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The Influence of Seed Sowing Times and Rate of Fertilizer Application on Leaf Surface Formation

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Annotation: This study examines the influence of sowing dates, seed rates, and mineral fertilizer application rates on the leaf surface formation of the triticale variety Sardor. Through scientific analysis, the research identifies optimal agricultural practices that enhance leaf development, which is crucial for improving photosynthetic efficiency and overall crop yield. Experimental data demonstrate how variations in these factors affect leaf surface area, contributing to better understanding and management of triticale cultivation. The findings provide practical recommendations for optimizing sowing and fertilization strategies to maximize the growth potential and productivity of Sardor triticale.

Keywords: Triticale, planting time, seed rate, mineral fertilizers, nitrogen, phosphorus, potassium, leaf level, spike.

Introduction

The efficiency of crop production largely depends on optimizing agronomic factors such as sowing time, seed rates, and fertilizer application. These elements directly influence plant

development, including the formation of leaf surface area, which plays a crucial role in photosynthesis and overall crop yield. The triticale variety Sardor presents a valuable hybrid grain with high adaptability, yet its growth potential is significantly affected by environmental and agronomic conditions.

This study aims to explore the impact of different sowing dates, seed rates, and mineral fertilizer application on the leaf surface development of Sardor triticale. By analyzing variations in leaf area across different growth stages, the research provides insights into optimizing these factors for enhanced photosynthetic activity and productivity. Furthermore, understanding these relationships contributes to improving agronomic practices and ensuring sustainable crop production in diverse climatic conditions.

It is known that leaves play an important role in the growth and development of cereal crops, performing photosynthesis and influencing metabolic processes, as evidenced by numerous studies. Also, one of the most important factors of productivity is the size of the photosynthetic potential, the number of leaves on the plant, and the leaf surface area [5; 7].

The leaf surface area changes depending on the type of crop, applied agrotechnical measures. Some literature emphasizes that during drought years, the leaf area of a plant increases by 5-20 thousand/m^2, and by 70 thousand/m^2 when moisture and mineral fertilizers are sufficient in nitrogen (N). When the leaf surface area is 4-5 thousand/m^2, the photosynthesis process is good, but if the leaf surface area is more than 5 thousand/m^2, the lower leaves of the plant are shaded and their participation in the photosynthesis process is reduced, and even the upper leaves feed the lower ones [3; 4; 6].

Research methods: *In phenological observations in field conditions, the International Classifier (SEV Triticum species, 1984) developed by the Russian Research Institute of Plant Science was used, the following wheat formula was used for leaf surface area S=Dcp×Шcp×0,7×n, S- leaf area per plant, (cm^2), D- leaf length, cm, Ш- leaf width, cm, 0.7- correction coefficient for calculating leaf area, n- number of leaves per plant, pcs., Conducting field experiments was determined according to the UzPITI, Tashkent-2007 method.*

According to the results of the experiment in 2019, the effect of sowing date, seed and mineral fertilizer rates on the leaf surface of triticale was observed. Leaf surface was determined during the stages of bunching, tube formation, heading and milk ripening of the crop. In this case, when analyzing the leaf surface development phases during the autumn period of the experiment (1-10.11), the sowing rate was 2.5 million. In the control (without fertilizer) variant 1, the sowing rate was 4043.7 cm^2 in the accumulation phase, 8951.2 cm^2 in tuber phase, 19335.5 cm^2 in spike phase, 15448.8 cm^2 in milk ripening phase, in variants 2, 3, 4 and 5, when mineral fertilizers $P_{30}K_{30}$ kg/ha Fon, Fon+N_{30} kg/ha, Fon+N_{40} kg/ha, Fon+N_{50} kg/ha were applied, the accumulation phase was 4844.0-7018.1-5910.9-5420.8 cm^2, 13375.6-17687.6, 16179.6-14403.2 cm^2 in the tube phase, 25638.5-35161.9-32266.5-28739.2 cm^2 in the spike phase, 21449.0-29021.0-28140.5-24102.4 cm^2 in the milk ripening phase, the sowing rate is 3.0 million seeds of viable seeds, in the control (without fertilizer) variant 6, 4160.4 cm^2 in the accumulation phase, 8896.2 cm^2 in the tuber phase, 21930.8 cm^2 in the spike phase, 17217.2 cm^2 in the milk ripening phase, in variants 7, 8, 9 and 10, when mineral fertilizers $P_{30}K_{30}$ kg/ha Fon, Fon+N_{30} kg/ha, Fon+N_{40} kg/ha, Fon+N_{50} kg/ha were applied, the accumulation phase was 6439.1-10056.2-6469.2-6094.9 cm^2, 17714.1-23567.5-17822.2-16327.0 cm^2 in tuber phase, 35247.1-47415.9-36207.1-32277.9 cm^2 in spike phase, milk ripening phase 30850.9-41432.7-30811.8-27011.1 cm^2, The sowing rate is 3.5 million seeds of germinating seeds, and the control (without fertilizer) variant 11 is planted in the accumulation phase at 4449.6 cm^2, 9972.5 cm^2 in the tuber phase, 22158.7 cm^2 in the spike phase, 17418.4 cm^2 in the milk ripening phase, In variants 12, 13, 14 and 15, when mineral fertilizers $P_{30}K_{30}$ kg/ha Fon, Fon+N_{30} kg/ha, Fon+N_{40} kg/ha, Fon+N_{50} kg/ha were applied, the accumulation phase was 5512.6-7961.4-6669.2-6168.3 cm^2, 15025-19943.3-17407.0-16305.6 cm^2 in the tube phase, 28793.7-39754.3-33706.7-30411.8 cm^2

in the spike phase, during the milk ripening phase, it amounted to 23332.4-34781.1-28273.5-24824.9 cm^2. Table 1

It should be noted that increasing the sowing rate from 2.5 million to 3.0 million viable seeds will increase the leaf area by 1595.1-3037.9 cm^2 during the leaf accumulation phase, 4338.5-5879.9 cm^2 in the tube phase, 9608.6-12254.0 cm^2 in the spike phase, 9401.9-12411.7 cm^2 in the milk ripening phase, increasing the sowing rate from 3.0 million to 3.5 million units of viable seeds in the accumulation phase will result in 926.5-2094.8 cm^2, 2688.1-3624.2 cm^2 in the tube phase, it caused a decrease in the amount of 6453.4-7665.6 cm^2 in the spike phase, and 7518.5-6651.0 cm^2 in the milk ripening phase.

Table 1. The effect of sowing date, rate and mineral fertilizer rates on triticale leaf surface, 2019

№	Sowing time	Seeding rates, million units/ha, (kg/ha)	Rate of mineral fertilizers, kg/ha	Accumulation	Tubing	Spike	milk ripening
				1 ha/m^2	1 ha/m^2	1 ha/m^2	1 ha/m^2
1	Autumn term (1-10.11)	2.5 million units/ha (100 кг/га)	**Control without fertilizer**	4043,7	8951,2	19335,5	15448,8
2			P_{30} K_{30} Фон	4844,0	13375,6	25638,5	21449,0
3			Фон+N_{30}	7018,1	17687,6	35161,9	29021,0
4			Фон+N_{40}	5910,9	16179,6	32266,5	28140,5
5			Фон+N_{50}	5420,8	14403,2	28739,2	24102,4
6		3,0 million units/ha (120 кг/га)	**Control without fertilizer**	4160,4	8896,2	21930,8	17217,2
7			P_{30} K_{30} Фон	6439,1	17714,1	35247,1	30850,9
8			Фон+N_{30}	10056,2	23567,5	47415,9	41432,7
9			Фон+N_{40}	6469,2	17822,2	36207,1	30811,8
10			Фон+N_{50}	6094,9	16327,0	32277,9	27011,1
11		3,5 million units/ha (140 кг/га)	**Control without fertilizer**	4449,6	9972,5	22158,7	17418,4
12			P_{30} K_{30} Фон	5512,6	15025,0	28793,7	23332,4
13			Фон+N_{30}	7961,4	19943,3	39754,3	34781,7
14			Фон+N_{40}	6669,2	17407,0	33706,7	28273,5
15			Фон+N_{50}	6168,3	16305,6	30411,8	24824,9

During the second spring period of the experiment (20.28-02), when the leaf surface was analyzed in terms of development phases, the control (without fertilizer) variant 16, planted at the rate of 2.5 million viable seeds, had a total area of 3212.4 cm^2 in the accumulation phase, 7146.0 cm^2 in the tuber phase, 16455.5 cm^2 in the spike phase, 12882.5 cm^2 in the milk ripening phase, in variants 17, 18, 19 and 20, when mineral fertilizers $P_{30}K_{30}$ kg/ha Fon, Fon+N_{30} kg/ha, Fon+N_{40} kg/ha, Fon+N_{50} kg/ha were applied, the accumulation phase was 4304.8-5428.2-5394.4-4934.4 cm^2, 11818.4-14954.8-14168.2-13199.5 cm^2 in the tube phase, 21265.3-29931.4-27287.0-24795.3 cm^2 in the spike phase, 16203.0-23086.2-23005.0-20333.8 cm^2 in the milk ripening phase, the sowing rate is 3.0 million seeds of germinating seeds, and the control (without fertilizer) variant 21 is planted in the accumulation phase at 3273.1 cm^2, 7227.4 cm^2 in the tuber phase, 16876.6 cm^2 in the spike phase, 11825.0 cm^2 in the milk ripening phase, in variants 22, 23, 24 and 25, mineral fertilizers $P_{30}K_{30}$ kg/ha Fon, Fon+N_{30} kg/ha, Fon+N_{40} kg/ha,

Fon+N_{50} kg/ha were applied, and in the accumulation phase, 4667.8-8012.5-6098.5-5326.8 cm^2 of, 12956.1-17780.8-16782.9-14495.5 cm^2 in tube phase, 24773.7-34622.0-31477.1-27954.0 cm^2 in spike phase, milk ripening phase 19992.0-28118.0-26843.1-22532.9 cm^2, the sowing rate is 3.5 million seeds of germinating seeds, and the control (without fertilizer) variant 26 is planted in the accumulation phase at 4143.9 cm^2, 9661.7 cm^2 in tuber phase, 21384.4 cm^2 in spike phase, 16066.0 cm^2 in milk ripening phase, in variants 27, 28, 29 and 30, mineral fertilizers $P_{30}K_{30}$ kg/ha Fon, Fon+N_{30} kg/ha,

Table 2. The effect of sowing date, rate and mineral fertilizer rates on triticale leaf surface, 2019

№	Sowing time	Seeding rates, million units/ha, (kg/ha)	Rate of mineral fertilizers, kg/ha	Accumulation	Tubing	Spike	milk ripening
				1 ha m^2	1 ha m^2	1 ha m^2	1 ha m^2
16	Spring term (20-28.02)	2.5 million units/ha (100 кг/га)	**Control without fertilizer**	3212,4	7146,0	16455,5	12882,5
17			P_{30} K_{30} Фон	4304,8	11818,4	21265,3	16203,0
18			Фон+N_{30}	5428,2	14954,8	29931,4	23086,2
19			Фон+N_{40}	5394,4	14168,2	27287,0	23005,0
20			Фон+N_{50}	4934,4	13199,5	24795,3	20333,8
21		3,0 million units/ha (120 кг/га)	**Control without fertilizer**	3273,1	7227,4	16876,6	11825,0
22			P_{30} K_{30} Фон	4667,8	12956,1	24773,7	19992,0
23			Фон+N_{30}	8012,5	17780,8	34622,0	28118,0
24			Фон+N_{40}	6098,5	16782,9	31477,1	26843,1
25			Фон+N_{50}	5326,8	14495,5	27954,0	22532,9
26		3,5 million units/ha (140 кг/га)	**Control without fertilizer**	4143,9	9661,7	21384,4	16066,0
27			P_{30} K_{30} Фон	5396,1	14931,8	28360,6	22422,4
28			Фон+N_{30}	8695,5	19630,7	38128,4	32278,7
29			Фон+N_{40}	6499,8	17682,6	33881,1	28891,1
30			Фон+N_{50}	5160,4	16244,0	30826,4	30826,4

Fon+N_{40} kg/ha, Fon+N_{50} kg/ha were applied, and in the accumulation phase 5396.1-8695.5-6499.8-5160.4 cm^2 of, 14931.8-19630.7-17682.6-16244.0 cm^2 in tube phase, 28360.6-38128.4-33881.1-30826.4 cm^2 in spike phase, milk ripening phase it was observed to be 22422.4-32278.7-28891.1-30826.4 cm^2. Table 1.

It should be noted that increasing the sowing rate of triticale during the spring sowing period from 2.5 million to 3.0 million viable seeds will increase the leaf area by 363.0-2584.3 cm^2 in the leaf accumulation phase, 1137.7-2826.0 cm^2 in the tuber phase, 3508.4-4690.6 cm^2 in the spike phase, 3789.0-5031.8 cm^2 in the milk ripening phase, the increase in the number of viable seeds from 2.5 million to 3.5 million resulted in a corresponding increase in leaf area by 728.3-683.0 cm^2 in the accumulation phase, 1975.7-1849.9 cm^2 in the tube phase, 3587.9-3506.4 cm^2 in the spike phase, and 2430.4-4067.7 cm^2 in the milk ripening phase.

Based on the results obtained, it can be concluded that, In the conditions of typical gray soils of the Jizzakh region, increasing the sowing rate of triticale in the autumn period (1-10.11) from 2.5 million to 3.0 million viable seeds will increase the leaf surface area in the accumulation phase

by 1595.1-3037.9 cm^2, 4338.5-5879.9 cm^2 in the tuber phase, 9608.6-12254.0 cm^2 in the spike phase, 9401.9-12411.7 cm^2 in the cut ripening phase, Increasing the sowing rate from 3.0 million to 3.5 million units of viable seeds in the accumulation phase will result in 926.5-2094.8 cm^2, it caused a decrease in the amount of 2688.1-3624.2 cm^2 in the tuber phase, 6453.4-7665.6 cm^2 in the spike phase, and 7518.5-6651.0 cm^2 in the milk ripening phase. The application of mineral fertilizers Fon+N_{30} kg/ha compared to the rate of Fon+N_{40} kg/ha resulted in an increase of 3587.0 cm^2 in the accumulation phase, 5745.3 cm^2 in the tuber phase, 11208.8 cm^2 in the spike phase, and 10620.9 cm^2 in the milk ripening phase, compared to Fon + N_{50} kg/ha, it provided 3961.3 cm^2 in the accumulation phase, 7240.5 cm^2 in the tuber phase, 15138.0 cm^2 in the spike phase, and 14421.6 cm^2 in the milk ripening phase.

During the spring planting period (20-28.02), the planting rate is 2.5 mln. from 3.0 mln. The increase in the number of germinating seeds is 363.0-2584.3 cm^2 in the leaf accumulation phase, 1137.7-2826.0 cm^2 in the tuber phase, 3508.4-4690.6 cm^2 in the spike phase, 3789.0-5031.8 in the milk ripening phase. cm^2, the increase in the number of viable seeds from 2.5 million to 3.5 million resulted in a corresponding increase in leaf area by 728.3-683.0 cm^2 in the accumulation phase, 1975.7-1849.9 cm^2 in the tuber phase, 3587.9-3506.4 cm^2 in the spike phase, and 2430.4-4067.7 cm^2 in the milk ripening phase, The variant with the application of mineral fertilizers at the rate of 3.5 million seeds per hectare, Fon+N_{30} kg/ha, achieved high results, with an increase in leaf area of 2195.7 cm^2 in the accumulation phase, 1948.0 cm^2 in the tuber phase, 4247.3 cm^2 in the spike phase, and 3387.6 cm^2 in the milk ripening phase, compared to the one applied at the rate of Fon+N_{50} kg/ha, by 3535.1 cm^2 in the accumulation phase, 3386.7 cm^2 in the tuber phase, 7302.0 cm^2 in the spike phase, and 1452.3 cm^2 in the milk ripening phase.

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