30.04.2025, 4 days earlier than the Tezpishar variety, the new varieties and lines SP-1/448/2021, SP-1-382/2021 (earlyripe) eaten 1-2 days earlier, these varieties and lines eaten earlier than the Tezpishar variety.

The full ripening phase of wheat lines was determined, and lines maturing 2-3 days earlier than the standard Tezpishar variety were selected.

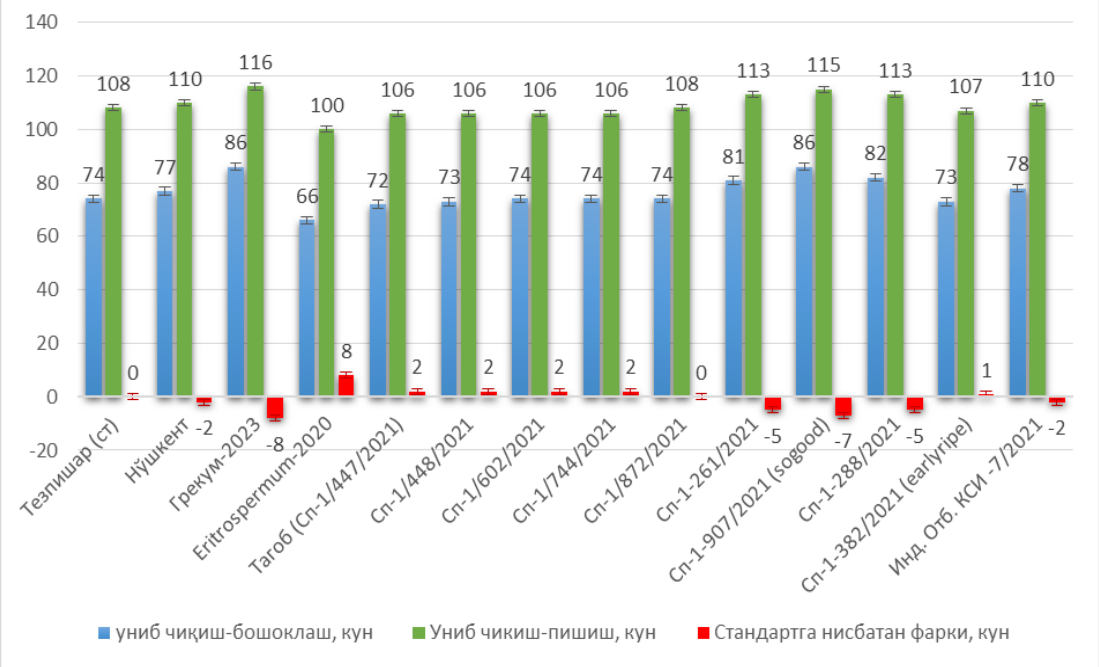

Figure. Duration of the growing season of Bread wheat lines in a Competitive variety testing field (days).

In the early-ripening variety, the total growing season was 108 days, and in a number of lines, new early-ripening varietal lines were selected. As noted above, one of the most important directions in the selection of Bread wheat in rainfed areas is plant height.

In the studies, the plant height of soft wheat varieties and lines studied in the competitive variety testing experimental plot was analyzed. If the plant height of the early-ripening variety in the competitive variety testing field averaged 96 cm, new varietal lines with a longer height than the standard were identified. These include new high-height varieties and lines such as otb-21/2021-SP-1-835/2021, SP-1/744/2021, SP-1-907/2021 (sogood) compared to the standard variety.

Considering that this year's dry and hot weather conditions negatively affected the development of rust diseases and yellow rust spores, which are considered dangerous in wheat plants, field experiments showed that 5-20% of mature lines were affected by yellow rust. The standard Early-ripening variety has 10% yellow rust, and the new ultra-early-ripening variety Eritrospermum-2020 has 20%. It was observed that brown rust did not appear in field conditions due to unfavorable conditions for its development.

At the same time, during the studies, when assessing the grain formed in wheat lines under field conditions, it was found that many new lines were severely affected by high heat, which occurred during the grain filling period in most lines. In all lines, the visual appearance of the grain was assessed on a scale of 0-5 points.

In the standard variety Tezpishar, which was highly resistant to drought and heat, grain appearance was 4 points, while new varietal lines were identified that were higher than the standard variety. For example, in such varieties and new lines as Nushkent, Grekum-2023, KSI-10/2023, SP-1/602/2021, SP-1/744/2021, grain formation was accelerated, compared to the grain of the Tezpishar variety, it was found that it is shiny, the grain pit is full, hard, and has a low flour content. According to the results of preliminary studies, new varietal lines SP-1/602/2021 (erythrospermumum), SP-1/744/2021 (albidum), studied in the competitive variety testing experimental field, according to valuable economic traits and characteristics, are selected in 2024-2025 as new varietal lines that are suitable for climate change and have high indicators.

CONCLUSION. The results of this study show the expediency of using early-ripening varieties and lines of soft wheat for sowing in the rainfed regions of the republic, adapted to global climate change, early-ripening, resistant to abnormal heat and drought, with high grain and technological quality indicators, as initial sources, with a grain filling period of 20-25 days.

It has been established that the use of ancient local varieties (landrace) is highly effective in creating new ultra-early, heat-resistant, drought-resistant, and disease-resistant varieties and lines.

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