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Influence of Mineral Fertilizers and Active Biostimulants on Yield Elements and Yield of the "Bakhmal-97" Winter Soft Wheat Variety in Foothill and Mountainous Areas of Rainfed Regions

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Abstract: This article examines the influence of mineral fertilizer rates and active biostimulants on the yield of the Bakhmal-97 winter soft wheat variety in the foothill and mountainous rainfed regions of the Jizzakh region based on yield elements (productive stems, number of grains per spike, grain weight per spike, and weight of 1000 grains). According to the analysis results, it was established and scientifically substantiated that the grain yield of the Bakhmal-97 variety increased by an average of 0.7-8.4 c/ha across the variants.

Keywords: Wheat, yield elements, productive stem, spike, weight of 1000 grains, yield, mineral fertilizer, nitrogen, phosphorus, potassium, baol biostimulator.

Introduction. Today, one of the urgent problems in the world is the cultivation of environmentally friendly products and increasing soil fertility, as well as increasing the yield of rainfed lands using mineral, organic fertilizers and active biostimulants when feeding agricultural crops. One of the main factors limiting productivity in all rainfed regions of the republic, along with soil moisture deficit, low soil fertility, is the disruption of the scientific farming system, and many other reasons. Therefore, all agrotechnological measures used in rainfed areas are aimed at the economical and efficient use of atmospheric precipitation, moisture accumulated in the soil, and, on this basis, increasing crop yields.

Tritikale is a new crop created by humans, obtained by crossing wheat and rye. In many European countries, triticale is used in the food industry, as well as in livestock and poultry farming as a high-quality feed substitute for wheat [11].

In European countries, in addition to baking bread, triticale flour is also widely used in the production of confectionery products (cakes, cookies, waffles). Most triticale varieties are unsuitable for baking, as they have weak gluten, but it is better when mixed with wheat flour and other cereal flour [12].

According to the results of A.I.Grabosev experiments, advanced breeding work is being carried out to create varieties of triticale with high bread quality, mainly at the P.P.Lukyanenko Krasnodar Agricultural Research Institute of the Russian Federation. Employees of this institute have created a number of new varieties of triticale with high baking qualities: TI-17, Kapriz, Kornet, Tribun [5].

They emphasize the need for a special approach to bake high-quality bread from triticale. Researchers recommend using wheat and triticale flour in ratios of 70:30, 80:20, 60:40, and sometimes varieties of 50:50 [6; 7]. As a result of such a mixture, the baked bread acquires a large volume of excellent taste and aroma.

In his experiments, A.V. Pominov emphasized that the main characteristics affecting triticale yield are crop elements (spike length, number of spikelets per spike, number of heads per spike, and weight of 1000 grains) [8].

The weight of 1000 seeds is the most important and valuable economic indicator of the plant. Increasing the seeding rate in triticale leads to a decrease in the weight of 1000 grains and grain naturality [9].

The number of grains in a spike depends on the plant's biology; in a high agrophone, the length of the spike and the number of grains in the spike increase significantly. Selection work, taking into account the number of grains per spike, proved to be effective. There is a positive correlation between this indicator and productivity [10].

Research methods: Field experiments were conducted in the field of the central experimental farm of the Bakhmal Scientific Experimental Station of the Scientific Research Institute of Rainfed Agriculture. The central experimental farm of the Bakhmal Scientific-Experimental Station is located in a mountainous region at an altitude of 1650-1700 m above sea level. In conducting field experiments, the Bakhmal-97 variety of winter soft wheat was used, and the sowing rate was set at 3.5 million germinating seeds per hectare. The experiment consisted of 11 variants, 33 plots of 25 m^2 in 3 repetitions. Sowing operations are carried out using a SKS-7-10 breeding seeder. The placement of field experiments was carried out according to the methodology developed by the Research Institute of Cotton Breeding, Seed Production and Growing Agrotechnologies 2007 [1], phenological observations according to the methodology of the International Classifier SEV Triticum species, 1984 [2], developed by the Russian Institute of Plant Growing, biometric analyses according to the methodology of the State Variety Testing Commission of Agricultural Crops (1989) [3]. Mathematical analysis of the obtained results was carried out according to the method of Dospekhov B.A. 1985 [4].

Research results: When analyzing and studying the yield elements of the Bakhmal-97 winter soft wheat variety in the 2023-2024 research years, in the control (without fertilizers) variant 1, the number of productive stems averaged 140.9 pieces, the number of grains in one ear averaged 19.5 donna, the weight of grains in one ear averaged 0.9 grams, and the weight of 1000 grains averaged 37.9 grams.

Table 1 Yield components of the winter wheat variety "Bakhmal-97," Bakhmal 2023-2024.

№	Norms of mineral fertilizers and active biostimulants, kg/ha	Productive stems		Average	Number of grains per spike, units		Average	Grain weight per spike, g		Average	weight of 1000 grains, g		ўртача
		2023	2024		2023	2024		2023	2024		2023	2024	
1	Control *(without fertilizers)*	131,2	150,5	140,9	19,8	19,1	19,5	0,7	1,0	0,9	35,8	40,0	37,9
2	$P_{30}K_{30}$ (fon) *pre-sowing*	152,7	169,5	161,1	23,1	22,4	22,8	0,8	1,1	1,0	35,9	41,1	38,5
3	(fon) N_{30} *susp-1 till/in*	161,1	175,4	168,3	23,0	22,8	22,9	0,9	1,1	1,0	37,1	42,1	39,6
4	(fon) N_{40} *susp-1 till/in*	149,8	180,1	165,0	23,8	23,1	23,5	0,9	1,1	1,0	38,1	42,4	40,3
5	(fon) N_{50} *susp-1 till/in*	142,3	188,2	165,3	24,3	23,7	24,0	0,9	1,1	1,0	38,4	42,5	40,5
6	(fon) N_{30} *susp-2 tub/in*	155,6	209,0	182,3	24,5	24,5	24,5	1,0	1,1	1,1	38,8	42,9	40,9
7	(fon) N_{40} *susp-2 tub/in*	181,7	212,6	197,2	25,7	25,7	25,7	1,0	1,1	1,1	38,5	43,1	40,8

8	(fon) N_{50} *susp-2 tub/in*	196,3	223,3	209,8	25,8	25,4	25,6	1,0	1,1	1,1	38,5	43,9	41,2
9	(fon) N_{30} *susp-2 tub/in+till/in*	175,5	225,8	200,7	26,7	26,2	26,5	1,1	1,1	1,1	39,2	44,0	41,6
10	(fon) N_{40} *susp-2 tub/in+till/in*	169,7	237,9	203,8	26,4	26,7	26,6	1,1	1,1	1,1	4,01	44,2	42,2
11	(fon) N_{50} *susp-2 tub/in+till/in*	188,3	245,1	216,7	28,1	27,1	27,6	1,1	1,1	1,1	4,03	44,6	42,5

In the variants with the use of $P_{30}K_{30}$ (Fon), Fon+N_{30} suspension-1 in tillering, Fon+N_{40} suspension-1 in tillering, Fon+N_{50} suspension-1 in tillering, Fon+N_{30} suspension-2 in tillering, Fon+N_{40} suspension-2 in tillering, Fon+N_{50} suspension-2 in tillering, Fon+N_{30} suspension-2 in during tillering+1 and tubing+1, Fon+N_{40} suspension-2 in during tillering+1 and tubing+1, Fon+N_{50} suspension-2 in during tillering+1 and tubing+1 with the application of mineral fertilizers and an active biostimulator, the number of productive stems averaged 161.1-168.3-165.0-182.3-197.2-209.8-200.7-203.8 and 216.7 pieces, the number of bolls per spike averaged 22.8-22.9-23.5-24.0-24.5-25.7-26.5-26.6 and 27.66 pieces, the weight of grain per spike averaged 1.0-1.1 grams, and the weight of 1000 grains averaged 38.

Analysis of yield elements showed that in variants 2, 3, 4, 5, 6, 7, 8, and 9 of the experiment, compared to the control (without fertilizers), the number of productive stems was higher on average by 20.2-104.2 pieces, the number of grains in one spike by an average of 3.3-8.1 pieces, the weight of grains in one spike by 0.1 grams, and the weight of 1000 grains by an average of 0.6-4.6 grams (Table 1).

When analyzing and studying the yield of the Bakhmal-97 variety, in the control (without fertilizers) variant 1 of the experiment, the grain yield averaged 8.0 c/ha, in the variants with the application of mineral fertilizers and active biostimulants in the $P_{30}K_{30}$ (Fon), Fon+N_{30} suspension-1 tillering, Fon+N_{40} suspension-1 tillering, Fon+N_{50} suspension-1 tillering,

Table 2 Grain yield of the Bakhmal-97 variety, Bakhmal 2023-2024.

№	Norms of mineral fertilizers and active biostimulants, kg/ha	2023	2024	Average yield, c/ha	Difference from control c/ha
1	Control *(without fertilizers)*	8,1	7,9	8,0	-
2	$P_{30}K_{30}$ (fon) *pre-sowing*	9,1	8,3	8,7	0,7
3	(fon) N_{30} *susp-1 till/in*	10,4	9,3	9,8	1,8
4	(fon) N_{40} *susp-1 till/in*	10,5	9,7	10,1	2,1
5	(fon) N_{50} *susp-1 till/in*	11,3	10,1	10,7	2,7
6	(fon) N_{30} *susp-2 tub/in*	11,8	11,8	11,8	3,8
7	(fon) N_{40} *susp-2 tub/in*	12,8	12,9	12,8	4,8
8	(fon) N_{50} *susp-2 tub/in*	13,3	13,2	13,2	5,2
9	(fon) N_{30} *susp-2 tub/in+till/in*	13,5	16,0	14,7	6,7
10	(fon) N_{40} *susp-2 tub/in+till/in*	13,9	16,6	15,2	7,2
11	(fon) N_{50} *susp-2 tub/in+till/in*	16,0	16,9	16,4	8,4
HCP_{05} =		0,9 ц	1,3 ц		

Fon+N_{30} suspension-2 tillering, Fon+N_{40} suspension-2 tillering, Fon+N_{50} suspension-2 tillering, Fon+N_{30} suspension-2 during tillering+1 and tubing+1, Fon+N_{40} suspension-2 during tillering+1 and tubing+1, Fon+N_{50} suspension-2 during tillering+1 and tubing+1 the grain yield averaged 8.7-9.8, 10.1-10.7-11.8-12.8-13.2-14.7-15.2 and 16.4 c/ha, and an additional grain yield of 0.7-8.4 c/ha was obtained compared to the control (without fertilizers) variant 1 (Table 2).

Conclusion Based on the results obtained, it can be concluded that in the conditions of rainfed mountainous and foothill regions of the Jizzakh region, the highest yield of winter soft wheat variety Bakhmal-97 was observed in the variants with the application of mineral fertilizers and active biostimulants during tillering+1 and tubing+1, with the application of Fon+N_{30} suspension-2 during tillering+1 and tubing+1, with the application of Fon+N_{50} suspension-2 during tillering+1 and tubing+1, and the grain yield averaged 14.7; 15.2; and 16.4 c/ha, and compared to the control variant (without fertilizers), an additional 6.7; 7.2 and 84.4 c/ha higher yields were obtained.

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