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INVESTIGATION OF THE VEGETATIONAL PERIOD IN THE FOURTH HYBRID LINES OF DURUM WHEAT

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Abstract. The research was conducted in the 2019-2020 growing season under irrigation conditions. Predecessors was chick pea, sowing was carried out manually in the third decade of October, each sample was sown in 2 replications on an $1m^2$ area, mass emergence was observed in the first decade of November. For pre-sowing fertilazition 150 kg of complex fertilizer (nitrophoska), and in the early spring, 250 kg/ha of nitrogen fertilizer at tillering stage (NH_4NO_3) were applied. In hybridization, the landraces (Sharg, Shiran 5, etc.), newly realized (Goytapa, Zangazur, etc.) local and foreign origin durum wheat varieties were used. The length of the vegetation period of 40 fourth-generation (F_4) hybrid lines of durum wheat was carried out in accordance with international methods. Having a rapid maturation as a result of research Zatino (France) x Turan, k-ST/2016/45; Zatino (France) x Turan, k-ST/2016/48; [Garabagh x Tartar-2] x Mirvari, k-ST/2016/66; [Turan x Zedoni-3D-56] x Garagılchig 2, k- ST/2016/137; [Turan x Zedoni-3D-56] x Garagılchig 2, k- ST/2016/144; [Turan x Zedoni-3D-56] x Garagılchig 2, k- ST/2016/147; [Turan x Zedoni-3D-56] x Garagılchig 2, k- ST/2016/151; [Giorgio-12-571 x Parinj] x Garabagh, k- ST/2016/157; Garabagh x Mirbashir-50, k- ST/2016/160; (v.apulikum x Altun) x Karol Odeskaya,k- ST/2016/172; v.hordeiforme x (Tartar x Mirvari), k- ST/2016/19a etc. the hybrid lines were tested at the Tartar and Jalilabad Regional Experimental Stations with different soil-climatic conditions in order to continue research in the later stages of selection so that to create new varieties having a rapid maturation.

Keywords: *breeding, durum wheat, hybrid lines, vegetation period.*

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1. Introduction

Wheat (*Triticum* L.) is one of the two crops (the other is rice) that is part of the daily food of 35% of the world's population and accounts for more than 40% of global food production.

Demand for wheat is expected to increase by 70 percent in the coming decades (2020-2050) due to a sharp increase in food consumption of global population and income growth (Rosegrant, 2011).

The creation of improved wheat varieties is the main task of wheat breeders, who play an important role in increasing of productivity (Reynolds *et al*., 2012).

Strengthening the sustainability of food security, improving the quality of scientific support and education in agriculture and etc. in the strategic goals reflected in the "Strategic Roadmap on production and processing of agricultural products in the Republic of Azerbaijan" approved by the Decree of the President of the Republic of Azerbaijan No. 1138 dated December 6, 2016. (Strategic Roadmap for the production and processing of agricultural products in the Republic of Azerbaijan: 2016).

In Azerbaijan, as a result of wheat breeding, especially selection of local

populations and valuable genotypes with significant economic characteristics, a number of durum and bread wheat varieties radically different from the initial forms have been created.Also,very successful results have been obtained y using synthetic breeding methods in the republic (Aliyev *et al.,* 2015).

Given the above, it is important to study the factors that affect the potential productivity of wheat. The formation of each new organ in plants creates a new change in its individual development and morphophysiology. During the vegetation period, individual organs are formed at different stages of plant development. Along with many factors to the formation of productivity is influenced by the vegetation period of plants, too. The length of the vegetation period is not only one of the main factors forming the productivity of genotypes, but also one of the characteristics that ensure the resistance of plants against drought, disease, pests and other stress factors (Allahverdiyev *et al.*, 2021).

Studies have shown that consideration of the characteristics of the development of wheat during the vegetation period allows to predict the productivity (Aliyev *et al.*, 2015).

Hybridization is one of the main methods currently used to create new varieties. For hybridization, it is important to choose the right parental forms. In this case, along with the technological and quality indicators of the grain of the parental form, other economically important treats must be taken into account. Based on the analysis of the literature and our research, it has been confirmed that the correct selection of initial materials and their purposeful involvement in hybridization is the basis for the creation of new high-yielding and high-quality varieties in the future.

2. Material and methods

In hybridization, landraces (Sharg, Shiran 5, etc.), newly realized (Goytapa, Zangazur, etc.) local, and geografically distant origin Zatino (France), Karol Odesskaya (Ukraine) and 6 durum wheat arieties were used.

At a time of global climate change, despite their high adaptability, these genotypes are tall. During hybridization, these samples were pollinated with short height varieties (Garagilchig-2, Garabagh, etc.) and backcrossed on the obtained first generation hybrids. The research was conducted under irrigation conditions in the Absheron Supporting Experimental Station (ASES) of the Research Institute of Crop Husbandryin the 2019-2020 growing season.

As a result of investigation, the length of the vegetation period of 40 fourth-generation (F_4) hybrid lines of durum wheat was carried out in accordance with international methods (https://www.extension.purdue.eu/extmedia/id/id-42 https://www.agric.wa.gov.au/grains/zadoks-growth-scale; https://www.agric.wa.gov.au/grains/feekes-growths-scale).

Predecessor was chick pea, sowing was carried out manually in the third decade of October, each sample was sown in 2 replications on an area of $1m^2$, mass emergence was observed in the first decade of November. For pre-sowing fertilization of the experimental field, 150 kg of complex fertilizer (nitrophoska), and in the early spring, 250 kg/ha of nitrogen fertilizer at tillering stage (NH_4NO_3) were applied. During the vegetation period, the samples were irrigated in the booting and milk ripening stages and agro-technical measures,intended for the region, were carried out.

Absheron SES of the Research Institute of Crop Husbandry is located in the central part of the Absheron Peninsula, and the gray-brown soils in the area are less fertile and poorly supplied with basic nutrients and atmospheric precipitations (Movsumov, 2006).

The Absheron Peninsula is included in the list of dry subtropical zones with hot summers, sunny autumns and mild winters. North (Khazri) and southern (Gilavar) winds often blow on the peninsula. Climatic conditions are unstable, as wind speed sometimes reaches 35-40 m / sec. and more. Therefore, the climate of Absheron is very hot, hot and sunny in summer, and mild in winter. Rarely, the air temperature drops to 1.3-5.7 ° C. Average annual precipitation amount equals to 220 mm, maximum 250 mm and minimum 200 mm. Relative humidity varies throughout the year, mainly in the range of 60-80% (Vekilova, 2011).

3. Results

The winter and spring temperatures of the research year and the precipitation amount generally corresponds to the average perennial precipitation in the region.

Taking into account the importance of vegetation period in increasing productivity, in our research, phenological observations were made in the samples such as germination, spike, milk, wax and full maturity phases, and the vegetation period of fourth generation (F_4) hybrid lines was studied and it was compared with the Barakatli 95 variety, it was grouped and the results are reflected in the relevant table and picture (Table 1, Figure 1).

Table 1. The length of the vegetation period in the fourth generation (F_4) durum wheat hybrid lines

№	Hybrid linesand local check	Date of spike	Growing date	Vegetation period, days	Difference from local check, days
1.	Barakatli- 95 (local check)	17.04	09.06	203	0
2.	[Parinj x Turan] x Mirvari, k-ST/2016/10	28.04	16.06	210	+7
3.	[Parinj x Turan] x Mirvari, k-ST/2016/11	28.04	15.06	209	+6
4.	[Parinj x Turan] x Mirvari, k-ST/2016/12	29.04	18.06	212	+9
5.	[Parinj x Turan] x Mirvari, k-ST/2016/13	25.04	11.06	205	+2
6.	[Fadda 98 x Garabagh] x Tartar, k-ST/2016/16	24.04	07.06	201	-2
7.	[Fadda 98 x Garabagh] x Tartar, k-ST/2016/17	26.04	12.06	206	+3
8.	[Fadda 98 x Garabagh] x Tartar, k-ST/2016/19	26.04	12.06	206	+3
9.	[Fadda 98 x Garabagh] x Tartar, k-ST/2016/20	27.04	12.06	206	+3
10.	[Fadda 98 x Garabagh] x Tartar, k-ST/2016/21	28.04	12.06	206	+3
11.	[Fadda 98 x Garabagh] x Tartar, k-ST/2016/23	30.04	14.06	208	+5
12.	[Fadda 98 x Garabagh] x Tartar, k-ST/2016/28	30.04	15.06	209	+6
13.	Zatino (France) x Turan, k-ST/2016/45	01.04	02.06	196	-7
14.	Zatino (France) x Turan, k-ST/2016/48	01.04	03.06	197	-6
15.	Zatino (France) x Turan, k-ST/2016/50	26.04	10.06	204	+1
16.	[Garabagh x Tartar-2] x Mirvari, k-ST/2016/65	26.04	07.06	201	-2
17.	[Garabagh x Tartar-2] x Mirvari, k-ST/2016/66	25.04	06.06	200	-3
18.	Mirvari x Turan, k-ST/2016/78	26.04	07.06	201	-2
19.	Mirvari x Turan, k-ST/2016/86	26.04	07.06	201	-2
20.	[Tartar x Kahraba] x Barakatli-95, k- ST/2016/107	26.04	08.06	202	-1
21.	Zangazur x Mirvari, k-ST/2016/119	24.04	07.06	201	-2
22.	Mirbashir-50 x Sharq, , k- ST/2016/123	26.04	07.06	201	-2
23.	Mirbashir-50 x Sharq, k- ST/2016/127	26.04	07.06	201	-2
24.	Mirbashir-50 x Sharq, k- ST/2016/133	26.04	07.06	201	-2
25.	[Turan x Zedoni-3D-56] x Garagılchig 2, k- ST/2016/137	01.04	31.05	194	-9

26.	[Turan x Zedoni-3D-56] x Garagılchig 2, k- ST/2016/144	09.04	01.06	195	-8
27.	[Turan x Zedoni-3D-56] x Garagılchig 2, k- ST/2016/147	10.04	01.06	195	-8
28.	[Turan x Zedoni-3D-56] x Garagılchig 2, k- ST/2016/151	01.04	01.06	195	-8
29.	[Giorgio-12-571 x Parinj] x Garabagh, k- ST/2016/157	30.03	28.05	191	-12
30.	Garabagh x Mirbashir-50, k- ST/2016/160	10.04	04.06	198	-5
31.	v.hordeiforme x (Tartar x Garabagh) x Karol Odeskaya, k- ST/2016/168	26.04	14.06	208	+5
32.	Garagilchig 2 x Barakatli-95, k- ST/2016/169	27.04	05.06	199	-4
33.	(v.apulikum x Altun) x Karol Odeskaya, k- ST/2016/172	26.04	02.06	196	-7
34.	v.hordeiforme x (Tartar x Mirvari),, k- ST/2016/173	01.05	14.06	208	+5
35.	v.hordeiforme x (Tartar x Garabagh) x Karol Odeskaya, k- ST/2016/174	20.04	04.06	198	-5
36.	(v.hordeiforme x (Tartar x Garabagh) x Garabagh) x Zatino, k- ST/2016/175	20.04	05.06	199	-4
37.	(v.hordeiforme x (Tartar x Garabagh) x Garabagh) x Zatino, k- ST/2016/176	24.04	10.06	204	+1
38.	(v.apulikum x Altun) x Goytapa, k- ST/2016/177	26.04	05.06	199	-4
39.	v.hordeiforme x (Tartar x Mirvari), k- ST/2016/18a	26.04	06.06	200	-3
40.	v.hordeiforme x (Tartar x Mirvari), k- ST/2016/19a	26.04	02.06	196	-7
41.	v.hordeiforme x (Tartar x Mirvari), k- ST/2016/23a	27.04	05.06	199	-4

Note: Sowing 25thOctober2019, mass emergence was observed in the 11th of November

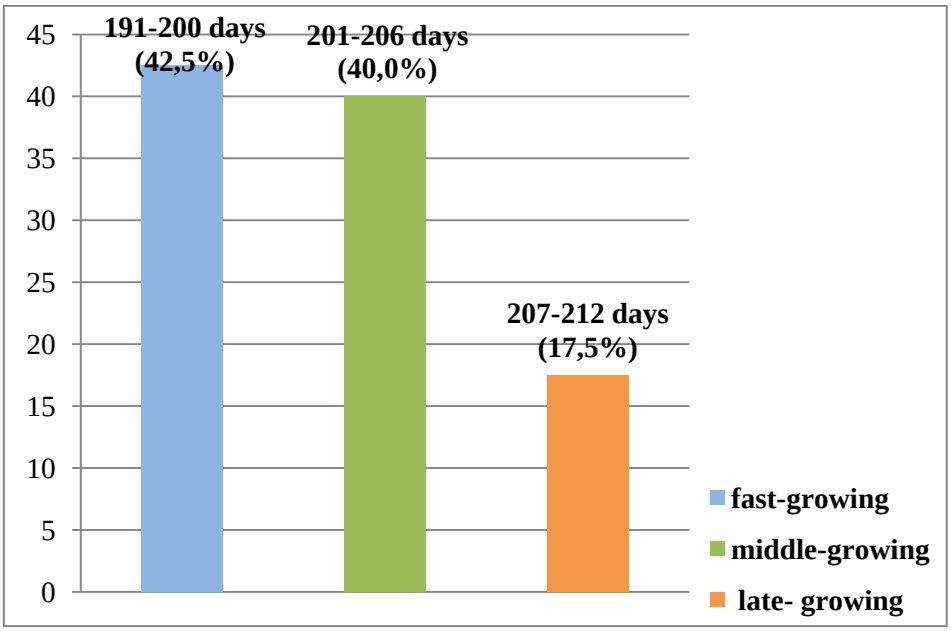

Figure 1. The length of the vegetation period in the fourth generation (F_4) durum wheat hybrid lines, days

The vegetation period of the studied hybrid combinations varied between 191-212 days. From the combinations [Giorgio-12-571 x Parinj] x Garabagh, k- ST/2016/157[Giorgio-12-571 x Parinj] x Garabagh, k- ST/2016/157 -growing in the 28th of May, growing 12 days earlier fom the local check Barakatli 95 (09.06;

vegetation period-203 days) vegetation period 191 days; [Turan x Zedoni-3D-56] x Garagilchig 2, k- ST/2016/137- growing in the 31th of May 09 days, [Turan x Zedoni-3D-56] x Garagılchig 2, k- ST/2016/144; [Turan x Zedoni-3D-56] x Garagılchig 2, k- ST/2016/147; Zatino (France) x Turan, k- ST/2016/45 etc, but the growing of the hybrid lines earlier than the local check 07-08 days and vegetation period has been 195-196 days.

As a result of other combinations Zatino (France) x Turan, k- ST/2016/50 –in the 10th of June; [Fadda 98 x Garabagh] x Tartar, k- ST/2016/17; [Fadda 98 x Garabagh] x Tartar, k- ST/2016/19 – in the 12 th of June; [Parinj x Turan] x Mirvari, k- ST/2016/12 – growing in the 18th of June, vegetation period between the interval 204-212 days has had more late-growing than local check Barakatli 95, 01-09 days.

According to the results of the 40 fourth-generation (F_4) hybrid lines of durum wheat studied, 42.5% had a fast growing season of 191-200 days, 40.0% had medium maturity (201-206 days), and 17.5% had late maturity (208-212 days).

4. Discussion

Increasing wheat yields will require improving farm production systems and introducing new technology, developing improved wheat varieties, identifying optimal crop rotation and diversification strategies, improving plant protection, and continued support from stakeholders throughout the value including technology providers, processors, manufacturers, and governments (Gan *et al.,* 2003; Hawkesford *et al.,* 2013; Vitale *et al.,* 2019).

Exposure of winter wheat to extreme weather conditions during long periods of development makes it more sensitive to climate change (Tack *et al.,* 2015).

In some studies it was reported, that in RICH, the breeding material consisted of promising lines and varieties of winter bread and durum wheat were studied and evaluated in irrigated and dry rainfed conditions by using them in hybridization, the varieties as Taraggi, Bayaz, Murov, Murov-4, Farahim, Khudafarin, Ravan, Gomur -74 and others were created. (Abdullayev & Shikhoev, 2000; Khudayev *et al.,* 2018).

With their fast-growing in the vegetation period, the hybrid lines such as Zatino (France) x Turan, k-ST/2016/45; Zatino (France) x Turan, k-ST/2016/48; [Turan x Zedoni-3D-56] x Garagılchig 2, k- ST/2016/137;[Turan x Zedoni-3D-56] x Garagılchig 2, k- ST/2016/144; [Turan x Zedoni-3D-56] x Garagılchig 2, k- ST/2016/147; [Turan x Zedoni-3D-56] x Garagılchig 2, k- ST/2016/151; [Giorgio-12-571 x Parinj] x Garabagh, k- ST/2016/157etc. were selected.

5. Conclusions

Having a rapid maturation as a result of research Zatino (France) x Turan, k-ST/2016/45; Zatino (France) x Turan, k-ST/2016/48; [Garabagh x Tartar-2] x Mirvari, k-ST/2016/66; [Turan x Zedoni-3D-56] x Garagılchig 2, k- ST/2016/137; [Turan x Zedoni-3D-56] x Garagılchig 2, k- ST/2016/144; [Turan x Zedoni-3D-56] x Garagılchig 2, k-ST/2016/147; [Turan x Zedoni-3D-56] x Garagılchig 2, k- ST/2016/151; [Giorgio-12-571 x Parinj] x Garabagh, k- ST/2016/157; Garabagh x Mirbashir-50, k- ST/2016/160; (v.apulikum x Altun) x Karol Odeskaya, k- ST/2016/172; v.hordeiforme x (Tartar x Mirvari), k- ST/2016/19a etc. the hybrid lines were tested at the Tartar and Jalilabad Regional Experimental Stations with different soil-climatic conditions in order to

continue research in the later stages of selection in order to create new varieties having a rapid maturation.

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