

COMPARATIVE ASSESSMENT OF MAIZE HYBRID PERFORMANCE UNDER SUPPLEMENTARY IRRIGATION IN DROUGHT-PRONE CONDITIONS OF SOUTHEASTERN ROMANIA

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Abstract. This study assessed the agronomic performance of seven maize hybrids cultivated under conventional tillage and supplementary irrigation ($1,600 \text{ m}^3 \text{ ha}^{-1}$) in Cogealac, Constanța County, during the 2024–2025 growing season. Although irrigation partially compensated for water deficit, the season was marked by reduced rainfall and thermal stress, influencing vegetative growth and reproductive development. Plant density remained stable at harvest (mean $5.87 \text{ plants m}^{-2}$), indicating good establishment under delayed sowing conditions. Thousand kernel weight showed limited variability (mean 300.1 g ; $\text{CV} = 2.72\%$), demonstrating relative stability of grain filling under irrigated conditions. Grain yield averaged $6,106 \text{ kg ha}^{-1}$, with a 19.5% difference between the highest- and lowest-performing hybrids. P88812, P9415, and Maxxatac II consistently exhibited superior biomass accumulation and grain conversion efficiency, exceeding the overall mean yield by 5–11%. The study aimed to evaluate the agronomic performance and adaptability of seven maize hybrids cultivated under the pedoclimatic conditions of Southeastern Romania and to identify the most suitable genetic material for maintaining stable productivity under climatic constraints. The experimental year was characterized by a pronounced precipitation deficit and episodes of high temperatures during flowering and grain filling, conditions that represented important limiting factors for maize development. Despite the application of supplementary irrigation, hybrid-specific responses were evident, highlighting significant differences in physiological adaptation and yield stability. The results confirm that irrigation alone cannot fully eliminate the negative effects of drought and heat stress. Hybrid genetic background, biomass production capacity, and assimilate partitioning efficiency remain decisive factors for achieving high and stable yields. These findings contribute to the identification of maize hybrids suitable for sustainable production systems and climate-resilient agricultural strategies in drought-prone areas of Southeastern Romania.

Keywords: maize hybrids; irrigation efficiency; drought stress; grain yield; hybrid adaptability.

INTRODUCTION

Maize (*Zea mays* L.) is one of the most important cereal crops worldwide, ensuring food, feed, and industrial raw materials. In Romania, maize occupies a leading position in cultivated area and total grain production, playing a strategic economic role (POPESCU ET AL., 2018). The evolution of the global maize market and Romania's contribution to it further highlights the crop's national and international relevance (DRAGOMIR ET AL., 2022).

In recent decades, climate change has significantly affected maize productivity in Southeastern Europe. Studies conducted under Romanian pedoclimatic conditions have demonstrated increasing variability in yield levels due to drought and heat stress (GHIORGHE ET AL., 2023). In the Dobrogea region, sustainable agricultural development strategies must account for water scarcity and extreme thermal conditions (BALASAN & BUHOCIU, 2025). Comparative analyses between Eastern Romania and other semi-arid regions emphasize the importance of climate and water use efficiency in maize cultivation (BECERRA BERNAL ET AL., 2025).

Water deficit during flowering and grain filling is recognized as one of the main constraints to maize productivity. Phenotypic stability studies under drought conditions indicate that grain yield is highly sensitive to water stress during reproductive stages (ALI ET AL., 2017). Drought tolerance mechanisms and breeding progress remain central research directions for maize improvement (SHEORAN ET AL., 2022). Heat stress during pollination further reduces fertilization efficiency and kernel set (EL-SAPPAH ET AL., 2022). Experimental evidence shows that drought significantly affects yield components, including ear weight and kernel number (SPITKO ET AL., 2014).

Sowing time and climatic conditions interact strongly with maize phenology. Field research in Romania demonstrated that variations in weather patterns influence growth stages and final yield (CELZIN ET AL., 2021). The impact of sowing season under variable climate conditions has also been documented in recent agronomic studies (ȘIMON ET AL., 2023). Moreover, weather variability associated with different sowing dates contributes to yield fluctuation (SU ET AL., 2025). Hybrid maturity group selection represents an important adaptation strategy. The evolution of maize hybrid types and FAO maturity groups registered in Romania reflects the need to adapt genetic material to changing climatic conditions (HARAGA & ION, 2022). Comparative trials conducted in different Romanian regions have confirmed that hybrid adaptability depends strongly on local pedoclimatic conditions (NIȚĂ ET AL., 2021). Similar evaluations performed in other Eastern European regions underline the importance of genotype-environment interaction (DELIBALTOVA, 2025).

Irrigation remains a fundamental technological component for stabilizing maize yield in drought-prone areas. Research conducted in Dobrogea demonstrated that irrigation significantly increases grain yield under limited rainfall (FILIP & MARIN, 2018). Studies analyzing irrigation regime and hybrid maturity interactions have shown improvements in thousand-kernel weight and grain quality (MIRCEA ET AL., 2023). Reviews focused on Southeastern Romania emphasize irrigation efficiency as a major adaptation measure under climate change (NIȚU ET AL., 2024). Furthermore, the impact of soil tillage systems under irrigated conditions has been linked to productivity and mechanization efficiency (IANCULESCU ET AL., 2026).

Soil tillage and fertilization practices significantly influence maize performance. Research conducted in Constanța County showed that tillage and fertilization levels affect yield expression in maize hybrids (AEDIN ET AL., 2019; MIHUȚ ET AL., 2024). Long-term evaluations of technological systems in southern Romania confirm the importance of adapting soil management practices to climatic stress (ZAFIU & MIHALACHE, 2021). The transition from conventional to minimum tillage systems has also been associated with yield variation under Dobrogea conditions (STROE & PANAITESCU, 2025). Nitrogen rate and fertilization type influence yield components and nutrient use efficiency (VELICU & ION, 2024). Similar conclusions regarding nitrogen efficiency were reported under contrasting soil conditions (NIGUSSIE, 2025). The interaction between manure and mineral fertilization has also been shown to affect maize productivity and soil quality (MHORO ET AL., 2025). Nutrient composition and grain quality are additionally influenced by nitrogen fertilization systems (BOJTOR ET AL., 2022). Research conducted at ARDS Secuieni further demonstrated the role of nitrogen and phosphorus in yield and quality indices (LEONTE ET AL., 2023).

Plant density represents another important agronomic factor influencing maize yield components (LASHKARI ET AL., 2011). Comparative agronomic studies in the Arad Plain have confirmed that hybrid performance depends on density and technological level (PORUBSKI ET AL., 2023). Evaluations of modern maize cultivation technologies under climatic challenges

emphasize the need for integrated management approaches (BOTOȘ ET AL., 2025). Similar findings were reported in trials assessing tillage and nitrogen rate effects in Danube Meadow conditions (AVARVAREI ET AL., 2025). Crop protection is equally important for maintaining yield stability. Integrated pest management strategies in maize crops have been extensively analyzed under Romanian conditions (TOADER ET AL., 2024). The control of Western Corn Rootworm has become increasingly relevant in Eastern Romania (AMARGHIOALEI ET AL., 2025). Sustainable alternatives to neonicotinoids are currently being explored within national agricultural policy frameworks (DESPA & RAHOVEANU, 2025). Biological and chemical seed treatments contribute to sustainable crop protection systems (FĂTU ET AL., 2025). Herbicide application timing and efficacy are also key elements in maize technology (YANEV, 2023; CERGAN ET AL., 2025). Soil biological indicators, such as earthworm communities, reflect the ecological sustainability of maize cropping systems (AMUZA & ILIE, 2023). In addition, biochemical analyses of maize cultivars highlight quality-related differences among genetic materials (POPOVICIU ET AL., 2025).

Considering the increasing climatic instability in Southeastern Romania and the need for resilient agricultural systems, the comparative evaluation of maize hybrids under real farm conditions remains essential. Therefore, the present study aimed to assess the agronomic performance of seven maize hybrids cultivated under conventional tillage, balanced fertilization, and supplementary irrigation in the pedoclimatic conditions of Cogealac, Constanța County, during the 2025 agricultural year. Special attention was given to the interaction between late spring frost, rainfall deficit, heat stress during pollination, and hybrid-specific yield response, in order to identify suitable genetic material for sustainable maize production in Dobrogea.

MATERIAL AND METHODS

The research was conducted during the 2024–2025 agricultural year at SC AgroTusa SRL farm, located in Cogealac, Constanța County, southeastern Romania. The area is representative of the Dobrogea region, characterized by a continental-excessive climate with frequent drought and heat stress events during summer. The soil type of the experimental field was cambic chernozem with medium to high natural fertility.

The study was organized as an on-farm comparative field trial, where each maize hybrid was cultivated on a 1-hectare plot under identical technological conditions. To account for within-field variability, three sampling points (subsamples) were established within each hybrid plot, located in different interior areas of the parcel. All biometric and yield-related measurements were performed within these sampling areas. The 2025 agricultural year was characterized by significant rainfall deficit. During the main growing season (April–August 2025), total precipitation reached 112.1 mm, compared to the multiannual average of 204.1 mm, resulting in a deficit of approximately 92 mm during the critical vegetation period. June was particularly dry, with only 8.2 mm recorded compared to a normal value of 53.2 mm. From a thermal perspective, mean monthly temperatures were generally favorable for vegetative growth; however, several episodes of heat stress were recorded during the reproductive stages. The absolute maximum temperature reached 40.1°C in July. Additionally, a late frost event occurred between April 10 and April 13, 2025, which delayed sowing until April 19, 2025. This delay shifted the flowering period toward hotter summer conditions, increasing the likelihood of thermal stress during pollination. Elevated temperatures during flowering may have reduced pollen viability and fertilization efficiency, potentially influencing kernel set and grain filling. Seven maize (*Zea mays* L.) hybrids belonging to semi-early and

semi-late FAO maturity groups were evaluated: Maxxatac II, Lipexx, Mylady, LID 3306, Pioneer P88812, Pioneer P8834, and Pioneer P9415.

The cropping system followed conventional soil management practices. Autumn plowing was performed at a depth of approximately 25 cm, followed by seedbed preparation in spring. The previous crop was pea, contributing residual nitrogen to the soil through biological nitrogen fixation. Sowing was carried out on April 19, 2025, at a density of 70,000 germinable seeds per hectare, with 70 cm row spacing. At seedbed preparation, 250 kg ha⁻¹ of a complex NPK fertilizer (4-10-20 + MgO + SO₃ + CaO + B + Zn) was applied. The fertilizer composition included 4% ammonium nitrogen (N), 10% P₂O₅ (7.2% water-soluble), 20% K₂O (water-soluble), 2% MgO, 17% SO₃, 12% CaO, 0.2% B, and 0.15% Zn. An additional 150 kg ha⁻¹ of a balanced complex fertilizer (15-15-15 + 8 SO₃ + Zn) was applied during the second mechanical hoeing, ensuring supplementary macro- and micronutrient supply during the intensive vegetative growth stage. The crop benefited from supplementary irrigation applied through sprinkler irrigation using reel (drum) systems. A total of four irrigations were performed, each supplying 400 m³ ha⁻¹, resulting in a seasonal total of 1,600 m³ ha⁻¹ (approximately 160 mm of water). Irrigation was scheduled during critical growth stages to partially compensate for rainfall deficit.

Weed control was achieved using a dicamba-based herbicide (480 g L⁻¹), applied at a rate of 0.75 L ha⁻¹ during the 2–5 leaf stage of maize (BBCH 12–15), when weeds were in the 2–6 leaf stage. Disease prevention was ensured by applying a fungicide containing 200 g L⁻¹ pyraclostrobin at a rate of 0.7 L ha⁻¹ between BBCH stages 30 and 66. Two mechanical hoeings were performed to control soil crusting and improve soil aeration. All agronomic practices were uniformly applied across all hybrid plots to ensure that performance differences were primarily attributable to genetic traits and adaptability to the specific climatic conditions of the year.

Throughout the growing season, the following parameters were recorded: plant density (plants m⁻²) at emergence and harvest, plant height at full tasseling, phytosanitary status (visual scoring), average plant weight (kg plant⁻¹), average ear weight (g), thousand-kernel weight (g), and grain yield (kg ha⁻¹). The collected data were centralized and comparatively analyzed in order to assess hybrid performance under the specific pedoclimatic and technological conditions of the 2024–2025 agricultural year.

RESULTS AND DISCUSSIONS

The maize crop was established under a conventional soil management system, including autumn ploughing at approximately 25 cm followed by spring seedbed preparation. Pea was used as the preceding crop, contributing residual nitrogen to the soil. Sowing was delayed by a late frost episode recorded between 10 and 13 April 2025 and was carried out on 19 April 2025, which shifted the reproductive stages toward the hotter part of the summer. All seven hybrids were managed under identical agronomic practices (fertilization, weed and disease control, and mechanical hoeing), ensuring that the observed differences were primarily related to hybrid-specific adaptability. Supplementary irrigation was applied by reel/drum sprinkler systems, consisting of four irrigations × 400 m³ ha⁻¹, totaling 1,600 m³ ha⁻¹ (≈160 mm) during the growing season. Rainfall during April–August 2025 was consistently below the multiannual normal (Figure 1). The cumulative precipitation for this interval reached 112.1 mm compared to the normal value of 204.1 mm, representing a 45.1% deficit. The strongest deviation occurred in June, when precipitation dropped to 8.2 mm versus 53.2 mm normally, corresponding to an 84.6% decrease. In April, precipitation was lower by 11.1 mm (33.1%

below normal), while July recorded 18.8 mm compared to 35.6 mm (47.2% below normal). These deficits indicate a pronounced water limitation during both rapid vegetative growth and the onset of reproductive development.

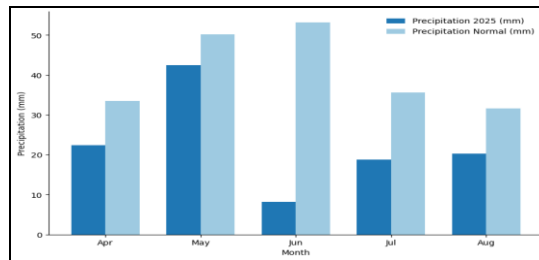


Figure 1. Monthly precipitation (mm) recorded during April–August 2025 compared to the multiannual average in Cogealac, Constanța County

Average monthly temperatures (Figure 2) followed a seasonal rise from April to July–August, but remained below the multiannual normals in each month of the interval. Compared to normal values, mean temperatures were lower by 0.4°C in April (3.7% below normal) and May (2.4% below normal), while larger deviations occurred in June (−4.0°C; 16.4% below normal) and July (−5.1°C; 18.4% below normal). Despite these lower monthly means, the season included severe heat episodes during reproductive stages (absolute maximum 40.1°C in July), which can impair pollen viability and fertilization.

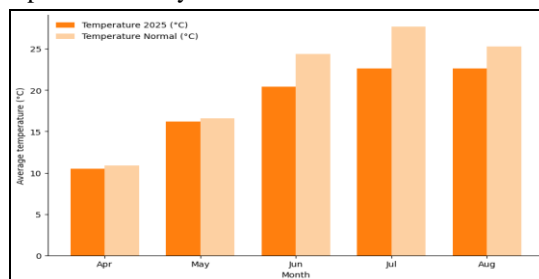


Figure 2. Average monthly temperature (°C) recorded during April–August 2025 compared to the multiannual average in Cogealac, Constanța County.

Plant density at emergence and harvest, as well as the percentage of density loss during the vegetation period, are presented in Table 1. Emergence density ranged from 5.9 plants m⁻² (P9415) to 6.4 plants m⁻² (P88812), with an overall mean of 6.13 plants m⁻². The low standard deviation (± 0.18 plants m⁻²) and reduced coefficient of variation (CV = 2.94%) indicate a high degree of uniformity in crop establishment. These values confirm that, despite the delayed sowing date caused by the late frost event, soil moisture conditions at planting and seed quality ensured an adequate and homogeneous emergence across all hybrids. The narrow amplitude between minimum and maximum values (0.5 plants m⁻²) suggests that early-stage environmental stress did not differentially affect germination capacity among hybrids. At

harvest, plant density varied between 5.5 plants m⁻² (P9415) and 6.3 plants m⁻² (P88812), with a mean value of 5.87 plants m⁻². Compared to emergence, variability increased (SD = ±0.30 plants m⁻²; CV = 5.11%), indicating that environmental conditions during vegetation influenced plant survival differently among hybrids. Density loss during the growing season ranged from 1.6% (P88812 and Maxxatac II) to 6.8% (P9415), with a mean reduction of 4.26%. The relatively high coefficient of variation for this parameter (CV = 51.17%) reveals pronounced hybrid-specific differences in stress tolerance. Hybrids P88812 and Maxxatac II exhibited superior population stability, maintaining high plant survival under restrictive climatic conditions. In contrast, P9415 and P8834 recorded losses exceeding 6.5%, suggesting greater sensitivity to water deficit and thermal stress during vegetative development. Although the overall average density loss was moderate, the variability among hybrids indicates that plant population stability may represent an important selection criterion under Dobrogea conditions. The interaction between limited rainfall, high evaporative demand, and supplemental irrigation likely influenced root development and plant vigor, ultimately affecting plant survival. Hybrids with reduced density loss may have benefited from improved root system efficiency or better physiological adaptation to transient water stress. Maintaining a stable plant population close to the target density (70,000 plants ha⁻¹ ≈ 7 plants m⁻²) is essential for maximizing yield potential.

Table 1.

Plant density at emergence and harvest and density loss (%) of maize hybrids cultivated in 2025

| Hybrid | Emergence (plants m ⁻²) | Harvest (plants m ⁻²) | Density loss (%) |
|-------------|-------------------------------------|-----------------------------------|------------------|
| P9415 | 5.9 | 5.5 | 6.8 |
| Lipexx | 6.1 | 5.8 | 4.9 |
| Mylady | 6.0 | 5.7 | 5.0 |
| P88812 | 6.4 | 6.3 | 1.6 |
| P8834 | 6.0 | 5.6 | 6.7 |
| Maxxatac II | 6.3 | 6.2 | 1.6 |
| Lid 3306 | 6.2 | 6.0 | 3.2 |
| Mean | 6.13 | 5.87 | 4.26 |
| Minimum | 5.9 | 5.5 | 1.6 |
| Maximum | 6.4 | 6.3 | 6.8 |
| SD (±) | 0.18 | 0.30 | 2.18 |
| CV (%) | 2.94 | 5.11 | 51.17 |

Across the seven hybrids, the mean plant height was 237.1 cm, with values ranging from 220 cm (P9415) to 260 cm (P88812). The amplitude of variation was therefore 40 cm, while the standard deviation was ±15.4 cm, corresponding to a coefficient of variation (CV) of 6.5%, indicating moderate inter-hybrid variability. The tallest hybrid, P88812 (260 cm), exceeded the overall mean by 9.7%, while Maxxatac II (255 cm) was 7.6% above the mean, confirming their superior vegetative vigor. In contrast, P9415 (220 cm) recorded a value 7.2% below the mean, and Mylady (225 cm) was 5.1% below the average height. When compared to the tallest genotype (P88812), the shortest hybrid (P9415) exhibited a 15.4% reduction in plant height, highlighting substantial genotypic differences in biomass accumulation capacity.

Similarly, LID 3306 (240 cm) was only 1.2% above the mean, indicating average vegetative performance.

The moderate coefficient of variation suggests that environmental conditions allowed relatively stable vegetative growth overall; however, the 40 cm difference between extreme values confirms that hybrid-specific physiological adaptability played a decisive role in plant development. Taller hybrids likely benefited from more efficient water uptake and sustained stem elongation, while reduced height in certain genotypes may reflect stress-induced limitations in cell expansion and biomass accumulation. From an agronomic perspective, differences in plant height can influence leaf area development, radiation interception, and ultimately assimilate availability for grain formation. Phytosanitary monitoring was conducted continuously throughout the growing season. Weed control was achieved through the application of a selective post-emergence herbicide at the 4–6 leaf stage, followed by two mechanical hoeings to prevent soil crust formation and improve aeration. Pest and disease pressure remained low during the season, which eliminated the need for additional insecticide or fungicide treatments. Plant health was assessed using a visual scoring scale from 1 to 5, where 5 represented excellent phytosanitary status. Maxxatac II, P88812, and LID 3306 achieved the maximum score (5), indicating very good tolerance and stable physiological development under the 2025 conditions. Lipexx and Mylady received a score of 4, reflecting good general health, while P9415 recorded a moderate score (3), suggesting slightly higher sensitivity despite the application of supplementary irrigation. Biomass accumulation was evaluated by harvesting and individually weighing 10 representative plants per hybrid. The average plant weight ranged from 1.60 kg (LID 3306) to 1.91 kg (P88812), with an overall mean of 1.77 kg and a standard deviation of ± 0.11 kg (CV = 6.2%), indicating moderate variability among hybrids. P88812 exceeded the overall mean plant weight by 7.9%, while P9415 was 6.2% above the mean, confirming strong vegetative vigor. In contrast, LID 3306 recorded a biomass value 9.6% below the mean, and Mylady was 4.5% below average. The amplitude between minimum and maximum values was 19.4%, highlighting considerable genetic influence on biomass production.

The comparative relationship between plant biomass and grain yield percentage is presented in Figure 3. Hybrids P88812 and P9415 showed both high plant weight (1.91 kg and 1.88 kg) and superior grain yield percentages (81.9% and 81.3%), indicating efficient conversion of vegetative biomass into economically valuable grain. These values are approximately 2.3–2.7% above the overall mean grain yield percentage (79.8%). Maxxatac II and P8834 demonstrated stable performance, maintaining grain yield values close to 80%, which is less than 1% deviation from the overall mean, suggesting balanced assimilate partitioning. Conversely, LID 3306 recorded the lowest grain yield percentage (77.6%), representing a 2.8% decrease below the overall mean, despite having good phytosanitary status. This indicates that biomass accumulation alone does not guarantee optimal grain conversion efficiency.

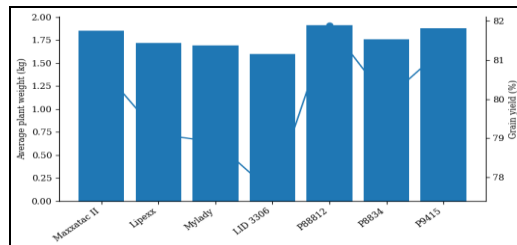


Figure 3. Relationship between average plant weight (kg) and grain yield (%) of maize hybrids cultivated under irrigated conditions in Cogevalac during the 2024–2025 growing season.

Thousand kernel weight (TKW) represents a key indicator of grain filling efficiency and reflects the hybrid’s capacity to convert assimilates into well-developed kernels under specific environmental conditions. The values recorded for the seven hybrids are presented in Figure 4. Across hybrids, the mean TKW was 300.1 g, with values ranging from 288 g (LID 3306) to 310 g (P88812). The amplitude of variation was therefore 22 g, while the standard deviation was ± 8.17 g, corresponding to a coefficient of variation (CV) of 2.72%, indicating relatively low variability among hybrids. The highest TKW was recorded for P88812 (310 g), exceeding the overall mean by 3.3%, followed by P9415 (308 g; +2.6%) and Maxxatac II (305 g; +1.6%). These results indicate superior grain filling capacity and good assimilate partitioning toward reproductive organs. P8834 (300 g) showed a value almost identical to the overall mean (−0.04%), suggesting stable performance. Lipexx (298 g) recorded a value 0.7% below the mean, while Mylady (292 g) and LID 3306 (288 g) were 2.7% and 4.0% below the average, respectively. When comparing the extreme genotypes, the difference between P88812 and LID 3306 was 7.6%, confirming clear genetic differences in kernel filling efficiency.

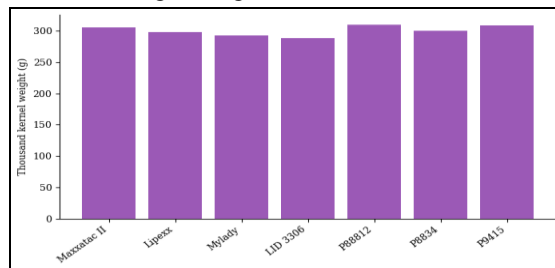


Figure 4. Thousand kernel weight (g) of maize hybrids cultivated under irrigated conditions during the 2024–2025 growing season in Cogevalac.

The 2025 agricultural season was characterized by significant rainfall deficit and episodes of elevated temperatures in the Cogevalac area. Although supplementary irrigation was applied ($1,600 \text{ m}^3 \text{ ha}^{-1}$ during the growing season), climatic constraints still influenced crop performance, particularly during reproductive stages. Grain yield values of the tested hybrids are presented in Figure 5. Across all seven hybrids, the mean yield was $6,106 \text{ kg ha}^{-1}$, with values ranging from $5,445 \text{ kg ha}^{-1}$ (LID 3306) to $6,765 \text{ kg ha}^{-1}$ (P88812). The amplitude of

variation was therefore 1,320 kg ha⁻¹, while the standard deviation reached ±498 kg ha⁻¹, corresponding to a coefficient of variation (CV) of 8.15%, indicating moderate inter-hybrid variability. The highest yielding hybrid, P88812 (6,765 kg ha⁻¹), exceeded the overall mean by 10.8%, followed by P9415 (6,600 kg ha⁻¹; +8.1%) and Maxxatac II (6,435 kg ha⁻¹; +5.4%). These hybrids demonstrated superior adaptability and efficient biomass-to-grain conversion under irrigated yet thermally stressful conditions. P8834 (5,950 kg ha⁻¹) recorded a value 2.6% below the overall mean, while Lipexx (5,874 kg ha⁻¹) and Mylady (5,676 kg ha⁻¹) were 3.8% and 7.1% below average, respectively. The lowest production was observed in LID 3306 (5,445 kg ha⁻¹), representing a 10.8% decrease compared to the mean and a 19.5% reduction compared to the best-performing hybrid (P88812). Despite the application of irrigation, yield differences confirm that hybrid genetic background strongly influenced productivity under combined water deficit and thermal stress. The relatively moderate coefficient of variation suggests that irrigation partially mitigated climatic limitations; however, genotype-specific resilience remained a decisive factor in achieving superior yields. From an agronomic perspective, the results emphasize the importance of hybrid selection even under irrigated systems, particularly in regions prone to increasing climatic variability.

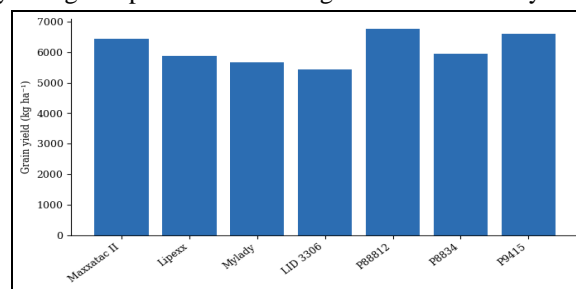


Figure 5. Grain yield (kg ha⁻¹) of maize hybrids cultivated under irrigated conditions during the 2024–2025 growing season in Cogealac, Constanța County.

DRAGOMIR AND PARTAL (2016) demonstrated that, in Dobrogea conditions, water supply significantly increases maize productivity; however, yield response differs among hybrids depending on their tolerance to high temperatures during flowering. This observation is consistent with the present results, where P88812 and P9415 maintained superior grain yield and kernel weight despite thermal stress episodes. Under similar pedoclimatic conditions, FILIP AND MARIN (2018) reported that irrigation improves grain filling and thousand kernel weight, particularly in seasons characterized by rainfall deficit. The relatively low variability of TKW observed in the present study supports these findings, confirming the buffering role of irrigation in stabilizing kernel development.

FURTHERMORE, GHIORGHE ET AL. (2023) showed that climate change trends in Romanian agricultural areas increasingly favor hybrids with improved stress resilience and efficient assimilate partitioning. The superior biomass-to-grain conversion observed in P88812 and P9415 aligns with this adaptive profile. Overall, the present findings confirm the conclusions of Romanian research that irrigation alone does not guarantee maximum

productivity. Instead, optimal performance results from the interaction between irrigation management and hybrid genetic potential, particularly under the increasingly variable climatic conditions specific to Southeastern Romania.

CONCLUSIONS

The 2024–2025 growing season in Cogealac was characterized by significant rainfall deficit and thermal stress episodes, despite the application of supplementary irrigation totaling 1,600 m³ ha⁻¹. Although irrigation partially mitigated water limitation, hybrid-specific responses remained decisive for final performance.

Plant density at harvest remained relatively stable (mean 5.87 plants m⁻²; CV=5.11%), confirming the effectiveness of the applied technology. However, density losses varied among hybrids (1.6–6.8%), indicating differences in stress tolerance during the vegetation period.

Plant height and biomass accumulation showed moderate variability (CV≈6%), reflecting genetic influence on vegetative vigor. Hybrids P88812, P9415, and Maxxatac II demonstrated superior growth capacity under irrigated but climatically restrictive conditions.

Thousand kernel weight (mean 300.1 g; CV=2.72%) proved to be a relatively stable yield component. The 7.6% difference between extreme genotypes highlights the importance of genetic background in maintaining grain filling efficiency under stress.

Grain yield averaged 6,106 kg ha⁻¹, with a 19.5% difference between the highest- and lowest-performing hybrids. P88812, P9415, and Maxxatac II exhibited superior productivity, exceeding the overall mean by 5-11%, confirming their adaptability to the pedoclimatic conditions of Southeastern Romania.

The results demonstrate that, even under irrigated systems, hybrid selection remains a critical factor for ensuring yield stability and efficient biomass-to-grain conversion. In the context of increasing climatic variability, the choice of stress-tolerant and physiologically efficient hybrids represents a key strategy for sustainable maize production in Dobrogea.

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