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Study of Yield Indicators of (f4) and (F5) Generation Wheat Hybrids Grown in Different Ecological Conditions According to Salt Tolerance

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Abstract

In the breeding work carried out in the direction of obtaining salt-tolerant wheat varieties, hybrid forms (F4) and (F5) were planted and cultivated in various environmental conditions. These hybrids were planted in normal soils of the Karabakh scientific research base of the Terter region of the Republic of Azerbaijan in the seasons of October 20, 2022 and October 22, 2023, as well as in saline soil areas with a predominance of sulfates (Na2SO4) of the base experimental station of the Ujar region of the Institute of Soil Science.After the completion of the grain ripening phase of the vegetation, the yield indicators of the hybrid forms cultivated both in normal conditions and in saline soils were studied in a comparative manner according to the main structural elements of the spike, mainly according to the weight of the spike, grain, weight of 1000 grains and the number of grains. Productivity indicators were calculated according to the tolerance index, and hybrids with less yield loss were evaluated as relatively salt-tolerant. So, from the hybrid forms Layagatli-80 x Mirbashir -128, Tale- 38 x Gyrmyzy gul-1, Dagdash x Murov , Nurlu-99 x Layagatli-80 , Barakatli -95 x

Vugar, Karabakh x Tartar, Karabakh x Mirbashir-128 showed more durability than other hybrid forms due to their productivity indicators.

Keywords: hybrid, productivity, tolerance, vegetation, selection

Introduction

One of the most important problems in the world is the lack of food, and more than one billion people in the world suffer from "chronic" hunger. Wheat plant (*T.aestivum* L., *T.durum* Desf.) is one of the most important and cultured food crops of the Earth and forms the basis of the population's diet (FAO, 2016). Wheat is one of the 3 major cereal crops (rice, maize, wheat) that are widely cultivated and is the main food source for nearly 2 billion people, more than 36% of the world's population (El-Sabagh et al., 2021). Especially the salinization of the soil over time creates more serious dangers. Limitation of suitable and productive land areas for agriculture poses a serious threat to meeting people's food needs (Khan et al., 2010). Therefore, in order to solve these problems, it is necessary to effectively use the existing genetic biodiversity in the world, to search for and find new genetic sources, to involve wild ancestors who are carriers of many positive traits in the process of new breeding, etc. extensive research is conducted in these directions, interspecies and intersex hybridizations are used. According to Aliyev (2002) many of the valuable examples of folk selection created in Azerbaijan during a long historical period have been lost or are in danger of being lost by being suppressed by modern selection varieties (and in some cases genetically modified plants). In order to eliminate this danger, targeted research should be continued (Aliyev et al 2002). Many researchers have noted that the disruption of the ecological balance and the presence of abiotic stress factors in nature require the creation of more plastic wheat varieties suitable for the regions of the republic. They showed that it is of great importance to carry out selection works in this direction (Rustamov et al 2017).

Thus, based on the research conducted in the world, as well as in our country, in the direction of salt resistance, it can be concluded that it will indeed be possible to purchase salt-resistant wheat varieties adapted to salinity in the future.

Materials and methods

(F4) and (F5) generation hybrids on certain days corresponding to the sowing of October 2022-23 in the normal (22. 10. 2022) of the Tartar region Karabakh Scientific Research Base and in the saline soils of the experimental base stations of the Ujar region of the Institute of Soil Science (25. 10. 2023 October) was planted and cultivated

The object of research is wheat grown in both normal (Tartar) and saline (Na_2SO4 1.5%, Ujar) soil conditions (F5) as a generation 1-Layagatli-80 x Mirbashir -128, 2-Golden wheat x Guneshli, 3-Tartar x Karabakh, 4-Tale-38 x , x Gyrmyzy gul-1, 5- Gobustan x Sheki-1, 6-Murov x Dagdash, 7-Bezostaya -1 x x

Gyrmyzy gul-1 1, 8-Dagdash x Murov, 9-Nurlu -99 x Worthy-80,10- Karabagh x Karakilchik-2, 11.- Sheki-1 x Gobustan, 1 2-Vuqar x Barakatli -95, 13- Gyrmyzy gul-1- x Tale-38 14 Barakatli-95 x Vugar, 15. Karabagh x Tartar 16 -Aran x Gyrmyzy gul-1-, 17-Mirbashir-50 x Shiraslan-23, 18-Karabakh x Gobustan, 19-Barakatli-95 x Gobustan, 20- Gobustan x - x Gyrmyzy gul-11, 21-Gobustan x Baraketli-95, 22 - Gobustan x Karabakh, 23-Karabakh x Mirbashir-128, 24-Karabakh x Şharg hybrids.

The planting area of each line was 1-8 m2, depending on the seed material. Before sowing, 100 kg of organic fertilizer per hectare was applied to the experimental field, and 90 kg of ammonium-nitrate (NH_4NO_3) fertilizer was applied to the experimental area in the early spring phase of the bushing. During the vegetation period, the samples were watered in the stages of tube-rooting (22.IV), spiking (19.V) and grain formation (08.VI), and agrotechnical maintenance works designed for the region were carried out in the experimental area. Observations on plants and structural elements of the product were carried out according to the existing methodology.To determine the resistance of varieties to salinity stress, the stress tolerance index given by Rosielle and Hambelen in 1981 was used :Tol = Yp-Ys,Here, Tol - durability;
Yp - productivity under normal conditions; Ys is the yield under saline conditions.
The effect of salt on the yield indicators of hybrid wheats taken from normal and saline soil conditions, and the changes that occurred, were studied in a comparative manner. If the tolerance index is low in the varieties, that variety will be highly resistant to salinity.

Graphical presentation of data was done using MS-Excel software and standard error was calculated in the same way. The least significant difference (LSD) test was performed using STATISTIX 8.1 at the 0.05 probability level.

Results and discussion

One of the most useful indicators of wheat is grain yield. High salt concentration in soil causes a decrease in grain yield (Katerji et al., 2005; Turki et al., 2012). The study of crop loss as the main indicator of productivity is one of the main conditions. The study of this yield loss was studied as a result of applying the tolerance index formula. Both normal and salinity-grown (F4) and (F5) hybrids were comparatively studied according to productivity. .
Tables 1 and 2 show the yield indicators of hybrids (F4) and (F5) grown in 2022-2023. both in normal (normal Tatar region) and saline (saline Ujar region) soil conditions with a predominance of sulfates (Na2SO4 1.5%) (ear weight, denier weight, number of denier, weight 1000 denier are indicated). A two-year comparative study of hybrids (F4) and (F5) grown under both normal and salinity conditions on key yield parameters again shows that some hybrids suffer relatively little yield loss due to salt. Some were moderately affected, while others suffered heavy crop losses.

Table 1. Characteristics of yield elements of (F_4) hybrids planted in normal soils of Tarter region and in saline soils of Ujar regions . (2022)
Mean value of 3 replicates for each hybrid is p = 0.05 with n = 3, ± SD

(F4) Hyibrids	Ear weight,(g)		Weight of grain,(g)		Number of grains in ear		Weight of 1000 grain (g)	
	Tartar normal soil	Ujar saline soil	Tartar normal soil	Ujar saline soil	Tartar normal soil	Ujar saline soil	Tartar normal soil	Ujar saline soil
1.Layaqatli-80 x Mirbashir-128	4.54±0.17	4.49±0.14	4.02±0.54	4.02±0.74	61±1.26	59±1.28	49.1±0.77	48.7±0.81
2.Golden wheat x Gunashli	3.13±0.07	2.24±0.11	2.31±0.72	1.42±0.23	39±1.26	31±1.24	42.6±0.62	39.2±0.12
3.Tartar x Karabagh	4.13±0.17	3.57±0.13	3.21±0.24	1.97±0.11	60±1.15	54±1.14	37.8±0.94	32.6±0.82
4.Tale-38 x Gyrmyzy gul-1-	3.49±0.27	3.32±0.13	2.44±0.62	2.40±0.16	48±1.28	46±1.19	57.2±0.82	56.4±0.88
5.Gobustan x Sheki-1	2.62±0.24	2.05±0.23	2.18±0.14	1.84±0.13	39±0.8 2	34±0.72	48.3±1.13	46.2±1.12
6.Murov x Daghdash	3.45±0.21	2.78±0.11	3.14±0.62	2.16±0.15	48±1.17	40±1.17	51.5±0.32	46.2±0.84
7.Bezostaya-1 x Gyrmyzy gul-1	2.42±0.12	1.78±0.17	2.25±0.11	2.05±0.02	55±0.54	42±0.33	44.4±1.08	40.8±1.11
8.Dagdash x Murov	3.65±0.17	3.65±0.21	3.99±0.12	3.13.±0.11	65±0.54	63±0.43	55.8±1.18	54.9±1.12
9.Nurlu-99 x Layaqatli-80	4.41±0.19	3.98±0.09	3.13±0.16	2.74±0.15	62±1.48	60±1.33	52.±1.031	52.1±1.04
10.Karabagh x Karakilchik-2	1.81±0.12	1.26±0.12	1.51±0.32	1.12±0.35	18±2.15	11±2.03	47.2±0.45	42.4±0.44
11.Sheki-1 x Gobustan	2.71±0.14	2.11±0.23	1.83±0.19	1.45±0.19	43±0.92	32±0.82	47.6±0.11	40.8±0.13
12.Vuqar x Barakatli -95	5.60±0.54	5.15±0.56	4.91±0.12	4.32±0.18	64±1.66	63±1.86	55.8±0.82	55.2±0.93
13. Gyrmyzy gul-1-x Tale-38	3.33±0.17	3.10±0.23	2.52±0.31	2.22±0.12	53±2.62	50±2.68	50.1±0.12	49.2±0.11
14.Barakatli-9 5 x Vuqar	4.64±0.21	4.62±0.20	4.26±0.16	4.24±0.12	66±0.22	64±0.42	58.4±0.33	58.2±0.32
15.Karabagh x Tartar	4..32±0.22	4.30±0.22	3.52±0.14	2.53±0.14	55±1.53	51±1.63	54.2±0.12	53.4±0.31
16.Aran x Gyrmyzy gul-1	2.26±0.14	1.92±0.18	1.84±0.21	1.35±0.22	53±0.72	42±0.75	56.1±0.11	54.2±0.12
17.Mirbashir-50x Shiraslan-23	4.47±0.21	4.24±0.31	3.54±0.36	3.42±0.61	60±0.13	55±0.14	50.2±0.43	49.3±0.43
18.Karabagh x Gobustan	3.18±0.22	2.53±0.12	2.12±0.32	1.81±0.22	41±2.11	33±2.11	43.5±0.44	40.4±0.73
19.Gobustan x Barakatli-95	3.82±0.23	3.24±0.21	2.71±0.23	2.18±0.33	44±0.81	34±0.72	48.7±0.82	46.3±0.92
20.Gobustanx x Gyrmyzy gul-1-	3.79±0.30	3.27±0.33	2.78±0.54	2.43±0.44	38±0.22	31±0.44	41.5±0.33	36.5±0.22
21.Barakatli-95 x Gobustan	4.28±0.16	3.62±0.27	3.12±0.04	3.10±0.02	44±2.23	38±2.51	54.2±0.18	52 .4±0.18
22.Kobustan x Karabagh -	3.32±0.24	3.13±0.23	2.82±0.41	1.34±0.51	45±0.42	33±0.44	51.2±0.12	49.2±0.21
23.Karabagh x Mirbashir-128	3.56±0.17	3.41±0.12	3.11±0.14	3.10±0.12	57±0.15	53±0.64	55.2±0.13	54.3±0.18
24.Karabagh-x Shark	5.42±0.15	5.18±0.12	4.21±0.11	4.01±0.11	67±0.33	65±0.16	56.6±0.72	55.8±0.42

indicates mean standard deviation.

Table 2. Characteristics of yield elements of (F5) hybrids planted in normal sioils of Tartar regions and in saline soils of Ujar region. (2023)

(F5) Hyibrids	Ear weight (g)		Weight of grain (g)		Number of grains in ear		Weight of 1000 grain (g)	
	Tartar normal soil	UJar saline soil	Tartar normal soil	UJar saline soil	Tartar normal soil	UJar saline soil	Tartar normal soil	UJar saline soil
1.Layaqatli-80 x Mirbashir-128	4.52±0.15	4.47±0.13	4.04±0.82	4.04±0.82	63±1.28	60±1.23	50.9±0.92	50.6±0.92
2.Golden wheat x Gunashli	3.18±0.17	2.62±0.15	2.22±0.82	1.52±0.15	42±1.28	32±1.28	43.6±0.82	38.2±0.92
3.Tartar x Karabagh	4.22±0.15	3.65±0.17	3.23±0.14	1.93±0.14	64±1.05	55±1.05	35.8±0.94	31.6±0.94
4.Tale-38 x Gyrmyzy gul-1-	3.51±0.37	3.32±0.15	2.54±0.82	2.51±0.15	46±1.28	42±1.28	59.3±0.82	58.8±0.92
5.Gobustan x Sheki-1	2.81±0.26	2.12±0.24	2.14±0.14	1.74±0.14	32±0.8 2	24±0.8 2	46.8±1.23	46.2±1.23
6.Murov x Daghdash	3.62±0.22	2.95±0.15	3.24±0.82	2.12±0.15	52±1.28	42±1.28	44.4±0.82	41.2±0.92
7.Bezostaya-1 xGyrmyzy gul-1	2.63±0.18	2.42±0.18	2.58±0.01	2.00±0.01	57±0.44	47±0.54	45.8±1.09	41.6±1.09
8.Dagdash x Murov	3.64±0.17	3.64±0.17	3.98±0.12	3.12±0.12	66±0.64	65±0.64	56.2±1.08	55.4±1.08
9.Nurlu-99 x Layaqatli-80	4.42±0.20	4.13±0.20	3.12±0.16	2.88±0.16	61±1.48	59±1.48	53.8±1.03	53.6±1.03
10.Karabagh x Karakilchik-2	1.84±0.16	1.33±0.16	1.61±0.35	1.11±0.35	20±2.05	11±2.05	50.1±0.45	44.4±0.45
11.Sheki-1 x Gobustan	2.83±0.34	2.18±0.34	1.83±0.29	1.44±0.29	47±0.92	45±0.92	48.8±0.21	42.3±0.21
12.Vuqar x Barakatli -95	5.56±0.58	5.45±0.58	4.81±0.14	4.52±0.14	66±1.76	65±1.76	57.2±0.92	54.3±0.92
13. Gyrmyzy gul-1-x Tale-38	3.42±0.37	3.14±0.37	2.51±0.34	2.32±0.34	52±2.64	49±2.68	49.8±0.11	49.3±0.11
14.Barakatli-9 5 x Vuqar	4.57±0.21	4.55±0.21	4.23±0.16	4.22±0.16	68±0.42	67±0.42	57.8±0.42	57.6±0.42

Table 2. (continued) Characteristics of yield elements of (F5) hybrids planted in normal sioils of Tartar regions and in saline soils of Ujar region. (2023)

15.Karabagh x Tartar	4.34±0.32	4.32±0.32	3.72±0.24	2.73±0.24	56±1.63	52±1.62	55.1±0.32	54.4±0.32
16.Aran x Gyrmyzy gul-1	2.43±0.17	1.81±0.17	1.94±0.13	1.45±0.21	54±0.78	44±0.78	58.1±0.16	56.3±0.16
17.Mirbashir-50x Shiraslan-23	4.65±0.31	4.33±0.31	3.62±0.66	3..54±0.66	62±0.15	58±0.15	51.4±0.45	50.7±0.45
18.Karabagh x Gobustan	3.57±0.25	2.52±0.25	2.22±0.42	1.90±0.42	42±2.12	35±2.12	46.6±0.84	41.4±0.84
19.Gobustan x Barakatli-95	3.64±0.13	3.13±0.23	2.71±0.33	2.11±0.33	46±0.71	41±0.71	50.4±0.93	47.8±0.93
20.Gobustanx x Gyrmyzy gul-1-	3.83±0.31	3.27±0.31	2.84±0.54	2.42±0.54	36±0.44	31±0.44	39.6±0.33	37.3±0.33
21.Barakatli-95 x Gobustan	4.31±0.28	3.63±0.28	3.11±0.01	2.78±0.01	44±2.82	40±2.82	53.2±0.17	50.4±0.17
22.Kobustan x Karabagh -	3.44±0.31	3.12±0.31	2.91±0.54	1.35±0.31	42±0.44	31±0.27	49.4±0.33	48.2±0.33
23.Karabagh x Mirbashir-128	3.65±0.10	3.52±0.10	3.28±0.11	3.27±0.11	54±0.62	51±0.62	54.1.±0.42	53.3±0.42
24.Karabagh-x Shark	5.64±0.14	5.49±0.14	4.13±0.10	4.05±0.10	66±0.56	64±0.56	57.6±0.96	56.9±0.96

Mean value of 3 replicates for each hybrid is p = 0.05 with n = 3, ± SD indicates mean standard deviation.

By ear weight, which is the main indicator of yield, H1 - 0.5 g, H8 - 0 g, H 9 - 0.01 g, H14 - 0.02 g, H15 - 0.02 g. The yield of these hybrids is lower. a loss was recorded. In hybrid forms with less losses, the number of seeds and other productivity indicators changed by almost 0-1%.

Among the complex measures carried out to obtain high yields from plants on saline soils, a special place is occupied by the purchase of plants that can adapt to such soils (Belovalova, 2011). However, it has been established that the effect of salt may be less at one stage of development and greater at another. According to most authors, the stage of greatest sensitivity of plants to salinity is the beginning of ontogenesis (Turki et al., 2012). Plants are more sensitive to salt during the formation of spikelets and nodules in cereals (Maas et al., 1997).

Plant productivity is reduced by salt exposure, but the decline and the salt concentrations that cause it vary among plant species. (Nedret et al., 2004). The response of plants to stress factors is different; this is the response of the genetic material. Thus, the genetic material regulates the rate and sequence of protein synthesis necessary in a stressful situation. A number of difficulties in growing salt-tolerant forms are associated with resistance to salt stress and the complex and polygenic nature of genes. During the process of evolution, all organisms, including plants, develop protective mechanisms against environmental stress factors. Therefore, when assessing resistance to stress factors, it is necessary to take into account the individual characteristics of each plant genotype (Ibragimova et al., 2021).

Conclusion

In the presented study, the yield indicators of the 4th and 5th generation hybrid forms of wheat genotypes were evaluated for 2 seasonal years in salt-free and salt stress conditions. The evaluation was determined according to the tolerance index based on productivity indicators. Based on the results of the research, hybrid forms of Layagatli-80 x Mirbashir-128, Tale-38 x Gyrmyzy gul-1, Dagdash x

Murov, Nurlu-99 x Layagatli-80, Barakatli-95 x Vugar, Karabakh x Tartar, Karabakh x Mirbashir-128 were rated as relatively stable.

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