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COMPARATIVE PERFORMANCE OF SOME MAIZE HYBRIDS FOR YIELD AND OTHER AGRONOMIC TRAITS

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Abstract

A field experiment was conducted at Agricultural Research and Development Station (ARDS) Simnic - Craiova during 2019 in rain fed condition, consisting of eight Romanian maize hybrids, to evaluate for grain yield and other agronomic traits. According to results: plant height between 189.5 cm (Turda 201) and 264 cm (Olt), ear height 79.5 cm (Turda 200) and 113.5 cm (F 423), thousand grain weight 230 g (Turda 200, Turda 201) and 306 g (Olt), hectolitre mass 61.1 kg/hl (Turda 332) and 74.4 kg (Turda Star), grain yield 4285.7 kg/ha (Turda 165) and 5432.1 kg/ha (Turda 200), was found. The hybrids Turda 200 (5432.1 kg/ha), Olt (5428 kg/ha) and F 376 (5378.6 kg/ha) produced significantly highest grain yield as compared to the average (control). Thus, it was concluded from the study that, the hybrids Turda 200, Olt and F376 have been found suitable for this region.

***Key words**: grain yield, maize (Zea mays L.), thousand seed weight, hectolitre mass.*

INTRODUCTION

The applying of different types and doses of fertilizers with field crops has had a beneficial effect on the yield (Dodocioiu et al., 2009).

Maize or corn (*Zea mays* L.) is a major cereal crop in many parts of the world and it used as an important source of food, animal feeds and industrial raw materials.

In Romania, the area under maize cultivation was 2371 thousand hectares with the total production of 18.353 thousand tons (MADR, 2018).

The changing environmental conditions affects the performance of maize genotypes, therefore, breeding programs must take into account the consequences of environment and exploring and developing more competitive maize genotypes (Ferdoush et al., 2017) evidence the evolution of the number of dairy cows, milk yield and total milk production in the period 1990-2010.

The drought tolerance traits of crops is probably the most difficult to identify with great precision, since grain yield is a complex traits and is influenced by the genotype by environment interaction and other mechanisms associated with heterosis (Farre et al., 2000; Messmer, 2006; Pereira 2016). Thus, in the absence of precise information regarding the complete genetic mechanism of drought tolerance in maize, some secondary traits of the plant have been used as selection criteria, such as morpho-physiological mechanisms (Wattoo et al., 2018) and agronomic traits (Mikić et al., 2016).

The Oltenia area is often affected by drought and heat, only two years out of ten are favourable to agricultural crops. Maize yield is highly influenced by environmental factors, especially by increasing temperature and the uneven distribution of rainfall. For this area, the rainfall during sowing to anthesis period and temperature during grain-filling period had a decisive role in defining the production capacity of maize (Bonea and Urechean, 2020; Urechean and Bonea, 2012).

The maize crop is particularly sensitive to drought one week before and two weeks after flowering resulting in an average yield loss of 20% to 50%, and at grain-filling period, the high temperatures, shorten this period and reduce grain weight, resulting in 10% reduction in grain yield (Meseka et al., 2018).

The grain yield reduction of maize due to the drought effects is varied between 1 to 76 % depending on the timing and stage of occurrence and severity (Mostafavi et al., 2011;

Khodarahmpour and Hamidi, 2012; Moradi et al., 2012; Adebayo and Mendkir, 2014).

Therefore, the identifying of genotypes with tolerance to drought and their use for high and stable productions are very important issues in this region (Urechean et al., 2010; Bonea, 2016; Bonea and Urechean, 2017; 2019).

One of the factors that determine the reduction of maize yields in farms is the use of low yielding hybrids.

Assessment of maize response to agro-climatic factors in each crop area, may be the basis for providing farmers with adequate information, so that they to properly plan the specific production management strategies (Farooq et al., 2011; Bonea and Urechean, 2019).

The aim of this paper is to compare the grain yield and other agronomic traits at an assortment of Romanian maize hybrids cultivate under agro-climatic conditions from central part of Oltenia and to select suitable hybrids.

MATERIALS AND METHODS

The experiment was performed under conditions of the reddish preluvosol in Agricultural Research and Development Station (ARDS) Simnic - Craiova area, Dolj County, and in the context of the climate conditions of the year 2019 (Figure 1). This station is located in central part of Oltenia area.

The experiment was laid out in randomized block design with three replications.

Sowing was performed on 5th of April. Fertilisation was performed with 250 kg/ha of complex fertilizer 7:21:21. For weed control was used DUAL GOLD in a rate of 1.5 l/ha.

At harvesting, determinations and analyses were performed regarding: the plant and ear height (cm), the thousand grain weight (g), the hectolitre mass (kg/hl) and the grain yield (kg/ha) at 15% moisture content.

The obtained data were processed by analyses of variance (ANOVA) and significant differences were determined at probability levels of 1%.

Differences in trait means were determined at $p \leq 0.05$ the least significant difference.

Figure 1. View from a experimental field in ARDS Simnic

In this study, eight Romanian maize hybrids (Turda 125, Turda 200, Turda 201, Turda 332, Turda Star, F 376, F423 and Olt) were used.

The year of the investigation was considered a dry year. The rainfall deficiency was largely pronounced in May (-39.7 mm), July (-23.2 mm) and August (-38.0 mm). The mean monthly temperatures were over the multiannual average in Iune (+1.2°C), August (+2.6°C) and September (+2.4°C) (Table 1).

Table 1. Climatic conditions at ARDS Simnic in 2019

Months	Temperature (^{0}C)		Precipitation (mm)	
	2019	Multiannual average	2019	Multiannual average
April	11.9	12.2	42.0	53.1
May	16.2	17.5	32.0	71.7
June	22.7	21.5	136.0	73.6
July	22.9	23.8	59.0	82.2
August	25.1	22.5	9.0	47.0
September	20.2	17.8	0	61.8
Total			278	389

RESULTS AND DISCUSSIONS

Analysis of Variance

The analysis of variance (ANOVA) for yield and other agronomic traits is presented in Table 2. Results indicated that means squares due to hybrids were highly significant (P < 0.01) for grain yield and all traits studied.

Plant height

The average of plant height at the studied maize hybrids was of 223 cm (Figure 2).

Table 2. Analysis of variance (mean squares) for different traits of maize genotypes

Traits	df	MS	F
Plant height	7	2641.5	64.2**
Ear height	7	415.6	17.2**
1000-grain weight	7	1762.1	66.8**
Hectolitre mass	7	53.9	11.66**
Grain yield	7	802970.8	16.07**

**Significant at 1% level of probability

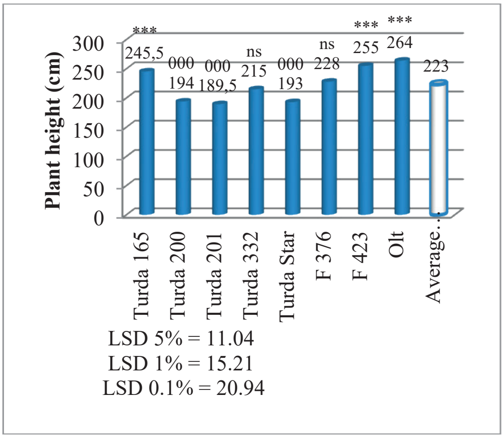

Figure 2. Plant height at the studied maize hybrids

The hybrids Olt, F423 and Turda 165 gave maximum mean values of 264 cm, 255 cm and 245.5 cm, respectively. However, these hybrids also produced significantly higher plant height than the average (control), while Turda 200 (194 cm), Turda Star (193 cm) and Turda 201 (189.5 cm) produced lowest plant height (125.03 g). The difference in plant height could be due to variation in genetic composition of the maize cultivars (Ali et al., 2006).

These results are in accordance with the results of Bonea and Urechean (2019) and Urechean and Bonea (2017), who also reported significant difference of plant height in different maize hybrids cultivated at ARDS Simnic.

Ear height

The average of ear height at the studied maize hybrids was of 94.1 cm (Figure 3).

The maximum ear height was observed in F423 (113.5 cm) and Turda 332 (104 cm) which are very significantly and significantly respectively, higher than the average (control) while the hybrids Turda 200 (79.5 cm), Turda 2001 (83.5 cm) and Turda Star (84.5 cm) are significant and distinctly significant negative, respectively.

The shorter ear heights are, generally, undesirable because the aeration and low transmission of sun light to the lower parts may result in drastic reduction in grain yield (Ali et al., 2011; Bawa et al., 2015). On the other hand, the ear placement at a greater height from the ground level is also undesirable since it may exert pressure on plants during grain filling and physiological maturity and may cause severe lodging, which could ultimately affect the final yield to the farmer (Menyonga et al., 1987; Younas et al., 2002).

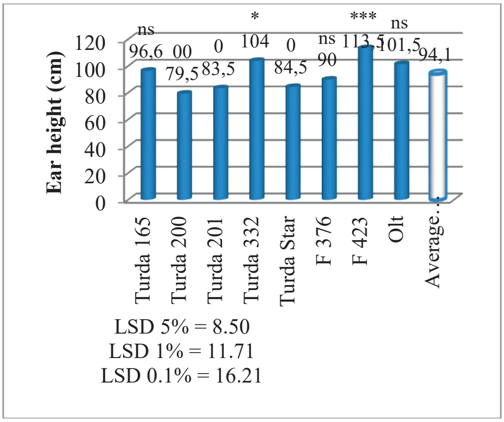

Figure 3. Ear height per cob at the studied maize hybrid

In our study, the maximum ear height is of 113.5 cm which can be considered as acceptable, while the lowest was of 79.5 cm which is good height.

The difference in ear height might be attributed to genetic diversity of tested maize hybrids (Muneeb et al., 2017).

Thousand grain weight (TGW)

The average 1000-grain weigh to eight hybrids was 248.7 g (Figure 4).

Compared with the average (control), the hybrid Olt (306 g) had achieved very significant positive TGW differences while the hybrids Turda 200 and Turda 2001 had very significant negative TGW differences. This was due to the fact that 1000-grain weight is a genetically controlled factor (Tahir et al., 2008).

Urechean and Bonea (2017) found significant differences among six Romanian maize hybrids cultivated at ARDS Simnic, for 1000-grain weight which strongly supports this result. They reported an average value of 259.16 g for 1000-grain weight.

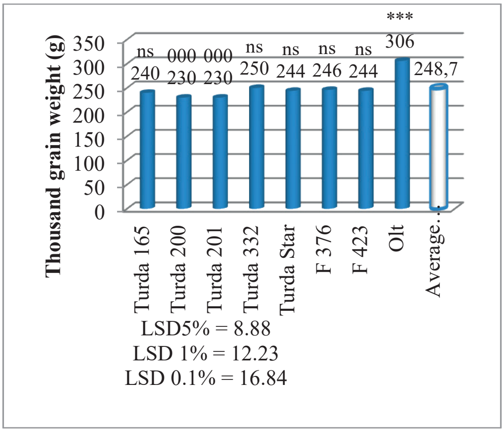

Figure 4. Thousand grain weight at the studied maize hybrids

Hectolitre mass

The average hectolitre mass to eight hybrids was 71.2 kg/hl (Figure 5).

Compared with the average (control), all other hybrids had achieved similar hectolitre mass assured from the point of view statistically, excepted the Turda 332 hybrid (61.1 kg/hl) which had registered, a difference very significant negative.

The results obtained by Toader et al. (2018) showed that the hectolitre mass ranged from 70.3-76.8 kg/hl for eight maize genotypes cultivated under non-irrigated conditions in a farm from Rovine village, Ialomita County.

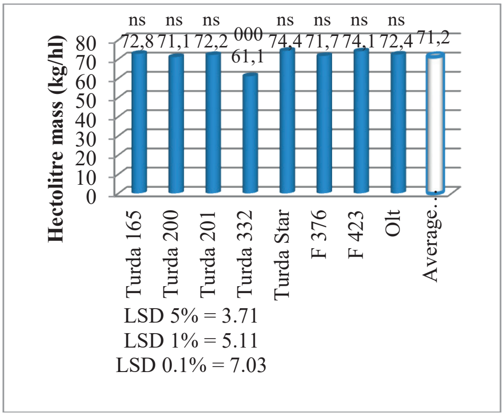

Figure 5. Hectolitre mass at the studied maize hybrids

Grain yield

The average of grain yield at the studied maize hybrids was of 4847.6 kg/ha (Figure 6).

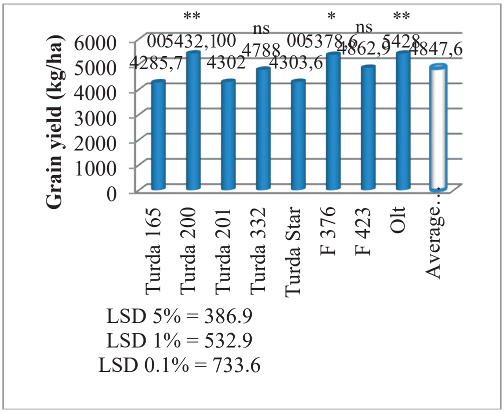

Figure 6. Grain yield at the studied maize hybrids

The grain yield was high, 5432.1 kg/ha for Turda, 5428 kg/ha for Olt and 5378.6 kg/ha for F376, with a yield difference compared to the control being distinct significant positive and significant positive, respectively.

Many researchers found that there were significant differences among hybrids for grainyield and other traits which strongly support the present finding (Ali et al., 2011; Bonea, 2016; Urechean and Bonea, 2017).

According to Cooper et al. (2014), obtaining hybrids with good grain yields in environments with water restriction and a significant increase in environments without water restriction has been the aim of many plant breeding programs.

CONCLUSIONS

For identifying superior hybrids, the highest grain yield was one of the basic criteria.
The hybrids Turda 200 (5432.1 kg/ha), Olt (5428 kg/ha) and F 376 (5378.6 kg/ha) were found superior in their grain yield potentiality.
Thus, it was concluded from the study that, the hybrids Turda 200, Olt and F376 have been found suitable hybrids for this region.

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