

AGRICULTURAL CHARACTERISTICS OF F₁ AND F₂ HYBRIDS OBTAINED BY INTERSPECIFIC HYBRIDIZATION

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Abstract. The research was carried out at the experimental plots and laboratories of the Azerbaijan State Agrarian University, during 2013-2017. The main purpose of the work is to study the agrobiological characteristics and features of interspecific wheat hybrids and use them in the breeding process. The traits and indicators of the economic significance of the studied materials are also studied, productivity elements, their use in breeding work is investigated.

Keywords: hybrid, combination, spike, productive bush, phenotype, genotype.

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1. Introduction

Organic farming requires breeding of new varieties in a holistic way. Thus, not only the variety itself but also the process of varietal development must comply with the guiding principles of organic agriculture. Important criteria are taken into account such as preserving the integrity of the plant, increasing genetic diversity, respect for crossing barriers, and interactions of the plant with the living soil and climate. Organic agriculture stands for a high genetic diversity at the farm level. It is necessary to grow a wide range of crops in order to deal with the heterogeneous environment found in organic farming systems in terms of field conditions, stocking densities, crop rotations and marketing options. For this, numerous regionally-adapted cultivars should be made available (Monika *et al.*, 2015; Enfissi *et al.*, 2021; Nuijten *et al.*, 2016).

Plant breeders specialize in breeding different groups of plants. Some focus on field crops (e.g., soybean, cotton), horticultural food crops (e.g., vegetables), ornamentals (e.g., roses, pine trees), fruit trees (e.g., citrus, apple), forage crops (e.g., alfalfa, grasses), or turf species. (e.g., Bluegrass, fescue) More importantly, breeders tend to specialize in or focus on specific species in these groups (e.g., corn breeder, potato breeder). This way, they develop the expertise that enables them to be most effective in improving the species of their choice. The principles and concepts discussed in this book are generally applicable to breeding all plant species (George, 2012; Jorasch, 2020).

Bread provides humans with 50% of proteins and carbohydrates, 70- 80% of the daily requirement of vitamin B1 (thiamine), a significant portion of vitamins PP and E1, minerals, and other substances. According to official statistics, the annual increase in the number of people around the world is 78 million. To meet this increase, wheat production should reach 840 million tons by future years. Undoubtedly, this is possible by the intensification and diversification of the agricultural system, the development of new high-yielding wheat varieties that are tolerant to biotic and abiotic stress factors, and their rapid introduction (Ismayilov, 2014; Khodjayeva *et al.*, 2022).

For this reason, scientists and specialists working in the agricultural sector have an important task to further increase the productivity of cereals and legumes in the future, to improve the quality of products. In perspective, achieving competitive, export-oriented agricultural and food production by fully providing the population of our country with key strategic products at the expense of local production is always in the focus of the leaders.

2. Materials and methods

Girmizi bughda, Parzvan-1, Sheki-1, Azamatli-95 and Murov soft wheat varieties and Karabakh, Shiraslan-23, Alinja-84, Garagilchig and Barakatli-95 hard wheat varieties will be used as research material. In the breeding process, hybridization is carried out both by the restricted free pollination method developed by Lukyanenko and by the Tvel method (Dagustu, 2002). It should be noted that to carry out the hybridization process in our research, first of all, castration was performed. For this purpose, 1/3 of the flower petals were cut lengthwise, castrated and the spike was put on the parchment paper and isolated. The restricted free pollination method was applied 3-7 days after castration. Castrated spikes and obtained hybrid grains were counted. Based on the results of the two indicators, the success rate was determined for each combination. Interspecific hybridization was carried out by setpross method. The obtained the first generation (F₁) hybrid grains were hand sown in the 1m² field with row spacing 15 cm, sample spacing 30 cm, grain spacing 2-3 cm, and 40-50 grains in each row for performing the comparative study with the parental forms.

Phenological phases were determined. Thus, after sowing, phenological observations were carried out in the phases of emergence, tillering, spiking, and full maturation.

During the experiments, all agro-technical measures for wheat cultivation, field research, and observations on plants, tolerance to lodging, grain shedding, frost, drought, the study of structural elements of the product were carried out following the existing methodological guidelines in this area (Ahmadov *et al.*, 2015).

Assessment of grain quality was performed using guidelines. The main quality indicators, including the protein content in the grain, were determined following the standard methodology.

3. Results and discussion

Based on the results of the structural analysis, the average height of the interspecific hybrids (F₁ and F₂) was different. The highest among the F₁ hybrids was Girmizi bughda-1 x Alinja-84 (128 cm) and the lowest combination was Barakatli-95 x Murov-2 (61 cm). Among F₂ hybrids, the highest was Sheki-1x Garabagh (108 cm) and the lowest –Alinja-84 x Sheki-1 (61 cm) (Table 1).

Descriptions of parent forms and hybrids are given, as well as spike and seam analysis and mathematical calculations were carried out according to the methodology.

Interspecific hybrids (F₁ and F₂) differed in tillering productivity. The highest tillering productivity (4.5) among F₁ hybrids is observed in Sheki-1 x Alinja-84, the lowest tillering productivity (1.5) was found in Murov-2 x Barakatli-95. In F₂ hybrids, the highest tillering productivity (7.3) was detected in Garabagh x Murov-2 and the lowest (4.4) in Parzvan 1x Garagilchig-2 (Table 2).

Table 1. Average height of the interspecific hybrids (cm)

Hybrid combinations	Number of hybrids	Average prices of the F ₁ and F ₂ hybrids	
		F ₁	F ₂
Girmizi bughda 1 x Garabagh	1x6	102	94
Girmizi bughda 1 x Shiraslan23	1x7	110	96
Girmizi bughda 1 x Alinja 84	1x8	128	107
Girmizi bughda 1 x Garaqlıçıq 2	1x9	110	95
Girmizi bughda 1 x Barakatli 95	1x10	117	103
Parzvan 1x Garabagh	2x6	98	95
Parzvan 1x Shiraslan23	2x7	97	88
Parzvan 1 x Alinja 84	2x8	97	106
Parzvan 1x Garaqlıçıq 2	2x9	110	96
Parzvan 1x Barakatli 95	2x10	92	105
Sheki 1x Garabagh	3x6	100	108
Sheki 1x Shiraslan23	3x7	105	94
Sheki 1 x Alinja 84	3x8	106	102
Sheki 1x Qaraqılçıq 2	3x9	109	99
Sheki 1x Barakatli 95	3x10	115	105
Azamatli 95x Garabagh	4x6	108	94
Azamatli 95x Shiraslan23	4x7	109	90
Azamatli 95 x Alinja 84	4x8	106	103
Azamatli 95x Garaqlıçıq 2	4x9	95	93
Azamatli 95x Barakatli 95	4x10	111	100
Murov 2x Garabagh	5x6	90	80
Murov 2x Shiraslan23	5x7	89	78
Murov 2x Alinja 84	5x8	77	89
Murov 2x Qaraqılçıq 2	5x9	78	92
Murov 2x Barakatli 95	5x10	96	88
Garabagh x Girmizi bughda	6x1	106	80
Garabagh x Parzvan 1	6x2	108	93
Garabagh x Sheki 1	6x3	101	92
Garabagh x Azamatli 95	6x4	105	91
Garabagh x Murov 2	6x5	94	89
Shiraslan23 x Girmizi bughda	7x1	108	99
Shiraslan23 x Parzvan 1	7x2	110	98
Shiraslan23 x Sheki 1	7x3	108	93
Shiraslan23 x Azamatli 95	7x4	113	93
Shiraslan23 x Murov 2	7x5	100	96
Alinja 84 x Girmizi bughda	8x1	122	101
Alinja 84x Parzvan 1	8x2	112	97
Alinja 84x Sheki 1	8x3	134	61
Alinja 84x Azamatli 95	8x4	94	99
Alinja 84x Murov 2	8x5	107	87
Garaqılçıq 2 x Girmizi bughda	9x1	113	92
Garaqılçıq 2 x Parzvan 1	9x2	103	92
Garaqılçıq 2 x Sheki 1	9x3	101	98
Garaqılçıq 2 x Azamatli 95	9x4	101	99
Garaqılçıq 2 x Murov 2	9x5	92	80
Barakatli 95 x Girmizi bughda	10x1	114	104
Barakatli 95 x Parzvan 1	10x2	109	97
Barakatli 95 x Sheki 1	10x3	101	105
Barakatli 95 x Azamatli 95	10x4	103	96
Barakatli 95 x Murov 2	10x5	61	69

Table 2. Tilling productivity of the interspecific hybrids (in numbers)

Hybrid combinations	Number of hybrids	Average prices of the F ₁ and F ₂ hybrids	
		F ₁	F ₂
Girmizi bughda 1 x Garabagh	1x6	2,6	5,0
Girmizi bughda 1 x Shiraslan23	1x7	2,4	5,3
Girmizi bughda 1 x Alinja 84	1x8	3,1	5,5
Girmizi bughda 1 x Qaraqılçiq 2	1x9	3,0	5,2
Girmizi bughda 1 x Barakatli 95	1x10	3,1	6,7
Parzvan 1x Garabagh	2x6	3,0	5,3
Parzvan 1x Shiraslan23	2x7	2,8	5,1
Parzvan 1 x Alinja 84	2x8	3,1	6,0
Parzvan 1x Qaraqılçiq 2	2x9	3,0	4,4
Parzvan 1x Barakatli 95	2x10	3,6	5,6
Sheki 1x Garabagh	3x6	3,0	5,5
Sheki 1x Shiraslan23	3x7	3,2	5,4
Sheki 1 x Alinja 84	3x8	4,5	5,5
Sheki 1x Qaraqılçiq 2	3x9	3,6	5,4
Sheki 1x Barakatli 95	3x10	3,1	5,4
Azamatli 95x Garabagh	4x6	3,3	5,1
Azamatli 95x Shiraslan23	4x7	3,4	5,1
Azamatli 95 x Alinja 84	4x8	3,1	5,4
Azamatli 95x Qaraqılçiq 2	4x9	2,9	5,6
Azamatli 95x Barakatli 95	4x10	3,0	5,6
Murov 2x Garabagh	5x6	2,7	6,5
Murov 2x Shiraslan23	5x7	1,8	5,9
Murov 2x Alinja 84	5x8	2,1	6,9
Murov 2x Qaraqılçiq 2	5x9	2,7	6,8
Murov 2x Barakatli 95	5x10	1,5	5,2
Garabagh x Girmizi bughda	6x1	2,1	5,7
Garabagh x Parzvan 1	6x2	2,9	6,7
Garabagh x Sheki 1	6x3	3,1	5,6
Garabagh x Azamatli 95	6x4	3,3	5,2
Garabagh x Murov 2	6x5	2,7	7,3
Shiraslan23 x Girmizi bughda	7x1	2,4	5,7
Shiraslan23 x Parzvan 1	7x2	2,6	6,0
Shiraslan23 x Sheki 1	7x3	2,5	5,6
Shiraslan23 x Azamatli 95	7x4	3,3	5,5
Shiraslan23 x Murov 2	7x5	2,0	6,6
Alinja 84 x Girmizi bughda	8x1	2,6	5,2
Alinja 84x Parzvan 1	8x2	2,2	5,1
Alinja 84x Sheki 1	8x3	3,6	5,2
Alinja 84x Azamatli 95	8x4	1,8	5,8
Alinja 84x Murov 2	8x5	3,9	6,8
Garaqılçiq 2 x Girmizi bughda	9x1	3,1	4,8
Garaqılçiq 2 x Parzvan 1	9x2	2,6	5,4
Garaqılçiq 2 x Sheki 1	9x3	3,0	4,7
Garaqılçiq 2 x Azamatli 95	9x4	2,6	5,6
Garaqılçiq 2 x Murov 2	9x5	2,7	5,7
Barakatli 95 x Girmizi bughda	10x1	3,1	5,5
Barakatli 95 x Parzvan 1	10x2	2,8	6,4
Barakatli 95 x Sheki 1	10x3	2,6	5,7
Barakatli 95 x Azamatli 95	10x4	2,8	5,9
Barakatli 95 x Murov 2	10x5	2,3	6,4

4. Conclusion

Certain similarities are found in the genotypic variability of model populations and hybrids. This allows predicting the degree of genotypic variability in future hybrid populations to be created by hybridization of parental pairs in model populations.

As a result of the research, a selection material consisting of families having many positive traits is created by interspecific hybridization and new forms of durum and bread wheat have been developed. Most of them are very important for breeding.

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