Scientific Papers. Series A. Agronomy, Vol. LVII, 2014
ISSN 2285-5785; ISSN CD-ROM 2285-5793; ISSN Online 2285-5807; ISSN-L 2285-5785

RESULTS REGARDING YIELD AND YIELD COMPONENTS AT DIFFERENT TRITICALE VARIETIES

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Abstract

Triticale (Triticosecale Wittm.) is more and more of interest for the Romanian farmers, the harvested area being increasing in the last years. In South Romania this is used both for grain yield and biomass, which is more and more of interest as fodder, but also as raw material for producing biogas. The cultivated varieties have to be tested and known as yielding capacity in different growing conditions. The South Romania has favourable conditions for growing triticale.

Researches were performed in the agricultural year 2012-2013, in field experiments located in South Romania at Moara Domneasca Experimental Farm (44°30' N latitude and 26°14' E longitude). Researches were performed at an assortment of 10 triticale varieties, respectively: Mezin, Stil, Titan, Oda, Negoiu, Cascador, Haiduc, Tulus, Polego, and Gorun 1. The aim of researches that conduced to the elaboration of the present paper was to present the results regarding yield components and grain yield obtained at an assortment of triticale studied under soil and climatic conditions from South Romania.

Key words*: triticale, varieties, yield, yield components, comparative crops, ecological plasticity.*

INTRODUCTION

Triticale (*Triticosecale* Wittmack) is a new cereal crop resulted from wheat and rye crossing for the better use of poor sandy soils, water stress and excessive temperature, in order to produce large yields under pedoclimatic conditions that are unsuitable for other agricultural crops (Gaspar and Butnaru, 1985). According to FAO database, in 2012 triticale was grown on 3.69 million ha all over the world, of which 86% in Europe. In Romania, in 2012 triticale was grown on 48 thou ha. Triticale is more and more of interest for the Romanian farmers, the harvested area being increasing in the last years. It is possible to extend the crop up to 160 thou ha (Ştefan et al, 2011).

Triticale is a plant species which is characterised by high genetic potential for grain yield, as well as good nutritive properties of its grain, while it is not as demanding as wheat in regard to agrotechnic measures and ecological conditions, so it is regarding as a very promising crop (Biberdžic et al., 2012).

Triticale has demonstrated high yield potential even under the marginal growing conditions and could be attractive alternative for raising cereal production globally (Kutlu and Kinaci, 2010).

New triticale varieties have been created over the past decade; they now compete with other cereals and even maize, particularly in the hilly areas, on soils of low fertility and acid pH (Ittu et al., 2005). New varieties of triticale are equal or superior to other crops for grain yield, forage and biomass production for human food, animal feed or industrial applications (Nefir and Tabără, 2012).

The new varieties are characterized by high capacity to use the environmental and technological conditions with top agronomic characteristics concerning the use of unfavourable climate and soil conditions, spike fertility, grain size and fill, and spike germination (Ittu et al., 2006).

The competitiveness of the Romanian triticale varieties has led to the certification of the Titan variety in Canada, France and Hungary, and the Decor line in the U.S.

The study of the triticale varieties in comparative crops allows hierarchization according to their production performances for crop purposes.

In South Romania triticale is used both for grain yield and biomass, which is more and more of interest as fodder, but also as row material for producing biogas. The cultivated varieties have to be tested and known as yielding capacity in different growing conditions. The South Romania has favourable conditions for growing triticale.

Yield components of triticale crop are developed successively during the vegetation period, as follows:

- number of emergent plants/m^2;
- number of tillers/m^2 at beginning of spring;
- number of ears/m^2.

The ear yield components are recorded from the phase of "1 cm" to harvest maturity, and refer to the following:

- ear length;
- total number of spikelets on ear;
- number of fertile spikelets on ear;
- number of sterile spikelets on ear;
- number of grains on ear;
- number of grains on spikelet;
- grain weigh on ear;
- thousand grain weight (TGW).

Grain yield is usually positively correlated with all its components (Kozak et al., 2007).

The aim of the paper was to present the results regarding yield components and grain yield obtained at an assortment of triticale studied under soil and climatic conditions from South Romania.

MATERIALS AND METHODS

Researches were performed in the agricultural year 2012-2013, in field experiments located in South Romania at Moara Domneasca Experimental Farm (44°30' N latitude and 26°14' E longitude) belonging to the University of Agronomic Sciences and Veterinary Medicine of Bucharest.

The soil from Moara Domneasca area is reddish preluvosoil. In the period September 2012 - August 2013, in Moara Domneasca area the average temperature was of 12.6°C and the sum of rainfall of 288 mm.

Researches were performed at an assortment of 10 triticale varieties, respectively: Mezin, Stil, Titan, Oda, Negoiu, Cascador, Haiduc, Tulus, Polego, Gorun 1. Each variety was sown on 144.8 m^2 (3.62 m of width and 40 m of length).

The sowing was performed on 16th of October 2012, at 12.5 cm row spacing. The preceding crop was rapeseed. The fertilization was performed with 86 kg ha^{-1} of nitrogen and 40 kg ha^{-1} of phosphorus. The weed control was performed by the help of herbicides.

To the studied triticale varieties, determinations were performed in view to establish the yield components and the grain yield. Thus, it was determined the number of ears per square meter. The ears from one square meter were harvested for determining the grain yield. The grain moisture content was determined by the help of a portable moisture analyser. A total of twenty ears were picked and analysed for determining the ear yield components, respectively: ear length; number of spikelets on ear (total, fertile and sterile spikelets), number of grains on ear, number of grains on spikelet, grain weight on ear. Also, it was determined the thousand grain weight and the hectoliter weight.

The obtained data were statistically processed by analyses of variance (Anova-single factor).

RESULTS AND DISCUSSIONS

Under the same pedoclimatic and technological conditions, each variety recorded different values for yield and yield components.

Number of ears/m^2

The analysis of the yield components indicates that the number of ears per square meter was in average of 337, with a wide variation between the analysed varieties (Figure 1).

The Cascador variety recorded the highest number of ears per square meter, i.e. 369.3 ears/m^2, while the Haiduc variety recorded the lowest number of ears per square meter, i.e. 309.3 ears/m^2. High values of the number of ears per square meter were also recorded in the Gorun variety (362.7 ears/m^2), and the Tulus variety (348 ears/m^2).

Most varieties under study recorded lower values of the number of ears per square meter than the average value of the ten studied varieties, as follows: Haiduc – 309 ears/m^2, Negoiu – 317 ears/m^2, Oda – 326.7 ears/m^2, and Mezin – 329.3 ears/m^2.

The number of ears per square meter had a direct influence on the ear yield components.

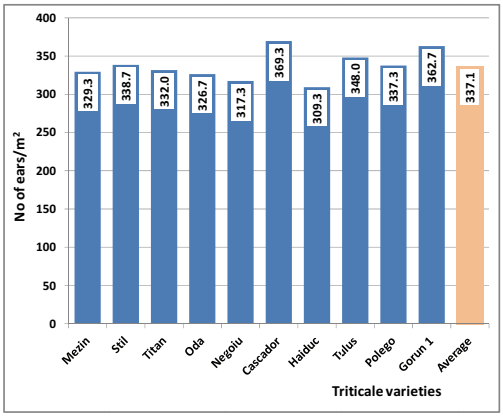

Figure 1. Average number of ears per square meter at studied triticale varieties

Ear length

Concerning ear length, there was a direct correlation with the number of ears per square meter; however, it had no direct influence on the grain yield. The ears were smaller in the varieties that recorded the highest number of ears per square meter (Figure 2). In the Cascador variety, the ear length was 7.27 cm, with a negative very distinct significant difference compared to the average value of the studied varieties. Also, the Stil variety recorded a 7.98 cm ear length, with a negative significant difference compared to the average value of the studied varieties

There were two remarkable varieties: Tulus, with a 10.92 cm ear length, and Polego, with a 10.32 cm ear length, both of them registering very distinct significant differences compared to the average value of the studied varieties.

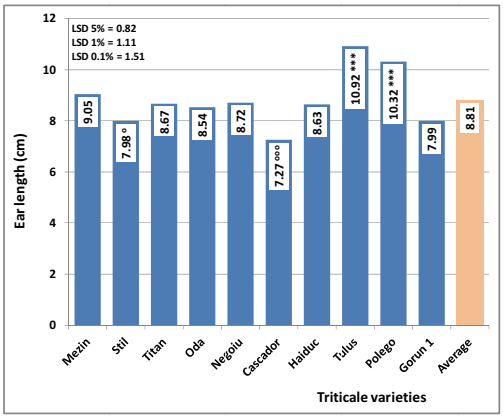

Figure 2. Average ear length at studied triticale varieties

Number of spikelets on ear

Ear length had a direct influence on the ear yield components; thus, the total number of spikelets on ear was determined by the ear length and compactness.

Long-eared varieties recorded a high number of spikelets on ear: Haiduc – 31.43 spikelets, Tulus – 30.63 spikelets, and Negoiu – 30.37 spikelets. Short-eared varieties recorded a low number of spikelets on ear: Cascador – 22.43 spikelets, and Stil – 27.20 spikelets (Figure 3).

The number of fertile spikelets on ear was influenced by the number of ears per square meter and the presence of several limiting factors during the critical period which determined the formation of sterile spikelets at the ear base.

The number of fertile spikelets on ear was correlated with the number of ears per square meter. There were remarked the following varieties: Haiduc – 29.43 fertile spikelets, Tulus – 28.90 fertile spikelets, and Negoiul – 28.83 fertile spikelets. The Cascador variety recorded the highest number of ears per square meter and only 21 fertile spikelets on ear, with a negative very distinct significant difference compared to the average value of the ten studied varieties.

The number of sterile spikelets on ear was influenced by several factors during grain formation and fill phases; at the same time, it was correlated with the ear length. Thus, most sterile spikelets occurred in the Titan, Oda and Haiduc varieties, while the least sterile spikelets occurred in the Gorun, Cascador and Stil varieties.

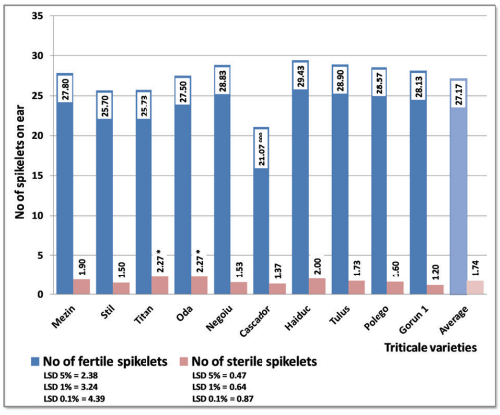

Figure 3. Average number of fertile and sterile spikelets on ear at studied triticale varieties

Number of grains on ear and on spikelets

The analysis of the number of grains on ear showed that it was influenced by the number of ears per square meter, the low competitiveness in the plant population, the absence of water and thermal stress during the grain formation and fill phase, the presence of the leaf diseases and pests after the ear-formation phase.

The average recordings consisted in 36 grains on ear for the ten triticale varieties (Figure 4).

The highest number of grains on ear resulted from the Haiduc variety (40.3 grains on ear) while the lowest number of grains on ear was recorded in Cascador (29.6 grains on ear). A large number of grains on ear were also recorded in the following varieties: Mezin (39.4 grains on ear), Negoiu (38.7 grains on ear) and Oda (38.4 grains on ear).

The average number of grains on spikelet was correlated with the number of ears per square meter and the number of spikelets on ear. Thus, the average number of grains on spikelet was different in the varieties under study. Most varieties recorded 1.4 grains on ear, the lowest number being recorded in the Tulus and Gorun varieties (Figure 4).

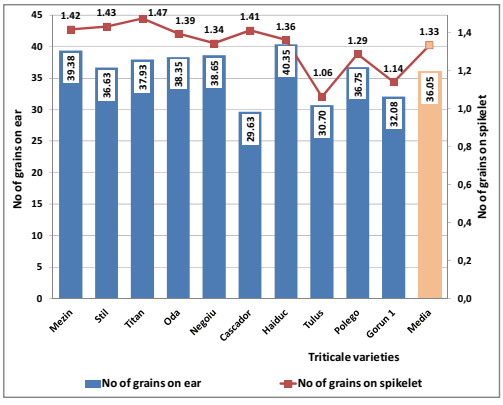

Figure 4. Average number of grains on ear and average number of grains on spikelet at studied triticale varieties

Grain weight on ear

Grain weight on ear had a direct influence on the yield resulted from the experiment.

In the ten triticale varieties under study, the average grain weight on ear was 2.18 g, with slight variations between the varieties, resulting from the number of ears per square meter (Figure 5). Grain weight on ear was influenced by the number of grains on ear and their size. The most productive varieties were the following: Mezin (2.51 g on ear), Haiduc (2.34 g on ear) and Gorun (2.28 g on ear). The lowest productivity was recorded in Tulus (1.96 g on ear) and Stil (1.99 g on ear).

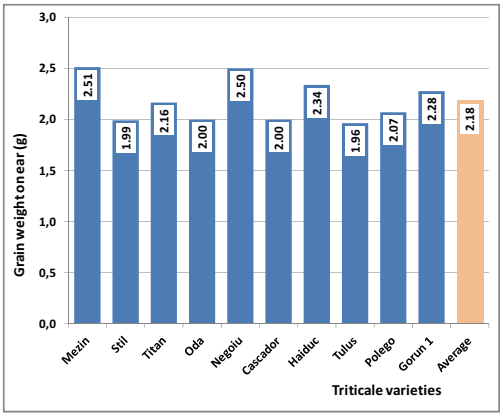

Figure 5. Average number of grain weight on ear at studied triticale varieties

Thousand grain weight (TGW)

TGW was influenced by water stress and high temperatures in the grain formation and fill phase, presence of leaf diseases and pests, as well as nitrogen amount, as shown in Figure 6.

The analysis of the data presented in the Figure 6 indicates that the average TGW was 51.5 g, with an evident variation between the varieties included in the experiment. The highest values were recorded in the following varieties: Negoiu (56.0 g), Haiduc (55.7 g) and Mezin (52.5 g). The lowest TGW was recorded in Polego – 47.8 g, Oda – 48.6 g and Stil – 48.3 g.

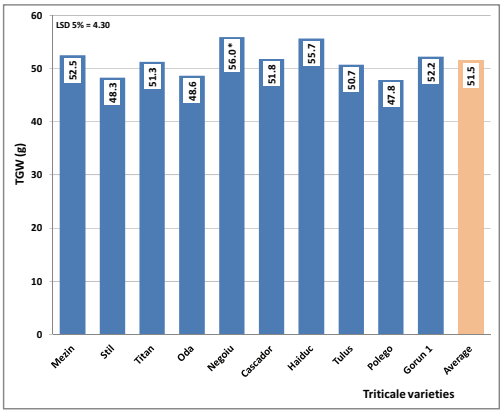

Figure 6. Average thousand grain weight (TGW) at studied triticale varieties

Grain yield at 14% moisture

The average grain yield at 14% moisture for the entire experiment was 8,337 kg/ha, with no significant differences between the ten triticale varieties under study. The Cascador variety recorded the highest yield (9,300 kg/ha), while Titan recorded the lowest yield (7,552 kg/ha). High productions were also recorded in the following varieties: Tulus (9,224 kg/ha), Mezin (8,775 kg/ha), Negoiu (8,714 kg/ha), and Haiduc (8,845 kg/ha).

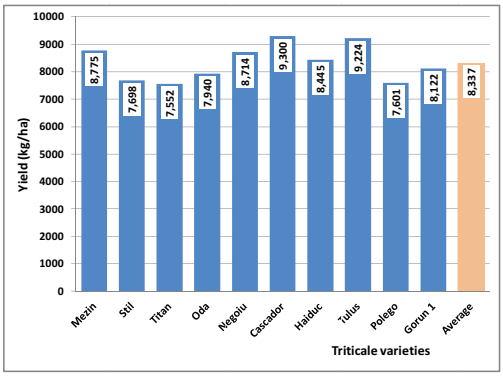

Figure 7. Average yield at 14% moisture at studied triticale varieties

Hectolitre weight

The quality indice that was measured at harvest time was hectolitre weight. The average hectolitre weight was 74.8 kg/100 l (Figure 8). The highest hectolitre weight was recorded in the Oda variety (76.5 kg/100 l), while the lowest was 73.0 kg/100 l in the Haiduc variety.

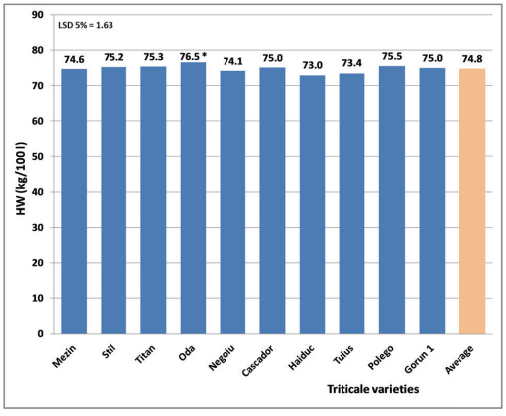

Figure 8. Average hectolitre weight at studied triticale varieties

CONCLUSIONS

- Triticale is a new cereal with high ecological plasticity which valorises the environment conditions less favourable to other crops.
- The varieties studied in the comparative crops achieved yields of over 7 t/ha, variable from one variety to another, under the favourable climate conditions of 2013 on the reddish preluvosoil from South Romania.
- The new triticale varieties valorise in a superior way the soil and climate conditions from the hilly area, less favourable to other crops;
- The studied triticale varieties in the specific conditions of 2013 and on reddish preluvosoil achieved higher grains productions than wheat and most of corn hybrids under identical environmental and technological conditions.
- Triticale is a grains species belonging to the future for areas with limiting soil and climate conditions but also for intensive technological conditions.

ACKNOWLEDGEMENTS

The researches carried out for the elaboration of the present paper were financed by Romanian Program "Partnerships for Priority Domains", project PN-II-PT-PCCA-2011-3.2-1778 "OPTImization of BIOMass and Approach to Water conservation" (OPTIBIOMA-W), Contract no. 45/2012.

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