RESEARCH ON THE BEHAVIOR OF SOME VARIETIES OF TRITICALE FOR SILOSIS, IN THE CONDITIONS OF THE BANAT PLAIN

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Abstract. Triticale is a cereal widely used lately due to its high production potential of both grains and biomass and its multiple uses in both animal feed (feed) and humans (flour, flakes, alcohol). The development of the livestock sector will also have the effect of increasing the areas cultivated with fodder plants. In addition to increasing the cultivated areas, a diversification of the assortment of crops with multiple uses is also desired. Increasing the production capacity per unit area, the study of several varieties (lines) of triticale (Triticosecale Witt.) And the selection of the most competitive contributing to the achievement of this objective. The purpose of this research is to study varieties (lines) of triticale (Triticosecale Witt.) In terms of their production capacity (green mass) and adaptation to pedo-climatic conditions specific to the Banat Plain, in order to enrich the current range of forage plants for silo, given the ever-increasing needs for feed in the context of a growing demand for animal products. We chose for this study nine varieties (lines) of triticale (Triticosecale Witt.), Noted: TMV1, TMV2, TMV3, TMV4, TMV5, TMV6, TMV7, TMV8, TMV9, in order to evaluate them in terms of the main characters that contribute to the achievement green mass production for silage and selection of the most valuable genotypes for breeding. The green mass productions of the nine varieties of triticale were directly influenced by the values of the studied productivity traits. Regarding the yield per plant, the character, the height of the plants contributes to the greatest extent; the TMV7 triticale variety has the highest value in terms of this production character. From the analysis of the synthesis of mass productions in order to ensilage obtained by the studied triticale varieties, in 2018 - 2020, it is found that the best production results, in the conditions of Timisoara were recorded by TMV7 registering an average production of 44.53 t.ha-1 green mass. Based on the results recorded, under the given conditions, the TMV7 triticale line is classified for future improvement programs.

Keywords: triticale, silage feed, breeding, plain.

INTRODUCTION

The development of the animal husbandry sector will also have the effect of increasing the areas cultivated with fodder plants (COJOCARIU et al, 2008). In addition to increasing the cultivated areas, a diversification of the assortment of crops with multiple uses is also desired.

Triticale is an amphidiploid between wheat and rye, a newly created species by hybridization between the two species. By obtaining it, an attempt was made to reunite in a single “organism”, the rusticity of rye with the productivity and quality of wheat, as well as the superior capitalization by this new species of the areas less favorable to wheat cultivation (ROMAN et al, 2001).

Triticale - Triticosecale Witt. is one of the most important cereals grown in Eastern and Northern Europe. A number of works in the field highlight the advantages of this crop for fodder, namely a high nutritional value, good winter hardiness and tolerance to environmental demands (EAPEN and RAO, 1985; TARGOŃSKA et al, 2012; COSKUN et al, 2014; COTUNA et al, 2019), such as low temperatures, drought and low claims on soil fertility (POCHIŞCANU et.al, 2016).

In silo triticale, from which the whole plant is used, the genotypes in which the production elements are best expressed together with the technology are considered for cultivation (PERCZE, 2006). Opt for large plants with many siblings and many leaves.

Research on triticale crop management in different harvesting systems has received little attention (WHITE et al, 2006). In the harvest of triticale crops for silage, hay, semi-hay, the vegetation phase matters a lot. (FILYA, 2003; KELES and DEMIRCI, 2011).

The twinning capacity is higher than that of wheat and close to that of rye, and the elongation of the straw begins at a temperature of 10 - 15ºC and proceeds similarly to rye (DRAGOMIR, 2009).

At maturity, in most varieties, in rainy weather the grains can sprout in the ear, which influences the quality and production of grains (ROMAN et al, 2001).

There is considerable scope for improving yields for this species, such as: the use of high quality seeds, new (hybrid) varieties and advanced management practices.
The purpose of this research is to study varieties (lines) of triticale (Triticosecale Witt.) In order to evaluate them in terms of the main characters that contribute to the realization of green mass production for silage and selection of the most valuable genotypes for improvement in pedo-climatic conditions, specific to the Banat Plain, in order to enrich the current assortment of fodder plants for silage, given the ever-increasing needs of fodder in the context of a growing demand for animal products.

MATERIAL AND METHODS
The researches presented in this paper were performed at the Experimental Didactic Station within Banat’s University of Agricultural Science and Veterinary Medicine Timisoara (Figure 1).

The experimental site is located in the Banat Plain, a subunit of the Western Plain of Romania.

The Banat Plain, as a whole, falls between 75 - 180 m absolute altitude and has a general inclination from east to west (GEOGRAFIA ROMÂNIEI, vol IV, 1992; POSEA, 2005; POSEA, 2006).

The entire plain area of Banat, and implicitly the area of interest in this paper, falls between the multiannual average isotherms of 10°C and 11°C (MUNTEANU and MUNTEANU, 1998; IANOȘ, 2008). At the level of the analyzed area, the multiannual average temperatures vary within very limited limits, the average value of the last 10 years being 12.3°C (CENTRUL REGIONAL BANAT-CRIȘANA).

Compared to the thermal average of the three years, the average annual temperatures recorded in 2018 were above this average value (12.8°C), against the background of low rainfall, below the multiannual average, in the first part of the year, during the vegetation period of the triticale culture. In 2019, the thermal values remained close to the multiannual average, but the amounts of precipitation were well above average, especially in May-June (Figure 2).
The year 2020 was characterized by values close to the average of the three years, and the precipitation amounts were below the multiannual average (Figure 2).

At the level of the study area, the Cernisols class predominates, with the Chernozem type (BLAGA, 2005; FLOREA et al, 2012; ȚĂRĂU and DICU, 2014).

Research material and methodology

In this study we chose nine varieties (lines) of triticale (*Triticosecale* Witt.), noted: TMV1, TMV2, TMV3, TMV4, TMV5, TMV6, TMV7, TMV8, TMV9, in order to evaluate them in terms of green mass production in order to silage.

The sowing was carried out in the experimental years (2018 - 2020), when the weather allowed - at the beginning of October with a distance between rows of 12.5 cm. The sowing density was 600 germinating seeds/m².

An experiment was set up in the field - placed according to the method of randomized blocks, in three repetitions, the surface of a plot being 20 m² (4m x 5m).

During the study period (2018 - 2020) the main elements of productivity were analyzed and the potential of green mass production was determined in order to ensile the nine varieties of perspective triticale cultivated in Timișoara.

The determinations regarding the elements that contribute to the realization of the green mass fodder production, respectively the plant height (PH), the number of shoots (NS), the number of internodes (NI), the number of leaves (NL) and the ear length (EL), were performed on a number of 10 individuals/variety of triticale/plot-repetition throughout the vegetation period; in the paper being presented only the data recorded in the grain filling phenophase - a moment conducive to silage.

Statistical evaluation of experimental results

Several programs were used for the statistical analysis of the experimental data: Excel 2010, PAST version 2.17.

RESULTS AND DISCUSSIONS

Analysis of the main elements of silo production

In triticale, as in other species of forage plants, genotype is one of the most important factors influencing feed production.

Thus, in the conditions from Timișoara, 9 varieties (lines) of triticale were analyzed: TMV1, TMV2, TMV3, TMV4, TMV5, TMV6, TMV7, TMV8, TMV9, in which the main production elements for pickled fodder were studied: plant height (PH), number of shoots (NS), number of internodes (NI), number of leaves (NL) and ear length (EL).

The main production characters and the amplitude of their variation are presented in Figure 3. Thus, the ear length of the studied triticale varieties registered the lowest value at TMV5 (10.52 cm) and the highest value of 14.1 cm at TMV7.

Regarding the character, the number of shoots in the analyzed triticale varieties, the maximum value was reached by TMV4 and TMV6, respectively 11.3 shoots/plant (Figure 3.).

![Figure 3 Amplitude of variation of the main quantitative characters in *Triticosecale* Witt.](image)

Legend: plant height (PH), number of shoots (NS), number of internodes (NI), number of leaves (NL) and ear length (EL)
From Figure 3 it can be seen that for the analyzed triticale varieties the average number of internodes/plant was between 4.9 and 7.4.

The number of leaves is another character analyzed in the studied triticale varieties. Thus it has a wide range of variation, being between 3.9 for TMV9 and 6.8 for TMV3.

For the cluster analysis (Figure 4) the algorithm of the paired groups was used using the Euclidean similarity function obtaining a correlation coefficient of 0.9994.

It is observed that all the analyzed characters for the studied triticale varieties, respectively: the number of shoots (NS), the number of internodes (NI), the number of leaves (NL) and the length of the ear (EL) are directly influenced by the height of triticale plants - PH.
From the Barchart Diagram (Figure 5) it can be noticed that, regarding the yield per plant, the character, the height of the plants contributes to a great extent, the variety of TMV7 triticale registering the highest value in the conditions from Timişoara.

**Results of green mass production for silage at Triticosecale Witt.**

Green mass production of the nine varieties of triticale was directly influenced by the values of productivity traits. Thus, from the analysis of the synthesis of green mass productions (Figure 6.) obtained by the studied triticale varieties, in the three experimental years, it is found that the best production results, in the conditions from Timişoara, were recorded by TMV7 registering a average production of 44.53 t.ha\(^{-1}\) green mass, the maximum production being in 2019 (45.8 t.ha\(^{-1}\)). This indicates that this variety has a high genetic stability and good adaptability to the environmental conditions in the study area.

Not to be neglected are the productions of the other four varieties of triticale in which the average production of green mass, in the phenophase of grain filling in ear, exceeds 40 t.ha\(^{-1}\) green mass: TMV9 (40.72 t.ha\(^{-1}\)), TMV1 (41.3 t.ha\(^{-1}\)), TMV6 (41.76 t.ha\(^{-1}\)), TMV2 (43.30 t.ha\(^{-1}\)).

The results obtained are consistent with other studies (COJOCARIU, 2005) which show that, if the destination is to obtain green mass, 35 - 44 t.ha\(^{-1}\).

It is noted that the best production results were recorded in 2019. Climatic factors in the spring of 2019 were favorable for the cultivation of triticale, so during the period of intense growth-flowering of plants precipitation was abundant due to temperatures moderate. Thermal conditions were normal during the grain filling period, so the plants could be harvested for silage in mid-June.

![Figure 6 The amplitude of variation of green mass registered at Triticosecale Witt. (2018-2020)](image.png)

For the cluster analysis (Figure 7.) the algorithm of the paired groups was used using the Euclidean similarity function obtaining a correlation coefficient of 0.7415.

From Figure 7. it can be seen that, depending on the registered green mass production, in the conditions of Timişoara, the studied triticale varieties are divided into two large clusters:

- 1A - which includes 3 varieties of triticale: TMV8, TMV9, TMV1, which recorded the lowest green mass production;
- 2B a large cluster which includes the other 6 varieties of triticale studied: TMV6, TMV7, TMV5, TMV2, TMV3, TMV4, differentiated according to the production obtained as follows: a. the varieties of triticale: TMV6, TMV7 (which recorded the most high yields) and b. varieties of triticale: TMV5, TMV2, TMV3, TMV4.
**CONCLUSIONS**

The results regarding the behavior of nine varieties of triticale (*Triticosecale* Witt.) harvested in the phenophase of filling the grains for silage, in the conditions of Timișoara, can be summarized as follows.

Regarding the yield per plant, the character, the height of the plants contributes to a great extent, the variety of TMV7 triticale registering the highest value in the conditions from Timișoara.

Green mass production of the nine varieties of triticale was directly influenced by the values of productivity traits (number of shoots, number of internodes, number of leaves, length of ear and height of plants).

From the analysis of the synthesis of mass productions in order to ensile the silage obtained from the studied triticale varieties, it is found that the best production results, in the conditions from Timișoara, were recorded by TMV7 registering an average production of 44.53 t.ha⁻¹ green mass.

Based on the results recorded, the TMV7 triticale line is classified for future breeding programs.

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