Research Journal of Agricultural Science, 58 (3), 2026; ISSN: 2668-926X;

http://doi.org/10.59463/RJAS.2026.3.33

PRODUCTIVITY EVALUATION OF MAIZE (*ZEA MAYS L.*) HYBRIDS IN THE PEDOCLIMATIC CONDITIONS OF THE TRANSYLVANIAN PLAIN

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Abstract. *Maize (Zea mays L.) is one of the most important field crops in Transylvanian, agriculture ranking second in terms of cultivated area worldwide. Although it has lost some area in favor of winter crops, corn remains a staple crop due to its use in a wide range of industries, mainly the food and livestock sectors. This study aimed to evaluate the yield performance of corn hybrids from different FAO maturity groups, under the conditions of the Transylvanian Plain. The research was carried out in 2025, on a plot located in Aiton, Cluj County. Twelve corn hybrids were evaluated. The maize hybrids studied were part of different FAO groups: (FAO 200-300 3 hybrids, FAO 300-350 3 hybrids, FAO 350-400 3 hybrids and FAO 400-490 3 hybrids). The main yield components assessed were the number of ears per hectare, the mean number of kernels per ear, and thousand-kernel weight (TKW). Based on these components, the grain yield was estimated and, the resulting data were subjected to statistical analysis. Estimated grain yield varied among the hybrids, with a higher-yielding hybrid identified within each maturity range. A tendency for production to increase with the advancement of the maturity group was found. These findings highlight the importance of hybrid selection and maturity group suitability for maize production in the Transylvanian Plain. However, further trials across multiple years and locations are needed to confirm the consistency of the observed differences and support recommendations for local growing conditions.*

Keywords*: Maize, hybrids, yield, FAO groups.*

INTRODUCTION

Maize (*Zea mays L.*) is one of the most important agricultural cereal crops worldwide and a major component of Romania's agricultural sector. Globally, maize is cultivated in more than 170 regions and is one of the most widely grown crops (WANG and HU, 2021). The United States of America (USA) is the world's largest maize producer, accounting for approximately 35% of global maize production (RANUM et al., 2014; ROUF SHAH et al., 2016). Maize is an important raw material for several sectors, particularly the food industry and livestock production (ERENSTEIN et al., 2022, SOARE and DOBRE, 2016, COLOMBO et al., 2021, MUNTEAN et al., 2014). In Romania, maize is one of the most widely cultivated crops (GHEȚE et al., 2018; DINCA et al., 2020).

Maize production is exposed to irregular precipitation, heat stress, and drought, which can reduce grain yield and increase its variability between years. Studies conducted in the Transylvanian Plain have documented the influence of weather conditions on maize yield and differences in the responses of hybrids to these conditions (HAȘ et al., 2022; POPA et al., 2021). Evaluating hybrids under local pedoclimatic conditions is therefore important when selecting biological material for cultivation.

In Romania, maize was cultivated on over 2 million hectares in 2024, representing approximately 8.38% of the country's total surface area and 21.28% of arable land (www.fao.org). Although total maize cultivation area exhibits a slight downward trend annually, national grain yields continue to achieve high production levels. This trend is largely

attributed to continuous genetic breeding programs that yield hybrids with superior environmental adaptability and physiological resilience relative to traditional landraces. Genetic progress in maize yield has been historically quantified at an estimated rate of 58 kg/ha/year, reflecting an overall productivity increase exceeding 100% between 1936 and 2018 (Volpato et al., 2021).

MATERIAL AND METHODS

Location of the Experiment and Soil Properties. The field experiment was established within the agricultural perimeter between Rediu and Aiton (Cluj County), a representative area for the pedoclimatic conditions of the Transylvanian Plain (635 m altitude, 10 ha total area) (figure1). The pedological profile exhibits a slightly acidic reaction (pH 6.3), which is optimal for nutrient availability in maize crops. Soil analysis indicated moderate nitrogen supply in soil and very good phosphorus and potassium approvision (BERECZKI et al., 2026).

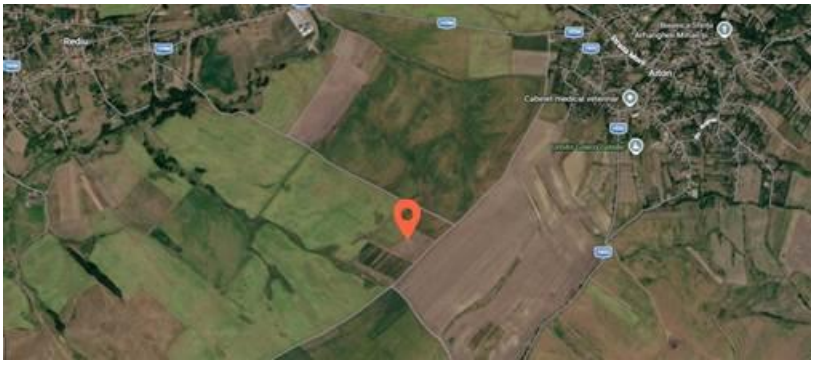


Figure 1. Location of the experimental field (https://www.google.com/maps)

Thermal and Pluviometric Regime. Meteorological monitoring during the 2025 vegetation cycle (May–October) demonstrated strong thermal and pluviometric variations. May recorded a mean monthly temperature of 11.2°C and 137.8 mm precipitation, favoring uniform germination. June experienced an average temperature of 19.7°C with reduced rainfall (22.6 mm). The critical flowering-silking period in July received exceptional rainfall (195.4 mm) with a mean temperature of 19.5°C, maximizing yield potential. August (18.4°C, 44.0 mm), September (15.1°C, 83.6 mm), and October (7.2°C, 74.0 mm) provided ideal conditions for grain filling and natural field drying (figure 1 and figure 2).

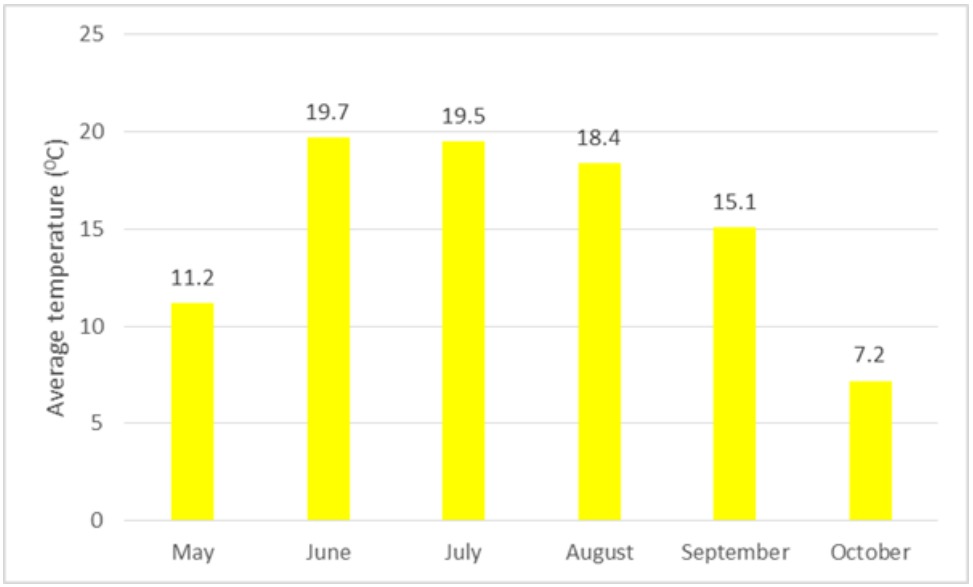


Figure 2. Average temperature over the growing season

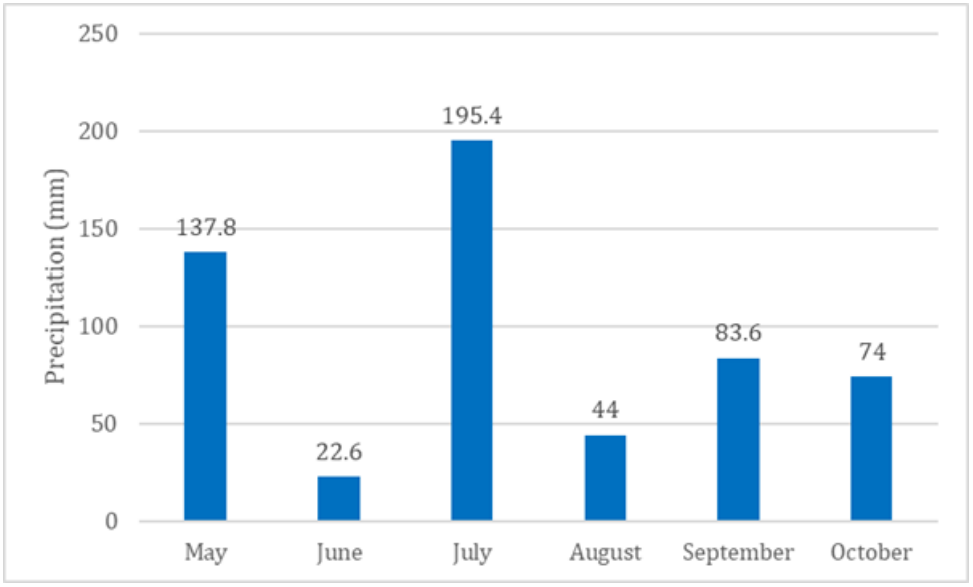


Figure 3. Cumulative precipitation over the growing season

Biological Material and Agronomic Technology. A total of 12 hybrids grouped across four maturity classes were evaluated: FAO 200–300 (Arturelo, Kavalier, Lauro), FAO 300–350 (Adonisio, Chorintos, Prexton), FAO 350–400 (P9889, Hypolito, Marengo, Oltenio), and FAO 400–490 (Darkness, Evident, P0710). The preceding crop was winter wheat. Deep

autumn plowing was followed by spring seedbed preparation using a rotary harrow. Pre-sowing fertilization (April 26, 2025) included 300 kg/ha NPK (15:15:15) and 160 kg/ha calcium ammonium nitrate (CAN 27% N). Sowing occurred on May 2, 2025, at 75,000 seeds/ha, accompanied by 240 kg/ha starter CAN (27% N). Weed control comprised pre-emergence Adengo 465 SC (0.4 l/ha) and post-emergence Cerlit Super (0.5 l/ha). Foliar protection on June 27, 2025, included Phylon Top fungicide (1 l/ha), Azosulf Boost&Protect (2 l/ha), and Coragen insecticide (0.15 l/ha) against *Ostrinia nubilalis*. Harvesting was completed mechanically on November 3, 2025, with grain yield adjusted to standard moisture content.

RESULTS AND DISCUSSIONS

The increase in maize grain yields over the past six decades has been attributed to genetic improvement and improved crop management practices (TOLLENAAR et al., 1994; DUVICK, 2001). It is estimated that 50–70% of of yield gains are attributable to improved genetics, with the remainder attributed to management practices (DUVICK, 2001).

Yield Evaluation for FAO 200–300 Maturity Group. Hybrids in the FAO 200–300 group achieved an average yield of 10,350.00 kg/ha (Control). Hybrid Arturelo achieved a distinct significantly positive yield difference of +1,495.67 kg/ha (11,845.67 kg/ha; 115% of control). Hybrid Lauro showed a distinct significantly negative difference of -1,271.00 kg/ha (9,079.00 kg/ha; 88% of control), while Kavalier produced 10,125.33 kg/ha (98% of control, statistically non-significant) (Table 1).

Table 1

Results obtained regarding grain yield in FAO 200–300 group hybrids (Aiton, Cluj County.)

Hybrid	Yield (kg/ha)	Percentage (%)	Difference	Significance	Duncan test
Hybrid Average	10,350.00	100	0.00	Mt.	-
Arturelo	11,845.67	115	1,495.67	**	c
Lauro	9,079.00	88	-1,271.00	00	a
Kavalier	10,125.33	98	-224.67	-	b
LSD (p 5%)				610.68	
LSD (p 1%)				1010.48	
LSD (p 0.1%)				1891.36	

Yield Evaluation for FAO 300–350 Maturity Group. The average yield for FAO 300–350 hybrids was 10,703.16 kg/ha. Hybrid Prexton yielded 12,151.67 kg/ha (+1,448.52 kg/ha over control, very significantly positive ***). Conversely, Chorintos (10,182.18 kg/ha)

and Adonisio (9,775.62 kg/ha) exhibited very significantly negative differences (-520.98 kg/ha and -927.54 kg/ha, respectively) (Table 2).

Table 2

Results obtained regarding grain yield in FAO 300–350 group hybrids (Aiton, Cluj Co.)

Hybrid	Yield (kg/ha)	Percentage (%)	Difference	Significance	Duncan test
Hybrid Average	10,703.16	100	0.00	Mt.	-
Chorintos	10,182.18	95	-520.98	000	b
Adonisio	9,775.62	91	-927.54	000	a
Prexton	12,151.67	114	1,448.52	***	c
LSD (p 5%)				155.01	
LSD (p 1%)				256.49	
LSD (p 0.1%)				480.09	

Yield Evaluation for FAO 350–380 Maturity Group. The FAO 350–380 group averaged 12,174.10 kg/ha. Marengo (12,392.97 kg/ha) and Hypolito (12,250.56 kg/ha) showed positive gains (+218.88 and +76.46 kg/ha, non-significant). Oltenio yielded 11,878.76 kg/ha, representing a significantly negative difference (-295.34 kg/ha) (Table 3).

Yield Evaluation for FAO 400–490 Maturity Group. Late hybrids in the FAO 400–490 group attained the highest group mean yield at 12,297.55 kg/ha. Hybrid'P0710 recorded the maximum trial productivity at 13,256.43 kg/ha (+958.88 kg/ha, ***). Evident yielded 12,602.16 kg/ha (+304.61 kg/ha, **), whereas Darkness produced 11,034.05 kg/ha (-1,263.49 kg/ha, 000) (Table 4).

Table 3

Results obtained regarding grain yield in FAO 350–380 group hybrids (Aiton, Cluj Co.)

Hybrid	**Yield (kg/ha)**	**Percentage (%)**	**Difference**	**Significance**	**Duncan Test**
Hybrid Average	12,174.10	100	0.00	Mt.	-
Oltenio	11,878.76	98	-295.34	0	a
Marengo	12,392.97	102	218.88	-	b
Hypolito	12,250.56	101	76.46	-	b
LSD (p 5%)				262.12	
LSD (p 1%)				433.72	
LSD (p 0.1%)				811.81	

Table 4

Results obtained regarding grain yield in FAO 400–490 group hybrids (Aiton, Cluj Co.)

Hybrid	**Yield (kg/ha)**	**Percentage (%)**	**Difference**	**Significance**	**Duncan Test**
Hybrid Average	12,297.55	100	0.00	Mt.	-
Evident	12,602.16	103	304.61	**	b
Darkness	11,034.05	90	-1,263.49	000	a
P0710	13,256.43	108	958.88	***	c
LSD (p 5%)				167.78	
LSD (p 1%)				277.62	
LSD (p 0.1%)				519.63	

Across all tested FAO groups, experimental yields exceeded 10 t/ha. Yield performance exhibited a positive linear correlation with maturity group duration, progressing from 10,350 kg/ha (FAO 200–300) to >12,200 kg/ha (FAO 350–490). Hybrids Arturelo, Prexton, and P0710 demonstrated exceptional genetic performance and regional adaptation. Later maturity hybrids better capitalize on seasonal solar radiation and soil moisture reserves under favorable environmental conditions (CIAMPITTI and VYN, 2012). Previous research has shown that yield and stability responses of maize hybrids can vary with maturity group and environment (DJUROVIĆ et al., 2014; HAȘ et al., 2022). The present results should therefore be interpreted as a local, one-year comparison.

CONCLUSIONS

In the pedoclimatic conditions of the Transylvanian Plain (Aiton, Cluj County), maize hybrids consistently demonstrated high yield potential, with all analyzed maturity groups exceeding 10 t/ha mean grain production. A clear positive trend between maturity group classification and total grain yield was identified, increasing from 10,350 kg/ha in early hybrids (FAO 200–300) to over 12,200 kg/ha in late-maturing groups (FAO 400–490). Hybrids such as Arturelo (FAO 200–300), Prexton (FAO 300–350), and P0710 (FAO 400–490) demonstrated superior genetic productivity and statistical significance, making them highly recommended for commercial cultivation in Transylvanian Plain. Commercial farm managers should diversify their maize portfolio by planting hybrids across multiple maturity groups to optimize machinery utilization, mitigate climate risk, and maintain consistent agricultural income.

ACKNOWLEDGEMENT

This research was supported by a strategic partnership between the private agricultural sector, USAMV Cluj-Napoca (including the dedicated students who assisted in this study), and the Agro Consulting Club. The authors thank East Group and East Agro Input for their technical expertise and project initiation. We express our gratitude to Transavia for providing the experimental infrastructure and logistics in Rediu.

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