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YIELD AND QUALITY OF SOME MAIZE HYBRIDS (*Zea mays L.*) UNDER DIFFERENT PLANTING DATES

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ABSTRACT

For optimal maize yield, selecting the appropriate planting date based on a region's climatic conditions is crucial. This is especially true when considering the varying needs of different maize hybrids. To better understand the relationship between planting dates and yield for various maize hybrids, a study was conducted in Jiroft during 2018 and 2019. This research examined ten maize hybrids across three distinct planting dates.The findings revealed that delaying the planting date reduced yield components, SPAD, GDD, oil percentage, and overall oil yield.Interestingly, the amino acid content increased with delayed planting. Among the hybrids, the 703 variant achieved its peak grain yield on July 18. In contrast, the lowest yield was recorded on August 1, marking a substantial 30.07% reduction in grain yield. These results underscore the significance of timely planting in maximizing both the yield and quality attributes of maize hybrids.

Keywords: Amino acids, oil, proline, protein, yield

INTRODUCTION

Maize (*Zea mays* L.) is a highly valued agricultural crop, prized for its adaptability across diverse climatic conditions, substantial dry matter production, rich nutritional content, and impressive water-use efficiency. Commonly, maize is cultivated in rotation following crops that enrich the soil with nutrients and enhance its permeability. This makes it ideal to follow crops such as alfalfa, clover, soybeans, potatoes, and cereals (Verma et al., 2019).

Achieving success in maize agriculture requires a holistic approach. The initial step is seed selection; the right modified seed variety should be chosen based on specific environmental conditions. Their lifespan and maturation rates can categorize maize seeds into early, mid, and semi-late maturing varieties. Additionally, during planting, the ambient temperature plays a crucial role. The average daily temperature is recommended to remain between 10-12 degrees Celsius. A temperature drop below 10 degrees Celsius can impede germination, and anything less than 6 degrees Celsius halts germination entirely (Solaimalai et al., 2020).

Planting in the spring is strategic and seeds sown at the right moment in spring benefit from the season's mild weather, promoting optimal growth (Nouri et al., 2020). This ensures that by the height of summer, the plants are mature and less vulnerable to intense heat and hot winds (Panda, 2018). Conversely, ill-timed planting can lead to compromised pollination, resulting in fewer seed rows on the cob due to unfavorable environmental conditions (Jans et al., 2010).

Adjustments in planting techniques, like altering planting dates, have been advocated as potent methods to amplify both the quality and quantity of grain yield (Mubeen et al., 2014). Significant growth phases and developmental shifts mark the journey from planting to harvest. The maize plant's physiological traits offer a clear reflection of these changes. It's important to note that early planting of heat-loving crops might be risky if they encounter cool weather, hampering seedling growth. On the other hand, late planting can limit the plant's vegetative growth and flowering phase. Thus, choosing the right planting window is pivotal to optimizing maize yield (Ribaut et al., 2009).

Optimal seed production in maize hinges on carefully selecting the appropriate planting date tailored to the unique climatic conditions of each specific region. When maize is cultivated in adverse environmental circumstances, the resultant hybrids yield less compared to their well-suited counterparts. The synchronization of pollination with unfavorable environmental factors like hot winds and low humidity undermines the consistency of hybrid growth, ultimately compromising the yield's quantity and quality (Gebrehiwot et al., 2011).

Significant repercussions arise from the delay in planting. This delay leads to heightened grain protein and fiber levels while simultaneously triggering a decline in vital nutrients such as iron, calcium, and zinc (Moshki et al., 2017). Furthermore, the overall biological yield of maize diminishes (Seifert et al., 2017). Bozorgmehr and Nastari Nasrabadi (2013) illustrated that postponing the planting of maize results in a quantitative and qualitative reduction in yield. However, in the case of late-maturing varieties, delaying planting until late June, particularly in arid regions characterized by hot and dry weather conditions—such as the southern reaches of Iran's Kerman province can enhance maize yield. This favorable outcome can be attributed to the planting period aligning with key growth phases, such as tillering, pollination, and seed filling. This strategy mitigates the impact of high temperatures, simultaneously fostering more remarkable leaf growth, elevated photosynthesis, and heightened assimilate production (Rousta et al., 2023).

Contrary to this, Dehghani et al. (2017) argued that postponing the planting date significantly diminishes both maize yield and its essential components, encompassing plant height, cob length, and overall biological yield, particularly in sweet maize varieties.

In numerous parts of Iran, a temporal gap of 80 to 90 days emerges between harvesting autumn crops and cultivating psychrophilic spring crops in late spring, leading up to the subsequent autumn planting season. Utilizing this brief time window effectively necessitates the identification of maize genotypes that tolerate delayed planting. While existing literature emphasizes the yield reduction associated with delayed planting, it is worth noting that recognizing and utilizing genotypes adept at enduring such delays could profoundly contribute to enhanced yields. The present study determined the most optimal planting date for diverse maize hybrids in the Jiroft region during the years 2018 and 2019.

MATERIALS AND METHODS

Site Description and Planting

Randomized complete block design (RCBD) based on combined analysis of variance was employed in the region of Jiroft, Iran, situated at a latitude of 28.11° N and a longitude of 57.66° E, with an elevation of 630 meters above sea level. This study was conducted during the 2018 and 2019 with second-crop maize planting to investigate the influence of varying planting dates on the phenology and the quality and quantity of yield for different maize (*Zea mays* L.) hybrids categorized into distinct maturing groups. The climate of this region is characterized by arid and semi-arid conditions, featuring cold winters and hot summers, spanning from -4°C to +48°C. The annual precipitation averages around 220 mm.

The experimental treatments encompassed different planting dates, denoted as PD1 (July 18), PD2 (July 25), and PD3 (August 1), coupled with 10 maize hybrids: 701, 703, 705, 706, 707, 201, 260, 370, 400, and 704 . The hybrid varieties were classified based on their maturation periods—100-400 representing early-maturing (85-100 days), 500-600 as mid-maturing (101-130 days), and 700-900 as semi-late maturing (131-147 days). These varieties were sourced from the Seed and Plant Improvement Institute in Iran.

Land preparation activities, including plowing, discing, and ridge creation, adhering to standard practices, with one plow and two perpendicular discs employed. Each experimental plot consisted of five planting rows spanning 10 meters, with a 75 cm inter-row spacing. Plants were positioned 20 cm apart within each row, while the gap between plots was set at 3 meters.

Before sowing, the seeds underwent surface sterilization using a 5% NaOCl (sodium hypochlorite) solution for 5 minutes to prevent fungal infestation (Ozturk and Aydin, 2023). Following sterilization, the seeds were rinsed with distilled water. Notably, no priming treatment was applied to the seeds before planting. Planting holes were seeded with three seeds each, with thinning performed at the 4-6 leaf stage. Weed control was executed through manual weeding throughout the experiment. Nutrient requirements were met in line with recommendations from the soil and water research department, while irrigation was carried out using a drip method. Irrigation was scheduled once 80 mm of water had evaporated from the class A evaporation pan. At the conclusion of the growth phase and upon physiological maturation, the plants were harvested. Sampling was conducted within the two outermost planting rows, at a distance of 50 cm from each side of these rows.

Laboratory Analyses

Upon the culmination of the growth phase and the attainment of full physiological maturation in the plants, the harvesting process was executed within an area spanning six square meters. Subsequently, the Grain Yield (GY) and Biological Yield (BY) were assessed, accounting for moisture content of 14%. The Harvest Index (HI) was determined using the formula: HI = (Grain yield/biomass) × 100.

A chlorophyll meter (SPAD) was employed to evaluate the total chlorophyll content. The calculation of growth degree days (GDD) was achieved using the formula: GDD

= Σ(Tmax + Tmin)/2 – Tbase, where Tmax represented the maximum daily temperature, Tmin indicated the minimum daily temperature, and Tbase signified the base temperature (Plett, 1992).

For quantifying the Oil Percentage (OP), Oil Yield (OY), Protein Percentage (PP), Protein Yield (PY), as well as the estimation of essential amino acids (Methionine, Threonine, Valine, Lysine, Phenylalanine) and nonessential amino acids (Proline, Glycine, Alanine), Near-Infrared Reflectance Spectroscopy (NIRS) was employed across the wavelength range of 1100–2500 nm, at intervals of five nm (Manivannan et al., 2008).

Statistical Analysis

The gathered data underwent a variance analysis using SAS software (version 9.3) to establish the statistical significance of the treatment's impact (SAS Institute, 1997). Moreover, correlation analyses between the various parameters were conducted employing a linear regression model. The Duncan test was employed at a significance level of 1% to compare treatments (Zareh Chahoki, 2019). The statistical analysis was further conducted using R software(McCune and Mefford, 1999).

RESULTS AND DISCUSSIONS

The Grain Yield was notably influenced by the hybrid type, planting date, and their interactions (Table 1). Meanwhile, Biological Yield exhibited significant variation in response to the hybrid type. The planting date exhibited a significant impact on the Harvest Index. Similarly, experimental treatments significantly affected protein content, oil percentage, and growth degree days (GDD) (Table 1).

Yearly changes and interactions between hybrid, year, and planting date did not significantly affect the essential and nonessential amino acids (Table 2). However, the effects of planting date were significant for all amino acid variables except for Phenylalanine. Additionally, the hybrid type significantly influenced Methionine, Lysine, and Proline.

The delay in planting translated to a reduction in grain yield, with the highest grain and biological yield observed in hybrid 707 across all three planting dates. Hybrid 201 and 260 also displayed elevated yields when planted on July 25, as did hybrid 10 when planted on both July 25 and August 1 (Fig. 1). The findings indicate that, in most hybrids, July 25 emerged as the optimal planting date for the region, resulting in superior yields compared to other dates. This outcome underscores the notion that appropriate planting timing enhances yield by optimizing the utilization of environmental factors. This, in turn, promotes enhanced vegetative growth and the allocation of a greater share of photosynthetic resources toward seed development (Zhou et al., 2016).

July 18 planting led to a decrease in grain yield, impacting grain oil yield. Optimal planting dates facilitated higher oil percentages and oil yields per hectare. Given the interconnectedness of grain yield and oil content to oil yield (Fanayi et al., 2008), delaying planting dates often translated to reduced grain and subsequently oil yields in select maize hybrids. The decrease in maize grain yield during late planting can be attributed to the synchronization of the grain-filling phase with cold autumn temperatures and inadequate heat accumulation during the vegetative growth period (Tsimba et al., 2013). The delay in maize planting curtailed grain yield due to a shorter growth window for the plant, which led to decreased availability of essential photosynthetic materials (Parker et al., 2016). Notably, the higher grain yield observed in the hybrids mentioned above could be attributed to their genetically enhanced yield potential and greater adaptability to prevailing climatic conditions (Masud et al., 2016). This is consistent with the fact that late and mid-maturing varieties boast extended vegetative growth periods, allowing plants to amass more photoassimilates and allocate them to grains during the crucial grain-filling stage (Alavi Fazel et al., 2013).

The SPAD readings showed no significant differences among hybrids. However, they exhibited a discernible trend under different planting dates, declining consistently from PD1 to PD3 (Fig. 2). Among the hybrids, HI values were highest for hybrid 260 (100.75) under PD1. In contrast, the lowest value (31.08) was observed for hybrid 260 under PD2. This decline in HI values with delayed planting could be attributed to reduced leaf area. In turn, decreased total chlorophyll content could be associated with late planting. Delayed planting likely impacted leaf chlorophyll levels and overall vegetative growth, subsequently influencing photoassimilation and crop yield. The current study identified a reduction in yield with later planting of hybrids.

The shortened interval between germination and flowering during late planting led to the reproductive phase onset before achieving proper vegetative growth and sufficient leaf area. This reduction in light energy absorbed by the leaves contributed to decreased biomass in later planting (Akter et al., 2016). Varieties possess distinct genetic traits that manifest in their phenotype, impacting potential yield in varying environmental conditions. As a result, varieties that can adapt effectively to regional conditions while maintaining a high yield potential are promoted as superior cultivars (Fosu-Mensah et al., 2012).

Other researchers have reported harvest index reduction in earlier planting dates due to promoting vegetative growth (Naraki et al., 2012). This phenomenon could be attributed to the more favorable temperature conditions during early planting, which enhances Radiation Use Efficiency, channeling greater photosynthetic resources into physiological reserves (i.e., seeds). The use of diverse crop varieties is a pivotal factor in agriculture, significantly influencing yield and harvest index through their inherent genetic potential (Dayal et al., 2016).

Table 1. Combined analysis of proprieties of 10 hybrids of maize at different years under different planting date

Variable	**df**	**Harvest Index (%)**	**Protein (%)**	**Protein Yield (%)**	**Oil (%)**	**Oil Yield (%)**	**Grain Yield (Ton/ha)**	**Biological Yield (Ton/ha)**	**Required GDD from planting to maturing**	**SPAD**
Year (A)	1	38.35**	0.05^{ns}	814.49^{ns}	0.06^{ns}	3872.23*	29.85**	142.71**	10.01^{ns}	7.74^{ns}
Year×rep	4	1.81**	1.84**	43992.67**	0.07**	4799.83**	0.77**	0.945*	90.82 ^{ns}	15.28**
Planting date (B)	3	139.18**	17.77**	38407.96**	16.51**	557890.23**	113.97**	279.97**	36789.92**	2667.59**
A×B	3	1.37 ns	0.12^{ns}	9098.37^{ns}	0.02^{ns}	2023.50^{ns}	0.07^{ns}	1.20 ^{ns}	0.69^{ns}	1.59^{ns}
Hybrid (C)	9	453.35**	27.38**	652638.53**	0.54**	247309.80**	179.29**	949.78**	259159.82**	116.56**
A×C	9	1.07 ns	0.09^{ns}	1509.74^{ns}	0.02^{ns}	898.44^{ns}	0.03^{ns}	0.58 ^{ns}	2.55^{ns}	3.06 ^{ns}
B×C	27	9.16**	0.27^{ns}	73087.31**	0.09**	36291.86**	23.53**	8.55**	350.78**	5.77*
A×B×C	27	0.59 ns	0.19^{ns}	1814.08^{ns}	0.01^{ns}	763.25^{ns}	0.03^{ns}	0.172 ^{ns}	2.34^{ns}	0.86^{ns}
Error	156	0.48	0.36	6881.05	0.02	909.99	0.14	0.35	85.71	3.39
CV%		3.87	9.32	11.04	4.72	7.45	3.17	2.48	2.51	6.46
) P (Bartlett test		0.95	0.75	0.65	0.54	0.64	0.91	0.84	0.85	0.88

ns,*, **: not significant or significant, respectively, at $p < 0.05$ and $p < 0.01$

Table 2. Combined analysis of amino acids (micromoles per gram wet weight) variables of 10 hybrids of maize at different years under different planting date

Variable	**df**	**Methionine**	**Threonine**	**Glycine**	**Valine**	**Lysine**	**Phenylalanine**	**Alanine**	**Proline**
Year (A)	1	139.20**	305.44^{ns}	18.74^{ns}	3.65^{ns}	68.79^{ns}	0.04^{ns}	322.17^{ns}	2.52^{ns}
Year×rep	4	5.14^{ns}	553.91^{ns}	103.77^{ns}	34.98^{ns}	169.89^{ns}	42.83 ^{ns}	3776.48**	58.54^{ns}
Planting date (B)	3	4306.77**	404347.77**	31999.95**	5380.69**	12915.19**	4422.34**	309836.35**	39748.49**
A×B	3	43.68**	1983.56^{ns}	92.31^{ns}	90.73^{ns}	272.15^{ns}	85.26^{ns}	144.32 ^{ns}	9.99 ^{ns}
Hybrid (C)	9	210.265**	1028.89**	478.51**	226.65**	2679.52**	207.28**	3252.07**	270.59**
A×C	9	69.95**	413.96^{ns}	21.89^{ns}	31.18^{ns}	326.65^{ns}	32.17^{ns}	375.79 ^{ns}	13.24 ^{ns}
B×C	27	16.97**	572.92**	185.36**	26.85 ^{ns}	343.28**	23.14 ^{ns}	727.49 ^{ns}	73.47 **
A×B×C	27	12.46*	420.68^{ns}	29.95^{ns}	13.34^{ns}	108.96^{ns}	15.61^{ns}	484.75 ^{ns}	17.50 ^{ns}
Error	156	6.82	279.06	60.13	18.99	135.29	26.95	570.52	25.69
CV%		8.04	5.42	6.49	5.67	12.05	6.57	7.56	7.02
Bartlett test (P)		0.84	0.94	0.89	0.77	0.75	0.64	0.89	0.93

ns,*, **: not significant or significant, respectively, at $p < 0.05$ and $p < 0.01$

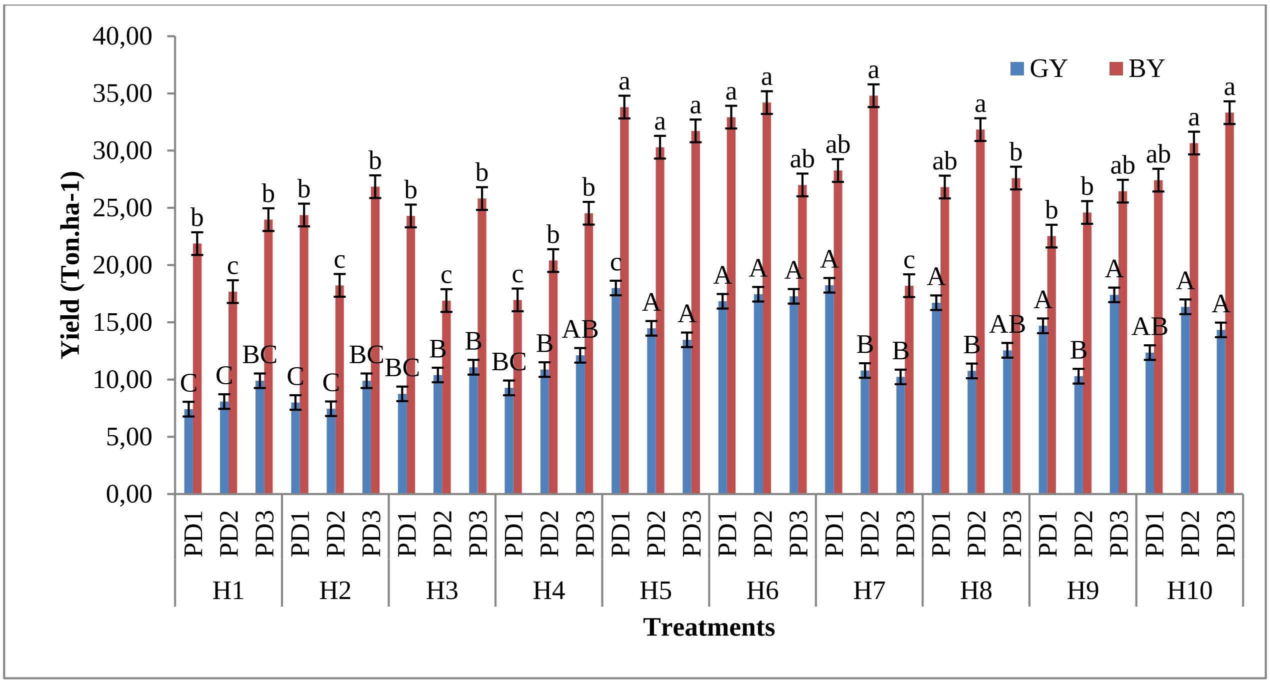


Figure 1. Grain Yield (GY), Biological Yield (BY) of maize (10 hybrids) under different planting date. Different case for interaction on the bars show significant differences (Duncan, P < 0.05). H1:701, H2:703, H3:705, H4:706, H5:707, H6:201, H7:260, H8:400, H9:370, H10:704. PD1: July-18, PD2: July-25, PD3: Agu-1.

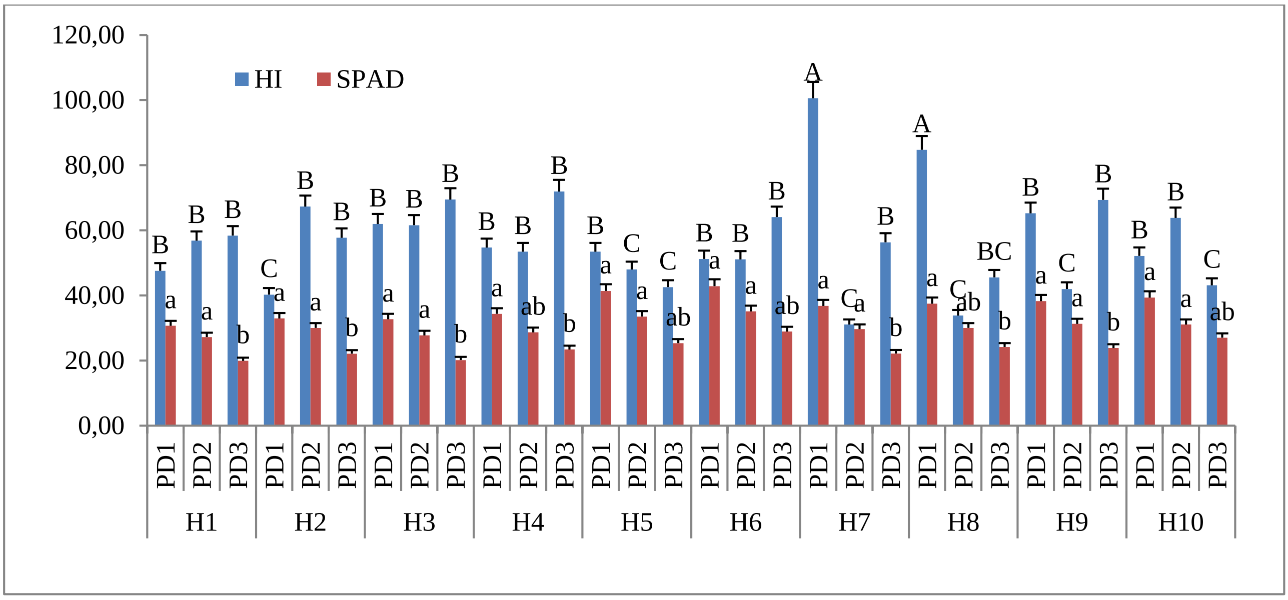


Figure 2. Harvest Index % (HI),SPAD of maize (10 hybrids) under different planting date. Different case for interaction on the bars show significant differences (Duncan, P < 0.05). H1:701, H2:703, H3:705, H4:706, H5:707, H6:201, H7:260, H8:400, H9:370, H10:704. PD1: July-18, PD2: July-25, PD3: Agu-1.

Results demonstrated that delayed planting correlated with diminished growth degree days (GDD) requirements, with the highest GDD observed for hybrid 201 when planted on PD1 (Fig. 3). The observed variability in GDD across different varieties and planting dates is primarily due to the fact that timely planting provides the necessary average temperatures required by each growth stage in a compact timeframe. In contrast, delayed planting stretches the periods over which the required heat is accumulated, thus causing each growth stage to be abbreviated due to less favorable conditions. Consequently, the plant fails to amass adequate growth degree days for its full growth cycle (Sun et al., 2007). Elevated temperatures and delayed planting culminate in shortened growth periods and hastened flowering (Fanaei et al., 2008). Such delays accelerate flowering, reduce the reproductive and vegetative phases, shorten the growth period, and expedite ripening (Thurling and Dass, 1997).

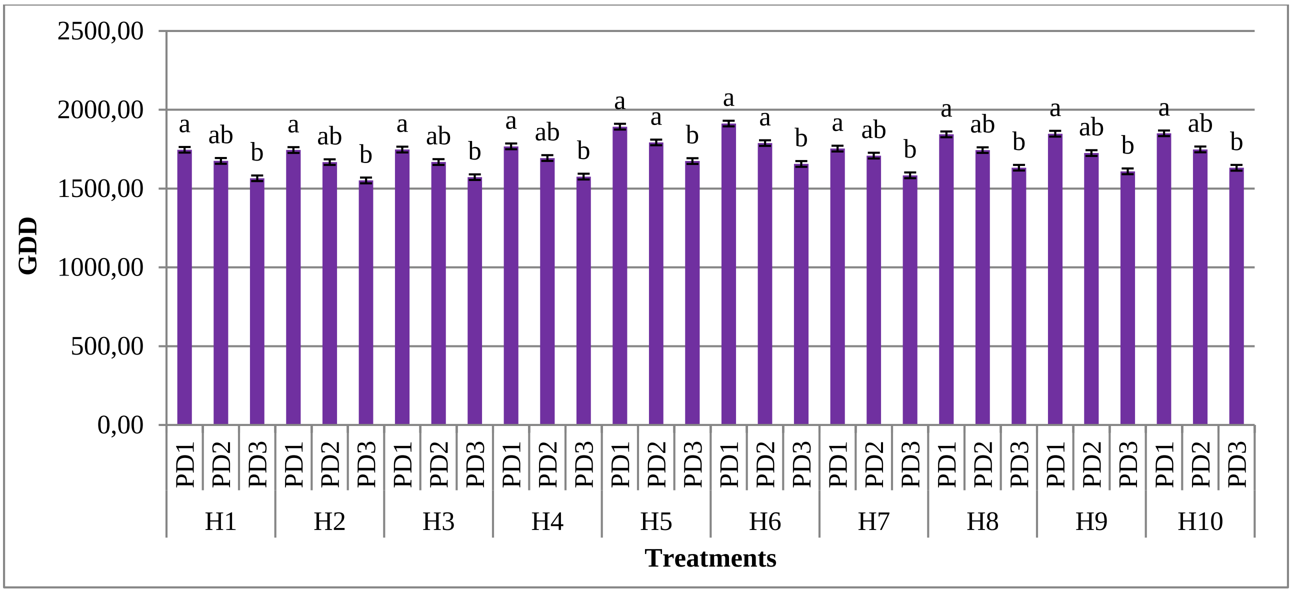


Figure 3. GDD required from planting to maturity of maize (10 hybrids) under different planting date. Different case for interaction on the bars show significant differences (Duncan, $P < 0.05$). H1:701, H2:703, H3:705, H4:706, H5:707, H6:201, H7:260, H8:400, H9:370, H10:704. PD1: July-18, PD2: July-25, PD3: Agu-1.

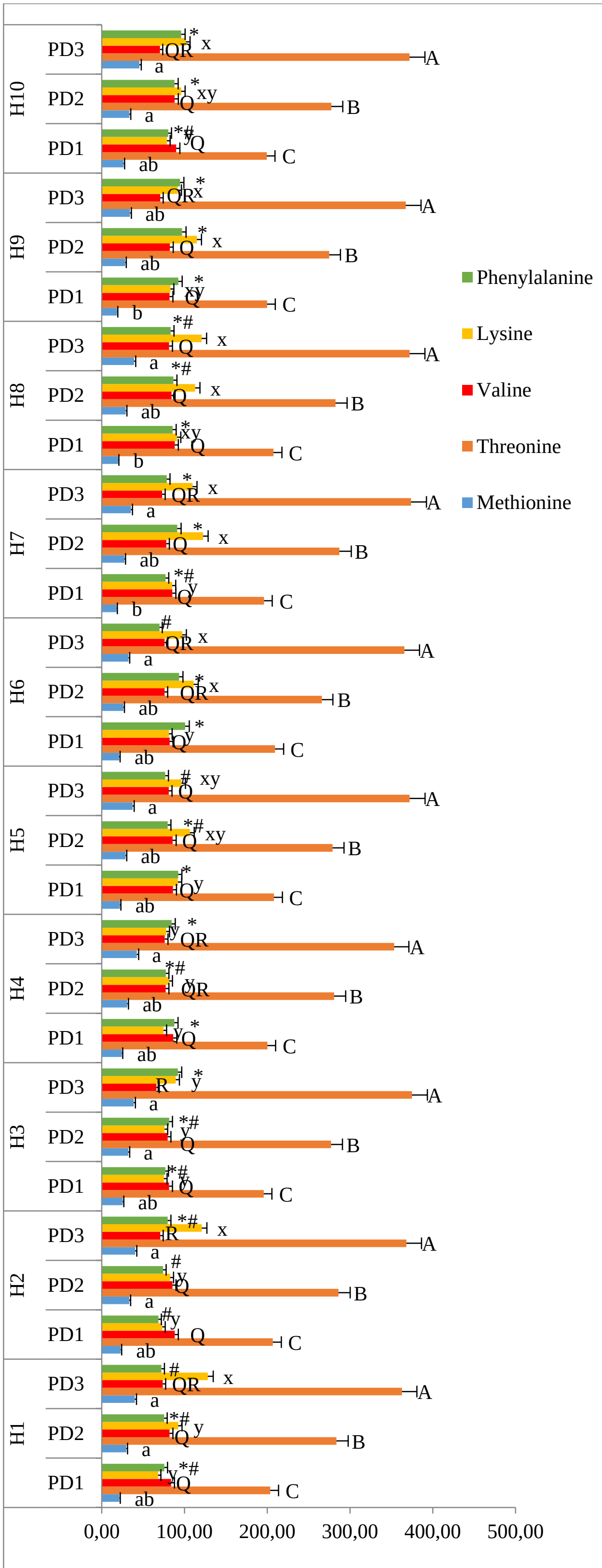
Mean comparison results indicated that essential amino acids, Phenylalanine and valine, demonstrated no significant variation among the planting dates across the 10 hybrids. Lysine displayed a significant increase in hybrid 701 and 703 under PD3, as well as hybrid 260 under PD2 (Fig. 4). Methionine and threonine exhibited a significant increasing trend across all 10 hybrids under different planting dates (PD1 < PD2 < PD3), while variations among the hybrids were insignificant (Fig. 4).

In terms of nonessential amino acids, the quantities of Alanine, Glycine, and Proline exhibited a significant increasing trend across the three planting dates (PD1 < PD2 < PD3) for all 10 hybrids (Fig. 5). Specifically, andalanine was notably higher in hybrid 370 and 706.

Amino acids are crucial plant metabolites, playing pivotal roles in environmental stress tolerance and regulation of internal plant processes (Rampino et al., 2006). The upsurge in amino acid levels could be attributed to augmented amino acid biosynthesis and protein proteolysis (Karamanos, 1995). Amino acid accumulation often intensifies in response to environmental stress in many plants, stabilizing cell membranes. Previous studies have reported increased amino acid levels due to delayed planting and exposure to elevated temperatures and heat stress (Dhyani et al., 2013). Certain amino acids function as osmotic regulators, accumulating in plant tissues and representing one of the most prevalent changes induced by stress (Bayoumi et al., 2010). Moreover, these amino acids act as non-enzymatic antioxidants, safeguarding cells and protecting against potential damage amid adverse environmental conditions (Shi and Zhu, 2009).

Correlation analysis among the examined traits revealed a robust positive correlation among the quantities of Glycine, Alanine, Threonine, and Proline, accompanied by a negative correlation with SPAD, GDD, protein percentage, and oil percentage (Fig. 6). Furthermore, a strong positive relationship was observed between Grain Yield and both protein yield and oil yield. Optimal planting timing enhances seed yield, oil percentage, and oil yield per hectare. Considering the interdependence of oil yield on both grain yield and oil percentage, planting delays lead to grain yield reductions followed by decreases in oil yield (Fanayi et al., 2008).

A principal component analysis was conducted to achieve a more comprehensive understanding of the relationships among the characteristics of hybrids under varying planting dates (Figure 7). The resulting graph displays the first and second components, accounting for approximately 50.2% and 12.8% of the variance. The angle between two vectors in the graph estimates their correlation, indicating that closely clustered points signify high correlation. Three distinct clusters of variables were identified, each displaying a strong internal correlation. The first cluster includes lysine, threonine, glycine, Methionine, alanine, and proline. Conversely, the second cluster, positioned in the opposite direction, exhibits a high negative correlation with the first cluster. This second cluster involves SPAD, GDD, valine, protein percentage, and oil percentage. Perpendicular to the first cluster, the third cluster encompasses Phenylalanine, biological yield (BY), and grain yield (GY), showing a high level of correlation within itself.



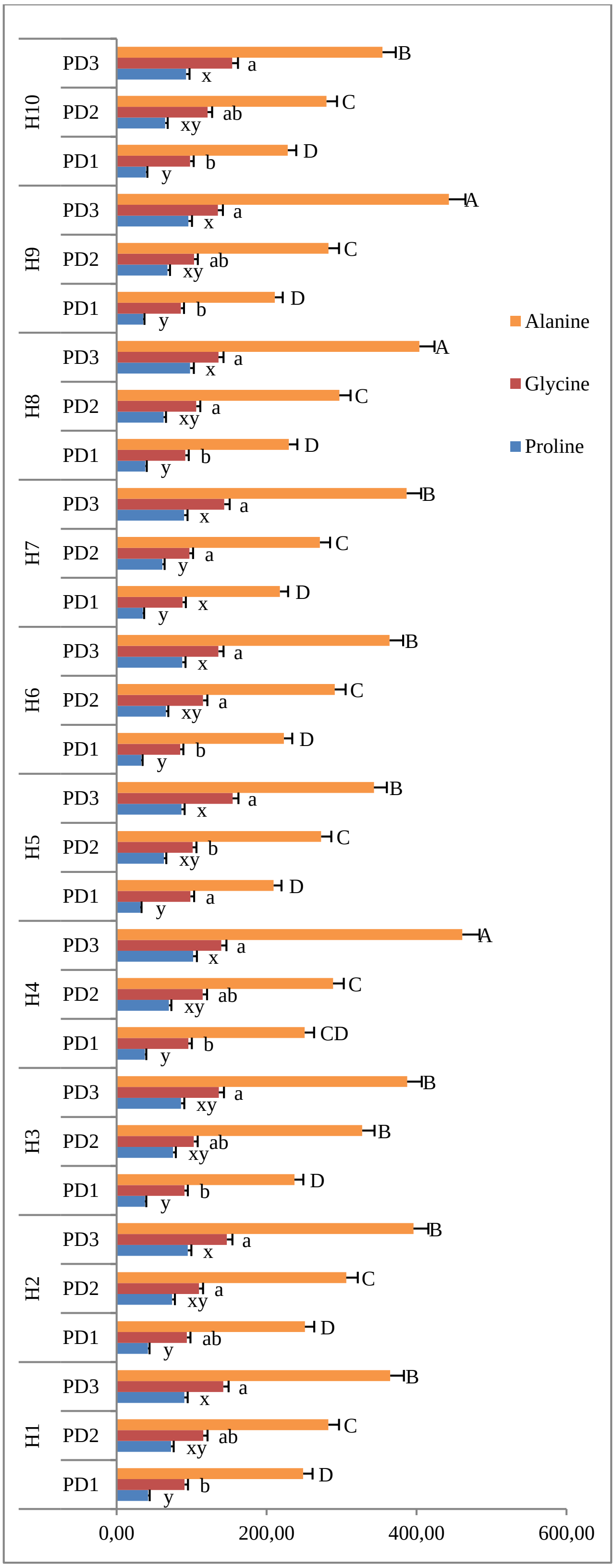
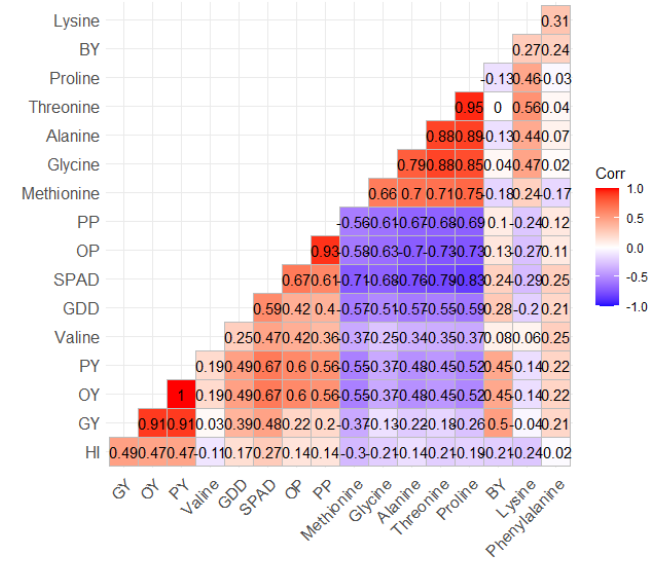


Figure 4. Essential amino acids(micromoles per gram wet weight) of 10 maize hybrids under different planting date. Different case for interaction on the bars show significant differences (Duncan, P < 0.05). H1:701, H2:703, H3:705, H4:706, H5:707, H6:201, H7:260, H8:400, H9:370, H10:704. PD1: July-18, PD2: July-25, PD3: Agu-1.

Figure 5. Nonessential amino acids (micromoles per gram wet weight) of 10 hybrids of maize at different years under different planting date. Different case for interaction on the bars show significant differences (Duncan, P < 0.05). H1:701, H2:703, H3:705, H4:706, H5:707, H6:201, H7:260, H8:400, H9:370, H10:704. PD1: July-18, PD2: July-25, PD3: Agu-1.



Variables	GY	BY	HI	GDD	SPAD	OP	OY	PP	PY	Methionine	Threonine	Valine	Lysine	Phenylalanine	Proline	Glycine
GY																
BY	**0.00**															
HI	**0.00**	**0.004**														
GDD	**0.00**	**0.00**	**0.03**													
SPAD	**0.00**	**0.001**	**0.00**	**0.00**												
OP	**0.003**	0.093	0.06	**0.00**	**0.00**											
OY	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**										
PP	0.007	0.178	0.06	**0.00**	**0.00**	**0.00**	**0.00**									
PY	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**								
Methionine	**0.00**	**0.014**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**							
Threonine	**0.016**	0.999	**0.01**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**						
Valine	0.723	0.278	0.14	**0.001**	**0.00**	**0.00**	0.01	**0**	**0.01**	**0.00**	**0.00**					
Lysine	0.619	**0.00**	**0.00**	0.006	**0.00**	**0.00**	0.07	**0.00**	0.07	**0.001**	**0.00**	0.441				
Phenylalanine	**0.004**	**0.001**	0.79	**0.004**	**0.001**	0.128	**0**	0.11	**0.00**	**0.024**	0.582	**0.001**	**0.00**			
Proline	**0.00**	0.092	**0.01**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0**	**0.00**	0.726		
Glycine	0.088	0.593	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.001**	**0.00**	0.782	**0.00**	
Alanine	**0.003**	0.081	0.07	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	0.358	**0.00**	**0.00**

Figure 6. Correlation plot of studied maize traits under different planting date and Table2. their significance level. GY: Grain Yield, OY: Oil Yield, PY: Protein Yield, OP: Oil Percentage, PP: Protein Percentage, BY: Biological Yield, HI: Harvest Index.

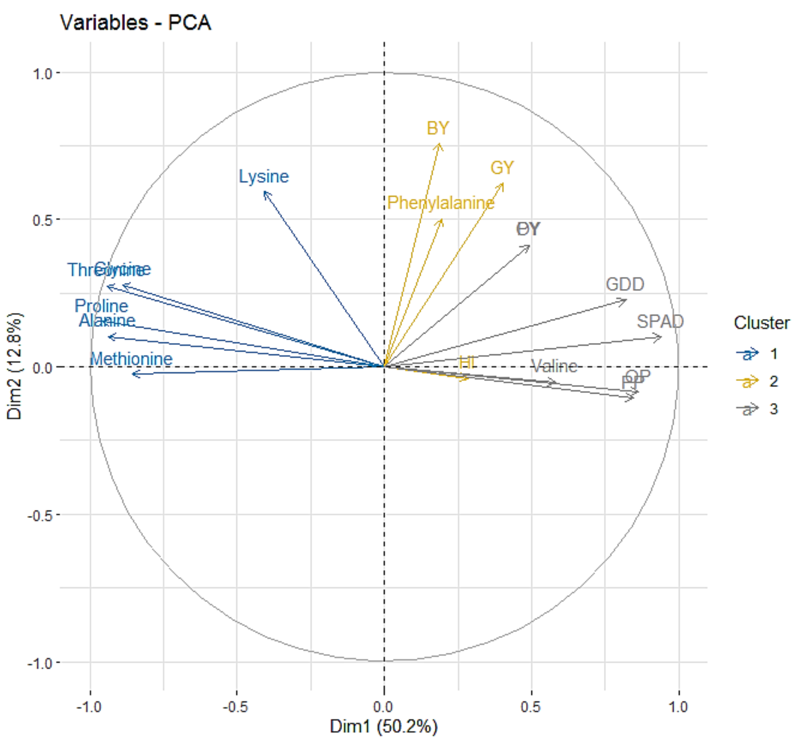


Figure 7. Principal Component Analysis (PCA) of data for all characteristics of 10 maize hybrids under different planting date. GY: Grain Yield, OY: Oil Yield, PY: Protein Yield, OP: Oil Percentage, PP: Protein Percentage, BY: Biological Yield, HI: Harvest Index.

CONCLUSION

Enhancing maize yield requires strategically applying agronomic practices and innovative plant breeding approaches. In tandem with this, introducing high-yield varieties, coupled with a keen focus on maximizing the genetic potential of cultivars under varying climatic conditions, remains pivotal. Achieving a substantial portion of this objective hinges on selecting the appropriate planting dates. Due to unfavorable temperatures during critical growth phases like tillering, pollination, and maturation, delayed planting culminates in a shortened vegetative phase, diminished active photosynthesis, and reduced transfer of photosynthetic resources—ultimately translating to diminished economic yield.

In the context of this research, hybrids 703 and 707 were cultivated on July 18, with hybrid 703 further planted on July 25 and August 1 to ascertain optimal yield. Notably, hybrid 703 demonstrated its highest grain yield on July 18, while the lowest yield was recorded on August 1—a stark 30.07% decrease. This outcome underscores the importance of choosing the right planting dates, enabling yield maximization through effectively utilizing environmental factors, improving vegetative growth, and allocating a greater share of photosynthetic resources toward seed production.

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