International Journal of Genetic Engineering 2023, 11(2): 19-21
DOI: 10.5923/j.ijge.20231102.02

Nutritionalvalue of Triticale Varieties in the Conditions of Khorezm Region

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Abstract The article highlights an analysis of the total protein and amino acid content of triticale varieties grown in moderately saline soil conditions of the Khorezm region. According to the results of the analysis on the non-exchangeable amino acids of the 4 triticale varieties, it was found that the content of lysine is high in the Sardar and GulDU varieties (0.15 and 0.14 mg/g), while it is almost the same amount in the Dostlik and Farhod varieties with 0.05 and 0.07 mg/g respectively.

Keywords Triticale, Biomass, Grains, Gluten, Amino acid content

1. Introduction

Triticale is used for three directions (forage, baking bread, green fodder) in agriculture. Triticale is a unique component for the preparation of fodder. Triticale grain is recommended to replace conventional feeds (wheat, barley, etc.) by 50% in livestock and poultry feed. Triticale shows good nutritional benefits in combination with barley [3; p. 29].

Another important thing is the use of green mass of triticale in animal husbandry. This plant is used for making grass flour, pellets and silage. Feeding large cattle with green mass with a high percentage of triticale allows to increase the amount of milk and its fat content, as well as to reduce the need for feed [5; p. 544, 3; p. 29].

Another important advantage of winter triticale is to provide livestock with green mass in early spring. Also, the high amount of carotenoid and sugar content of triticale green mass makes it a nutritious feed for livestock [6; 41-43 p]. In Spain, Hungary, Poland, Canada and the USA, triticale is actively cultivated as a pasture plant.

The protein in the grain of cereal crops is distinguished by the composition of non-exchangeable amino acids. They determine the nutritional value of the grain. One of these amino acids is lysine. Due to the high content of lysine in its composition (3%), triticale grain is more nutritious than wheat grain [1; 98-109 p].

As a result of feeding 60-120-day-old young chickens with the required amount of standard feed and 50% ground triticale grain, the weight of chickens in the experimental group increased up to 16%, and the feed consumption per 1 kg of added weight was reduced to 0.9 g of feed unit compared to the control group [2; 23-25 p].

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Received: May 27, 2023; Accepted: Jun. 16, 2023; Published: Jun. 21, 2023
Published online at http://journal.sapub.org/ijge

2. Materials and Methods

As objects of research, triticale varieties such as Sardar, GulDU, Dostlik, Farhod obtained from the Gallaorol Scientific-Experimental Station, Scientific Research Institute of Cereals and Legumes were grown and phenological, as well, biometric experiments were conducted on them in the fields of the Khorezm Scientific-Experimental Station of the Scientific Research Institute of Cotton Selection, Seeding and Cultivation during 2017-2020.

In the experiment, the varieties were randomly placed and planted in 3 replications. 1300 seeds were sown in an area of 2 meters wide and 5 meters long (10 m^2) with 15 cm between rows and 5 cm between plants.

In order to study the dynamics of plant nutrient uptake, plant specimens were taken from 0.25 m^2 of all variants of three replications in all development periods of triticale. The plant obtained in all periods of growth and development was separated into parts (leaf, stem, spike) and dried in a thermostat at 65-70℃ for 24 hours. Based on these data, the dry matter accumulation of the plant was calculated.

Triticale plant specimens in 1 m^2 were taken from each unit. After the obtained specimens were dried in the shade, the total biomass and the total number of spiked stems in 1 m^2 were determined. Using these data, quality indicators of grain yield (protein, exchangeable and non-exchangeable amino acid amounts) were determined in all variants of three replications.

3. Results of the Experiment and Their Analysis

In our experiments, the above-ground biomass accumulation dynamics of triticale varieties studied over the last three years were analyzed. The first analysis were conducted on March 18, when the specimens were at the beginning of the tillering phase. In this case, 15 plants of each variety were taken, weighed on an electronic scale in laboratory conditions, and the obtained results were statistically analyzed per hectare. Experiments were repeated every 15 days.

In our experiments conducted in the 2018-2019 vegetation year, the analysis of the dynamics of above-ground biomass accumulation in 4 varieties of triticale coincided with April 9, 2019, and by this day, the Sardar variety of triticale showed the highest indicator of collected biomass - 846±58.3 kg/ha, and the rest of the varieties showed the average results- 550 to 650 kg. When the next analysis was carried out on April 23, the highest indicator was observed in Dostlik varieties, in which an increase of 2656±42.2 kg/ha was observed, respectively. It was found that the intensive growth of biomass in all varieties of triticale coincided with the month of May, and in this month the above-ground biomass exceeded 10,000 kg per hectare in all specimens. The increase in biomass was observed in our analyzes in the specimens taken at the beginning of June, and among triticale varieties, the highest indicator was observed in GulDU and Farhod varieties, which were 13326±285.9 and 11080±693.7 kg, respectively.

According to the research results, in the conditions of Khorezm region, in the first ten days of April, the average biomass was estimated at 500-600 kg/ha, by the end of April, this indicator increased to 2000-2500 kg/ha, and by the end of May, it was observed that the biomass increased intensively in all varieties, and by the end of this month. It can be seen that the growth phase of the plants stopped and the ripening phase began, in which the plant lost a certain amount of water and the main product was directed only to the ripening of the grain. (Table 1)

Table 1. 3-year above-ground biomass of triticale species, kg/ha

N	Species	2018 M±m	2019 M±m	2020 M±m	Average M±m
1	Sardor	8924,49 ±270,95	9543,8 ±547,7	9243,08 ±894,17	9237,12 ±570,94
2	GulDU	10165,46 ±379,33	11840,7 ±879	7767,43 ±979,66	9924,53 ±745,99
3	Dostlik	7904,42 ±208,55	7662,2 ±423,1	7787,68 ±442,06	7784,76 ±357,9
4	Farhod	8478,23 ±200,47	9563,7 ±133,7	8353,1 ±169,25	8798,34 ±167,81

In 2019, the arrival of cool weather and precipitation in May led to the extension of the growing season of triticale varieties in Khorezm region, but in 2020, it was found that this period was slightly shortened. The peak period of dry mass accumulation of plants coincided with the end of May, and from the beginning of June, the plants began to turn yellow, and it was observed that the above-ground biomass also began to decrease. In 2020, the varieties that collected the most biomass were Sardar and Farhod varieties.

When analyzing the total amount of above-ground biomass of varieties studied for three years in Khorezm soil climatic conditions, it was observed that the above-ground biomass of all varieties was higher in 2019 compared to other years. One of the main reasons for this is the change of weather, the precipitation is more than in other years, and it may also depend on the extension of the vegetation period and agrotechnical activities.

It is known that the best use of climate, soil resources, as well as the effect of agrotechnical measures is found in cultivated areas with optimal leaf surface. The optimal leaf surface index for most legumes is 4-5, and the photosynthetic potential is 2 million m^2/ha per day.

The composition of proteins and amino acids is one of the most important characteristics of the biological value of grain. The composition of amino acids determines the biological importance of food and food products (according to the total amount of non-exchangeable amino acids) as a biochemical criterion [9; pp. 443-451].

Essential amino acids determine the nutritional value of triticale grain. Triticale protein is characterized by a well-balanced amino acid composition. Because the grain endosperm is deficient in some essential amino acids, the proteins are unbalanced and therefore less valuable. One of these amino acids is lysine. Triticale grain meets the demand for food due to its lysine content of about 3% higher than that of wheat grain [1; pp. 98-109] (Table 2).

Table 2. Total protein mass of Tritcale species, %

N	Species	2018	2019	2020	Average
1	Sardor	13,925	13,85	13,77	13,85
2	GulDU	14,135	14,06	13,98	14,06
3	Dostlik	13,035	12,96	12,88	12,96
4	Farhod	12,955	12,88	12,80	12,88

In our experiments, when the protein content of triticale grain was studied, the highest indicator was found to be 14.06% in the GulDU variety. It was found to be 12.96 and 12.88% in Dostlik and Farkhod varieties, respectively. The amount of protein in grain, its fractional composition, the presence of non-exchangeable amino acids, the amount and quality of gluten is an important technological criterion of the nutritional value of protein and the quality of grain. The protein content of triticale varies between 12-25%, as it depends on many factors, including soil and climatic

conditions, genotype, growing conditions, planting and harvesting time. [4; pp. 31-32].

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The amino acid composition of the varieties studied in the experiment can be seen in Table 3.

Table 3. Essential amino acid content of studied triticale varieties (mg/g)

Amino acids	Sardor	GulDU	Dostlik	Farhod
Threonine	0,24	0,24	0,28	0,22
Valin	0,12	0,12	0,07	0,08
Methionine	0,07	0,03	0,02	0,03
Isoleucine	0,21	0,22	0,04	0,06
Leucine	0,18	0,27	0,06	0,09
Histidine	0,11	0,19	0,03	0,04
Tryptophan	0,16	0,15	0,07	0,07
Phenylalanine	0,12	0,15	0,08	0,04
Lysine	0,15	0,14	0,05	0,07
Total	5,05	3,32	2,54	3,32
Average	0,25	0,17	0,13	0,17

Triticale has a high nutritional value due to its high protein content and better amino acid content than wheat [7; pp. 273-280]. Quality indicators of grain crops depend on growing conditions, agronomic and genetic factors. Therefore, it is appropriate to analyze the reaction of amino acids to these factors from the point of view of their composition. One of the important aspects of this analysis should be the concentration of amino acids that cannot be synthesized by the human and animal body. Few studies have been carried out in this direction, and only the effects of agronomic factors, lack of water, planting rate and herbicides [10; pp. 627-633] and mineral fertilizers[8; pp.16-25] have been studied. Soil salinity and amino acid content screening of triticale cultivars in saline environments have not been performed. The obtained results show that there is a great difference in amino acid composition among triticale varieties, but it was found that the amount of amino acids in its content, especially non-exchangeable amino acids, is higher than that of soft wheat. Among these amino acids, it was observed that threonine has almost the same amount in all varieties. The greatest difference was found in the amino acids leucine and isoleucine. Lysine, one of the most important amino acids, was found to be high in Sardar and GulDU varieties (0.15 and 0.14 mg/g), and almost the same amount in Dostlik and Farhod varieties (0.05 and 0.07 mg/g).

4. Conclusions

On average, the yield of triticale varieties was 9 tons per hectare in GulDU variety and 7 tons in Dostlik variety.

It is recommended to plant triticale plant instead of wheat in medium salinity areas, to plant Sardar and GulDU varieties, which are better than wheat grown for animal feed and are more productive and rich in amino acids.

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