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The Valuable Traits of Varieties and Lines for Breeding Durum Wheat

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Abstract. The article presents the results of the study of the resistance to drought and heat, which are the valuable traits of Durum wheat varieties and lines studied in the field of advanced yield trial nursery of Durum wheat in dry areas, in laboratory conditions. Based on the results of the analysis, four varieties and lines of Durum wheat high resistance to drought and heat were selected for use in the selection process.

Key Words. Variety, line, Durum wheat, rainfed conditions, drought tolerance, heat tolerance, plant height, upper internode, total water, biomass.

Introduction. High air temperatures and low relative humidity during the growing season of grain crops in Uzbekistan makes it necessary to study the variability of the traits and properties of drought tolerance of these crops.

In studies of drought resistance on seed germination in a solution of sucrose, an increase in the variability of traits was observed in variants with sucrose. The maximum value of the coefficient of variation in the experiment was noted for the length of the roots - 42.7%. In general, wheat is characterized by an average, strong and very strong degree of variability of traits under stress conditions [1].

The heat resistance of wheat is closely related to the coagulation temperature of water-soluble proteins in the cell sap of the leaves [5].

With an acute moisture deficit, the spatial orientation of the leaves is of paramount importance. The study revealed the great importance of the horizontal arrangement of the leaves. The vertical arrangement of the leaves did not optimize the increase in grain yield [6].

Use the selection of forms for productivity along the length of the upper internode, the correlation coefficient between the length of the upper internode and productivity is r=0.724 [7].

Groups of variety samples significantly differing in the length of the upper medjonode, in fewer cases had significant differences in yield elements than similar groups identified by plant height (50% of cases vs. 78%) [2].

Found that varieties that are least responsive to drought have high values of specific water-holding capacity [4].

Analysis of experimental and literature data testifies to the importance of the ratio of root and ear mass in the flowering phase in cereals for the formation of their final productivity [3].

Material And Methods. The material of our research was the varieties of advanced yield trial nursery of Durum wheat on the rainfed land of the Scientific research Institute of rainfed Agriculture.

According to the methods of VIR study of Durum wheat for drought and heat resistance was carried out.

The purpose of this study was to study varieties of Durum wheat advanced yield trial nursery for drought-resistance, followed by selection of varieties with high rates of drought-resistance in rainfed conditions.

Research Results. As a result of studying the drought-heat tolerance of Durum wheat varieties advanced yield trial nursery it was noted that in the dry years of 2021 and 2022, plant height, the length of the upper

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internode, and the total water content in the leaves were sharply inferior to those in comparison with the wet years of 2020, Table 1.

Table 1.
Variability of morphological and physiological parameters of Durum wheat on rainfed lands. (Gallyaaral, 2020 - 2022)

Year	Durum wheat		
	lim	x	V
Angle of inclination of the flag sheet, ^{0}C			
2020	10,8 - 16,4	16,1	13,10
2021	6,6 - 17,8	12,1	22,08
2022	5,4 - 21,9	13,3	29,40
Plant height, cm			
2020	90,6 - 126,0	115,9	6,58
2021	63,8 - 90,4	75,5	8,44
2022	64,0 - 91,6	79,5	8,30
Upper internode length, cm			
2020	16,2 - 53,4	43,9	20,37
2021	21,6 - 39,2	26,7	16,08
2022	21,6 - 37,2	29,3	15,90
Total water content in leaves, %			
2020	65,6 - 76,4	71,1	5,33
2021	59,6 - 69,9	63,9	3,99
2022	54,6 - 70,9	60,8	7,10
Coagulation temperature of water-soluble proteins in leaves, °C			
2020	59,0 - 62,5	61,1	1,68
2021	57,5 - 62,0	60,2	1,97
2022	57,0 - 61,5	60,3	1,50

As can be seen from the tabular data, high coefficients of variation were in the angle of inclination of the flag leaf in 2021 (V=22.08%), in 2022 (V=29.40%), along the length of the upper internode in 2020. (V=20.37%). Low coefficients of variation were for the temperature of coagulation of water-soluble proteins in the leaves (V=1.68%, V=1.97%, V=1.50%), for the total water content in the leaves (V=5.33%, V= 3.99%, V=7.10%), by plant height (V=6.58%, V=8.44%, V=8.30%).

The results of the studying of drought-head resistance of selected varieties of Durum wheat competitive variety testing are presented in Table. 2.

Table 2.
Morphological and physiological parameters of drought-heat tolerance of Durum wheat varieties in the heading phase on Advanced yield trial nursery on rainfed lands (Gallyaaral, 2020 - 2022)

Year	Varieties				
	Leukurum-3 (st)	Javokhir	Billurdon	RNS-2014/22	NP-2017/19
The angle of inclination of the flag sheet, °C					
2020	13,4	12,2	14,2	10,8	13,8
2021	9,8	11,4	13,0	7,8	16,4
2022	21,4	10,8	12,2	11,4	14,2
x	14,8	11,4	13,3	10,0	14,8
Plant height, cm					
2020	120,4	125,4	114,8	121,4	123,4
2021	65,2	79,4	75,2	77,4	73,2

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2022	75,6	80,0	81,2	71,6	69,8
x	87,0	94,9	90,4	90,1	88,8
Upper internode length, cm					
2020	53,4	45,6	48,4	38,2	49,2
2021	24,0	22,4	28,4	23,8	21,6
2022	29,6	29,2	28,6	22,8	23,4
x	35,6	32,4	35,1	28,2	31,4
Total water content in leaves, %					
2020	68,7	70,9	65,6	73,8	70,3
2021	65,7	64,5	63,7	69,9	69,3
2022	54,8	62,0	61,0	70,9	63,0
x	63,0	65,8	63,4	71,5	67,5
Coagulation temperature of water-soluble proteins in leaves, °C					
2020	59,0	60,5	60,0	60,5	62,0
2021	58,0	57,5	59,5	61,0	61,0
2022	57,0	58,5	59,0	60,0	60,0
x	58,0	58,8	59,5	60,5	61,0

The table data show that the selected varieties of Durum wheat exceeded the standard in terms of plant height from 1,8 cm (NP-2017/19) to 7,9 cm (Javokhir), in terms of total water content in leaves - from 0,4% (Billurdon) up to 8,5% (RNS-2014/22), according to the temperature of coagulation of water-soluble proteins in leaves - from 0,8 °C (Javokhir) to 3,0 °C (NP-2017/19).

Accumulation and distribution of the total biomass of varieties of advanced yield trial nursery of Durum wheat in rainfed conditions for 2020-2022 are presented in table. 3.

Table 3.

Variability of the accumulation and distribution of the total biomass of Durum wheat varieties on the Advanced yield trial in the heading phase on rainfed lands (Gallyaaral, 2020 - 2022)

Plot	Variety	Weight of the total raw biomass of 10 plants, g	Spikes weight with 10 plants		Roots weight with 10 plants	
			g	Share of spikes, %	g	Share of roots, %
2020 y.						
1	Leukurum-3 (st)	325,20	45,18	13,89	47,86	14,72
2	Javokhir	237,34	33,24	14,00	29,34	12,36
6	454612	271,76	38,34	14,10	49,54	18,22
7	RNS-2014/22	331,36	38,40	11,58	62,04	18,72
13	NP-2016/49	339,96	46,82	13,77	63,24	18,60
15	DNS-2017/30	213,90	29,84	13,95	29,98	14,01
22	DNS-2019/30	261,22	30,88	11,82	56,68	21,09
2021 y.						
1	Leukurum-3 (st)	169,48	38,30	22,59	17,04	10,05
2	Javokhir	193,04	56,58	29,30	18,06	9,35
6	Kumushdon	169,72	34,56	20,36	18,82	11,08
7	454612	135,64	33,98	25,05	11,82	8,71
8	RNS-2014/22	187,02	40,70	21,76	18,42	9,84
10	NP-2016/49	216,52	53,42	24,67	27,66	12,77
12	DNS-2017/30	132,72	33,60	25,31	10,64	8,01
18	DNS-2019/30	178,00	44,58	25,04	19,02	1068

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2022 y.						
1	Leukurum-3 (st)	123,82	34,48	27,84	10,74	8,67
2	Javokhir	170,08	48,00	28,22	15,54	9,08
6	Kumushdon	144,14	28,14	19,52	15,62	10,83
7	454612	170,57	43,62	25,57	20,42	11,97
8	RNS-2014/22	158,60	32,70	20,61	17,42	10,98
10	NP-2016/49	172,54	50,60	29,32	16,20	9,38
12	DNS-2017/30	153,28	43,30	28,24	12,36	8,06
18	DNS-2019/30	141,80	36,44	25,69	13,02	9,18

According to the table, it can be seen that the total biomass of Durum wheat varieties in 2020 ranged from 213.90 g (DNS-2017/30) to 339.96 g (NP-2016/49), for the standard 325.20 tons. (Leukurum-3), in 2021 - from 132.72 g. (DNS-2017/30) to 216.52 g. (NP-2016/49), the standard is 169.48 g. (Leukurum-3) , in 2022 - from 141.80 g. (DNS-2019/30) to 172.54 g. (NP-2016/49), the standard has 123.82 g. (Leukurum-3).

According to the accumulation of total biomass, Durum wheat varieties Javokhir, 454612, RNS-2014/22, NP-2016/49, DNS-2019/30 with high rates of this trait were selected.

When studying the drought resistance of Durum wheat varieties by seed germination on a sucrose solution, varieties Yakut-2014, NP-2016/5, NP-2019/51, NP-2019/75 were distinguished (Table 4.).

Table 4.

Percentage of seed germination on sucrose solution, number and length of rootlets, length of Durum wheat coleoptile on the Advanced yield trial nursery
(Gallyaaral, 2022)

Plot	Variety	% germinated seeds		Number of roots, pcs.		Root length, cm		Coleoptile length, cm	
		Control	Sucrose	Control	Sucrose	Control	Sucrose	Control	Sucrose
1	Leukurum-3 (st)	100	92	5,0	3,3	10,2	4,6	5,1	2,3
3	Marvarid	96	85	5,0	3,1	9,7	3,1	5,7	2,5
4	Yakut-2014	98	96	5,0	3,4	4,5	3,7	5,2	2,4
6	Kumushdon	98	97	5,2	5,0	6,8	4,0	5,4	2,9
8	RNS-2014/22	100	93	5,0	2,9	6,7	3,0	5,0	2,8
11	NP-2016/55	94	90	3,7	4,8	3,2	4,4	3,2	3,7
14	DNS-2018/26	100	94	4,5	3,6	3,9	2,9	3,7	2,6
15	DNS-2018/30	88	85	3,3	3,6	3,4	3,0	3,4	2,9
20	NP-2019/51	94	90	5,0	3,0	6,4	2,4	4,8	2,2
22	NP-2019/75	98	97	5,0	4,1	4,9	3,9	4,7	2,8
25	DNS-2020/5	96	92	4,9	4,3	10,4	3,7	5,1	3,2

From the table data it can be seen that the percentage of germination of Durum wheat seeds in a sucrose solution ranged from 85% (DNS-2018/30) to 97% (NP-2019/75) for varieties, 92% for the standard (Leukurum-3), the length of primary roots - from 2,4 cm (NP-2019/51) to 4,4 cm (NP-2016/55), for the standard 4,6 cm (Leukurum-3)

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According to the results of studying the heat resistance of Durum wheat seeds after heating, varieties DNS-2018/26, NP-2019/7, DNS-2020/29 were distinguished, Table. 5.

Table 5.

The percentage of seed germination after heating, the number and length of roots, the length of the coleoptile on the Advanced yield trial (Gallyaaral, 2022).

Plot	Variety	% germinated seeds		Number of roots, pcs.		Root length, cm		Coleoptile length, cm	
		Control	t° (57°C)	Control	t° (57°C)	Control	t° (57°C)	Control	t° (57°C)
1	Leukurum-3 (st)	90	80	5,0	4,0	7,5	4,6	4,8	3,4
3	Marvarid	90	83	5,0	5,0	7,5	6,4	5,3	4,9
14	DNS-2018/26	94	92	4,9	4,9	5,1	4,9	3,9	3,6
15	DNS-2018/30	94	84	5,0	4,8	8,8	5,8	5,1	3,9
16	NP-2018/69	88	82	5,0	4,1	5,9	4,1	4,5	3,2
19	NP-2019/7	90	86	4,9	4,9	5,2	4,9	4,2	3,8
20	NP-2019/51	89	88	4,6	3,1	4,6	2,3	3,1	2,1
24	DNS-2020/14	88	84	4,7	4,7	5,1	4,8	3,9	3,7
27	DNS-2020/29	98	85	4,9	4,7	5,2	4,9	3,9	3,5

It can be seen from the table data that the percentage of germination of Durum wheat seeds after heating ranged from 82% (NP-2018/69) to 92% (DNS-2018/26) for varieties, for the standard 80% (Leukurum-3), the length of the coleoptile was from 2,1 cm (NP-2019/51) to 4,9 cm (Marvarid), for the standard 3,4 cm (Lekurum-3).

Conclusions. It was found that the coefficients of variation of the studied traits of drought tolerance varied widely depending on the variety and, to a lesser extent, on the conditions of the year.

According to the complex of traits of drought and heat tolerance of Durum wheat varieties on the Advanced yield trial nursery Javokhir, Billurdon, RNS-2014/22, NP-2017/19 were selected.

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