

Article

# Study of the Dependence of Biological Dry Matter Accumulation on Seed Sowing Dates and Rates in Winter Triticale Varieties

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**Abstract:** This article provides information on the nutritional value of triticale, uses and species of triticale, history of origin and distribution, and results of the studied of the dependence of biological dry matter accumulation on seed sowing dates and rates in winter triticale varieties in the condition of the republic of Uzbekistan.

**Keywords:** Triticale, Hybrid Grain, Variety, Norman, Armug'On-60, Accumulation, Biological Dry Matter, Seed, Sowing Dates, Rates, Kg, Ha

## Introduction

Triticale is a hybrid of wheat (*Triticum*) and rye (*Secale*) and was first bred in laboratories during the late 19th century in Scotland and Germany. Commercially available triticale is almost always a second-generation hybrid, i.e., a cross between two kinds of primary triticales [1]. Triticale is the common name and the accepted botanical designation (*Triticosecale*) for a hybrid grain that crosses wheat (*Triticum*) and rye (*Secale*). It is a man-made cereal, developed for its high yield, disease resistance, and nutritional value, serving as a key fodder crop and an emerging ingredient in human food. [2].

Triticale combines the yield potential and grain quality of wheat with the disease and environmental tolerance (including soil conditions) of rye. Only recently has it been developed into a commercially viable crop [3]. Depending on the cultivar, triticale can more or less resemble either of its parents. It is grown mostly for forage or fodder, although some triticale-based foods can be purchased at health food stores and can be found in some breakfast cereals [4].

**Nutritional Value of Triticale.** Every 100 g of Triticale contains 336 calories of energy, 2.09 grams of total fat ( out of which saturated fatty acids is 0.366 g, monounsaturated fatty acids is 0.211 g and polyunsaturated fatty acids is 0.913 g), carbohydrate is 72 mg, protein is 13 mg, folate is 73.00 mcg, niacin is 1.430 mg, Pantothenic acid is 1.323 mg, Riboflavin is 0.134 mg.

Triticale nutritional content includes thiamine around 0.416 mg, Vitamin B6 is 0.138 mg, Vitamin E is 0.90 mg, Alpha Tocopherol is 0.90 mg, Calcium is 37.00 mg, Copper is 0.457 mg, Iron is 2.57 mg, Magnesium is 130.00 mg, Manganese is 3.210 mg, Phosphorus is 358.00 mg, Potassium is 332.00 mg, Sodium is 5.00 mg and Zinc is 3.45 mg. [5].

**Uses of Triticale.** Being a good source of many vital nutrients, triticale is used as breakfast cereal. Flour from triticale is used in making breads and other bakery items. It is also used as forage and silage crops, as an animal feed, as a winter grazing crop[2].

**Species.** Triticale hybrids are currently classified by ploidy into three nothospecies:[12]

- × *Triticosecale semisecale* (Mackey) K.Hammer & Filat. - tetraploid triticale. Unstable, but used in breeding bridging. Includes the following crosses:
  - *Triticum monococcum* × *Secale cereale*, genome AARR;
  - Alternative crosses, genome ABRR (mixogenome A/B).
- *Triticosecale neoblaringhemii* A.Camus - hexaploid triticale. Stable, currently very successful in agriculture. May be produced by *Secale cereale* × *Triticum turgidum*, genome AABBRR.
- *Triticosecale rimpau* Wittm. – octaploid triticale. Not completely stable, mainly historical importance. May be produced by *Secale cereale* × *Triticum aestivum*, genome AABBDDRR[6].

The current treatment follows the Mac Key 2005 treatment of *Triticum* using a broad species concept based on genome composition. Traditional classifications used a narrow species concept based on the treatment of wheats by Dorofeev *et al.*, 1979, and hence produced many more species names. The genome notation follows Taxonomy of wheat § Genome, with the rye genome notated as R.[7].



**Origin and producers:** The first successful hybrid was produced in 1875. [8]. Triticale is often known simply by its botanical name or as a hybrid cereal [9].

Poland is the Table 1. world's leading producer of triticale, producing over 5 million tonnes annually and accounting for roughly 38% of global production. Over 90% of the world's triticale is grown in Europe, with Poland, Germany, France, Belarus, and Spain being the top producers. The crop is popular in European agriculture as a high-yield, low-input animal feed source [10].

### TOP TRITICALE PRODUCER COUNTRIES

in 2022

Numbers in million tonnes

1.		Poland	5.44 (38.42%)
2.		Germany	1.93 (13.63%)
3.		France	1.61 (11.37%)
4.		Belarus	1.19 (8.4%)
5.		Spain	0.63 (4.45%)
6.		China	0.39 (2.75%)
7.		Turkey	0.32 (2.26%)
8.		Russia	0.31 (2.19%)
9.		Austria	0.29 (2.05%)
10.		Czech Republic	0.21 (1.48%)
<b>World total</b>			<b>14.16</b>

Source: UN [Food and Agriculture Organization](https://www.fao.org)

["FAOSTAT".www.fao.org](https://www.fao.org). Retrieved 5 March 2024.

## Materials and Methods

The scientific research was carried out at the Tashkent State Agrarian University Agricultural Research and Training Experimental Farm. The experimental farm was located in the upper stream of the Chirchik River, 481 m above sea level, 41° 11' N north latitude and 69° 31' E east distance in Kibray district of Tashkent province. The climatic conditions of Tashkent province are continental and arid. However, the climatic conditions are specific, the air temperature decreases from the plains of the region to the mountainous areas, and the amount of atmospheric precipitation increases. In the plains and hills, the temperature of the winter months is unstable, fluctuating over the years. The coldest month in the region is January, with temperatures ranging from 0 °C to 29 °C. The amount of atmospheric precipitation in the region also varies. In the plains, the annual precipitation is 261-316 mm, in the foothills 366-435 mm, and in the mountains 700-895 mm. The sum of the useful seasonal temperatures required for the care of field crops in April-October averages 2200-2400 °C and the duration of non-cold days averages 235-240 days. The highest rainfall is in winter and spring, averaging 400-500 mm. The average annual rainfall is 510-520 mm, so it is recommended to irrigate field crops. The soil of the experimental farm was a typical gray soil that has been irrigated since ancient times. The soil contains 0.8-1.0% humus, about 0.058-0.089% nitrogen, about 0.141-0.184% phosphorus and about 0.154-0.148% potassium. The Table 2. soil was not saline. This soil differs in water permeability, the complexity of softening. Groundwater was located in a deep layer of 15-18 m. For irrigation, the experimental farm used water from the Gray Canal, which flows through the northern part.[11]

**Table 1.** Preliminary agrochemical indicators of experimental field soils

Soil depth, sm	General forms of nutrients, %			General forms of nutrients, mg/kg		
	humus	nitrogen	phosphorus	N-NO <sub>3</sub>	P <sub>2</sub> O <sub>5</sub>	K <sub>2</sub> O
0-30	0.920	0.083	0.152	4.7	47.1	180.7
30-50	0.715	0.065	0.134	3.1	40.3	140.0

In conducting field and laboratory experiments, phenological observations, biometric measurements and yield determination, the methodological manuals "Methods of State Variety of Agricultural Cultivation", "Methods of Field Experiments", "Scientific Research in Botany" were used. Agrophysical and agrochemical analysis of soils was carried out on the basis of "Methods of agrochemical, agrophysical and microbiological research in pollinated cotton fields". The data obtained in the field experiments were analyzed mathematically statistically using Microsoft Excel program based on the method of B.A. Dospikhov.

Field experiments were conducted in the conditions of typical gray soils of the Tashkent State Agrarian University agricultural research and educational experimental farm during the 2017-2020 yy. The field experiments are annually tested and evaluated by a special commission of the Uzbek State Agrarian University and the Tashkent State Agrarian University. Ammonium nitrate from nitrogen fertilizers (NH<sub>4</sub>NO<sub>3</sub> - 33-34% nitrogen), amorphous from phosphorus fertilizers (NH<sub>4</sub>H<sub>2</sub>PO<sub>4</sub>-11-12% nitrogen, 46-60% phosphorus), potassium chloride from potassium fertilizers (KCl-57% potassium) were used to feed peanuts. Nitrogen in amorphous was taken into account in determining the annual norms of mineral fertilizers.

## Results and Discussion

In cereal crops, as in other field crops, it has been found that the accumulation of biological dry matter varies inextricably with the development phases. In winter cereal crops, including triticale, the accumulation of biological dry matter in plants varies depending on a number of factors: the rate, method, and timing of sowing, the density of seedlings per hectare, the rate of feeding with local and mineral fertilizers, irrigation measures, and the timely implementation of measures to combat plant diseases and pests.

In field experiments conducted in the typical gray soil-climatic conditions of the Tashkent region, phenological observations and calculations were carried out to study the effect of sowing dates

and rates on the accumulation of biological dry mass in the winter tritikale varieties "Norman" and "Armugon-60".[12]

In the field experiments, plant samples were taken from ten plants at each developmental phase, from three points of the variants and thinnings for tritikale varieties. The obtained plant samples were divided into morphological parts (root, stem, leaf, spike) and the dry mass accumulation rate was determined using the electronic weighing method. Although similar data were obtained for the winter tritikale varieties studied in the experiments, it was observed that the sowing dates and norms of tritikale varieties significantly affected the processes of biological dry mass accumulation.

When analyzing the biological dry mass accumulation of seedlings maintained in option 1, in which 4.0 million germinating seeds per hectare of winter tritikale varieties were sown during the first sowing period of September 20-25, the biological dry mass accumulation of seedlings was 0.140 g in the germination phase, 0.531 g in the tillering phase, 1.363 g in the tuberous phase, 3.586 g in the heading phase, 4.455 g in the flowering phase, and 5.322 g in the waxy ripening phase of the ripening phase. [13]

In field experiments, it was determined that the biological dry mass accumulation of one plant in the winter tritikale variety "Armugon-60" was equal to 5.788 g during the development phases of the first sowing period of September 20-25, when 4.0 million germinating seeds were sown per hectare. The second option was used to grow the following plants: 0.162 g in the germination phase, 0.542 g in the tillering phase, 1.367 g in the stem elongation phase, 3.650 g in the spiking (heading) phase, 4.559 g in the flowering phase, and 5.788 g in the waxy ripening phase.

The second sowing period was October 10-15, when winter tritikale varieties were sown at the rate of 5.0 million germinating seeds per hectare. In the 9<sup>th</sup> and 10<sup>th</sup> variants, the following indicators were observed for the accumulation of biological dry mass per plant: including 0.225-0.149 g in the germination phase, 0.441-0.456 g in the tillering phase, 1.098-1.161 g in the stem elongation phase, 3.075-3.172 g in the spiking (heading) phase, and 4.738-5.144 g in the waxy ripening phase of the ripening phase.[14]

During the same period, in the Table 3. 11<sup>th</sup>-12<sup>th</sup> variants planted at the rate of 6.0 million seeds per hectare, the biological dry mass accumulation of one plant in the tritikale varieties "Norman" and "Armugon-60" was determined by development phases, and it was found that the varieties were 0.139-0.154 g in the germination phase, 0.4161-0.442 g in the tillering phase, 0.961-1.019 g in the stem elongation phase, 2.679-2.800 g in the spiking (heading) phase, and 4.277-4.695 g in the waxy ripening phase.

**Table 2.** Effect of sowing dates and rates on biological dry mass accumulation of tritikale varieties, (3 year average)

№	Name of tritikale varieties	Seed sowing rates, mln seeds per hectare	The biological dry mass accumulation of seedlings maintained in option 1, gramm					
			germination of seeds	tillering phase	stem elongation phase	spiking (heading) phase	flowering phase	waxy ripening phase
			20-25 September					
1	Norman	4,0	0,140	0,531	1,363	3,586	4,455	5,322
2	Armug'on-60		0,162	0,542	1,367	3,650	4,559	5,788
3	Norman	5,0	0,159	0,494	1,243	3,137	4,151	4,841
4	Armug'on-60		0,174	0,512	1,303	3,264	4,444	5,446
5	Norman	6,0	0,156	0,460	1,084	2,801	3,770	4,482
6	Armug'on-60		0,167	0,478	1,144	2,899	4,160	4,969
			10-15 October					

7	Norman	4,0	0,127	0,473	1,244	3,442	4,110	5,226
8	Armug'on-60		0,134	0,485	1,251	3,546	4,210	5,663
9	Norman	5,0	0,225	0,441	1,098	3,075	3,798	4,738
10	Armug'on-60		0,149	0,456	1,161	3,172	4,090	5,144
11	Norman	6,0	0,139	0,416	0,961	2,679	3,472	4,277
12	Armug'on-60		0,154	0,442	1,019	2,800	3,808	4,695
01-05 November								
13	Norman	4,0	0,115	0,454	1,204	3,413	4,004	5,253
14	Armug'on-60		0,131	0,476	1,207	3,505	4,160	5,724
15	Norman	5,0	0,131	0,419	1,119	3,015	3,687	4,769
16	Armug'on-60		0,140	0,418	1,132	3,114	3,962	5,079
17	Norman	6,0	0,119	0,381	0,969	2,644	3,381	4,240
18	Armug'on-60		0,121	0,379	0,973	2,702	3,618	4,576

The first sowing of winter triticale seeds of the Norman variety was carried out on September 20-25, at a rate of 4.0 million seeds per hectare. When analyzed in terms of development phases, the biological dry mass accumulation of seedlings maintained in option 1 was 4.1 s/ha in the germination phase, 15.5 s/ha in the tillering phase, 39.8 s/ha in the stem elongation phase, 104.7 s/ha in the spiking (heading) phase, 130.1 s/ha in the flowering phase, and 155.4 s/ha in the wax ripening phase of the ripening phase.

In the winter triticale variety "Armugon-60", the first sowing was carried out on September 20-25, with 4.0 million germinating seeds per hectare. The biological dry mass accumulation of seedlings maintained in the 2nd variant was as follows by development phases: 4.8 s/ha in the germination phase, 16.1 s/ha in the tillering phase, 40.6 s/ha in the stem elongation phase, 108.4 s/ha in the spiking (heading) phase, 135.4 s/ha in the flowering phase, and 171.9 s/ha in the waxy ripening phase.

It was noted that the accumulation of biological dry mass in variants 7 and 8, planted at the rate of 4.0 million germinating seeds per hectare during the second sowing period of October 10-15, was relatively low: in the germination phase, 3.6-3.9 s/ha, in the tillering phase, 13.4-14.1 s/ha, in the stem elongation phase, 35.2-36.4 s/ha, in the spiking (heading) phase, 97.4-103.2 s/ha, and in the wax ripening phase of the ripening phase, 147.9-164.8 s/ha.

The biological dry mass accumulation of seedlings grown in option 5, where the first sowing of the winter triticale variety "Norman" was carried out between September 20-25, was analyzed in terms of development phases. In the 5th variant of the experiment, the following was observed: in the germination phase, 6.5 s/ha, in the tillering phase, 19.2 s/ha, in the stem elongation phase, 45.2 s/ha, in the spiking (heading) phase, 116.8 s/ha, in the flowering phase, 157.2 s/ha, in the waxy ripening period of the ripening phase, 186.9 s/ha, in the 6th variant, in the first sowing period of the winter triticale variety "Armugon-60", 6.0 million germinating seeds per hectare, the biological dry mass accumulation of the seedlings cultivated by the development phases is as follows: in the germination phase, 7.1 s/ha, in the tillering phase, 20.3 s/ha, in the stem elongation phase, 48.6 s/ha, in the spiking (heading) phase, 123.2 s/ha, in the flowering phase, 176.8 s/ha, in the waxy ripening period of the ripening phase it was determined to be 211.2 s/ha. It can be clearly seen from the table data that the rate of sowing tritikale seeds had a significant impact on the accumulation of biological dry mass per hectare.

The second sowing period, October 10-15, was observed in variants 9<sup>th</sup> and 10<sup>th</sup>, where winter triticale varieties were sown at the rate of 5.0 million germinating seeds per hectare. The following indicators were observed for the accumulation of biological dry mass: in the germination phase, 4.8-5.3 s/ha, in the tillering phase, 15.3-16.2 s/ha, in the stem elongation phase, 38.1-41.2 s/ha, in the spiking (heading) phase, 106.7-112.6 s/ha, and in the wax ripening phase of the ripening phase, 164.4-182.6 s/ha.

During the same period, in the Table 4. 11<sup>th</sup>-12<sup>th</sup> variants, planted at the rate of 6.0 million seeds per hectare, the accumulation of biological dry mass in the "Norman" and "Armugon-60" varieties of triticale was determined by development phases, and it was determined that the accumulation of biological dry mass in the varieties was 5.7-6.4 s/ha in the germination phase, 17.1-18.4 s/ha in the tillering phase, 39.5-42.8 s/ha in the stem elongation phase, 110.1-116.5 s/ha in the spiking (heading) phase, and 175.8-195.3 s/ha in the waxy ripening phase.

**Table 3.** The effect of sowing dates and norms on the biological dry mass accumulation of tritikale varieties, (3year average)

№	Name of tritikale varieties	Seed sowing rates, mln seeds per hectare	The biological dry mass accumulation of seedlings, s/ha.					
			germination of seeds	tillering phase	stem elongation phase	spiking (heading) phase	flowering phase	waxy ripening phase
20-25 September								
1	Norman	4,0	4,1	15,5	39,8	104,7	130,1	155,4
2	Armug'on-60		4,8	16,1	40,6	108,4	135,4	171,9
3	Norman	5,0	5,7	17,7	44,5	112,3	148,6	173,3
4	Armug'on-60		6,3	18,6	47,3	118,5	161,3	197,7
5	Norman	6,0	6,5	19,2	45,2	116,8	157,2	186,9
6	Armug'on-60		7,1	20,3	48,6	123,2	176,8	211,2
10-15 October								
7	Norman	4,0	3,6	13,4	35,2	97,4	116,3	147,9
8	Armug'on-60		3,9	14,1	36,4	103,2	122,5	164,8
9	Norman	5,0	7,8	15,3	38,1	106,7	131,8	164,4
10	Armug'on-60		5,3	16,2	41,2	112,6	145,2	182,6
11	Norman	6,0	5,7	17,1	39,5	110,1	142,7	175,8
12	Armug'on-60		6,4	18,4	42,4	116,5	158,4	195,3
01-05 November								
13	Norman	4,0	3,1	12,2	32,4	91,8	107,7	141,3
14	Armug'on-60		3,6	13,1	33,2	96,4	114,4	157,4
15	Norman	5,0	4,3	13,8	36,8	99,2	121,3	156,9
16	Armug'on-60		4,8	14,3	38,7	106,5	135,5	173,7
17	Norman	6,0	4,6	14,8	37,6	102,6	131,2	164,5
18	Armug'on-60		4,9	15,4	39,5	109,7	146,9	185,8

The biological dry mass accumulation of seedlings cultivated in the third sowing period of the studied winter triticale variety "Norman" in the period of November 1-5, 4.0 million germinating seeds per hectare, taking into account the development phases, in the 13<sup>th</sup> variant of the experiment, 3.1 s/ha in the germination phase, 12.2 s/ha in the tillering phase, 32.4 s/ha in the stem elongation phase, 91.8 s/ha in the spiking (heading) phase, 107.7 s/ha in the flowering phase, and 141.3 s/ha in the wax ripening phase of the ripening phase.

In the 14<sup>th</sup> variant of the winter triticale variety "Armugon-60" in the third sowing period, the biological dry mass accumulation of seedlings cultivated in the variant of 4.0 million germinating seeds per hectare, according to the development phases, is as follows: including in the germination phase 3.6 s/ha, 13.1 s/ha in the tillering phase, 33.2 s/ha in the stem elongation phase, 96.4 s/ha in the spiking (heading) phase, 114.4 s/ha in the flowering phase, and 157.4 s/ha during the waxy ripening period of the ripening phase. Analysis of the table data shows that sowing dates significantly affect the

accumulation of biological dry mass per hectare of land, in direct connection with the sowing rates of triticale seeds.

The third sowing period, November 1-5, saw the following biological dry mass accumulation in the 15<sup>th</sup>-16<sup>th</sup> variants, where winter triticale varieties were sown at the rate of 6.0 million germinating seeds per hectare: including 4.3-4.8 s/ha in the germination phase, 13.8-14.3 s/ha in the tillering phase, 36.8-38.7 s/ha in the stem elongation phase, 99.2-106.5 s/ha in the spiking (heading) phase, and 156.9-173.7 s/ha in the waxy ripening phase of the ripening phase.

During the same period, in the 17<sup>th</sup>-18<sup>th</sup> variants, planted at the rate of 6.0 million seeds per hectare, the biological dry mass accumulation of triticale varieties "Norman" and "Armugon-60" was determined by development phases, and was 4.6-4.9 s/ha in the germination phase, 14.8-15.4 s/ha in the tillering phase, 37.6-39.5 s/ha in the stem elongation phase, 102.6-109.7 s/ha in the spiking (heading) phase, and 164.5-185.8 s/ha in the waxy ripening phase of the ripening phase.[15]

## Conclusion

From the results of the scientific research obtained in the research work, it can be seen that, while maintaining the same regularity in the studied triticale varieties: "Norman" and "Armugon-60", it was determined that the rates and dates of sowing seeds affect the accumulation of biological dry mass of plants.

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