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Effect of Sowing Term on the Photosynthetic Activity and Yield of Autumn Wheat Varieties

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Running title: Photosynthetic activity and productivity

ABSTRACT

The article examines the effect of photosynthetic activity on important physiological indicators, such as leaf index, accumulation of dry matter in plants, productivity of the photosynthetic network of biological varieties of winter wheat "Sanzar-8", "Skifyanka", "Intensive", "Unumli-bugdoy" during sowing (September 15, September 30, October 15, October 30, November 15, November 30). The counts of varieties (after overwintering) in the phases of germination, flowering, and waxy ripening showed that the leaf index was the highest in the variant on October 15 for all studied varieties. When the seeds were sown at the optimum time, that is, September 30 and especially October 15, the plants had a high leaf index (leaf level) and therefore high photosynthetic potential.

Special attention is paid to some aspects, or rather to the good accumulation of winter wheat varieties, amino acids and carbohydrates in the storage joints during the winter. At the beginning of winter (December 1), it was noticed that the differences between cultivars in total amino acids are greater between planting periods. All of the cultivars studied were found to have relatively high amino acid levels in seeds sown on October 15th, while those sown later than November 15th were found to be insufficient.

In winter, it was found that the amount of glucose in all cultivars and during sowing was up to 2 times higher than that of sucrose. The fact that the glucose content is significantly higher than that of sucrose and that in general the cells accumulate more soluble sugars is of great importance during the wintering process. Such changes have a positive significance, indicating an increase in the frost resistance of wheat varieties. The greatest number of glucose and sucrose seeds was observed in the Sanzar-8 variety sown on October 15-30.

Keywords: autumn wheat; wall; sowing period; leaf index; photosynthetic potential; dry matter; photosynthesis net productivity; amino acids; soluble hydrocarbons; productivity.

I. INTRODUCTION

In the irrigated soils of the Samarkand region, sowing of winter wheat usually begins in September and continues until December. As a result, some early wheat varieties grow rapidly, and there are cases of severe damage from the first winter frost, reducing yields. In turn, it was found that the yield of wheat varieties sown too late is low. In Uzbekistan, especially in

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Samarkand and Syrdarya regions, winter wheat dies more because of the cold than in other regions. As a result, in some years the wheat yield becomes very small. Especially in years when dry frosts are frequent and there is little snowfall, autumn wheat is more likely to die from low temperatures. Such fields produce much less crops. However, low temperatures negatively affect cereals of wheat varieties in different ways. The degree of damage depends on the characteristics of the variety, the level of development of the cereals and the weather conditions. Therefore, the selection and placement of varieties suitable for the soil and climatic conditions of each region, the introduction of modern advanced agricultural technologies is an urgent task. The choice of varieties of winter wheat and the scientific substantiation of the optimal timing of their sowing in the conditions of the Samarkand region is especially relevant.

II. MATERIALS AND METHODS

In experiments, the seeds of biologically autumn wheat varieties "Sanzar-8", "Skifyanka", "Intensive", "Unumli-bugdoy" were sown in 6 periods: on September 15, September 30, October 15, October 30, at 15 November and 30 November.

Field experiments were carried out in two tiers with four repetitions; the size of the considered plots was 50 m^2.

When growing wheat varieties, soil moisture was maintained at a level of at least 70% of the maximum field moisture capacity (LFMC). In the experiment, mineral fertilizers were applied at the rate of $N_{200}P_{140}K_{100}$ kg / ha. Phosphorus and potash fertilizers were applied in full before plowing; nitrogen fertilizers were applied in three periods: in autumn, early spring and in the phase of soil cultivation.

Phenologicalobservations and biometric measurements were carried out according to the method of the State Inspectorate for Variety Tests of Agricultural Crops on Model Plants [1971].

The surface of the sheet was determined according to the methods of N.N.Tretyakov [1990], photosynthetic potential, net productivity of photosynthesis by A.A.Nichiporovich et al. [1961].

Analysis of variance of the obtained data on yield was carried out according to B.A.Dospekhov [1985].

III. LITERATURE REVIEW

Correct determination of the timing and methods of sowing winter wheat varieties will serve as a decisive factor in the development of the grain sector of the republic and further strengthening of grain independence.

The correct sowing time for winter wheat varieties is one of the important factors in obtaining high and high-quality grain yields from irrigated lands. Sowing time significantly affects the germination of seeds, the formation of the root system, the intensity of development cycles, accumulation, resistance of plants to cold, diseases and pests, photosynthetic activity of the plant, grain yield and its quality.

According to R.I.Siddikova [9], from the experience of R.I.Siddikov and R.Sh.Tellyaev [12] and others, it is advisable to sow winter wheat 45-60 days before the end of the autumn growing season, even in different soil and climatic conditions. During this period, the overall efficiency of temperature reaches 450-620 ºC. Research by S.Tursunov, N.Teshaboev, S.Akbarov [14] 2-3, as well as in the experiments of N.Kh.Khalilova, M.Atamuradova [16] shows that up to 5 stems were subsequently found in the seeds sown within these days. Winter hardiness and productivity of such plants were also high.

The resistance of wheat to unfavorable conditions, cold, diseases and pests depends to some extent on the duration of sowing. If winter wheat germinates late, the plant will form a weak top layer and poorly developed root system until the autumn vegetation ceases, which will lead to significant damage to the wheat field in rare winters, thinning, and sometimes even death of plants even in very favorable autumn due to the fact that in autumn and spring they ineffectively use the moisture reserves in the soil [6].

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According to the results of experiments carried out in Uzbekistan, the timing of sowing winter wheat on irrigated lands depends on the soil and climatic conditions, the biological characteristics of the variety.

In the experiments of N.Khalilov, M.Atamuradova [16] on the irrigated lands of the Samarkand region, the optimal time for sowing biological winter wheat Bezostaya-1 is the first decade of October, and for biological spring and wall varieties such as Intensive, Wheat Unumly, Sete-Cerros-66, the second decade of October.

According to K.Dzhuraev, A.Khaidarov, G.Rakhmatullaev [1], experiments carried out at the Samarkand variety testing ground showed that a much larger and better harvest can be obtained from sowing grain in autumn than in spring. When sowing in autumn, the weight of 1000 wheat seeds increased by 9 g, and in barley by 14 g, compared to spring wheat.

According to the analysis of scientific sources, due to the biological characteristics of winter wheat varieties, the duration of the autumn growing season is recommended 45-60 days or sowing seeds 50-60 days before the onset of persistent frosts, regardless of the planting zone [5, 11].

The growth, development, ripening of winter wheat in autumn depends on the sowing period, species, variety, weather of the year, fertilizers, irrigation and predecessors. Therefore, the optimal sowing time is October 10-15 in Almaty, Toldi-Kurgan, Dzhambul regions of Kazakhstan, September 20-30 in Shymkent [4], October 10-15 in the Samarkand region of Uzbekistan, October 21 in Kashkadarya, October 5-10 in the Tashkent region and in the Republic of Karakalpakstan from September 21 to October 10, in the North Caucasus from September 10 to 20 [2].

Many researchers note that with a delay in planting, the weight, nature, protein and gluten content of 1000 grains decreases. The timing of sowing winter wheat significantly affects the physical, biochemical and technological qualities of grain [10].

In the experiments of K.Musinov [4] under the conditions of Northern Kazakhstan, when sown on August 30 from the winter wheat variety Mironovskaya 808, before winter, each plant gave 1.9–2.3 stems. The highest seed germination under field conditions was also observed in seedlings sown on August 30. Sowing on August 10 reduced the winter hardiness and productivity of the plant.

According to R.Kh.Khiromamedov, F.Kazimetova, O.A.Hasanguseynov [19] the optimal period for sowing winter wheat in Dagestan is the last decade of September on the plain, the first decade of October in the foothills and the third decade of August in the mountains.

When winter wheat is planted too early, the temperature is too high; before winter, the plant grows strongly, grows in excess and, as a result, is affected by various fungal diseases and pests. With late planting, they do not have time to accumulate before winter, plastic substances do not accumulate a sufficient amount of surface mass, and in most cases the plants leave for the winter alone. The resistance of such plants to unfavorable environmental factors decreases, the yield decreases [7, 13, 15, 17, 18, 20].

Thus, the analysis of literature data shows that the optimal sowing time for winter wheat should be determined depending on the soil and climatic conditions of the region, the biological characteristics of the variety. In recent years, with warming in some regions, the optimal sowing dates for winter wheat are postponed 10 days ago than the data obtained 40-50 years ago.

IV. RESULTS

Leaf index. A high-quality crop can be obtained only from those crops that dynamically form an optimal leaf surface and can undergo photosynthesis for a long time.

From the data obtained, it can be seen that the leaf index varies significantly depending on the planting time, depending on the biological characteristics of wheat varieties. Such changes are less common among cultivars and more common depending on the sowing time and apply to all studied phases. When calculating varieties (after winter) in the phases of tubular, spike, flowering and waxy ripening, it was found that the leaf index of all studied varieties was

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maximum in the variant on October 15. The leaf index was observed to be lower for early and especially late planting varieties than during this period.

Although the leaf index in the tubular wheat phase of the wheat cultivars was lower than in the other phases studied, the difference between the sowing periods was significant. It was noted that the varieties planted on November 30 had a much lower leaf index than the varieties planted on September 15 and especially on October 15. Similar differences were also observed in the phases of germination, flowering, and waxy ripening, and the leaf index in variants with planting dates of October 30 and November 15 was intermediate.

Table 1.
The effect of sowing dates on the leaf index of wheat varieties(2017-2020)

Varieties	Sowing dates	Development phases					
		tubular	earingofwheat	bloom	waxyripening	average	
						index	%
«Sanzar-8»	15 September	2,96	4,11	4,80	4,20	4,00	100,0
	30 September	3,27	5,56	5,79	4,53	4,78	119,5
	15 October	3,45	5,78	5,91	4,72	4,96	124,0
	30 October	3,00	3,95	4,75	4,00	3,92	98,0
	15 November	2,56	3,71	4,44	3,90	3,65	91,2
	30 November	1,93	2,35	3,84	3,60	2,93	73,3
«Skifyanka»	15 September	2,54	3,08	3,76	3,89	3,32	100,0
	30 September	2,93	3,79	4,27	4,00	3,75	112,9
	15 October	3,24	4,80	4,91	4,83	4,44	133,7
	30 October	2,50	2,84	3,45	3,57	3,09	93,0
	15 November	1,90	2,12	2,17	2,28	2,11	63,5
	30 November	1,48	1,86	2,20	2,10	1,91	57,5
«Intensive»	15 September	3,08	4,00	4,92	4,31	4,10	100,0
	30 September	3,15	5,55	5,54	4,83	4,76	116,1
	15 October	3,23	5,91	5,84	5,10	5,02	122,4
	30 October	2,90	4,45	4,85	4,76	4,24	103,4
	15 November	2,31	3,83	4,01	4,24	3,59	87,6
	30 November	2,00	2,21	3,90	4,00	3,02	73,6
«Unumli-bugdoy»	15 September	3,00	3,86	4,90	4,40	4,04	100,0
	30 September	3,22	4,93	5,88	5,12	4,78	118,3
	15 October	3,76	5,69	5,99	5,18	5,15	127,5
	30 October	2,61	3,87	4,98	4,83	4,07	100,7

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	15 November	2,00	3,23	4,00	4,15	3,34	82,7
	30 November	1,52	2,01	3,17	3,73	2,60	64,3

In general, the leaf level of all cultivars studied varied depending on planting dates. In the typical gray soils of Samarkand region, the highest leaf level was observed when seeds were sown on 15 October. Sowing the seeds earlier or later than this period resulted in lower leaf levels of the plants.

Photosynthetic potential. One of the important indicators determining the yield of crops is their photosynthetic potential. The photosynthetic potential of wheat varieties was determined during the tubing, germination, flowering, and wax ripening phases of the plants (Table 2).

The data obtained show that the photosynthetic potential of wheat varieties varies depending on the time of sowing the seeds, the stages of development of the plant and the biological characteristics of the varieties. In the relatively active growth and development phases of wheat varieties (sprouting, sprouting and flowering), the photosynthetic potential is high and decreases in the wax ripening phase. The decrease in photosynthetic potential during the wax ripening phase of the grains is due, of course, to the yellowing, drying and falling of the lower leaves. The greatest photosynthetic potential was observed in the germination and flowering phases of the varieties, and in all the cultivars studied, the seeds corresponded to the variants sown on 15 October. The lowest photosynthetic potential seeds were observed in the variants sown on 30 November.

Table 2.
Influence of sowing, times on photosynthetic potential of wheat varieties, thousand m^2 /ha * per day (2017-2020)

Varieties	Sowingdates	Developmentphases					
		tubular	earingofwheat	bloom	waxyripening	average,thousand	
						m^2/ha*per day	%
«Sanzar-8»	15 September	429,0	536,0	530,8	317,5	453,3	100,0
	30 September	610,1	725,6	708,9	450,0	623,6	137,5
	15 October	890,0	955,0	950,0	455,6	812,6	179,2
	30 October	331,7	556,8	531,7	220,2	410,1	90,5
	15 November	310,3	475,0	442,6	125,1	338,2	74,6
	30 November	199,8	254,1	210,0	86,0	187,5	41,4
«Skifyanka»	15 September	400,7	500,0	460,8	250,0	402,8	100,0
	30 September	460,0	704,9	625,5	324,0	528,6	131,2
	15 October	750,0	820,7	800,0	414,4	696,3	172,8
	30 October	355,0	490,6	420,0	229,1	373,6	92,7
	15 November	270,6	330,0	309,6	215,6	281,4	69,9
	30 November	127,7	201,3	195,1	70,9	148,7	36,9

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«Intensive»	15 September	407,5	512,4	501,0	300,4	430,3	100,0
	30 September	580,2	730,0	684,5	484,3	619,0	143,9
	15 October	842,2	949,1	945,0	503,3	809,0	188,1
	30 October	430,0	567,3	536,0	424,5	489,3	113,7
	15 November	300,1	470,0	405,6	130,7	326,6	75,9
	30 November	197,0	220,0	198,0	80,6	173,9	40,4
«Unumli-bugdoy»	15 September	403,5	525,0	480,0	311,0	429,8	100,0
	30 September	628,8	709,4	680,0	487,8	626,0	145,6
	15 October	880,0	907,0	896,0	467,6	787,6	183,2
	30 October	350,0	490,0	450,0	238,7	382,2	88,9
	15 November	320,1	358,5	343,3	135,5	289,3	67,3
	30 November	205,4	260,1	210,0	98,0	193,4	45,0

Thus, the sowing time of the studied wheat varieties had different effects on the leaf index and photosynthetic potential. When the seeds are sown at the optimum time, that is, September 30 and especially October 15, the leaf index (leaf level) of the plants and therefore the photosynthetic potential is high. With early sowing (September 15) and late (November 30) sowing, these plant rates are sharply reduced.

Accumulation of dry matter. The data obtained on the influence of the sowing time on the accumulation of dry weight of wheat varieties are shown in Table 3.

At the end of the growing season, the dry weight of plants averages 32.7-37.5 g / bush for the Sanzar-8 variety, 34.7-39.3 for the Intensive variety, 30.3-35.8 for the Fertile wheat ”and“ Skifianka ”- 27.9-30.0 g / bush. These indicators are 18.0-35.4% for the Sanzar-8 variety, 14.5-29.7% for the Intensive variety and 13.9-34% for the Unumli-bugdoy variety. Compared to the early ripening (September 15) variant, the Skifianka variety has a 6% increase and a 12.0-20.5% increase.

Table 3.
Dependence of dry mass of wheat varieties on sowing dates (g / bush)

Varieties	Sowingdates	Duration			Average	
		2018 year	2019 year	2020 year	g	%
«Sanzar-8»	15 September	25,8±0,24	30,4±0,26	26,9±0,17	27,7	100,0
	30 September	30,9±0,18	35,0±0,21	32,3±0,26	32,7	118,0
	15 October	35,4±0,20	39,8±0,22	37,5±0,26	37,5	135,4
	30 October	26,0±0,22	30,7±0,28	28,4±0,28	28,4	102,5
	15 November	23,6±0,21	27,1±0,18	26,3±0,26	25,7	92,8
	30 November	17,1±0,18	20,3±0,21	19,2±0,26	18,9	68,2
«Skifyanka»	15 September	22,7±0,20	26,5±0,24	25,6±0,28	24,9	100,0
	30 September	24,8±0,29	28,9±0,27	30,0±0,28	27,9	112,0
	15 October	26,5±0,25	31,7±0,25	32,0±0,20	30,0	120,5
	30 October	22,5±0,27	25,6±0,21	25,0±0,21	24,4	98,0
	15 November	20,0±0,22	23,0±0,24	22,3±0,26	21,7	87,1
	30 November	16,7±0,26	18,2±0,22	17,4±0,29	17,5	70,3

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«Intensive»	15 September	28,1±0,22	32,7±0,21	30,0±0,18	30,3	100,0
	30 September	33,4±0,25	36,9±0,21	33,7±0,22	34,7	114,5
	15 October	38,7±0,21	40,3±0,20	38,9±0,24	39,3	129,7
	30 October	29,8±0,22	31,6±0,26	30,6±0,24	30,7	101,3
	15 November	26,3±0,25	28,9±0,30	27,0±0,22	27,4	90,4
	30 November	20,5±0,28	22,1±0,20	20,1±0,27	21,1	69,6
«Unumli-bugdoy»	15 September	25,0±0,46	29,6±0,18	25,4±0,26	26,6	100,0
	30 September	27,3±0,23	32,9±0,25	30,7±0,19	30,3	113,9
	15 October	33,1±0,24	38,8±0,24	35,6±0,25	35,8	134,6
	30 October	24,3±0,25	28,5±0,19	26,3±0,21	26,3	98,9
	15 November	21,1±0,22	25,4±0,22	24,0±0,22	23,5	88,3
	30 November	18,2±0,25	19,1±0,24	17,6±0,21	18,3	68,8

Seeds were sown late (especially on November 15 and 30), with a very low dry mass in the variants. When the seeds were sown late, on November 30, it was found that the dry mass of the plants averaged 17.5-21.1 g / bush by variety. These figures were 29.7–31.8% lower than when seeds were sown early, and 50.2–67.2% less than when seeds were sown on 15 October.

In general, wheat varieties studied for planting periods had a strong effect on dry mass accumulation. It was found that the highest dry mass accumulation of all cultivars studied corresponded to plants sown on October 15 and the lowest mass seed yield to plants sown too late (November 30).

Pure productivity of photosynthesis is one of the most important indicators determining the biological yield of crops. In turn, planting times have a strong effect on the photosynthetic activity of plants.

During the vegetation period of wheat varieties, the net productivity of plant photosynthesis varied (Table 4). In the tubular and sprouting stages of plant development, this figure is slightly higher, and in the flowering phase, the pure productivity of photosynthesis is highest. Subsequently, the net productivity of photosynthesis is significantly reduced until the wax ripening phase of the grains.

In variants with sowing seeds on November 15 and 30, the net productivity of plant photosynthesis was very low throughout the growing season in all studied varieties. The average decrease in the net productivity of photosynthesis during the growing season is 5.1-9.0% for the Sanzar-8 variety, 4.4-15.9% for the Intensive variety, 7.4-16.7% for the Fertile wheat ", and 6.1-15.5% for the Skifianka variety.

Table 4.
Dependence of net productivity of photosynthesis of wheat varieties on sowingdates, g / m^2 * per day (2017-2020).

Varieties	**Sowingdates**	**Developmentphases**					
		tubular	**earingofwheat**	**bloom**	**waxyripening**	**Average**	
						g/m^2*per day	**%**
«Sanzar-8»	15 September	6,14	5,27	7,34	2,65	5,35	100,0
	30 September	7,19	6,24	8,45	3,76	6,41	119,8
	15 October	8,05	7,10	8,73	4,00	6,97	130,3
	30 October	6,00	5,30	7,45	2,70	5,36	100,2
	15 November	5,87	5,00	7,01	2,44	5,08	94,9

	30 November	5,54	4,81	6,85	2,30	4,87	91,0
«Skifyanka»	15 September	4,75	5,09	6,35	2,38	4,64	100,0
	30 September	4,89	5,47	7,61	3,04	5,25	113,1
	15 October	6,47	5,61	8,06	3,59	5,93	127,8
	30 October	4,95	5,28	6,40	2,20	4,70	101,3
	15 November	4,63	5,00	5,80	2,00	4,36	93,9
	30 November	4,09	4,71	5,03	1,84	3,92	84,5
«Intensive»	15 September	6,00	5,30	7,48	2,89	5,42	100,0
	30 September	7,07	6,46	8,91	3,53	6,49	119,7
	15 October	8,00	6,94	8,65	3,91	6,87	126,7
	30 October	5,90	5,47	7,65	3,00	5,50	101,5
	15 November	5,50	5,28	7,05	2,90	5,18	95,6
	30 November	5,00	4,09	6,78	2,40	4,56	84,1
«Unumli-bugdoy»	15 September	5,86	5,20	7,51	2,70	5,32	100,0
	30 September	7,15	6,35	8,59	3,49	6,39	120,1
	15 October	7,99	7,12	8,88	3,87	6,96	130,8
	30 October	6,29	6,00	7,80,	3,50	5,89	110,7
	15 November	5,30	4,85	6,78	2,80	4,93	92,6
	30 November	5,08	4,00	6,59	2,07	4,43	83,3

In general, based on the data obtained for all planting dates and studied phases, the varieties can be ranked in the following order: "Sanzar-8", "Intensive", "Unumli-bugdoy" and "Skifyanka".

The number of amino acids. The resistance of plants to unfavorable factors and their ability to adapt depends on the specific features of the physiological and biochemical processes that take place in them. Consequently, there is a need to study the physiological mechanisms of the level of resistance of plants grown in each specific state. In this direction, the type and amount of free amino acids are important.

All studied varieties differed from each other in the total amount of amino acids. The total amount of amino acids in the leaves of Intensive wheat was higher than in other varieties, and the least in Skifyanka, and Sanzar-8 and Unumli-bugdoy were intermediate (Table 5).

In early winter (December 1), it was observed that the differences between cultivars in total amino acids were less and more between planting periods. In all cultivars studied, it was found that plants sown on October 15th had relatively high levels of amino acids, while plants sown later than November 15th were deficient in amino acids.

In the middle of winter (January 15), the total amount of amino acids was high in all variant varieties, and the number of seeds was even higher in the plants sown on October 15.

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Even at the end of winter (March 1), it was noticed that the total amount of amino acids in wheat varieties was high at all sowing dates.

According to data obtained in the middle of winter (January 15) and at the end (March 1), wheat varieties significantly differed from each other in the total amount of amino acids. In the middle of winter, the highest amount of amino acids is 78.6-118.3 mg / g for the Sanzar-8 variety, 72.5-113.2 mg / g for the Intensive variety, 70.8-107 mg / g for the variety Fertile Wheat. 0 mg / g, the smallest value was in the "Skifyanka" variety and amounted to 65.9-101.7 mg / g.

Table 5.
The total amount of free amino acids in wheat varieties
(mg / g in dry mass, 2017-2020)

Sowingdates	Varieties	Developmentphases		
		1 December	15 January	1 March
15 September	«Sanzar-8»	77,6	88,3	87,8
	«Skifyanka»	74,4	77,4	76,6
	«Intensive»	80,7	84,2	83,1
	«Unumli-bugdoy»	80,0	83,1	83,0
30 September	«Sanzar-8»	85,6	101,4	100,7
	«Skifyanka»	80,2	85,9	83,3
	«Intensive»	84,3	96,2	90,4
	«Unumli-bugdoy»	83,7	90,1	87,5
15 October	«Sanzar-8»	100,7	119,3	114,2
	«Skifyanka»	86,7	101,7	96,4
	«Intensive»	97,1	113,2	109,1
	«Unumli-bugdoy»	95,0	107,0	102,7
30 October	«Sanzar-8»	80,3	90,8	88,4
	«Skifyanka»	75,4	80,4	76,3
	«Intensive»	80,7	87,2	84,6
	«Unumli-bugdoy»	78,2	84,3	81,2
15 November	«Sanzar-8»	68,9	80,8	79,6
	«Skifyanka»	68,0	70,4	67,1
	«Intensive»	70,1	75,7	73,8
	«Unumli-bugdoy»	69,2	73,5	71,1
30 November	«Sanzar-8»	-	78,6	80,0
	«Skifyanka»	-	65,9	67,7
	«Intensive»	-	72,5	74,3
	««Unumli-bugdoy»»	-	70,8	72,1

According to the data obtained, it was found that all studied varieties differed from each other in the number of amino acids. In winter, the leaves of the wheat cultivars had relatively high levels of alanine, valine, leucine, asparagine, and glutamic acid. By mid-winter (January 15), the number of these compounds increased even more. As a result, there is a difference between the varieties in their total quantity: 57.85 mg / g in the Sanzar-8 variety, 56.22 mg / g in the Intensive variety, 52.00 mg / g in the Unumli-bugdoy variety and "Scythian". “It was 49.4 mg / g. The amount of these amino acids was relatively high even at the end of the winter period (March 1). In particular, it was found that wheat varieties had a higher amount of proline amino acids during winter than the amino acids mentioned above.

The amount of methionine, tryptophan, and proline was lower than other amino acids in late spring and early winter compared to spring (March 1), while the amount of methionine and tryptophan remained virtually unchanged in winter. However, the content of the amino acid

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proline in the leaves of wheat varieties in the middle of winter ("Skifyanka") is 5.0 times higher, and in "Sanzar-8" - 7.1 times.

Thus, the amount of amino acids in wheat varieties varied depending on varietal characteristics and sowing time. The total amino acids were found to be relatively high in wheat varieties planted at the right time, and low in early and especially late-planted varieties. The total amount of amino acids during the overwintering of varieties, including the maximum content of proline in the Sanzar-8 wheat variety, determines the winter hardiness of this variety. According to such characteristics, "Intensive" and "Unumili-wheat" are in second place, and in the last - "Scythian".

The amount of soluble carbohydrates. It has been proven that the amount of carbohydrates formed and accumulated in the tissues of green plants is one of the important indicators that determine their resistance to cold and unfavorable winter factors.

Studies have shown that the winter hardiness of the biologically autumn varieties "Sanzar-8", "Scythian" and the biological wall "Intensive", "Unumli-wheat" depends on the sowing time. For binding, the amount of soluble carbohydrates - glucose and sucrose - was determined in the storage junction of wheat varieties planted at different times.

Based on the data obtained, it was found that the amount of soluble sugars in the storage seam varies depending on the sowing time, as well as the biological characteristics of varieties. In all plantings, the amount of sucrose in the storage seam was, on average, 2 times higher than that of glucose. If we pay attention to the fact that sucrose is a carbohydrate that performs the main transport function, we will understand that this is of great importance, that is, metabolic processes are active.

Significant differences were observed between cultivars in terms of the total sugar content: the Sanzar-8 wheat had the highest levels of glucose and sucrose at the accumulation stage, while the Skifianka wheat had the lowest levels at all sowing periods.

Such differences, identified in the fall between wheat varieties and planting times, persisted even in early winter and spring. However, data obtained in the middle of winter (January 15) show that the amount of water-soluble carbohydrates in the accumulation joints of plants was 1.2-1.5 times higher than in autumn, depending on the planting period. In turn, it was found that the amount of glucose in all varieties and sowing periods during the winter was up to 2 times higher than sucrose. The fact that glucose is significantly higher than sucrose and that more soluble sugars accumulate in the cells in general is of great importance during the wintering process. Such changes are of positive significance, indicating an increase in frost resistance of wheat varieties. During this period, the highest amount of glucose and sucrose seeds was observed in the variety "Sanzar-8" sown on October 15-30.

Depending on the sowing seasons of wheat varieties, the amount of glucose and sucrose in their accumulation joint decreased from winter to spring. At the beginning of spring, the amount of sucrose was significantly higher than that of glucose. This process is associated with the activation of metabolic processes as a result of an increase in air temperature. The result was the formation of new stems and roots.

Thus, among the studied wheat varieties, Sanzar-8 was found to have a relatively high solubility in the body and winter hardiness. According to these indicators, the variety "Skifyanka" is the last, "Intensivnaya" and "Unumli-bugdoy" is in the middle.

Yield of wheat varieties. Determining the optimal sowing dates under certain natural conditions in which winter wheat varieties are grown is a guarantee of high yields.

In the experiment, according to the sowing dates and biological characteristics of wheat varieties, the average grain yield was 26.9-59.9 ts / ha (Table 6).

The yield of biological autumn wheat variety "Sanzar-8" was on average from 33.3 ts / ha (sown on November 30) to 59.9 ts / ha (when sown on October 15), depending on the sowing period. The grain yield of the plants whose seeds were sown in mid-October was the highest, with a 56.7% increase compared to the variants sown in mid-September (September 15). When this variety was planted late, ie in late November (November 30), on the contrary, the yield

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decreased by 12.8% -4.9 ts / ha compared to the variant sown in mid-September. The yield of the biological autumn variety Skifyanka was also higher in the variant sown on October 15, averaging 41.9 ts / ha. In the variant where the seeds were sown on November 30, its amount was the lowest, averaging 27.9 ts / ha. The yield of Skifyanka was significantly lower than that of Sanzar-8 at all planting periods.

Table 6.
The effect of sowing times on the yield of wheat varieties

Sowingdates	Productivity, ts/ha			
	2018 year	2019 year	2020 year	Average
«Sanzar-8»				
15 September	38,4	37,3	39,0	38,2
30 September	52,4	50,7	56,7	53,3
15 October	58,5	58,4	62,8	59,9
30 October	44,3	42,8	46,9	44,7
15 November	40,8	40,1	43,2	41,4
30 November	34,0	30,9	35,0	33,3
P%	2,79	1,27	2,84	
$ЭКФ_{05}$	3,63	4,57	3,15	
«Skifyanka»				
15 September	31,2	30,3	33,5	31,7
30 September	40,6	37,5	40,4	39,5
15 October	41,4	40,6	43,7	41,9
30 October	32,2	32,0	34,9	33,0
15 November	28,8	28,1	30,3	29,1
30 November	27,6	27,2	28,6	27,8
P%	2,45	3,48	3,19	
$ЭКФ_{05}$	4,34	4,43	3,20	
«Intensive»				
15 September	33,4	31,0	37,6	34,0
30 September	41,3	35,3	43,4	40,0
15 October	47,8	42,7	50,5	47,0
30 October	38,5	37,2	40,3	38,7
15 November	35,6	31,8	38,2	35,2
30 November	31,9	29,6	34,5	32,0
P%	3,86	2,26	2,71	
$ЭКФ_{05}$	4,03	4,23	3,83	
«Unumli-bugdoy»				
15 September	32,9	29,5	34,1	32,2
30 September	42,0	38,4	44,3	41,6
15 October	47,0	41,5	49,2	45,9
30 October	38,9	34,6	42,3	38,6
15 November	32,5	27,9	33,0	31,1
30 November	26,8	22,3	28,5	26,9
P%	3,46	3,24	2,98	
$ЭКФ_{05}$	3,53	3,14	4,08	

It was found that the yield of both Intensivnaya and Unumili-wheat varieties depends on the sowing period. In these varieties, too, relatively high yield seeds were observed in the

variants sown in mid-October (October 15), while the lowest yields were observed in the variants sown in late November (November 30).

According to the analysis, changes in temperature during the winter in wheat varieties also affect the physiological properties of plants, growth and development processes and subsequent yield. It was found that the grain yield of wheat varieties obtained in years when the average and minimum temperatures in winter were relatively low (2017-2018) and high (2019-2020) differed significantly from each other, that is, the yield of wheat varieties in 2018 was lower than in 2020. Such a decrease in yield was noted at all planting dates.

Thus, in the conditions of typical gray soils of the Samarkand region, the optimal time for sowing biological autumn and round wheat varieties is the first half of October. Sowing earlier than the optimal time (September 15) or late (November) leads to a sharp decrease in grain yield.

DISCUSSIONS

The life of green plants is constantly dependent on photosynthetic activity, which is characterized by the accumulation of organic matter and the release of molecular oxygen into nature. The ability of plants to accumulate dry matter during the growing season of agricultural crops is one of the important indicators that determine the level of their photosynthetic productivity. Therefore, all measures taken in agriculture should be aimed at optimizing the photosynthetic activity of crops.

The resistance and adaptability of plants to unfavorable factors depends on the specifics of the physiological and biochemical processes taking place in them. Therefore, there is a need to study the physiological mechanisms of plant resistance in each specific situation. In this direction, the type and amount of free amino acids are important.

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