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YIELD COMPONENTS AT DIFFERENT MAIZE HYBRIDS UNDER THE SPECIFIC CONDITIONS FROM SOUTH ROMANIA

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Abstract

Maize is the most important crop in Romania, covering an area that varied between 2.0 and 3.2 million hectares in the years after 2000. The large surfaces grown with maize in Romania are due to favourable climatic conditions for this crop, but also to high-performance crop technologies which makes the crop to be performant. Taking into consideration the total maize production, Romania ranges the second position in EU, after France. In this context, selecting the most suitable maize hybrids for each agricultural area is essential in view to obtain high yields in an efficient way.
The aim of this paper is to present the results related to yield components and grain yields at an assortment of maize hybrids cultivate with a high-performance crop technology and under favourable soil and climatic conditions from South Romania. Our study was performed under conditions of the cambic chernozem in Baneasa area, Giurgiu County from South Romania, and in the context of the favourable climate conditions of the year 2013. The studied maize hybrids in our field experiment were the following: DKC 4964 (FAO group 390), PR36R10 (FAO group 400), PR37K67 (FAO group 400), Olt (FAO group 400), Fundulea 376 (FAO group 450), PR35F38 (FAO group 450), PR35P12 (FAO group 470), Florencia (FAO group 490), PR35T06 (FAO group 500), Rapsodia (FAO group 500), and Generos (FAO group 540).
From the climate point of view, the year 2013 was favourable for maize crop in the experimental area. At harvesting time, determinations and analyses were performed regarding: the above-ground biomass, the cob weight, the number of grains per cob, the grain weight per cob, the grain ratio on cob, the thousand grain weight, and the grain yield.

***Key words**: maize hybrids, growing conditions, yield, yield components.*

INTRODUCTION

At present, Romanian farmers growing maize benefit of a divers assortment of maize hybrids with a high yield potential, but they also have to pay attention to the climatic conditions and the crop technology which have a considerable influence on the yield components and the average yield of these hybrids.
According to their precocity, the maize hybrids react considerably function of: cultivation area, climatic conditions and rainfall distribution during plant growth, fertilization strategy, weed control, and the correct establishment of the plant density according to the growing conditions in the field. These hypotheses are confirmed by several experimental results cited in the specialised literature.
The yield components are influenced considerably by the hybrid selected for a certain cultivation area and the fertiliser doses used (Aadeyemi, 2011).
Even in the case of the high-performance crop technologies used for growing maize, aggressive temperatures in the context of rainfall shortages during the growth stages with maximum water requirements have a considerable influence on the yield components, regardless of the selected hybrid (Ion et al., 2013). Thus, it can be stipulated that an understanding of the environmental and agronomic responses of maize hybrids is fundamental to improving efficiency of maize production (Grada and Ciulca, 2012). In this respect, for a better understanding of climatic and technological effects on maize yield and grain quality, intensive research that evaluates different geographic locations, sowing dates and genotype selection are needed (Koca and Canavar, 2014).

Establishing the plant density correctly has a considerable influence on the competition among the plant population, allows the use of the natural resources and determines the yield components and the yield obtained for each hybrid (Sharifi et al., 2009).

Plant spacing has significant effects on growth, yield and yield components of maize hybrids (Mukhtar et al., 2012). Varying row spacing and distance between plants on the same line can contribute to the decreasing of the competition among plants, respectively it can ensure a better use of growth resources.

Farmers growing maize must use the appropriate crop technology in view to diminish the effects of the limitative factors on yield components and for a maximum use of soil and climatic resources (Dumbrava et al., 2016). However, identifying maize hybrids with genetically improved characteristics and high level of adaptability in order to have low yielding losses is indeed relevant (Schitea and Motca, 2013).

The aim of this paper is to present the results related to yield components and grain yields at an assortment of maize hybrids cultivate with a high-performance crop technology and under favourable soil and climatic conditions from South Romania.

MATERIALS AND METHODS

Our study was performed under conditions of the cambic chernozem in Baneasa area, Giurgiu County, and in the context of the favourable climate conditions of the year 2013.

The climatic conditions were considered as being favourable for maize crop, as the annual amount of rainfall was of 625.7 mm, with a good distribution along the growing period, and the average annual temperature was of 11.7°C.

The studied maize hybrids were the following: DKC 4964 (FAO group 390), PR36R10 (FAO group 400), PR37K67 (FAO group 400), Olt (FAO group 400), Fundulea 376 known also as F376 (FAO group 450), PR35F38 (FAO group 450), PR35P12 (FAO group 470), Florencia (FAO group 490), PR35T06 (FAO group 500), Rapsodia (FAO group 500), and Generos (FAO group 540).

The field experiment was designed with four replications, the number of variants was 44 (11 hybrids x 4 replications), each variant having four lines with a length of 10 m. Sowing was performed on 15th of April, with a plant density of 55,000 plants per hectare.

The main elements of crop technology were the following: the preceding crop was wheat, fertilisation was performed with 100 kg/ha of complex fertilizer 16:48:0 applied before bed preparation and 150 kg/ha of ammonium nitrate applied at the growing stage of seven leaves. For weed control, during the growing period of maize plants, the following herbicide was used at the growing stage of five leaves: Equip, which is based on active substance foramsulfuron - 22.5 $g.l^{-1}$ and isoxadifen-etil 22.5 $g.l^{-1}$ as safener, and which was applied in a rate of 2 $l.ha^{-1}$.

At harvesting, determinations and analyses were performed regarding: the above-ground biomass, the cob weight, the number of grains per cob, the grain weight per cob, the grain ratio on cob, the thousand grain weight, and the grain yield. The obtained data were processed by analyses of variance.

RESULTS AND DISCUSSIONS

Above-ground biomass

The above-ground biomass was calculated by weighing the plants which were cut at soil surface at harvesting time, when the plants were completely dried. The grain humidity upon harvesting varied between 15.5% for the hybrid DKC 4964 and 18.5% in the case of the hybrid Fundulea 376. Under these conditions, the average yield of above-ground biomass at plant humidity from harvesting time was of 24.72 $t.ha^{-1}$ (Figure 1).

The highest above-ground biomass yields were recorded for the hybrids Fundulea 376 (27.58 $t.ha^{-1}$) and PR35P12 (27.14 $t.ha^{-1}$). The lowest above-ground biomass yield was recorded in the case of hybrid DKC 4964, with 17.43 $t.ha^{-1}$. Of the eleven maize hybrids studied in the field experiment, seven hybrids achieved above-ground biomass yields higher than the average per experiment (Figure 1).

It is noteworthy that the above-ground biomass yield was boosted by the very favourable growth conditions until the second decade of July (last rainfall of 25 $mm.m^{-2}$ was recorded on 19th of July) the hybrids being at the stage of silk emergence – the beginning of grain development. Starting with the last decade of July, there were registered temperatures above 35°C, in the context of a rainfall shortage, which had different influences on the yield potential of the testes hybrids.

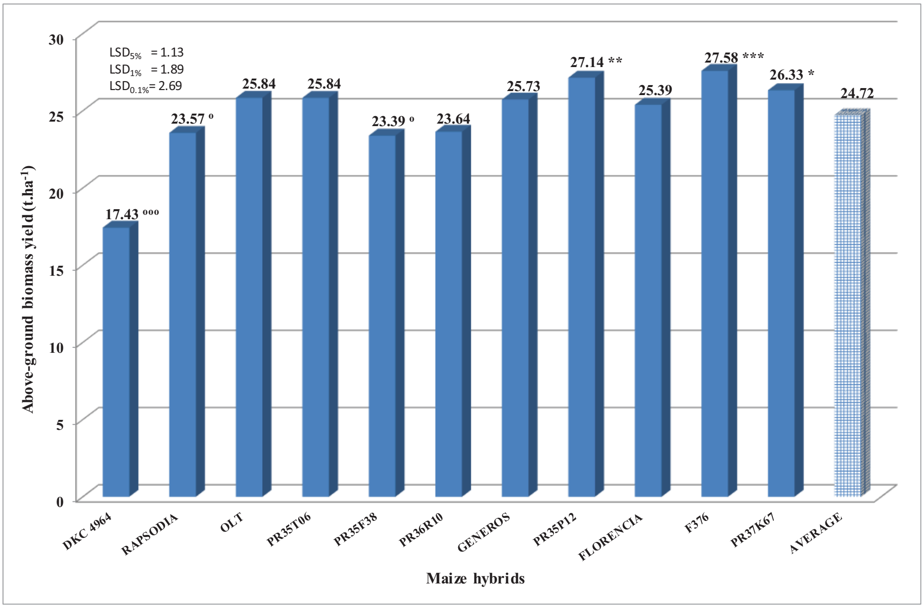

Figure 1. Above-ground biomass yields at the studied maize hybrids

Cob weight

The cob weight is variable and correlated to the number of grains per cob and grain weight per cob.

The average weight of cob at the studied maize hybrids was of 293.42 g (Figure 2). Based on this indicator, we point out the hybrids with more than 300 g the weight of cob, respectively: Fundulea 376 with 344.86 g, PR35P12 with 319.2 g, PR36R10 with 319.20 g, Generos with 318.35 g, Florencia with 306.8 g, and PR35T06 with 303.56 g. On the opposite side, there is the hybrid DKC 4964, with less than 200 g the weight of cob, respectively 184.14 g.

Number of grains per cob

The number of grains per cob is correlated with the size and mass of the grains per cob. The average number of grains per cob at the studied maize hybrids was of 674 (Figure 3).

We point out the hybrids PR35P12 with 848 grains per cob, PR35T06 with 768 grains per cob, Florencia with 720 grains per cob, which significantly exceed the average of the eleven studied maize hybrids. On the opposite side there are the hybrids Rapsodia with 552 grains per cob and PR37K67 with 565 grains per cob.

Grain weight per cob

The grain weight per cob was influenced by the cob weight, grain weight, grain size and grain humidity. In the case of the eleven tested maize hybrids, we noticed a variation of the grain weight per cob from 161.46 g for the hybrid DKC 4964 to 280.75 g for the hybrid PR35P12 (Figure 4). Higher values of the grain weight per cob, statistically ensured, were recorded also in the case of hybrids Fundulea 376 (270.1 g), PR36R10 (255.15 g) and Florencia (251.2 g). Lower values of the grain weight per cob were recorded also for the hybrids Rapsodia and Olt.

The grain weight per cob and the plant density influenced directly the grain yield.

Grain ratio on cob

This indicator is influenced but the cob weight, the grain weight per cob, the thousand grain weight, and the grain humidity.

For the maize hybrids with grain humidity higher than 18% at harvesting time (Figure 5), the grain ratio on cob had low values, respectively: 77.1% for the hybrid Generos, 77.3% for the hybrid Olt, and 78.3% for the hybrid Fundulea 376. For the maize hybrids with grain humidity less than 17% at harvesting time (Figure 5), this being because they have higher rates of humidity loss at plant maturity, the grain ratio on cob registered higher values, respectively: 87.4% for the hybrid DKC 4964, 82.5% for the hybrid PR35P12, and 81.8% for the hybrid Florencia.

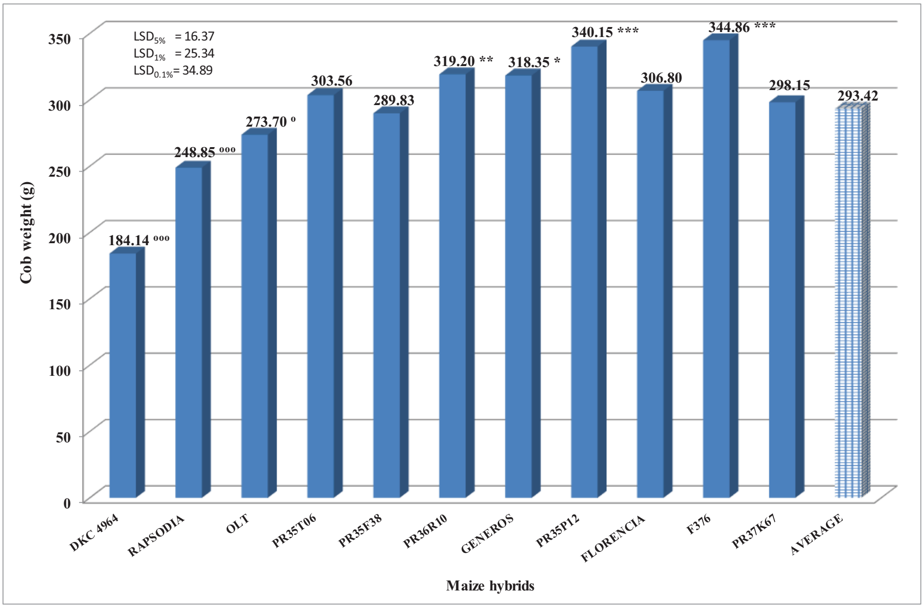

Figure 2. Cob weight at the studied maize hybrids

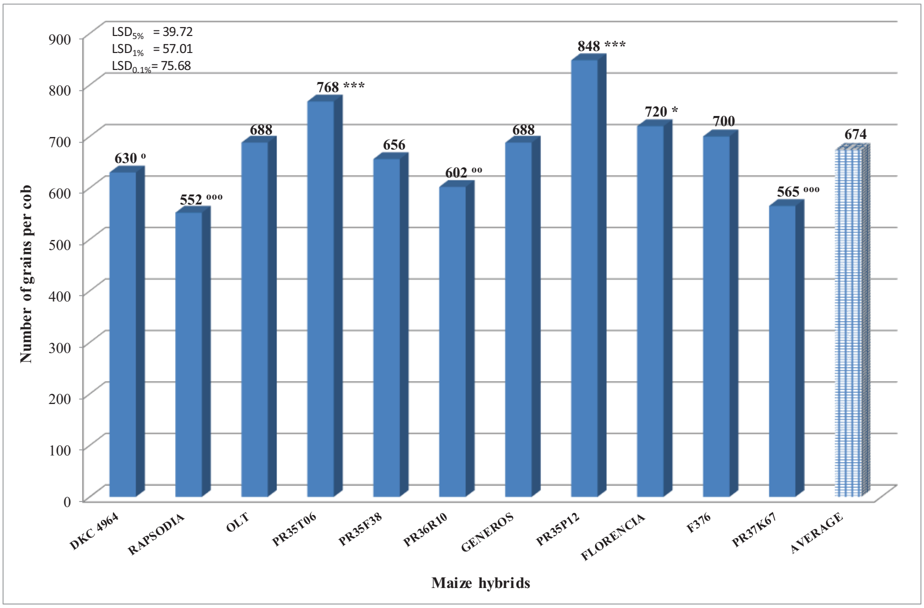

Figure 3. Number of grains per cob at the studied maize hybrids

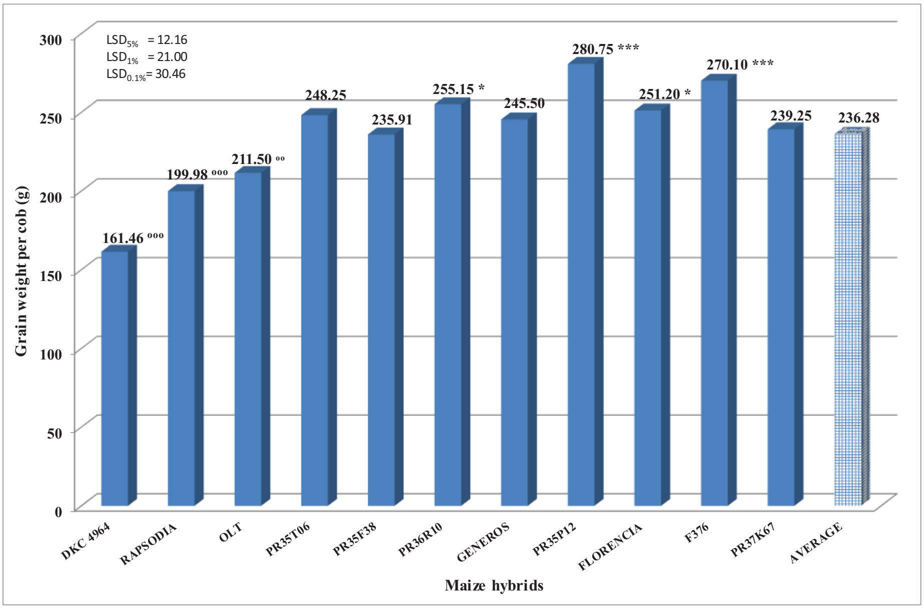

Figure 4. Grain weight per cob at the studied maize hybrids

Thousand grain weight (TGW)

TGW is determined by the hybrid characteristics, growing conditions, presence of limitative factors and grain humidity.

The average TGW for the studied maize hybrids was of 354.7 g, with values ranging from 250.5 g for the hybrid DKC 4964 to 444.1 g for the hybrid Generos.

Significantly higher values of the TGW were also recorded for the hybrids PR36R10 (423.8 g) and Fundulea 376 (400.1 g). Significantly lower values of the TGW were also recorded for the hybrids Olt (307.4 g) and PR35T06 (323.2 g).

Grain yield

The average grain yield for the studied maize hybrids was of 10.14 t.ha^{-1}, with important significant variations among hybrids (Figure 5).

The highest yield was of 11.48 t.ha^{-1} for the hybrid PR35P12 and 11.37 t.ha^{-1} for the hybrid Fundulea 376. High yields which significantly exceeded the average yield per experiment were also recorded for the hybrids Florencia (11.29 t.ha^{-1}), PR35T06 (11.19 t.ha^{-1}), and PR35R10 (10.68 t.ha^{-1}). Lower yields, significantly distinct from the average yield per experiment, were recorded for the hybrids DKC 4964 (7.27 t.ha^{-1}), Rapsodia (8.99 t.ha^{-1}), Generos (9.27 t.ha^{-1}), and Olt (9.52 t.ha^{-1}).

Grain humidity

We noticed that the average grain humidity of the studied maize hybrids was of 17% (Figure 5).

Some of the hybrids registered grain humidity valued above 18%, such as Fundulea 376 (18.5%), Generos (18.1%), and Olt (18.1%). Except the hybrid Rapsodia with grain humidity of 17.7%, all the other hybrids registered values of the grain humidity less than 17%, more precisely values between 15.5 and 16.9%. These maize hybrids with grain humidity less than 17% had the ability to lose grain humidity fast at plant maturity, which represents an advantage for the mechanical harvesting.

Standard yield at the humidity 15.5%

The average standard yield for the studied maize hybrids was of 9.96 t.ha^{-1} (Figure 5).

Significantly higher standard yields were recorded for the following hybrids: PR35P12 (11.39 t.ha^{-1}), PR35T06 (11.11 t.ha^{-1}), Florencia (11.11 t.ha^{-1}), and Fundulea 376 (10.96 t.ha^{-1}).

Significantly lower standard yields were recorded for the following hybrids: DKC 4964 (7.27 t.ha^{-1}), Rapsodia (8.76 t.ha^{-1}), and Generos (8.99 t.ha^{-1}).

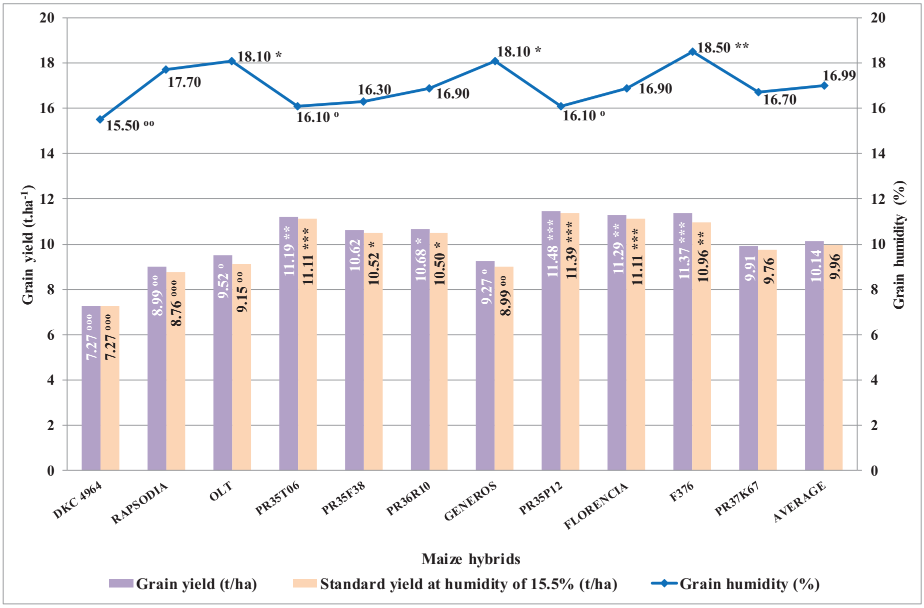

Figure 5. Grain yield, standard yield at 15.5% humidity, and grain humidity at the studied maize hybrids

CONCLUSIONS

The yield components are elaborated along the growing period of the maize plants. They are determined by the cultivated hybrid, being influenced by the growing conditions (soil and climatic conditions), as well as by the crop technology (as for example the correct establishment of plant density according to the precocity of the hybrid and the supply of water and nutrients). Through the crop technology, it is envisaged the decreasing of the effect of limitative factors which have a considerable impact on the yielding capacity of the plants.

The studied maize hybrids reacted differently to growing conditions, despite the year 2013 was favourable to maize crop on the area the field experiment was performed. Therefore, the correct choice of the maize hybrid according to the specific growing and technological conditions is essential for maize grower in order to achieve high and profitable yields.

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