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Select of Promising Resources in Perennial and Annual Wheat Selection

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Abstract: The article shows the scientific and practical importance of perennial wheat, the perennial characteristics of the collection samples studied for the first time in the conditions of the Uzbekistan region, the growth and development in climatic conditions, the growth period, productivity signs, resistance to yellow rust disease, the weight of 1000 grains and the results of studying the signs of root system development.

Keywords: perennial wheat, yellow rust, root, varieties and samples, erosion, air temperature, growth period, stress factor, productivity, selection, interspecies hybridization, selection.

Introduction

Perennial wheat varieties will improve the condition of long-standing erosion and degraded soils, and provide opportunities for rational use of unproductive and underutilized land.

In recent years, one third of the total arable land in the world has suffered soil erosion [1]. About 47 percent of the irrigated areas in our republic consist of various degrees of saline and degraded soils. The growth of these indicators is of course closely related to the growth of people's demand for food products.

Perennial wheat plant is important in the production of additional fodder for livestock in summer and autumn [4].

Stabilization of resistance to stress factors in wheat based on cross-species hybridization, creation of high-yielding breeding stock is one of the urgent problems.

The Scientific Research Institute of Plant Genetic Resources and the Southern Agricultural Scientific Research Institute, in close cooperation, are testing perennial wheat lines. In this case, selection studies on the creation of multi-year and one-year soft wheat varieties were started by fully assessing the resistance of each studied line to the main stress factors in grain cultivation.

It is intended to create perennial and one-year forms of wheat in the natural climatic conditions of Uzbekistan, based on cross-species hybridization, which are early-early, resistant to heat, drought and rust diseases, have a strong root mass, and have high productivity and grain quality in infertile lands.

Materials and Methods

In the research, 43 lines of perennial soft wheat from the Lend Institute of the USA and 12 hybrids obtained by crossing with one-year soft wheat were used. Planting of experiments was carried out in 2-3 ten days of October. The lines were planted in 1 m^2 plots, the seed rate was 300 seeds per 1 m^2. Experiments were carried out according to the method of VIR (Former All-Union Scientific Research Institute of Plant Science) (1984), biometric analyzes and phenological observation works were carried out according to the method of the State Variety Testing Commission of Agricultural Crops (1989). Hybridization Tvel Merezhko and others [5], paternity Yurev, selection in hybrid generations Ya. It was conducted based on the method of Lelli (1980). Evaluation of resistance to rust diseases in the field using the Modified Cobb scale [7] in 0-100 percent, the hypersensitivity of the plant was determined according to the method of Roelfs (1992) - *R = resistant, MR = moderately resistant, MS = moderately susceptible, S = susceptible.*

The place of research and its climatic conditions

The Republic of Uzbekistan is located in the middle of Central Asia. In addition, due to the fact that Uzbekistan is located near the subtropical latitude, the agricultural crops grown here are provided with full light and heat.

Practical studies were carried out at the Scientific Research Institute of Plant Genetic Resources in Kibrai district of Tashkent region (41°2′ N and 69°2′ N).

In 2020, the air temperature in Tashkent region was slightly lower than the average long-term norm (- 6.1°C). In January and February, the air temperature was 0.4-1.6°C lower than the long-term average, and in March it was 2.0°C higher than the long-term average. In March, it was observed that the precipitation was significantly less than the perennial average, up to 83.0 mm, and in April and May, the air temperature was significantly (0.0-1.6) higher than the perennial average. 29.9-36.5 mm more compared to the year created favorable climatic conditions for conducting research. The fact that the amount of precipitation in April-May was higher than the average for many years caused a positive situation in the development of the plant. In this case, the high humidity made it possible to evaluate the resistance of diseases observed in varieties and samples. Although the amount of precipitation was not observed in June and July (0.7-1.7 mm), by August, it was observed that the amount of precipitation was higher than the average for many years up to 9.1 mm.

In the region, the air temperature in 2021 was slightly higher than the average multi-year norm. In January, the air temperature was equal (0.3°C) to the average for many years, in February it was higher up to 1.2°C, and by March it was slightly less (-0.8°C).

Table 1 Precipitation amount and air temperature (mm) 2020-2022 weather monitoring center "Oq-qovoq"

Months	Perennial	Precipitation, years			Perennial	Air temperature years		
		2020	2021	2022		2020	2021	2022
January	34,6	39,9	13,3	50,5	2,8	1,2	2,5	4,6
February	62,0	82,1	53,7	50,2	6,5	6,1	7,7	5,7
March	108,2	25,2	103,2	196,3	9,6	11,6	8,8	8,3
April	43,7	80,2	38,6	12,2	17,3	15,7	16,1	20,1
May	43,8	73,7	12,1	45,6	22,2	22,2	23,5	20,9
June	4,5	1,7	0,0	11,7	27,1	26,3	27,7	27,2
July	1,8	0,7	4,6	0,0	28,8	28,3	29,3	28,7
August	4,5	13,6	0,0	0,0	26,3	25,9	27,5	25,5
September	0,0	0,0	0,0	0,0	21,5	19,3	22,5	22,6
October	32,0	-	1,5	62,5	14,0	12,9	15,2	14,0
November	62,6	62,6	-		3,8	4,1	3,4	
December	25,3	25,3	51.6		-0,4	-0,4		
Total, mm	**423**	**405**	**227,0**	**429**	**179,3**	**173,2**	**184,2**	**177,6**

It was observed that the amount of precipitation in January and February was 8.3 - 21.3 mm less compared to the annual average, and by March it was equal to 5.0 mm. This created an opportunity to create an artificial infection site dealing with rust diseases.

In April, it was observed that the air temperature was low (- 1.2°C) compared to the average for many years, and by May it was observed that it was high up to 1.3°C. It was observed that the amount of precipitation in April and May was less than the average for many years (- 5.1-31.7). This made it possible to conduct field experiments in time for phenological observations. The fact that the air temperature in June and July was higher than the perennial average (+ 0.5-0.6°C) led to an acceleration of the ripening period of the plant. While no rainfall was observed in June, up to 4.6 mm of rainfall was observed in July (1 table).

In the region, January 2022 was distinguished by a high amount of precipitation (15.9 mm in January), it was 11.8 mm less by February, and 88.1 mm more than the long-term average in March. A large number of observations of precipitation in March had a positive effect on research. In January, the air temperature was slightly higher than the perennial average (+ 1.8°C), in February and March it was lower to 0.8-1.3°C, in April it was distinguished by a higher air temperature up to 2.8°C, in May It was observed that it was less than 1.3°S, and in June it was almost equal. In April, the amount of precipitation was significantly less than the annual average (- 31.5 mm), while in May it was equal to the average (1.8 mm), in June, the amount of precipitation was 7.2 mm more, in July, August and September no precipitation was observed.

Results and Discussion

The results obtained in the course of the research on the characteristics of the tuft, plant height and weight of 1000 grains of the perennial and one-year wheat variety samples were analyzed. According to the results, it was observed that the clustering index range of the samples of the studied variety is 1-24 pieces, while the clustering index is up to 4-6 pieces in 12 samples, 7-9 pieces in 10 samples, 10-12 pieces in 8 samples, 13-15 pieces in 11 samples and It was observed that 10 samples have the characteristic of clustering up to 16-21 pieces. It was observed that the highest concentration index was up to 22-24 pieces in 2 samples.

When analyzing plant height samples, it was found that 10 short samples have a plant height of up to 80 cm, 31 medium height samples have a plant height of up to 100 cm, and 14 samples are over 100 cm.

The results of 1000 grain weight, which is an important productivity marker in wheat breeding, were analyzed.

It was found that the change in the weight of 1000 grains of 55 studied varieties was 14-45 grams, 8 samples were 14-17 grams, 16 samples were 18-29 grams, and 8 samples were 30-37 grams. and it was determined that the number of samples with a medium size of 38-41 grams was 16, while the number of samples with a large grain, i.e. 42-45 grams was 7. According to the results of the study, medium-sized specimens with a high yield index were selected and involved in selection studies.

Table 2 Evaluation of productivity indicators of samples

Branching			Plant height			1000 grain weight		
piece	sample number	Compare to the total %	cm	sample number	Compare to the total %	gram	sample number	Compare to the total %
1-3	1	1,8	60-70	2	3,6	14-17	8	14,5
4-6	12	21,8	71-80	8	14,5	18-21	2	3,6
7-9	10	18,1	81-90	14	25,4	22-25	4	7,2
10-12	8	14,5	91-100	17	30,9	26-29	10	18,1
13-	11	20,0	100-	6	10,9	30-	4	7,2

15			110			33		
16-18	8	14,5	111-120	4	7,2	34-37	4	7,2
19-21	3	5,4	121-130	3	5,4	38-41	16	29,0
22-24	2	3,6	131-140	1	1,8	42-45	7	12,7
Total	**55**	**100**	**-**	**55**	**100**	**-**	**55**	**100**

The perennial characteristics of 43 perennial soft wheat samples studied in the course of research were studied in regional conditions.

It is known that fields planted with perennial wheat remain green throughout the year. That is, after many years of wheat has been harvested for grain, or without harvesting for grain at all, the earth is covered with a blue mass of wheat throughout the year. Such a situation certainly prevents water and wind erosion [2]. In addition, the cost of growing grain is reduced [8]. In general, planting of perennial wheat in mountain and sub-mountain regions of our country and in reserves and in irrigated regions with soil degradation (erosion, salinity, gypsum) has a great effect.

Table 3 Study of perennial nature of samples (2018-2020 years)

№	Name of samples	2018 year			2019 year			2020 year		
		t e	n	t h	t e	n	t h	t e	n	t h
1	WHEAT-AGROPYRON PONTICUM PARTIAL AMPHIPLOID8	40	0,43	0,89	-	-	-	-	-	-
2	MADSEN//CHINESE SPRING/PI53-17181	20	0,46	0,92	-	-	-	-	-	-
3	MADSEN//CHINESE SPRING/PI53-17182	25	0,45	0,94	-	-	-	-	-	-
4	WHEAT-AGROPYRON PONTICUM PARTIAL AMPHIPLOID1	22.2	0,40	0,84	-	-	-	-	-	-
5	PI573182/BFC24//BFC2-N/3/PI440048/4/(TAM11-0/PI401201//JAG & 213-7)/5/(PI636500/PI414667-//PI414667/3/(PI573182-/PI314190//BFC1FF))1	20	0,45	0,96	-	-	-	-	-	-
6	WHEAT-AGROPYRON PONTICUM PARTIAL AMPHIPLOID2	24.1	0,42	0,86	-	-	-	-	-	-
7	T.DURUM/AG.ELON-GATUM	50	0,45	0,95						
8	11/2016	100	0,5	115	100	0,7	170	100	0,94	267

According to the results of the research, 20-100 percent grass re-germination was observed in 8 samples after harvesting for grain in the 1st year, while in the next years of the research (2021-2022), complete re-germination was observed only in the 11/2016 sample.

When the length and total length of the main root part (97%) of the samples were studied, the high rate was observed in the 11/2016 sample, which retained its perennial character, in the first year of the research, the main part and the total length were equal to 0.50-115 cm, and in the second year, 0.70 -170 cm, and by the third year it was observed to be 0.94-267 cm. This sample was recommended for breeding research to create varieties resistant to drought, cold, salt, heat, and for use as pasture for livestock (3 tables).

Table 4 Evaluation of valuable traits in perennial wheat samples

№	Samples.	Growing period, day	Yellow rust, %	1 spike			
				spike length, cm	number of spikes, pcs	number of grains, pieces	grain weight, gr
1	BEZOSTAYA (control)	238	205	11,5	18,4	51,4	2,1
2	TAM110/PI401201//JAG & 2137	248	105	10,4	17,2	36,7	1,1
3	PI573182/BFC24//BFC2N/3/PI44-0048/4/(TAM110/PI401201//JAG & 2137)/5/(PI636500/PI414667//-PI41-4667/3/(PI573182/PI314190-//BFC1FF))	247	R	13,8	16,1	36,8	1,3
4	(KEQIANG/NANDA2419)/AG.-INTERMEDIUM//WHEAT	243	R	14,2	19,7	61,7	1,6
5	HEZUO#2/AG.INTERMEDI-UM//WHEAT	239	R	11,4	18,4	54,2	1,6
6	WHEAT-AGROPYRON PONTI-CUM PARTIAL AMPHIPLOID	240	R	12,6	16,8	50,4	1,5
7	11/2016	256	R	16,5	16,8	45,2	1,2
8	MADSEN//CHINESE SPRING/-PI531718	254	10S	17,2	19,4	55,6	1,1
9	WHEAT-AGROPYRON PON-TICUM PARTIAL AMPHIPLOID5	254	R	15,7	15,2	47,8	1,3
10	(KEQIANG/NANDA2419)/AG.-INTERMEDIUM//WHEAT	245	R	16,5	22,6	65,4	1,6
11	PI634318/PI414667	251	R	10,4	15,2	52,6	1,2
12	VILMORIN 27*2/AG.INTERME-DIUM	255	R	12,8	18,3	57,1	1,1
13	T.DURUM/AG.ELONGATUM1	256	R	17,4	18,2	52,8	1,3
14	TAM110/PI401201//JAG & 2137/-3/PI520054/4/PI401168/5/(TAM-110/PI401201//JAG & 2137)	244	R	13,2	17,8	51,2	1,1

This is of great importance in the efficient use of unproductive land and the cultivation of fodder for livestock in resource-efficient conditions. In the course of research, valuable traits and characteristics were studied in 43 samples of perennial wheat in field conditions. According to the results, 13 samples with high productivity indicators were selected. It was observed that the growth period in the samples was between 238 - 256 days.

The growth period was 238 days in the model Bezostaya variety, while the growth period was observed late by 1-18 days in the samples compared to the model variety.

This indicator was 256 days in the 11/2016 sample, which has retained its perennial character (4 tables).

Sample Bezostaya 1 was infected with yellow rust up to 20%, samples TAM110/PI401201//JAG & 2137, MADSEN//CHINESE SPRING/PI531718 were infected up to 10%, all other samples were not infected with yellow rust disease.

The number of grains per spike and weight of the samples were analyzed. The number of grains in one ear of the Bezostaya variety was 51.4 grains, and the grain weight was 2.1 grams. It was observed that the change of the number of grains in one spike in the samples was 36.7-65.4 grains, and the change of grain weight in the samples was 1.1-1.6 g (4 tables).

Compared to one-year wheat, perennial wheat has a shorter growth period and productivity characteristics, but it is highly resistant to stress factors. Therefore, when these samples were selected for selection, they were involved in selection research to create resources resistant to stress factors and high productivity characteristics based on interspecies hybridization.

Conclusion

Perennial wheat is 2-3 times higher than one-year soft wheat varieties, samples with a growing period of no more than 256 days were selected.

The 11/2016 sample of perennial wheat, which has preserved its perennial characteristics under the regional conditions, was selected and involved in selection research.

13 samples of long-term wheat samples resistant to yellow rust, number of grains 36, grain weight 1.1 grams and 1000 grains weight more than 18 grams were selected.

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