

## Study of wheat genotypes with different architectonics and their use in breeding

Sevda Hajiyeva\*, Faig Khudayev, Abidin Abdullayev, Garib Novruzlu

*Plant Breeding Department, Research Institute of Crop Husbandry, Ministry of Agriculture of the Republic of Azerbaijan, Pirshagi, Sovkhoz 2, AZ 1098, Baku, Azerbaijan*

*\*For correspondence: sevda.hajiyeva64@gmail.com*

Received: May 16, 2023; Reviewed: June 125, 2023; Accepted: June 20, 2023

**The article provides information on the results of long-term wheat breeding performed at the Absheron Auxiliary Experimental Farm. As a result of the conducted research, for irrigated regions, bread wheat varieties Parvin, Metin, Altun 2, Shafag 2, and for rainfed regions, a bread wheat variety, Farahim and durum wheat varieties Ravan and Khudafar were regionalized, patented, and submitted to the State Register of Breeding Achievements allowed for use in agricultural production and protected in the territory of the Republic of Azerbaijan. Durum wheat varieties Gomur 74, Yasemen, Taj 20, Galib, Daralayaz, Polad, and bread wheat varieties Royal, Mubariz, Babek 79 were created, submitted to the Agrarian Services Agency under the Ministry of Agriculture of the Republic of Azerbaijan for regionalization, and are currently being planted and tested in the irrigated and rainfed regions of the republic.**

**Keywords:** *Wheat, breeding, collection, variety, bread wheat, durum wheat, tolerance, productivity*

### INTRODUCTION

Agriculture is an important component of Azerbaijan's economy. The development of this area should not be due to the increase of cultivated areas but by the creation of productive and high-quality varieties and their application to production. The timely agrarian reforms in accordance with the requirements of the era led to the establishment of new farms that had a special effect on the development of this field. National Leader Heydar Aliyev noted that the implementation of agrarian reforms is not a short-term measure, but a historical process. In this process, the previous farming mechanism should be replaced with a new one, and agricultural management should be adapted to the requirements of the principles of transition to market economy. Radical structural changes should be carried out, state property should be privatized, new property relations and diverse economic forms should be applied for the development of entrepreneurship. Legal, economic, organizational, and technical conditions should be created, and the real competition for agricultural producers should be organized by establishing new inter-sectoral, inter-enterprise and inter-state production-economic relations (Aliyev, 2001).

The changes in the crop structure resulting from these requirements are more directed toward increasing food production. According to the prognosis, due to the growth dynamics of the world

population, by 2050, the demand for cereals, mainly wheat will increase by 60% (Ray et al., 2013). In this regard, as a result of global climate change, due to the impact of stress factors (increasing temperature, water scarcity, soil exposure to anthropogenic effects, degradation, and decrease in fertility, etc.), it will be difficult to meet the needs of people who prefer to use bread and flour products in their diet. The most important issues facing the scientists of the world at the moment are the reconstruction of the wheat plant, the creation of new wheat varieties which are highly productive and tolerant to stress factors and have high-quality indicators. New methods of selection, genetics, molecular biology, and biotechnology in addition to classical methods should be used to minimize the impact of these negative factors in the future and to meet the demand for food products.

Since the earing-flowering, grain ripening phases of growth and development of the plant are observed under conditions of increased soil water deficit, wheat which is important for the nutrition of about 35% of the world's population is exposed to water stress (Allahverdiyev, 2016; Liu et al., 2015). Winter wheat with a long vegetation period is more exposed to the effects of extreme climate during the development period (Tack et al., 2015).

Creation and distribution of new adaptive varieties tolerant to drought and other stress factors faced by all mankind, use of resource-saving

technologies in plant cultivation, differential crop rotation, restoration of soil fertility by applying agrochemical and ecological measures, application of ecologically balanced farming systems, implementation of other measures aimed at efficient use of natural resources are relevant and important. High and quality wheat grain can be produced only by applying modern intensive agrotechnologies. Therefore, the creation and distribution of wheat varieties that require organic and mineral fertilizers, optimal irrigation regime, are tolerant to biotic and abiotic environmental factors, are short and medium-sized, and have high grain quality are of great importance (Petrova, 2013; Rustamov, 2017; 2022).

In 2022, 1736.1 thousand tons of wheat were produced from 547.2 thousand hectares of land, and the average yield was 31.9 cwt/ha. According to the food balance sheet prepared by the State Statistics Committee in 2020, the annual demand for wheat in Azerbaijan is approximately 3.5 million tons. The country's level of self-sufficiency in food wheat is 57 percent, and part of the domestic demand is covered by imports (<https://www.dragro.az>news>).

It is important to increase the production of bread and durum wheat to meet the daily demand for bread and bakery products, which are the main food of people in our republic. This plant has strategic importance in ensuring food security in our country. The Decree of the President of the Republic of Azerbaijan dated July 19, 2022 "On a number of measures to increase the level of self-sufficiency with food wheat" further stimulated the implementation of research in the direction of selection in order to ensure food security in the Republic of Azerbaijan (<https://president.az>).

Breeders-scientists have worked in Azerbaijan at different times and this tradition is being continued today. Under the leadership of Academician J. A. Aliyev, multi-year research was carried out on wheat genotypes at the Research Institute of Crop Husbandry, and a rich selection material was created through breeding and hybridization. The researchers created bread wheat varieties Azamatli 95, Gobustan, Gyrmzy gul 1, Murov 2, Askaran, etc., and durum wheat varieties Barakatli 95, Karabakh, Goytepe, Zangezur, etc., from these materials using hybridization and individual selection. These varieties are cultivated in large fields in different regions of the republic and play an important role in ensuring food security.

The Research Institute of Crop Husbandry is the owner of the patents of 45 (41.7%) from 108 bread wheat varieties and 14 (63.6%) from 22 durum wheat varieties included in the State Register of Breeding Achievements allowed for use

in agricultural production and protected in the territory of the Republic of Azerbaijan in 2022.

It is a necessity for breeders to carry out selection work, to create high-yielding and high-quality, stress-tolerant new varieties and to apply them to production on a regular basis. Some of the ways to solve this problem are the use of plant genetic resources more efficiently, the careful study of the ancient and recent wheat populations adapted to local conditions, determination of the productivity and other indicators of genotypes introduced from different parts of the world in local conditions, and the selection of starting material for the creation of new wheat varieties with high grain yield and quality indicators, tolerant to abiotic and biotic stress factors by widely using them in hybridization.

## **MATERIALS AND METHODS**

From 2011 to 2022, 4774 bread wheat, 2518 durum wheat, a total of 7292 local and introduced genotypes of various geographical origins were studied in the collection nursery in the Absheron Auxiliary Experimental Farm of the Research Institute of Crop Husbandry. The predecessors were leguminous plants. Each sample was sown by hand in two replicates on an area of 1m<sup>2</sup>. Out of every 20 samples, local Murov 2 and Barakatli 95 varieties, which have large cultivated areas in the republic, were sown as standard for bread and durum wheat, respectively.

During the vegetation period, agrotechnical maintenance work designed for the region was carried out in the trial area, 200 kg of complex fertilizer with a physical weight of 200 kg per hectare was applied along with sowing, and 250 kg of nitrogen fertilizer (NH<sub>4</sub>NO<sub>3</sub>) was applied in early spring during the tillering phase. During the vegetation period, the samples were watered two to three times depending on the year.

The Absheron Auxiliary Experimental Farm, where field experiments were conducted, is located on the Absheron peninsula, the gray-brown soils spread in the area are less fertile and poorly supplied with basic nutrients (Movsumov, 2006). As Absheron soils absorb excess moisture easily, the soil is aerated normally. Because the soil is very porous, rapid evaporation occurs and cultivation of agricultural crops under these conditions requires more rapid irrigation than for other soils.

The Absheron Peninsula is included in the dry subtropical zone with hot summer, sunny autumn and mild winter. North (khazri) and south (gilavar) winds often blow in the peninsula. Since the wind speed is sometimes 35-40 m/s and more, the

climatic conditions are not stable. Therefore, the climate of Absheron is very hot, stuffy, and sunny in summer, and mild in winter. In the coldest months of the year (January-February), the average monthly temperature is 0.9-6°C, and in the hottest months (July-August) the highest temperature is 38-39°C and during this period, the average monthly temperature is 25.9°C, and the average minimum temperature is 18-20°C. Winter is relatively warm and short. In rare cases, the air temperature drops to 1.3-5.7°C. The number of frosty days during the year is small (from 1 to 30 and none in some years), and the number of sunny days is large. A characteristic feature of the region is the presence of strong northerly winds blowing throughout the year, as well as low and uneven distribution of atmospheric precipitations throughout the year. The low relative humidity of the air, the small amount of atmospheric precipitations, and strong winds blowing on average for 60-90 days, often cause soil and air drought. The average annual amount of rain is 220 mm, the maximum is 253.1 mm, and the minimum is 200.5 mm. On average, the snow cover is between 3-120 mm per year, and the relative humidity of the air varies mainly in the range of 60-80% throughout the year (Vakilova, 2011).

During the research years, the air temperature and the amount of precipitation were generally in accordance with the average perennial of the region.

In the collection nursery, phenological observations were made during the vegetation period. Height indicators of genotypes (Musayev et al., 2008) and technological-quality indicators of grain were determined based on the accepted methods (Methods for assessing the technological qualities of grain, 1971; Directory on Grain Quality, 1977). Evaluation of rust diseases is based on the modified scales of Cobb recommended by CIMMYT and ICARDA (McIntosh et al., 1995). Evaluation of powdery mildew was conducted on the basis of methodical indicators (V. I. Krivchenko et al., 1980) proposed by V.I.Krivchenko et al., based on a 9-point scale developed by N. Simlakovich (1966).

## RESULTS AND DISCUSSION

As a result of the conducted research, local and introduced wheat genotypes selected for their characteristics such as high yield and quality indicators, height, ripeness, resistance to diseases and pests, etc. were used in hybridization to create new varieties with complex high indicators. Ancient bread wheat genotypes adapted to the soil and

climate conditions of Azerbaijan - Mirbashir 128, Ughur, Akinchi 84, and Parzivan 1, etc. currently cultivated varieties - Gobustan, Murov 2, Shafag 2, Fatima, Farahim, and Gilavar, etc. introduced varieties - Gonen (Turkiye), Bezostaya 1 (Russia), Nota (Krasnodar), Olviya (Odessa), Renan (France), Fin bughdası (Finland), 17<sup>th</sup>FAWWON.KN<sub>149-193</sub> (CIMMYT) etc., local ancient varieties of durum wheat - Sharg, Mirvari, Agbugda 13, Mugan, Tartar, etc., currently cultivated Barakatli 95, Karabakh, Goytepe, etc. introduced varieties - Fadda 98 (Turkiye), Karol Odeskaya (Ukraine), Zatino (France), etc. were used in hybridization.

Obtained first (F1) and second (F2) generation hybrid combinations were studied at the Absheron Auxiliary Experimental Farm. Subsequent generations are being tested in the irrigated and rainfed regions of the republic to create new varieties.

As a result of the hybridization carried out in previous years, the following varieties were regionalized and patented: bread wheat varieties Parvin, Metin, Altun 2, and Shafag 2 for irrigated regions, and a bread wheat variety, Farahim and durum wheat varieties Ravan and Khudafarin for rainfed regions. These varieties are included in the State Register of Breeding Achievements allowed for use in agricultural production and protected in the territory of the Republic of Azerbaijan.

Durum wheat varieties Gomur 74, Yasemen, Taj 20, Galib, Daralayaz, Polad, and bread wheat varieties Royal, Mubariz, Babek 79 were developed and submitted to the Agrarian Services Agency under the Ministry of Agriculture of the Republic of Azerbaijan for regionalization, and are currently being planted and tested in irrigated and rainfed regions of the republic (Table 1).

Economic indicators and resistance to diseases of newly created durum and bread wheat varieties are given in Table 2 and Table 3.

The **Gomur 74** variety of durum wheat was obtained by individual selection from intraspecific hybrids of the local Tartar variety and the Zedoni 3-D-56 variety of Algerian origin. The height of the Tartar variety, which is used as the maternal form, is 92.5 cm on average and it is resistant to lodging. It belongs to the *Provenciale* species, its potential yield under irrigation is on average 65.0 cwt/ha. The grain is very large, the mass of 1000 grains is 55.5 grams. The quality of the pasta is satisfactory. It belongs to the second group according to the quality of gluten. Weakly affected by rust and powdery mildew, moderately affected by stem rust. It is resistant to smut diseases. Tolerance to winter is poor. The variety Zedoni 3d-56 used as the paternal form is of Algerian origin and belongs to the *Erythromelan* species..

**Table 1.** Wheat varieties submitted for regionalization to the Agrarian Services Agency under the Ministry of Agriculture of the Republic of Azerbaijan

New varieties	Genealogy	Species	Year of submission	Regions recommended for cultivation
<b>Durum wheat varieties</b>				
Gomur 74	Tartar (Azerbaijan) x Zedoni 3-D-56 (Algeria)	leucomelan	2018	Rainfed and rainfed provided with moisture
Yasemen	Karabakh x Tartar (Azerbaijan)	leucomelan	2020	Rainfed and rainfed provided with moisture
Taj 20	Fadda 98 (Turkiye) x Karabakh (Azerbaijan)	leucomelan	2020	Rainfed and rainfed provided with moisture
Galib	Ijasyr (Turkiye) x Mirvari (Azerbaijan)	leucomelan	2021	Rainfed and rainfed provided with moisture
Daralayaz	Fadda 98 (Turkiye) x Karabakh (Azerbaijan)	hordeiforme	2021	Rainfed and rainfed provided with moisture
Polad	Yagut x Alinje 84 (Azerbaijan)	leucomelan	2022	Rainfed and rainfed provided with moisture
<b>Bread wheat varieties</b>				
Royal	Sanzor 4 (Uzbekistan) x Gobustan (Azerbaijan)	qrecum	2020	Irrigated plain and foothill rainfed
Mubariz	Renan (France) x Gobustan (Azerbaijan)	erythrospermum	2021	Rainfed provided with different degrees of moisture
Babek 79	Gobustan (Azerbaijan) x Lütessens-pr 11/82 (Ukraine)	qrecum	2022	Rainfed and rainfed provided with moisture

**Table 2.** The main economic indicators of wheat varieties submitted for regionalization to the Agrarian Services Agency under the Ministry of Agriculture of the Republic of Azerbaijan, averaged over three years

New varieties	Plant height, cm	Productivity, cwt/ha	1000 gain mass, g	Vitreousness, %	Gluten, %	Protein, %
<b>Durum wheat varieties</b>						
Gomur 74	93.3	45.8	48.5	86.0	28.2	13.4
Yasemen	100	45.0	51.6	80.0	28.6	13.6
Taj 20	97.7	47.0	48.6	87.0	28.6	14.1
Galib	92.0	45.3	42.7	68.0	23.0	13.7
Daralayaz	90.7	56.6	44.7	93.0	26.0	12.0
Polad	92.5	48.6	47.4	77.8	25.2	13.5
<b>Bread wheat varieties</b>						
Royal	108	66.5	39.6	48.0	28.4	12.0
Mubariz	92.0	47.9	38.9	82.0	31.9	13.7
Babek 79	97.5	49.5	37.9	68.0	34.0	13.6

**Table 3.** Disease resistance of wheat varieties submitted for regionalization to the Agrarian Services Agency under the Ministry of Agriculture of the Republic of Azerbaijan

New varieties	By types of rust:			By types of smut		Powdery mildew, points
	yellow	brown	stem	dust	hard	
		Durum wheat varieties				
Gomur 74	R	0	0	0	0	2
Yasemen	5 R	R	0	0	0	1
Taj 20	R	0	0	0	0	2
Galib	R	5 R	0	0	0	2
Daralayaz	R	0	0	0	0	2
Polad	5 R	R	0	0	0	1
		Bread wheat varieties				
Royal	5 R	R	0	0	0	2
Mubariz	R	0	0	0	0	1
Babek 79	R	5 R	0	0	0	2

**Note:** 0-immune, R-resistant, MR-moderately resistant, MS-moderately susceptible, S-susceptible

The height of the plant is 137.5 cm, the potential productivity under irrigation is 45.8 cwt/ha on average, the mass of 1000 grains is 45.0 g, the vitreousness is 90.0%, the gluten content per grain is 27.5%, the amount of protein is 13.7%, it is

moderately tolerant to diseases

The newly created **Gomur 74** variety of durum wheat was submitted for regionalization to the Agrarian Services Agency under the Ministry of Agriculture of the Republic of Azerbaijan in 2018.

The average height of the variety is 93.3 cm and it is resistant to lodging. It belongs to the *Leucomelan* species, the productivity under rainfed conditions is 45.8 cwt/ha, the mass of 1000 grains is 48.5 g, the vitreousness is 86.0%, the gluten content per grain is 28.2%, and the amount of protein is 13.4%. Tolerant to winter, drought, high temperatures, and resistant to diseases. Cultivation is recommended in the rainfed regions of the Republic and rainfed regions which are provided with moisture.

The **Yasemen** variety of durum wheat was created by individual selection from intraspecific hybrids of the local Karabakh variety and the Tartar variety. The Karabakh variety, which is used as the maternal form, has an average height of 100 cm and is resistant to lodging. It belongs to the *Provenciale* species, its potential yield under irrigation is on average 75.0 cwt/ha. The grain is very large, the mass of 1000 grains is 57.2 grams. The general pasta quality is very high, the gluten content per grain is 27.8%, and the amount of protein is 15.0%. It is resistant to rust diseases, powdery mildew, hard and dust smut. The Tartar variety, which was used as the maternal form in the Gomur 74 variety, was used as the paternal form in this variety.

In 2020, the newly created **Yasemen** variety of durum wheat was submitted to the Agrarian Services Agency under the Ministry of Agriculture of the Republic of Azerbaijan for regionalization. The height of the variety is 100 cm on average and it is resistant to lodging. It belongs to the *Leucomelan* species. The average yield is 45.0 cwt/ha, the mass of 1000 grains is 51.6 g, the vitreousness is 80.0%, the gluten content per grain is 28.6%, and the amount of protein is 13.6% under rainfed conditions. It is highly tolerant to winter, drought, temperature, and resistant to hard and dust smut, and rust diseases. Cultivation is recommended in the rainfed regions of the Republic and rainfed regions that are provided with moisture.

The **Taj 20** variety of durum wheat was created by individual selection from intraspecific hybrids of the Fadda 98 variety from Turkiye and the local Karabakh variety. The variety Fadda 98, which is used as the maternal form, has an average height of 100 cm and is resistant to lodging. It belongs to the *Leucomelan* species. Its potential productivity is 55.0 cwt/ha on average under irrigated conditions. The grain is medium-sized, the mass of 1000 grains is 46.8 grams. The content of gluten in the grain is 24.5%, and the amount of protein is 13.0%. It is resistant to rust diseases, powdery mildew, hard and dust smut. The Karabakh variety, which is used as the maternal form in the Yasemen variety, was also used as the paternal form in this variety.

In 2020, the newly created **Taj 20** variety of

durum wheat was submitted to the Agrarian Services Agency under the Ministry of Agriculture of the Republic of Azerbaijan for regionalization. The height of the variety is 97.7 cm and it is resistant to lodging. It belongs to the *Leucomelan* species, the average yield is 47.0 cwt/ha, the weight of 1000 grains is 48.6 g, the vitreousness is 87.0%, the gluten content per grain is 28.6%, and the amount of protein is 14.1% under rainfed conditions. It is tolerant to winter, drought, high temperatures, highly resistant to hard and dust smut, and to rust diseases. Cultivation is recommended in the rainfed regions of the Republic and rainfed regions that are provided with moisture.

The **Galib** variety of durum wheat was created by individual selection from intraspecific hybrids of the Icasyr variety of Turkish origin and the local ancient Mirvari variety. The height of the Icasyr variety used as the maternal form is 105 cm on average, it belongs to the *Leucomelan* species, the potential yield under irrigation is 52.5 cwt/ha on average. The grain is medium-sized, the mass of 1000 grains is 45.7 grams. The gluten content per grain is 23.8%, and the amount of protein is 12.7%. It is moderately resistant to rust diseases, powdery mildew, hard smut and dust smut. The Mirvari variety used as the paternal form is of local origin and belongs to the *Leucomelan* variety. Under irrigated conditions, the plant height is 105 cm on average, the potential yield is 40.8 cwt/ha, the mass of 1000 grains is 50.0 g, the vitreousness is 90.0%, the gluten content per grain is 26.5%, the amount of protein is 14.3%, and it is moderately resistant to diseases.

The newly created **Galib** variety of durum wheat was submitted to the Agrarian Services Agency under the Ministry of Agriculture of the Republic of Azerbaijan for regionalization in 2021. The height of the variety is 92.0 cm and it is resistant to lodging. It belongs to the *Leucomelan* species, the average yield is 45.3 cwt/ha, the mass of 1000 grains is 42.7 g, the vitreousness is 68.0%, the gluten content in the grain is 23.0%, and the amount of protein is 13.7% under rainfed conditions. Tolerant to winter, drought, and high temperatures and highly resistant to hard and dust smut and rust diseases. Cultivation is recommended in the rainfed regions of the Republic and rainfed regions that are provided with moisture.

The **Daralayaz** wheat variety was created by individual selection from intraspecific hybrids of the local Karabakh variety and the Fadda 98 variety of Turkish origin. Varieties taken as maternal and paternal forms were also involved in the development of the Taj 20 variety, and information about parental forms was given.

The newly created **Daralayaz** variety of durum wheat was submitted to the Agrarian

Services Agency under the Ministry of Agriculture of the Republic of Azerbaijan for regionalization in 2021. The height of the variety is 90.7 cm on average and it is resistant to lodging. It belongs to the *Hordeiforme* species, the average yield per hectare is 56.6 cwt/ha, the mass of 1000 grains is 44.7 g, the vitreousness is 93.0%, the gluten content per grain is 26.0%, and the amount of protein is 12.0%. It is tolerant to winter, drought, high temperatures, and highly resistant to hard and dust smut and rust diseases. Cultivation is recommended in the rainfed regions of the Republic and rainfed regions that are provided with moisture.

The **Polad** variety of durum wheat was created by individual selection from intraspecific hybrids of the local Yakut variety and the Alinja 84 variety. The Yakut durum wheat variety used as the maternal form is of local origin and belongs to the *Hordeiforme* species. The plant height is 105 cm, the potential yield is 40.8 cwt/ha on average, the mass of 1000 grains is 49.5 g, the vitreousness is 80.5%, the gluten content in the grain is 26.5%, the amount of protein is 14.3% under irrigated conditions. It is tolerant to drought and resistant to diseases and lodging. The height of Alinja 84 variety, which is used as the paternal form, is 92.5 cm on average and is resistant to lodging. It belongs to the *Leucomelan* species. The potential productivity under irrigation is on average 80.0 cwt/ha. The grain is large, the mass of 1000 grains is 57.5 grams. The gluten content per grain is 25.0%, and the amount of protein is 13.9%. It is tolerant to drought, poorly tolerant to frost, resistant to rust and powdery mildew, and weakly susceptible to hard smut.

The newly created **Polad** variety of durum wheat was submitted to the Agrarian Services Agency under the Ministry of Agriculture of the Republic of Azerbaijan for regionalization in 2022. The average height of the variety is 92.5 cm and it is resistant to lodging. It belongs to the *Leucomelan* species, the average yield is 48.6 cwt/ha, the mass of 1000 grains is 47.4 g, the vitreousness is 77.8%, the gluten content per grain is 25.2%, and the amount of protein is 13.5%. It is tolerant to winter, drought, high temperatures, and highly resistant to hard and dust smut, and rust diseases. Cultivation is recommended in the rainfed regions of the Republic and rainfed regions that are provided with moisture.

The **Royal** variety of bread wheat was created by individual selection from intraspecific hybrids of the Sanzor 4 variety of Uzbekistan origin and the local Gobustan variety. The Sanzor 4 bread wheat variety used as the maternal form belongs to the *Erythrospermum* species, the plant height is 110 cm on average, the potential yield under irrigation is 66.0 cwt/ha on average, the mass of 1000 grains is 41.4 g,

the vitreousness is 60.5%, the gluten content per grain is 33.8%, the amount of protein is 13.8% under irrigated conditions. It is tolerant to drought, resistant to diseases and lodging. The Gobustan variety, which is used as the paternal form, has an average height of 98.0 cm and is resistant to lodging. It belongs to the *Qrecum* species, its potential productivity under irrigation is on average 73.5 cwt/ha. The mass of 1000 grains is 42.0 g, the gluten content per grain is 30.5%, and the amount of protein is 15.1%. It has a high technological and baking ability. Tolerant to drought and resistant to diseases.

The newly created **Royal** variety of bread wheat was submitted to the Agrarian Services Agency under the Ministry of Agriculture of the Republic of Azerbaijan for regionalization in 2020. The average height of the variety is 108 cm and it is resistant to lodging. It belongs to the *Qrecum* species, its productivity is 66.5 cwt/ha on average, the mass of 1000 grains is 39.6 g, the vitreousness is 48.0%, the gluten content per grain is 28.4%, and the amount of protein is 12.0% under irrigated conditions. It has high technological and baking quality. It is tolerant to winter, drought, high temperatures, and resistant to hard and dust smut and rust diseases. Cultivation is recommended in irrigated plains and rainfed foothills.

The **Mubariz** variety of bread wheat was created by individual selection from intraspecific hybrids of the Renan variety of French origin and the local Gobustan variety. The Renan bread wheat variety used as the maternal form belongs to the *Erythrospermum* species, the plant height is 80.0 cm on average, the potential yield is 85.0 cwt/ha, the mass of 1000 grains is 44.3 g, the vitreousness is 50.5%, the gluten content per grain is 30.8%, the amount of protein is 11.4% under irrigation. It is tolerant to drought, resistant to diseases and lodging. The Gobustan variety, which was used as the paternal form in the Royal variety, was also used as the paternal form in this variety.

The newly created **Mubariz** variety of bread wheat was submitted to the Agrarian Services Agency under the Ministry of Agriculture of the Republic of Azerbaijan for regionalization in 2021. The height of the variety is 92.0 cm and it is resistant to lodging. It belongs to the *Erythrospermum* species, its average yield is 47.9 cwt/ha, the weight of 1000 seeds is 38.9 g, the vitreousness is 82.0%, the gluten content per grain is 31.9%, and protein content is 13.7% under rainfed conditions. It has high technological and baking quality. It is tolerant to winter, drought, high temperatures, resistant to hard and dust smut, and rust diseases. Cultivation is recommended in rainfed areas provided with varying degrees of humidity.

The **Babek 79** variety of bread wheat was created by individual selection from intraspecific hybrids of the local Gobustan variety and the Lütessens-pr 11/82 sample of Ukrainian origin. The Gobustan bread wheat variety used as the maternal form was used as the paternal form for the Royal and Mubariz varieties. The Lütessens-pr 11/82 specimen, used as the parental form, is 100 cm tall on average and resistant to lodging. It belongs to the *Lütessens* species, its potential productivity under irrigation is on average 80.5 cwt/ha. The mass of 1000 grains is 40.2 g, the gluten content per grain is 34.2%, the amount of protein is 13.6%, it has a high technological and baking quality. It is resistant to drought and diseases.

The newly created **Babek 79** variety of bread wheat was submitted to the Agrarian Services Agency under the Ministry of Agriculture of the Republic of Azerbaijan for regionalization in 2022. The height of the variety is 97.5 cm on average and it is resistant to lodging. It belongs to *Qrecum* species, its productivity is 49.5 cwt/ha on average under rainfed conditions, the mass of 1000 grains is 37.9 g, the vitreousness is 68.0%, the gluten content per grain is 34.0%, and the amount of protein is 13.6%. It has high technological and baking quality. It is tolerant to winter, drought, high temperatures, and resistant to hard and dust smut, rust diseases. Cultivation is recommended in rainfed regions and rainfed regions provided with moisture.

## CONCLUSIONS

As a result of the conducted research, for irrigated regions, bread wheat varieties Parvin, Metin, Altun 2, Shafag 2, for rainfed regions, a bread wheat variety, Farahim and durum wheat varieties Ravan and Khudafarin were regionalized, patented, and entered into the State Register of Breeding Achievements allowed for use in agricultural production and protected in the territory of the Republic of Azerbaijan.

Durum wheat varieties Gomur 74, Yasemen, Taj 20, Ghalib, Daralayaz, Polad, bread wheat varieties Royal, Mubariz, Babek 79 were created and submitted to the Agrarian Services Agency under the Ministry of Agriculture of the Republic of Azerbaijan for regionalization, and are currently being planted and tested in the irrigated and rainfed regions of the republic.

## REFERENCES

- Aliyev I.** (2001) Heydar Aliyev and Azerbaijan's agriculture. Baku: Ziya-Nurlan NPM, 148 p. (in Azerbaijani).
- Allahverdiyev T.I.** (2016) Impact of soil water deficit on some physiological parameters of durum and bread wheat genotypes. *Agriculture & Forestry*, **62**(1): 131-144.
- Krivchenko V.I., Sukhanberdina E.H., Vershinina V.A.** (1980) Study of the resistance of cereal crops to powdery mildew. Methodical instructions. Leningrad, 79 p. (in Russian).
- Liu H., Searle I.R., Mather D.E., Able J.A.** (2015) Morphological, Physiological and yield responses of durum wheat to pre-anthesis water-deficit stress are genotype-dependent. *Crop and Pasture Science*, **66**(10): 1024-1038.
- Musayev A.J., Huseynov H.S., Mammadov Z.A.** (2008) Methodology of field experiments on research in the field of selection of cereal crops. Baku, 87 p. (in Azerbaijani).
- Methods of evaluating technological qualities of grain** (1971). Scientific council on the quality of grain, Moscow, p. 136 (in Russian).
- Movsumov Z.R.** (2006) Scientific bases of the efficiency of elements of nutrition of plants and their balances in the system of crop rotation. Baku: Elm, 244 p. (in Russian).
- McIntosh R.A., Wellings C.R., Park R.P.** (1995) Wheat Rusts. An atlas of resistance genes. The Netherlands: CSIRO and Kluwer Publishers, pp. 149-177.
- Petrova I.F.** (2013) The concept of development of grain production on an intensive basis. *Bulletin of the Altai State Agrarian University*, **3** (101): 120-123. (in Russian).
- Rustamov Kh.N.** (2017) New in the gene pool of wheat (*Triticum* L.) of Azerbaijan. *Proceedings of the All-Russian scientific and practical conference with international participation "Development of the scientific heritage of N.I. Vavilov on genetic resources by his followers", dedicated to the 80th anniversary of U.K.Kurkiyev*. Derbent, Makhachkala: Aleph, pp.109-113 (in Russian).
- Rustamov Kh., Akparov Z., Abbasov M., Abdullayev A.** (2022) Creation of new varieties (*T.durum* Desf.) for the Karabakh region, Azerbaijan National Academy of Science. *The international conference on "Biodiversity, land and water resources of Shusha and its surrounding areas: a vision for the future", materials of the international conference (dedicated to the year of Shusha)*. Azerbaijan-Baku-Shusha, p. 28. (in Azerbaijani).
- Ray D.K., Mueller N.D., West P.C., Foley J.A.** (2013) Yield trends are insufficient to double global crop production by 2050. *PLOS ONE*, **8**(6): e66428.
- Manual of grain quality** (1977) G.P.Zhemeli. Kyiv: p. 53 (in Russian).
- Tack J., Barkley A., Nalley, L.L.** (2015) Effect of

warming temperatures on US wheat yields. *Proc. Natl. Acad. Sci. USA*, **112**: 6931-6936.

**Vekilova E.M.** (2011) Accumulation of organic carbon in the soil of Absheron depending on the

use of organic fertilizers and sowing alfalfa. *Soil Science and Agrochemistry*, 20(1): 488-491 (in Russian).

### **Müxtəlif arxitektonikalı buğda genotiplərinin tədqiqi və seleksiyada istifadəsi**

**Sevda Hacıyeva, Faiq Xudayev, Abidin Abdullayev, Qərib Novruzlu**

*Azərbaycan Respublikası Kənd Təsərrüfatı Nazirliyi Əkinçilik Elmi-Tədqiqat İnstitutunun  
Bitki seleksiyası şöbəsi, Bakı, Azərbaycan*

Aparılmış tədqiqatlar nəticəsində suvarma bölgələri üçün yumşaq buğdanın Pərvin, Mətin, Altun 2, Şəfəq 2, dəmyə bölgələri üçün yumşaq buğdanın Fərəhim, bərk buğdanın Rəvan, Xudafərin sortları rayonlaşaraq, patentləşdirilmiş və Azərbaycan Respublikası ərazisində kənd təsərrüfatı məhsulları istehsalı üçün istifadəsinə icazə verilmiş və mühafizə olunan seleksiya nailiyyətlərinin Dövlət Reyestrinə daxil edilmişdir. Bərk buğdanın Gomur 74, Yasəmən, Tac 20, Qalib, Dərələyəz, Polad, yumşaq buğdanın Royal, Mübariz, Babək 79 sortları yaradılmış, rayonlaşdırılmaq üçün Azərbaycan Respublikası Kənd Təsərrüfatı Nazirliyi yanında Aqrar Xidmətlər Agentliyinə təqdim olunmuşdur və hal-hazırda respublikanın suvarma və dəmyə bölgələrində əkilərək sınağı həyata keçirilir.

**Açar sözlər:** *Buğda, seleksiya, kolleksiya, sort, yumşaq buğda, bərk buğda, məhsuldarlıq*