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COMPARATIVE STUDY OF GRAIN MAIZE HYBRIDS IN THE AGRO-ECOLOGICAL CONDITIONS OF SOUTHERN DOBRUJA

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Abstract. *The experiment has been carried out through the period 2017 - 2019 in the region of South Dobruja, Bulgaria. The field trials have been conducted in the block method in four replications with the size of the experimental plot - 25 m^2. The tested corn hybrids belong to 3 maturity groups, according to FAO classification – early, mid-early and mid-late. The experimental fields are located in various regions of the Dobruja region, to cover more soil and climate diversity. Grain yields were averaged over 4 replications, with the values equated to standard moisture of 14% and grain moisture at harvest. The average yields of maize grain obtained in the study area are lower than the national average. This is because corn in Dobruja is grown exclusively under non-irrigation conditions. The lowest yields in the area were obtained from the standard for the early group - Clarica, with all other hybrids far exceeding the standard. Divided into maturity groups, the PR38D89 hybrid is the most productive of the early ones, the PR37N01 hybrid the mid-early and the PR35F38 mid-late. Grain moisture at most points shows a strong upward trend from early to mid-late hybrids, with a positive correlation between productivity and grain moisture.*

Keywords*: maize, grain yields, grain moisture, Dobruja*

INTRODUCTION

Maize (*Zea mays* L.) is an agricultural cereal crop grown mainly for grain, green fodder, and silage. The annual stable yields of maize grain depend both on the specific meteorological conditions during the respective economic year and on the used agronomy practices for growing the crop (HUSSAIN et al., 2025; YANKOV et al., 2014; LI et al., 2025; MARTINS et al., 2025; TASNIM ET AL., 2025).

Specifics of weather in maize growing in Dobruja is mainly related to the available soil and air moisture, needed for the building of the crop because of the inability to irrigate crops in the region (DRAGOMIR and PARTAL, 2014; DELIBALTOVA, 2009). This requires the production of corn to rely solely on rainfall. The cultivation of corn without irrigation overall in this agro-climatic region is possible because of the proximity of the Black Sea and the flat nature of the region. This is the main reason for the high air moisture during the growing season, which somewhat provides the water regime of the crop (CIOCAZANU et al., 1995; MAQBOOL et al., 2019; POPESCU, 1994; HAS et al., 2012; POPOVA et al., 2015; PRAKASH et al., 2019; SIRAKOV and MIHAYLOV, 2022).

MATERIAL AND METHODS

The experiment has been carried out through the period 2017 - 2019 in the region of Dobruja, Bulgaria. The field trials have been conducted in the block method in four replications with the size of the experimental plot - 25 m^2. The tested corn hybrids belong to 3 maturity groups, according to FAO classification (Marton et al., 2004):

(i) Early (FAO 200-299) – Clarica (standard); PR39D81; PR39F58; PR38B12; PR38D89; PR38V91; PR38N86; PR38R56

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(ii) Mid-early (FAO 300-399) – Evelina (standard); PR38A79; PR38A24; PR37D25; PR37H24; PR37N01; PR37F73; PR36D79; Colomba; PR36R10; PR36P85; PR36K67; PR36H43

(iii) Mid-late (FAO 400-500) – Florencia (standard); PR35P12; PR35F38; PR34N43

The experimental fields are located in various regions of the Dobruja region, to cover more soil and climate diversity:

1. Zahari Stoyanovo village – (43°41'24.1"N 28°27'24.2"E)
2. Lozenec village – (43°45'48.0"N 27°43'49.2"E)
3. Krasen village – (43°50'22.1"N 27°56'03.2"E)
4. Balchik town – (43°26'35.0"N 28°09'07.3"E)

Grain yields (average for the three years) were averaged over 4 replications, with the values equated to standard moisture of 14% and grain moisture at harvest.

RESULTS AND DISCUSSIONS

The studied maize hybrids belonging to 3 maturity groups exhibit different productivity responses on average across the country.

The early hybrids, characterized by lower productive potential, form yields in the range of 547 kg/da to 673 kg/da on a national average (Fig. 1). With the lowest productivity, the average for all regions of Bulgaria differs hybrid PR38B12 - 547 kg/da and the highest production in the country conditions can be mentioned hybrid PR38A79 with an average country yield of 673 kg/da - with 88 kg more from the Clarica standard.

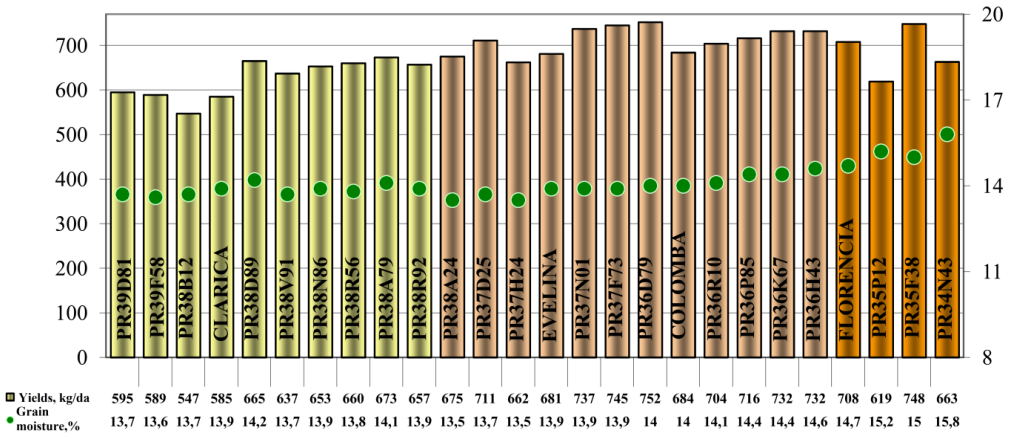

Figure 1. Maize grain yields and grain moisture, average in Bulgaria

On average, early hybrids have a productivity of between 662 and 752kg/da, with the lowest yield being the PR37H24 hybrid and the highest performing hybrid PR36D79 with 71 kg more than the standard - Evelina.

The PR35F38 hybrid, which yielded an average yield of 748 kg/da - 40 kg above the Florencia standard, can be distinguished from the late hybrids used in this study.

In addition to productivity, the percentage of moisture in the grain that makes the batch of grain from each hybrid suitable or not for direct storage is of fundamental economic importance. Higher grain humidity than standard (14%) requires pre-drying which further increases the cost of production.

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Almost all of the tested genotypes in the early and mid-early hybrids group yielded moisture rapidly and were harvested at grain moisture of 13.5% to 14.6%. For mid-late hybrids, harvesting was performed at grain moisture above standard, with the lowest grain moisture at harvesting reported at the Florencia standard - 14.7% and the remaining 3 mid-late hybrids harvested at grain moisture above 15%.

The average maize grain yields obtained for the Dobruja region for all the tested hybrids were lower than the average for the country. This is because maize in Southern Dobruja is grown exclusively under non-irrigated conditions. The lowest average yields in the area were obtained from the early Clarica standard (507 kg/da), with all other hybrids in the group far exceeding the standard. The PR38D89 hybrid is particularly distinguished, yielding a yield of 635 kg/da - 25% above the Clarica standard. Under the conditions of Dobruja, this hybrid evens out and even in some cases exceeds the hybrids of the later groups, which in principle have higher productive potential.

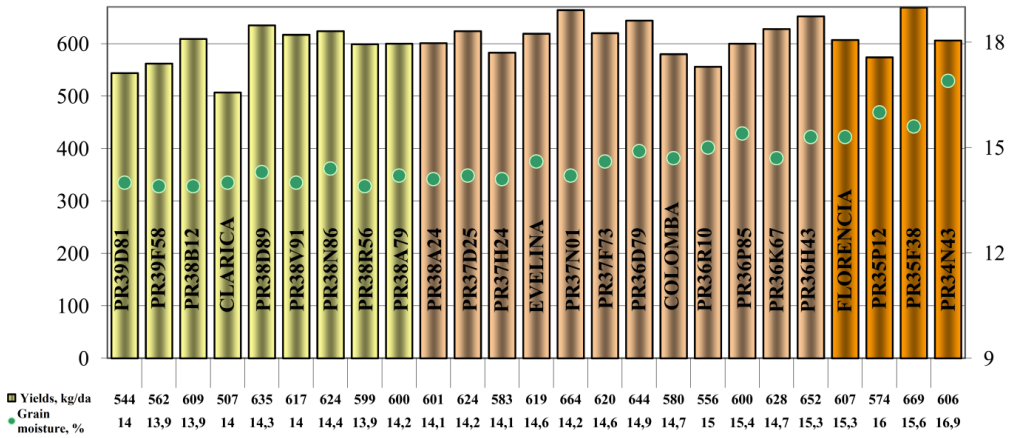

Figure 2. Maize grain yields and grain moisture, average in Dobruja region

In the group of mid-early hybrids, the highest yield was obtained from the hybrid PR37N01 - 664kg/da, 43 kg above the standard hybrid Evelina.

The highest grain yield in the Dobruja region overall was obtained from the medium-late hybrid PR35F38 - 669 kg/da, 62 kg more than the Florencia group standard.

Grain moisture shows a clear upward trend from early to mid-late hybrids. In the early hybrids, there was a positive correlation between the signs of productivity and grain moisture. The two most productive early hybrids, PR38D89, and PR38N86, were harvested at 14.3% and 14.4%, respectively, in the grain moisture (Fig. 2).

In the area of Zahari Stoyanovo village, Shabla municipality the average yields of maize grain vary depending on the hybrid, with the variety specificity being clearly expressed here (Fig. 3).

Of the early hybrids, the least productive expected is the earliest hybrid PR39D81, which belongs to the earliest FAO hybrids at 568 kg/da. The rest of the hybrids, except three, are aligned with the Clarica standard, and three of the hybrids in the early group exceed the productivity standard, with the highest yielding hybrid PR38D89 - 749 kg/da, which is the highest yield of maize grain on the experimental station of the village of Zahari Stoyanovo. In

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terms of grain moisture content, all early hybrids were harvested at a moisture level lower than the standard 14%.

For mid-early hybrids, yields exceeding the standard Evelina were obtained in 5 of the hybrids in the group. This group is also the hybrid with the lowest yield on the station - PR36R10 (528 kg/da).

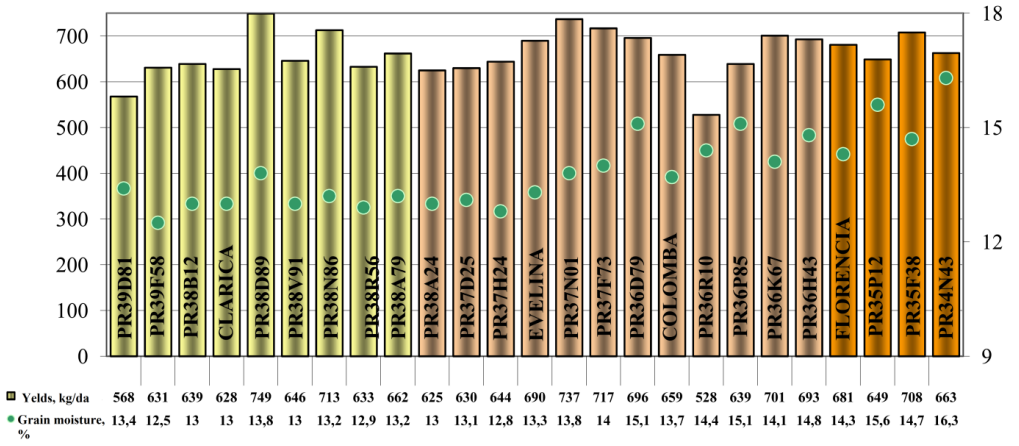

Figure 3. Maize grain yields and grain moisture at the Zahari Stoyanovo station

The mid-late hybrids in this region of Dobruja produce relatively stable yields, with higher yields than the Florencia standard obtained only from the PR35F38 hybrid - 708 kg/da. The other two hybrids in the mid-late group, in addition to not exceeding the standard of productivity, were also harvested with grain moisture between 15.6 and 16.3%.

In terms of grain moisture at harvest, in the area of Z. Stoyanovo village, all early hybrids were harvested at lower moisture than the standard, average early ones, except for three of them.

In the experimental station of Lozenec village, Krushari municipality, the average maize yields are relatively high - between 526 kg/da in the most early-mature hybrid PR39D81 and 791 kg/da in the mid-early hybrid PR37D25 (Fig. 4). In this area, even early hybrids exhibit high productive potential and, with mid-early hybrids, all except PR37H24 produce higher yields than the standard Evelina. In terms of moisture in the grain at harvest, in all hybrids, it is above the standard and varies between 14.3 and 17.3%.

The highest and most stable maize grain yields were obtained in the experimental station of the village of Krasen, municipality of Gen. Toshevo (Fig. 5). In this region, except for PR39F58, all hybrids in the early hybrids exceed the Clarica standard, and the highest extracted from this early hybrid group is PR38N86 - 766 kg/da.

The mid-early hybrids in this area emerge as the most productive, as compared to the Evelina standard, and can be divided into two groups - lower than the standard (PR38A24; PR37H24; PR37F73; Colomba; PR36R10 and PR36P85) and those exceeding the Evelina control hybrid - PR37D25; PR37N01; PR36D79; PR36K67 and PR36H43. The latest hybrid of this group (PR36H43) is also the highest yielding in the area - 820 kg/da. This is also the highest harvest of maize grain from all study areas.

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The mid-late hybrids on the station of the village of Krasen exhibit productivity close to or even lower than the average early hybrids, similar in productivity to the standard for the average early hybrids of Evelina. The main drawback of this area is the high grain moisture at harvest, which can reach 19.1%.

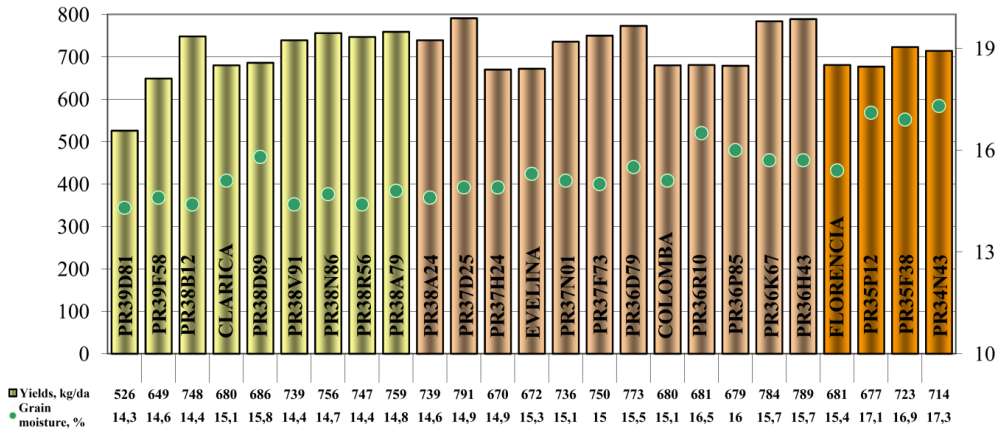

Figure 4. Maize grain yields and grain moisture at the Lozenec station

In general, in the region of the village of Krasen, similar to the region of the village of Lozenec, all hybrids are harvested at higher moisture of the grain than the standard (14%) - between 14.7 and 19.1%. These results are expected since higher productivity is known to correlate positively with higher grain moisture.

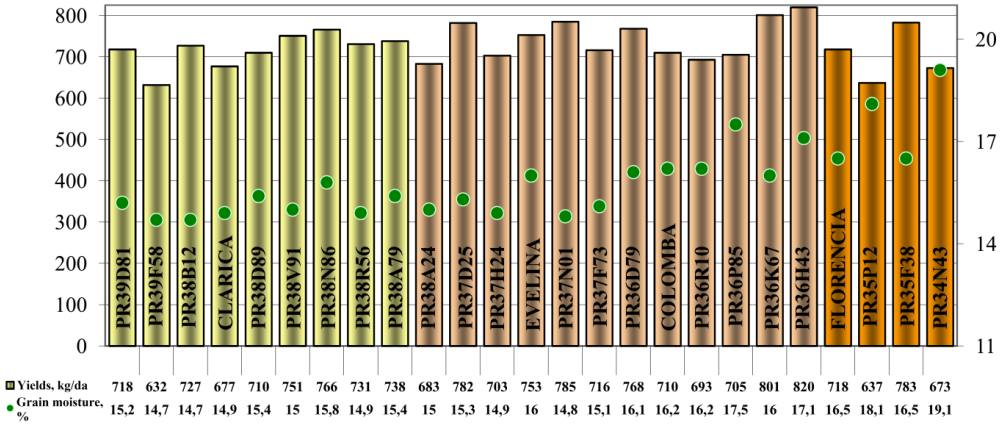

Figure 5. Maize grain yields and grain moisture at the Krasen station

In the area of Balchik, maize grain yields vary between 528 and 699 kg/da (Fig. 6). In the hybrids of the early group, the yield is relatively stable and the differences between the hybrids in terms of their productivity are small. The lowest yield of this group was obtained from the standard Clarica - 550 kg/da and the other hybrids in the group formed yields between

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579 and 632 kg/da. All hybrids in this group were harvested at grain moisture above standard - between 14.4 and 15.7%.

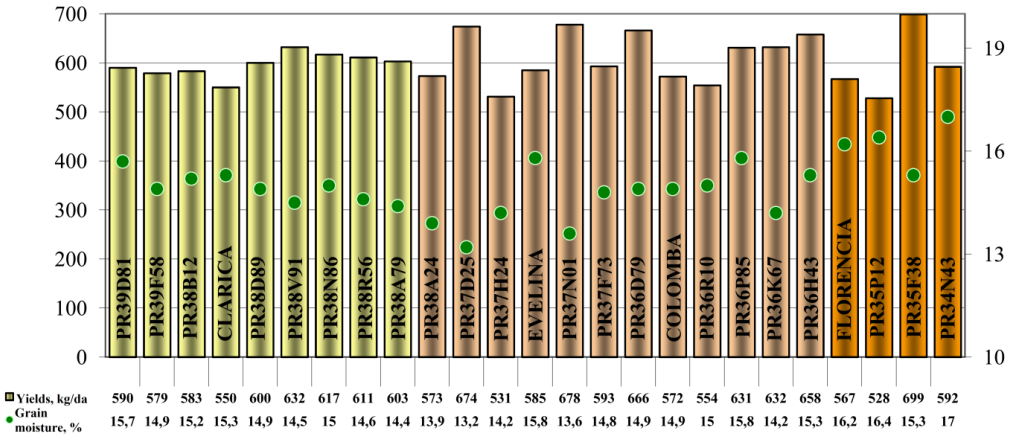

Figure 6. Maize grain yields and grain moisture at the Balchik station

For mid-early hybrids, yields vary more depending on the hybrid compared to the early hybrids, between 531 and 678 kg/da. Two hybrids are distinguished from this group - PR37D25 and PR37N01, which exceed the standard Evelina in yield and are harvested at lower moisture than the standard - 13.2 and 13.6%, respectively.

The mid-late hybrids grown in the Balchik region produce close yields to the mid-early ones, except for the PR35F38 hybrid, from which the highest yield in the region was obtained - 699 kg/da at a relatively low to mid-late hybrid grain moisture of 15,3%.

CONCLUSIONS

The study on the productivity of maize hybrids grown under the conditions of Dobruja allows us to draw the following conclusions regarding the impact of genotype and region:

The average yields of maize grain obtained in the study area are lower than the national average. This is because corn in Dobruja is grown exclusively under non-irrigation conditions. The lowest yields in the area were obtained from the standard for the early group - Clarica, with all other hybrids far exceeding the standard. Divided into maturity groups, the PR38D89 hybrid is the most productive of the early ones, the PR37N01 hybrid the mid-early and the PR35F38 mid-late. Grain moisture at most points shows a strong upward trend from early to mid-late hybrids, with a positive correlation between productivity and grain moisture.

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