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RESEARCH ON THE INFLUENCE OF SOWING TIME ON THE HEIGHT OF CORN GROWN IN THE CARACAL AREA

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Abstract

Six Corteva hybrids placed in three FAO groups (300-350, 350-450, 450-500): P 8834, P9398, P9889, P9944, P0450, P0710, were sown on four different dates, two weeks apart, on the chernozem of Caracal in 2024 and 2025. The aim of the paper was to establish the influence of the sowing date on the height as well as to carry out the distribution of yields according to the height of the plants but also to the earliness groups. The distribution of the height according to the FAO groups was also established. The height was influenced by the sowing period, the ascending order of the height values being period I, period II, period IV and period III. The distribution of yield by height showed that the most productive hybrids were placed in the 190-200 cm and over 200 cm height groups. Regardless of the sowing date, among the tested hybrids, the P0710 hybrid from the FAO 450 group was the most productive - 7087 kg/ha.

Key words*: corn, sowing season, chernozem, height, yield.*

INTRODUCTION

Corn (*Zea mays*) is one of the most important and versatile cereals cultivated worldwide, ranking second among the most cultivated plants in the world. Originally from Central America, it has become a central pillar of modern agriculture due to its high yield capacity and remarkable adaptability to diverse climatic conditions (Guzzon et al., 2021; Tanumihardjo et al., 2020).

In the context of a growing global population, advances in genomics and biotechnology are key to ensuring food security, providing the tools needed to develop highly productive and resilient corn hybrids (De Souza and Bonciu, 2022a, 2022b). One such character is plant architecture, largely defined by the height of the stem. This is closely linked to photosynthetic efficiency, with a direct relationship between the growing season in cereal species and the area of the standard leaf through production.

Agrotechnical research indicates that the sowing time exerts a direct influence on the height of corn, acting through the thermal and photoperiod regime in the early stages of vegetation (Domokos et al., 2024; Shibzukhov et al., 2021).

Sowing at the early stage (when the soil temperature reaches 8-10°C) often favors a larger plant height. Lower temperatures in early spring extend the vegetative growth period, allowing the accumulation of a larger biomass before panicle emergence (Walne and Reddy, 2022).

Delaying sowing usually causes a decrease in plant height. The rapid increase in temperatures in May-June accelerates the passage of phenological stages, shortening the time available for internode elongation.

Although plant height is a genetic trait, its phenotypic expression is strongly influenced by environmental factors and technological management, especially the sowing time. The latter dictates how the plant goes through critical stages of development, influencing vegetative vigor and, implicitly, the role of the flag leaf in cereal production, as the main source of assimilates for filling the grain (Rădoi et al., 2022, 2025). Moreover, the quantity and especially the nutritional profile of the harvest are directly influenced by the conditions of the plant's development, with subsequent ramifications on changes in food quality during storage (Bonciu et al., 2022).

Early hybrids tend to be less influenced in terms of height by the sowing date compared to late hybrids, which can significantly reduce their height if sown outside the optimal window (Varma et al., 2014). If late sowing coincides with periods of drought during the straw elongation phase (intense growth), the plant height remains reduced, directly affecting the leaf area (Oner, 2024).

The aim of this work is to evaluate the impact of the sowing time on the height of corn plants, under the specific pedoclimatic conditions of Caracal area, Romania.

MATERIALS AND METHODS

Six hybrids of company Corteva placed in three FAO groups (300-350, 350-450, 450-500): P 8834, P9398, P9889, P9944, P0450, P0710, were sown on 4 different dates, two weeks apart, on the chernozem of Caracal in 2024 and 2025. The first era was placed in mid-March (second decade), the second in late March (third decade), the third in mid-April (second decade) and the last in late April (third decade). The bifactorial experience was carried out in subdivided plots where factor A was the hybrid with 6 graduations and factor B – the sowing period with 4 graduations. Since the corn sown in the first period in 2025 did not sprout, it was excluded from both years of experimentation and reporting was carried out compared to the second period (control).

The soil on which the experiment was located was the argic chernozem from Caracal, a soil characterized by a humus content of 3.04% in the Ap horizon and 1.78% in the Am horizon, decreasing to 1.24% in the B horizon. It is medium supplied in total nitrogen, with 0.172% in Ap, very well supplied in Ap with mobile phosphorus (168 ppm) and well supplied with mobile potassium (248 ppm).

The technology applied was conventional and consisted of sowing the crop at a distance of 0.7 m between rows, with a density of 64,000 plants/ha. Fertilization was carried out with NPK 20:20:0 fertilizers in a quantity of 250 kg/ha when preparing the seedbed and with an input of 250 kg/ha of ammonium nitrate in vegetation. Herbicide was applied pre-emergent with Dual Gold in a dose of 1.5 l/ha and post-emergent with Elumis in a dose of 2 l/ha.

The climatic conditions for the two years highlighted a surplus of 40.97 mm compared to the multi-year average for March–September 2024 (Table 1) and a deficit of 105 l/m² during the corn growing season in 2025 (Table 2).

Table 1. Climate data for the corn growing season in 2024

Specification		III	IV	V	VI	VII	VIII	IX	Total vegetation period
Temperature °C	Monthly Average	7.7	10.7	15.0	21.4	25.8	25.8	21.1	
	NORMAL	6	12	17.7	21.6	22.8	23.5	18.1	
	Difference ±	+1.7	-1.3	-2.7	-0.2	+3.0	+2.3	+3.0	
Rainfall mm	Monthly Total	20.8	68.8	78.6	44.4	120	40.8	21	394.4
	Multi-year average	34.2	47.8	58.6	69.7	52.9	50.7	39.6	353.5
	Difference±	-13.4	+21.0	+20.0	-25.3	+67.1	-10.1	-18.6	

Table 2. Climate data for the corn growing season in 2025

Specification		III	IV	V	VI	VII	Average/Total vegetation period
Temperature oC	Monthly Average	9.3	12.5	16.0	24.0	23.9	17.1
	NORMAL	6.0	12.0	17.7	21.6	22.8	16.0
	Difference ±	+3.3	+0.5	-1.7	+2.4	+ 1.1	+ 1.1
Rainfall mm	Monthly Total	19.0	22.0	104.6	21.8	0.0	167.4
	Multi-year average	34.2	47.8	58.6	69.7	62.1	272.4
	Difference±	-15.2	-25.8	+46.0	-47.9	- 62.1	- 105.0

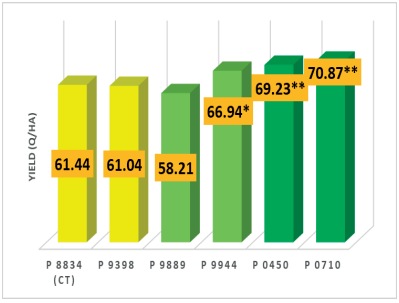
The size, insertion height, yield, and moisture content were determined for all variants and in all repetitions. The latter was used to calculate the yield at STAS moisture content, which is 14% for the corn crop.

The results were interpreted using statistical calculations for two-factor experiments and distributions.

RESULTS AND DISCUSSIONS

The results obtained were interpreted in terms of the singular influence of the studied characters (height, cob insertion height, yield), the influence of the interaction hybrid x sowing time for the same characters and their distributions.

In terms of the yields obtained, the hybrids P9944, P0450, P0710 stood out, the last two from the FAO 400-450 group, the increases being statistically assured in relation to the hybrid P8834 - an early hybrid (FAO 300-350) (Figure 1).

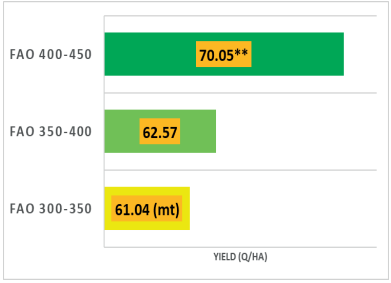


DL 5%=4.64 q/ha; DL 1%=6.60 q/ha; DL 0.1%=9,56 q/ha

Figure 1. Yield of tested corn hybrids, regardless of sowing time – Caracal 2024-2025

The minimum average yield of the experiment was recorded by the hybrid P8834 sown at the end of April (50.84 q/ha) and the maximum average, by the hybrid P0710 sown at the end of March (75.65 q/ha), practically a month in advance.

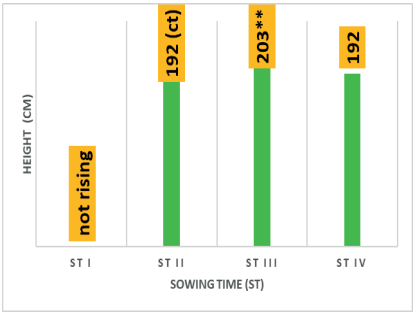
The yield increase obtained by hybrids classified as late under Caracal conditions was distinctly significant compared to the yield of hybrids in the FAO 300-350 group (Figure 2).



DL 5%=4,64 q/ha; DL 1%=6,60 q/ha; DL 0,1%=9,56 q/ha

Figure 2. Yield of tested corn hybrids, depending on classification in FAO groups – Caracal 2024+2025

The plants sown in the first period in 2025 did not sprout. As a result, the reporting was made on the average values obtained in the second period. In terms of height, regardless of the hybrid tested, the height in the third period was distinctly significantly higher than the one recorded in corn sown in mid-April (Figure 3).

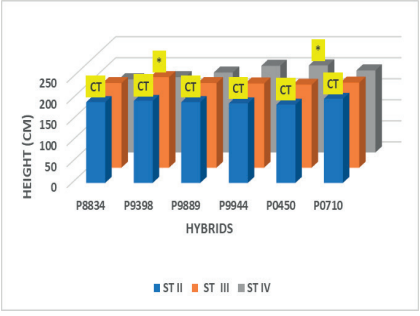


DL 5%=8 cm; DL 1%=11 cm; DL 0.1%=15 cm

Figure 3. Height of tested corn hybrids, depending on sowing period – Caracal 2024-2025

The interaction between the hybrid and the sowing period highlighted the fact that it influenced height to a small extent. Significant increases in height were recorded for the P9398 hybrid in period III and for the late P0450 hybrid sown in period IV (Figure 4).

Some studies show that although the dominant factor for height is the genotype (hybrid), its interaction with the sowing period can produce significant variations, depending on the climatic conditions of the year (Branković-Radojčić et al., 2017; Rajičić et al., 2025).



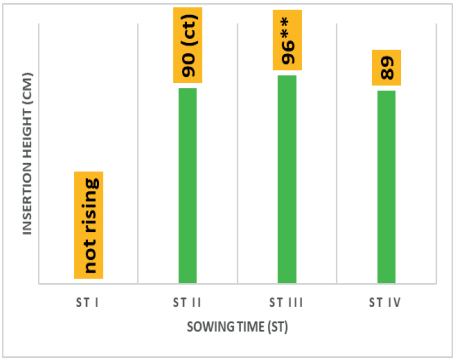
DL 5%=20 cm; DL 1%=27 cm; DL 0.1%=36 cm

Figure 4. Hybrid x sowing time interaction through the perspective of height – Caracal 2024-2025

Other results suggest that early corn hybrids are not the best choice for Southeast Europe in the

following years, as they are more sensitive to heat waves than late-maturing ones (Buhiniček et al., 2021).

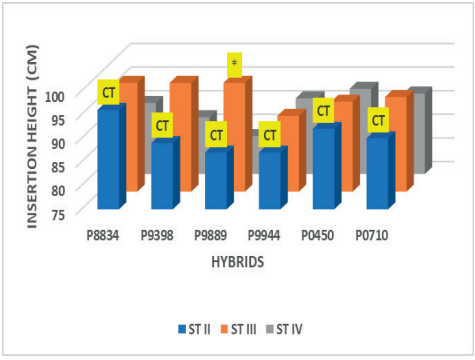
The sowing time also influenced the cob insertion height. As in the case of height, there was a distinct increase of 6 cm in period III compared to period II (Figure 5).



DL 5%=4 cm; DL 1%=6 cm; DL 0.1%=8 cm

Figure 5. Insertion height of tested corn hybrids, depending on sowing period – Caracal 2024+2025.

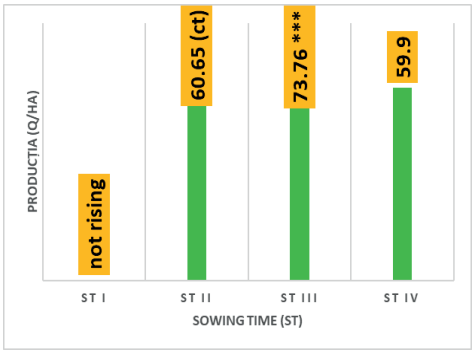
The interaction between hybrid and sowing time had a minor influence on the trait studied. Only hybrid P9889 showed a significant increase in insertion height when sown in mid-April compared to sowing period II (end of March) (Figure 6).



DL 5%=10 cm; DL 1%=14 cm; DL 0.1%=18 cm

Figure 6. Hybrid x sowing time interaction through the perspective of corn insertion height – Caracal 2024+2025

Yield was also influenced by the sowing period, with the increase in yield in period III being very significant compared to the yield of the variant sown two weeks earlier. At the end of April, the yield obtained was practically equal to that in period II (sown one month earlier) (Figure 7).



DL 5%=2.59 q/ha; DL 1%=3.52 q/ha; DL 0.1%=4.72 q/ha

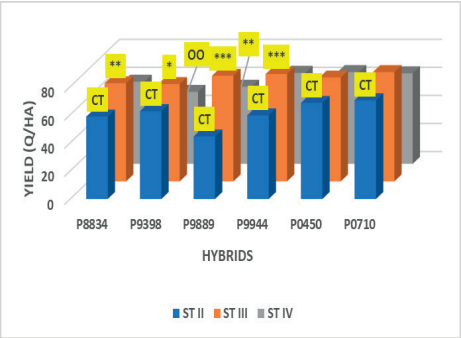
Figure 7 Yield of tested corn hybrids, depending on sowing period– Caracal 2024-2025

Some studies show that continuously adapting the sowing period and maturity of hybrids can counteract negative climate effects, even allowing for increased yields. In both France and China, studies indicate a favorable trend toward replacing early or medium varieties with late ones as temperatures rise (Butler et al., 2013; Caubel et al., 2018; Liu et al., 2013; Moore et al., 2014).

On the other hand, according to the study by Maryam and colleagues (2011), it was found that sowing at the optimal time favors higher cob weight compared to late sowing. Dekhane and Dumbre (2017) reached the same conclusion following experiments conducted on sweet corn.

The interaction between hybrid and sowing time greatly influenced yield. In the third sowing period, four of the hybrids showed statistically significant increases (those in the FAO 300-350 and 350-400 groups). Both hybrids belonging to the FAO 350-400 group recorded the highest increases, which were very significant (Figure 8).

The height distribution showed that the largest share of its values fell in the category over 201 cm (40.8%) but the highest average yield was recorded in the group 191-200 cm – 68.44 q/ha. A higher plant height allows for stronger growth and nutrition capable of developing larger cobs that are the basis for obtaining a higher yield (Figure 9).



DL 5%=6.34 q/ha; DL 1%=8.63 q/ha; DL 0.1%=11.56 q/ha

Figure 8. Hybrid x sowing time interaction through the perspective of yield – Caracal 2024-2025

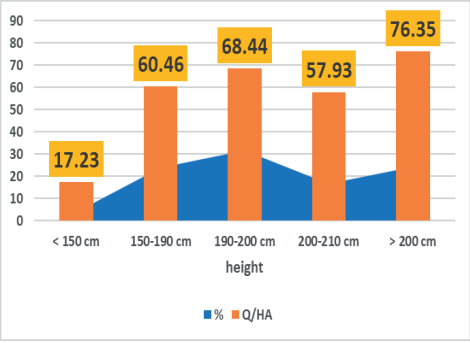


Figure 9. Height distribution of tested hybrids and related yields – Caracal 2024-2025

As the results in the literature show, the correlation between plant height, growth rate and grain yield in corn shows significant variations depending on the time of monitoring and environmental conditions (Anderson et al., 2019; Arslan et al., 2022; Sweet et al., 2025).

CONCLUSIONS

Sowing season influenced the height, insertion height and yield of the hybrids tested on the chernozem of Caracal.

The interaction between hybrid and sowing time highlighted the fact that it influenced the height, but only to a small extent.

The most productive hybrids were those in the FAO 400-450 group sown in mid-April.

The distribution of yield (yield) according to height showed that the most productive hybrids were placed in the 190-200 cm and over 200 cm height groups.

The distribution of yield according to the earliness groups showed that the hybrids placed in the FAO 350-450 and FAO 450-500 groups were more productive compared to the hybrids in the FAO 300-350 group.

The minimum yield of the experiment was recorded by the P8834 hybrid sown at the end of April (50.84 q/ha) and the maximum by the P0710 hybrid sown at the end of March (75.65 q/ha), practically a month in advance.

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