

**AGROBIOLOGICAL AND TECHNOLOGICAL ADVANTAGES OF HYBRID WHEAT LINES DEVELOPED BASED ON INNOVATIVE BREEDING TECHNOLOGIES***Southern Agricultural Research Institute**Azizov Bekzod Gayrat ugli**ORCID iD: 0009-0009-5894-0963**PhD in Agricultural Sciences**Head of the “Cereal Crops Breeding” Laboratory*

**Abstract** The study evaluated the yield and economically valuable traits of 16 spring hybrid wheat lines under different environmental conditions. The research was conducted in the Qarshi district using the Bunyodkor variety as a standard check. The results demonstrated significant genetic differences among the hybrids ( $P < 0.0001$ ). Some lines exceeded the standard variety by 15–17 centners/ha under Qarshi conditions. In addition, improved heat tolerance and better morpho-biological characteristics were observed. The obtained results indicate that these hybrids can be recommended as promising breeding material for developing high-yielding and locally adapted new wheat varieties.

**Keywords** Hybrid wheat, spring wheat, innovative breeding, yield, genetic differentiation, heat tolerance, agrobiological indicators, technological quality, breeding material, adaptability.

**Introduction.** Currently, climate change, limited water resources, and population growth are increasing the demand for grain products. Under such conditions, developing high-yielding, stress-resistant, and locally adapted spring wheat varieties is one of the urgent tasks.

Innovative breeding technologies — including hybridization, genetic analysis, and targeted selection methods — allow the combination of economically valuable traits within a single genotype. In particular, ensuring stable yield formation under various ecological conditions, optimizing the growing period, and improving heat tolerance are priority directions in breeding research.

In this regard, the present study aimed to evaluate the agrobiological and technological advantages of hybrid wheat lines developed based on innovative breeding technologies and to identify promising genotypes.

Chosh A. and Puste A.M. [3] reported that high yield can be achieved not only through repeated irrigation or fertilization, but also by selecting varieties adapted to specific natural climatic conditions. The productive tillering capacity of cereal crops, the number of grains per spike, and the weight of 1000 grains can also be influenced by the agro-background and micro-relief conditions of the field.

**Materials and Methods.** The research was conducted in 2025 at the central experimental field of the Southern Agricultural Research Institute located in Qarshi district. Seeds of 16 spring soft wheat hybrid lines introduced from agricultural universities of Pakistan and Australia under innovative breeding technologies were sown for the first time under local climatic conditions for scientific evaluation. The experiment was established on plots of 5 m<sup>2</sup> in three replications on March 17, 2025.

Phenological observations were carried out under both field and laboratory conditions using



the methodological guidelines of the State Variety Testing Commission of Agricultural Crops (1989) and the Russian Institute of Plant Industry (1991). Statistical analyses were performed using ANOVA.

During phenological observations, the main growth stages (germination, emergence, tillering, stem elongation, heading, milk ripeness, wax ripeness, and full maturity), as well as resistance to lodging and diseases, were evaluated under field conditions according to the International Classifier (SEF Triticum species, 1983) developed by the Russian Institute of Plant Industry.

Plant density in the experimental plots was determined at three marked points along the diagonal. Counts were conducted in the 1st and 3rd replications after full emergence. At maturity, before harvesting, plants were manually uprooted from marked areas for biometric analysis of yield structure. Physiological traits were evaluated according to the methodologies of Kojushko N.N. (1987) for complex physiological assessment of drought and heat resistance of winter wheat under Uzbekistan conditions and Udoenko R.V. (1988) for diagnosing plant resistance to stress factors.

**Results** Under the conditions of Qarshi district, hybrid wheat lines were sown on March 15, and their developmental phases were assessed through phenological observations. Comparative analysis was carried out against the local Bunyodkor variety.

Observations showed that emergence occurred on March 22–23, heading stage took place between April 26–30, and full maturity was completed on June 7–10, coinciding with the onset of high temperatures. The average vegetation period ranged from 76 to 80 days. The relatively short growing period can be explained by the spring sowing date and the alternative (facultative) biological characteristics of the hybrid lines. At the same time, the hybrids demonstrated superiority over the standard variety in several economically valuable traits.

### Valuable Traits of Hybrid Wheat Generations

(Qarshi District, 2025)

№	Name of Hybrids	Emergence date	Heading date	Emergence–heading period, days	Full maturity date	vegetation period, days	Plant height, cm	Yield, s/ga	to the standard Bunyodkor variety, s/ga	1000-grain weight, g
1	Bunyodkor	22-Mar	27-Apr	36	08-June	78	66,2	65,3	0	35,8
2	N-1 (one)	23-Mar	29-Apr	37	07-June	76	76,8	75,6	10,3	38,4
3	N-2 (tu)	22-Mar	26-Apr	35	09-June	79	75,2	72,8	7,5	35,2



4	N-3 (three)	22-Mar	30-Apr	39	08-June	78	76,4	60,3	-5	36,7
5	N-4 ( Four)	23-Mar	28-Apr	36	08-June	77	83,8	75,9	10,6	39,1
6	N-5 (fife)	23-Mar	30-Apr	38	07-June	76	70,2	68,7	3,4	34,1
7	N-1 AR5xBhakkar Star	22-Mar	29-Apr	38	08-June	78	71,6	65,4	0,1	36,9
8	N-2 BLA-AUS-07 x Bhakkar Star	22-Mar	28-Apr	37	07-June	77	80,2	78,9	13,6	40,2
9	N-5 BAL-AUS -02 x WV-1195	23-Mar	29-Apr	37	10-June	79	74,8	61,6	-3,7	37,4
10	H-6 BAL-AUS-04 x WV-1195	22-Mar	30-Apr	39	09-June	79	86,2	82,3	17	41,5
11	H-8 BAL-AUS-03 x WV-1197	23-Mar	30-Apr	38	10-June	79	79,6	88,6	23,3	40,6
12	H-9 AR26xWV-1197	22-Mar	27-Apr	36	07-June	77	90,3	84,5	19,2	39,7
13	Nishan (International Check)	23-Mar	30-Apr	38	08-June	77	83,7	73,4	8,1	37,9
14	BAL-7 BAL-7 Male sterile	23-Mar	28-Apr	36	09-June	78	64,6	62,1	-3,2	38,2
15	BLA-3 BLA-3 Male sterile	23-Mar	30-Apr	38	08-June	77	71,9	65,8	0,5	37,4
16	BF-1 AR26-3-1 Male sterile	22-Mar	29-Apr	38	10-June	80	62,4	64,6	-0,7	39,3
17	BF-2 AR5Male sterile	22-Mar	30-Apr	39	07-June	77	67,3	58,2	-7,1	38,6

During the study, hybrid wheat lines showed yield results ranging from 58.2 to 88.6 centners per hectare (c/ha). In comparison with the local Bunyodkor variety, 5 lines demonstrated lower yield, 2 lines showed similar yield, and 9 lines produced higher yield. In particular, the H-8 (BAL-AUS-03 × WV-1197) and H-9 (AR26 × WV-1197) lines yielded 23.3 and 19.2 c/ha more, respectively. These results indicate that these hybrids are capable of producing high yields even under autumn sowing conditions. Therefore, it is planned to evaluate them in autumn trials next year as well.

Additionally, 16 spring soft wheat hybrid lines were tested at the experimental field in Qarshi district. The results showed that lines such as D-2 N-1, D-3 N-2, D-10 H-6 (BAL-AUS-



04 × WV-1195), D-12 H-8 (BAL-AUS-03 × WV-1197), and D-12 H-9 (AR26 × WV-1197) had a vegetation period 2–6 days shorter than the standard Zamin-1 variety and were early maturing.

These hybrids demonstrated high yield potential, short vegetation period, and good adaptability to local conditions, indicating their importance as promising breeding material (Table 1).

**Table 1**

**Description of the Vegetation Period of Spring Bread Wheat Hybrid Lines (Qarshi District, 2025)**

№	Name of Hybrids	From Emergence to Tillering, days	From Tillering to Heading, day	From Heading to Milk Ripeness, days	Vegetation Period, days
1	Zamin-1	29	30	32	91
2	N-1 (one)	29	27	31	87
3	N-2 (tu)	29	25	31	85
4	N-3 (three)	29	31	32	92
5	N-4 ( Four)	29	34	30	93
6	N-5 (fife)	29	33	30	92
7	N-1 AR5xBhakkar Star	29	35	30	94
8	N-2 BLA-AUS-07 x Bhakkar Star	29	34	27	90
9	N-5 BAL-AUS -02 x WV-1195	29	30	30	89
10	H-6 BAL-AUS-04 x WV-1195	29	30	29	88
11	H-8 BAL-AUS-03 x WV-1197	29	28	33	90
12	H-9 AR26xWV-1197	29	26	33	88
13	Nishan Local Check	29	28	33	89
14	BAL-7 BAL-7 Male sterile	29	27	31	87
15	BLA-3 BLA-3 Male sterile	29	36	30	95
16	BF-1 AR26-3-1 Male sterile	29	34	30	93
17	BF-2 AR5Male sterile	29	36	32	97



At present, due to climate change, the second half of the growth and development period (heading–ripening stage) of winter cereal crops in almost all irrigated areas of the Republic takes place under conditions of soil moisture and nutrient deficiency, as well as critical air temperatures of +35 to +40°C and sometimes even higher.

It is well known that during this particular period of cereal crop development, optimal conditions for ensuring high yield and grain quality are air temperatures of +25 to +30°C, relative humidity of 40–50%, and soil moisture levels around 50–60%.

High temperatures during the flowering stage of cereal crops lead to a reduction in the number of grains per spike, resulting in a yield decrease of up to 20%.

**Conclusion.** The results of the study showed that the investigated hybrid wheat lines possess favorable growth duration, heat tolerance, and economically valuable traits. In particular, the H-8 (BAL-AUS-03 × WV-1197), H-6 (BAL-AUS-04 × WV-1195), H-2, and H-9 lines were distinguished by their high yield potential and are considered priority materials for wheat breeding. These hybrids are valuable not only in terms of productivity but also for their technological and economic characteristics, serving as important genetic sources for the development of new high-yielding wheat varieties adapted to local conditions. Further research should focus on a more in-depth evaluation of their additional agronomic traits, genetic stability, and seed production potential.

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