INFLUENCE OF PLANTING GEOMETRY ON GROWTH, PHENOLOGY, AND YIELD OF WHITE MAIZE IN PADMA-WASHED LANDS

Abstract: This study was carried out at the SingairUpazilla of Manikganj from November to December, 2015-2016 to evaluate the optimum plant spacing of white maize varieties. There were three plant spacing viz.S_1(50 cm x 25 cm), S_2 (60 cm x 25 cm) and S_3(70 cm x 25 cm) and two white maize varieties viz.V_1(PSC-121) and V_2(KS-510) were included in the experiment. The study was conducted using a factorial randomized complete block design (RCBD) with three replications. The variety, V_1(PSC-121) exhibited superior performance, displaying higher plant height, cob length, cob breadth, number of rows cob^{-1}, number of grains row^{-1}, total number of grains cob^{-1}, 100-grain weight, grain yield plant^{-1}, and grain yield ha^{-1}. However, the variety, V_2(KS-510) took more days to reach key growth stages and showed lower performance in several yield attributes. Plant spacing also played a significant role, with S_3 (70 cm x 25 cm) producing the maximum plant height, cob dimensions, and grain yield per plant but showed the lowest grain yield ha^{-1}. Conversely, S_1 (50 cm x 25 cm) resulted in the highest grain yield, stover yield, and biological yield, despite lower plant height and cob dimensions. The interaction between variety and plant spacing revealed interesting outcomes, such as V_1S_3 demonstrated the tallest plants, V_2S_3 exhibited higher stover yield, and V_1S_1 achieved the highest grain yield, biological yield, and harvest index. The study was found no significant variation in days to 1st tasseling, days to 1st silking, days to maturity, and harvest index across different plant spacing treatments.In conclusion, this research provides valuable insights into optimizing yield performance in white maize cultivation by considering both the choice of variety and appropriate planting spacing.

Keywords: White maize, Variety, Planting configuration, Grain yield, Harvest index

1. Introduction

White maize plays an important role in human diet(Ganapati, et al., 2018). White grain maize has the potential to be an alternative staple food due to its physical appearance, chemical properties, and taste (FAO, 2017). In Venezuela, white corn is the most important crop in terms of production, harvest area, and consumption (Yasin, et al., 2014). White maize has been studied for its fatty acid profile, with significant differences found between hybrids and localities (Baffour et al., 2011). Improved white maize varieties have been released in Indonesia, with characteristics such as drought tolerance and high protein quality. Overall, white maize is important for its role in human diet, potential as an alternative staple food, and its significance in crop production and farming systems in different regions.

White maize is an important crop in Bangladesh, ranking third in terms of area and production after rice and wheat (Islam and Hoshain, 2022). Research has been conducted to evaluate the physico-functional and nutritional properties of pigmented and non-pigmented maize in Bangladesh, revealing that white maize had the highest brightness value and bulk density, and contained the highest amount of zinc [2]. Maize production in Bangladesh has shown high profitability and economic efficiency, with maize ranking first in terms of yield and return compared to rice and wheat (Subrin, et al., 2022). Overall, white maize cultivation in Bangladesh has shown promise and potential for increasing agricultural growth and profitability (Miah, et al., 2014).

The inadequate maize productivity is linked to various factors such as soil fertility decline, suboptimal agronomic practices, limited input utilization, insufficient technology advancement, subpar seed quality, and challenges posed by diseases, insects, pests, and weeds. Overall, the low yield productivity of crops in this country is commonly associated with deficient agronomic management (Ullah et al*.,* 2017). Among these agronomic management practices, establishing the optimal plant density through appropriate spacing stands out as a crucial cultural practice that influences grain yield and other significant agronomic characteristics of this crop (Sangoi, 2001).

Various Indian white maize varieties underwent assessment in multiple research endeavors to evaluate their growth and yield under diverse planting geometries. The outcomes underscore the significant impact of planting geometry on maize growth and yield attributes (Ahmmed, et al*.,* 2020). Specifically, wider spacing (60 cm x 20 cm) exhibited superior performance in plant height, leaves per plant, cob dimensions, grains per cob, shelling percentage, 100-grain weight, and harvest index, while narrower spacing (40 cm x 20 cm) led to higher grain yield (Baishya et al*.,* 2022). In a separate experiment, VHM-45 emerged as the variety with the highest grain yield and stover yield (Nand, et al*.,* 2018). Recognizing the crucial role of plant density and arrangement in resource utilization, such as light, nutrients, and water, it influences various aspects of crop development and yield, including leaf area index, plant height, root length and density, and susceptibility to diseases and pests (Jettneret al., 1998).

Considering the main issues of the experiment with Indian white maize variety and planting geometry, optimizing crop yield becomes paramount. Implementing appropriate agronomic practices, with a focus on optimizing varieties and planting spacing, is crucial for efficiently maximizing productivity in limited land, ensuring sustainable agricultural output. The research was designed to harness these benefits, addressing the core challenges encountered in the experimental setup involving Indian white maize variety and planting geometry.

2. MaterialsandMethods

The experimental site was situated in Singair, Manikganj, and the study duration extended from November 2015 to April 2016, encompassing the rabi or winter season. The experiment incorporated two varieties, namely V1 (PSC-121) and V2 (KS-510), and three planting geometries labeled as S1 (50 cm × 25 cm), S2 (60 cm × 25 cm), and S3 (70 cm × 25 cm), treated as experimental factors to explore their interactions. Employing a factorial Randomized Complete Block Design (RCBD) with three replications, the experimental area was divided into three blocks, each subdivided into six plots. Each unit plot, measuring 6.0 m² (3 m × 2 m), had an 80 cm border between adjacent plots and a 1 m gap between adjacent replications or blocks, resulting in a total of 18 unit plots. Fertilizer management adhered to the BARI guideline of 2014.

On December 07, 2015, seeds were sown following the designated treatments by creating furrows 3-4 cm deep, covering them with soil on the ridge, and placing two seeds in each hill. Various intercultural operations were conducted according to the guidelines provided by BARI (2014).

In the study, data for growth and growth-indicating parameter was collected by measuring plant height at 30 DAS, 60 DAS, 90 DAS, and harvest using a measuring tape from the soil surface to the highest tip of the tassel. Phenological parameters, including days to first tasseling, days to first silking, and days to maturity, were recorded through visual observation. Yield and yield-contributing parameters involved measuring cob length without husk and cob diameter at the middle of each cob from ten randomly selected plants, determining the number of rows per cob and the number of grains per row on ten cobs, calculating total grains per cob, and assessing the 100-grains weight from three samples. Grain yield was determined by harvesting ten plants randomly, removing cobs, separating kernels, oven-drying, and expressing the weight as grams per plant, later converted to tons per hectare. Stover yield was determined similarly, and biological yield, the sum of grain yield and stover yield, was expressed in tons per hectare. The harvest index was computed as the ratio of grain yield to the total above-ground dry matter yield, presented as a percentage.

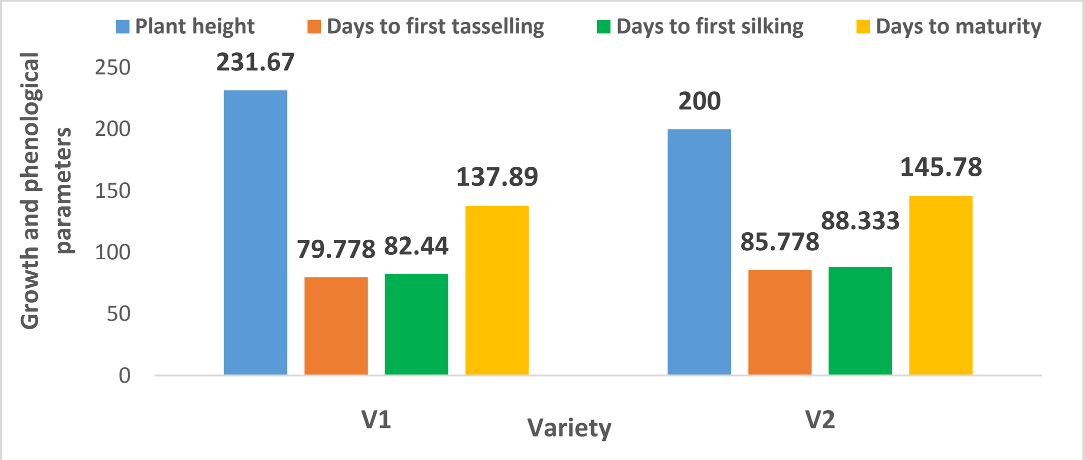
Information pertaining to growth, phenology, yield, and related characteristics was compiled and organized in Microsoft Excel. The gathered data underwent statistical analysis through the MSTAT-C computer package. To assess mean differences among the treatments, the Least Significant Difference (LSD) technique, as outlined by Gomez and Gomez (1984), was applied at a 5% significance level.

3. ResultsandDiscussion

Theresearchprogramwasformulatedaimingatinvestigating the combined effect of twoIndian white maize varieties and three planting spacings on their growth, yield and yield attributing characters.Relevant datahavebeen presented in this chapter and statistically analyzed withthepossibleexplanations. Almost all the growth parameters were significantly affected by maize varieties and plant densities.

3.1. Plant height

Various treatments, including two maize varieties and three plant spacing configurations, were employed to assess their impact on white maize plant height. The experimental results, presented in Fig. 1, 2, and 3, indicated significant influences of varieties, plant spacing, and their combinations on plant height. V1 exhibited taller plants (231.67 cm) compared to V2 (200.00 cm), with a statistically significant difference. Among plant spacing treatments, S3 resulted in the tallest plants (222.50 cm), followed by S2 (217.00 cm), while S1 had the shortest plants (208.00 cm), showing a statistically significant difference. Combinations like V1S3 showed the tallest plants (237.33 cm), statistically similar to V1S2 (233.33 cm). On the other hand, V2S1 displayed the smallest plants (191.67 cm), similar to V2S2 (200.67 cm). The findings align with Bahadur et al. (1999) and Sangakkara et al. (2004), who observed increased plant height with wider spacing, attributing variations to intra-specific competition for resources, such as nutrients and sunlight interception. This underscores the impact of plant density on maize growth.

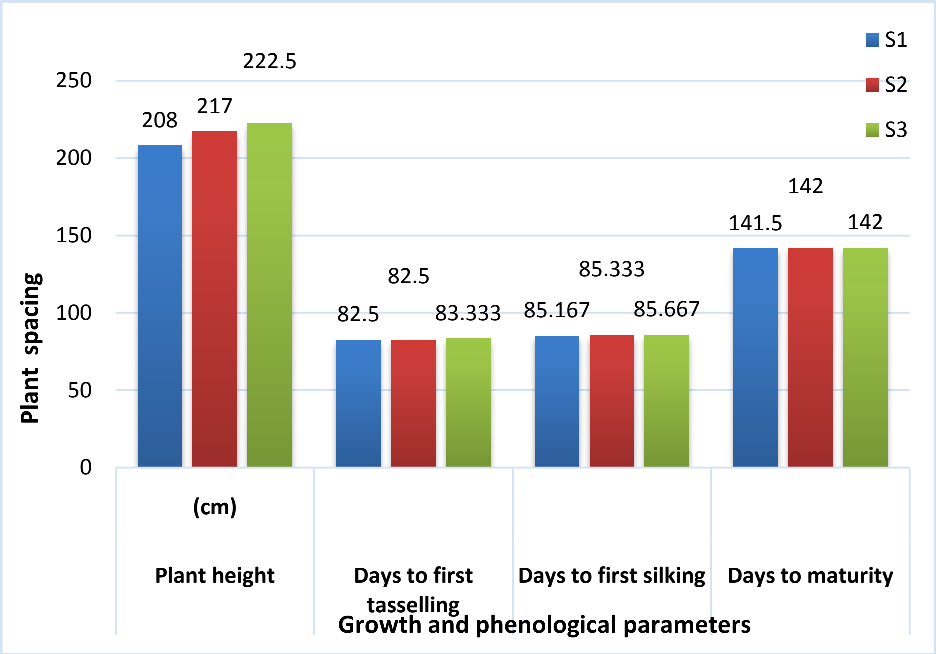


Here, V_1 = PSC- 121, V_2 = KS - 510

Figure 1. Effect of variety on plant height, days to first tasseling, days to first silking and days to maturity

3.2. Days to first tasseling

The impact of two varieties on the days to first tasseling in white maize was examined (Fig. 1), revealing a significant influence of varietal treatments. V2 required more days for tasseling (94.889 days) compared to V1 (79.778 days). Additionally, various plant spacing configurations were studied for their effect on days to first tasseling (Fig. 2). S3 exhibited the highest days to first tasseling (83.333 days), followed by S2 (82.50 days) and S1 (82.50 days), with treatments being statistically identical, indicating no spacing impact on tasseling days. Notably, S1 and S2 had numerically equivalent days to first tasseling. Results for the combined effect of variety and spacing were presented in Fig.3. V2S3 treatment required the maximum days for tasseling (86.66 days), statistically significant compared to other combinations. Conversely, V1S1 showed the minimum days to tasseling (79.33 days), statistically similar to V1S2 (79.66 days) and V1S3 (80.667 days). Similarly, V2S2 (85.33 days) and V2S3 (85.33 days) were statistically similar. Notably, studies by Gozubenli (2004) and Park et al. (1989) align with these findings, indicating that both inter and intra-row spacing, as well as plant density, do not significantly affect the tasseling and maturity period of maize.

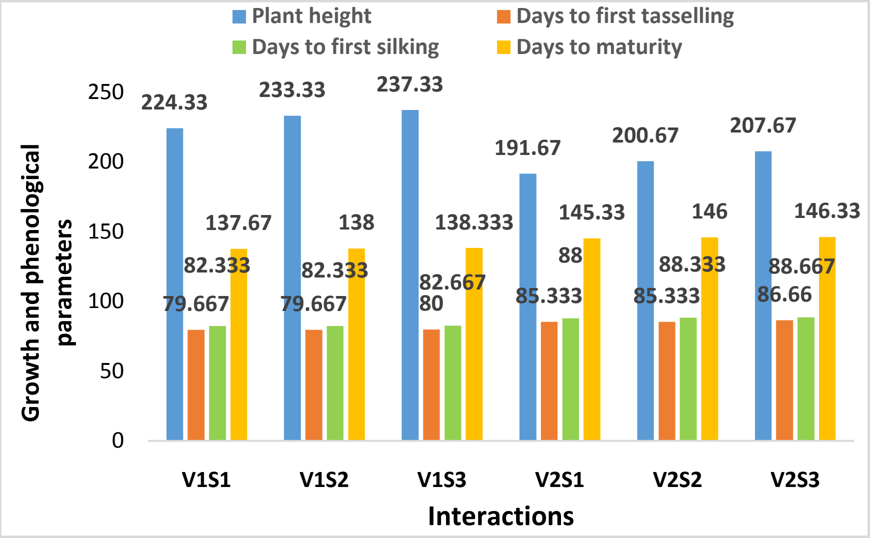


Here, S_1 = 50 cm x 25 cm; S_2 = 60 cm x 25 cm; S_3 = 70 cm x 25 cm

Fig.2. Effect of plant spacing on plant height, days to first tasseling, days to first silking and days to maturity

3.3. Days to first silking

The outcomes depicting the impact of variety, spacing, and their combination are illustrated in Fig.1, 2, and 3. Significantly, the days to first silking were influenced by varieties, with V2 requiring more days (88.333 days) compared to V1 (82.44 days). Regarding plant spacing, three configurations were employed, revealing that S3 exhibited the maximum days to first silking (85.667 days), followed by S2 (85.33 days) and S1 (85.16 days), yet all three spacing treatments were statistically identical, indicating an insignificant spacing effect on days to first silking. In the combined analysis of variety and plant spacing, V2S3 treatment necessitated more days to silking (88.667 days), statistically similar to V2S2 (88.333 days) and V2S1 (88.00 days). Conversely, V1S1 exhibited the minimum days to silking (82.333 days), statistically similar to V1S2 (82.333 days) and V1S3 (82.667 days).



Here, V_1 = PSC -121; V_2 = KS -510

S_1 = 50 cm x 25 cm; S_2 = 60 cm x 25 cm; S_3 = 70 cm x 25 cm

Fig.3. Interaction effect of variety and plant spacing on plant height, days to first tasseling, days to first silking and days to maturity of white maize

3.4. Days to maturity

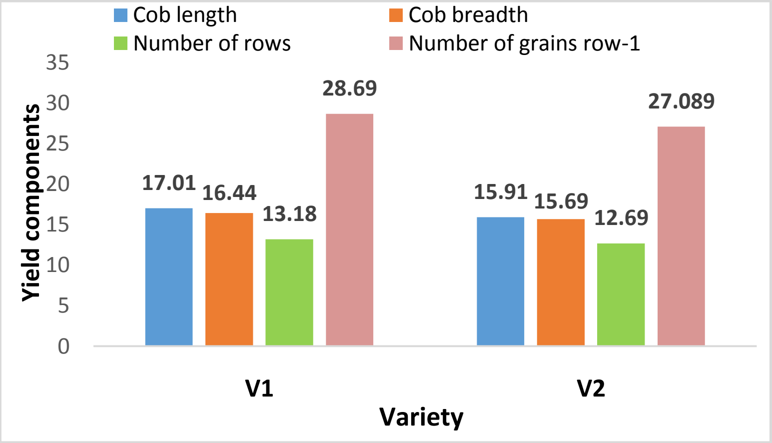
Statistically significant differences were observed in plant maturity concerning varieties (Fig. 1). V2 required more days to reach maturity (145.78 days), while V1 exhibited the minimum days (137.89 days). The impact of plant spacing on days to maturity was found to be insignificant, with all treatments being statistically identical (Fig. 2). Specifically, S2 and S3 both required numerically equal days for maturity (142.00 days), with S2 having the highest. S1 recorded the lowest days needed for maturity (141.50 days). In the combined analysis of variety and plant spacing (Fig. 3), V2S2 and V2S3 treatments required the highest days to mature (146.33 days), statistically significant compared to other combinations. Conversely, V1S1 exhibited the minimum days to maturity (137.67), statistically similar to V1S2 (138.00) and V1S3 (138.33). This finding aligns with Ullah et al.'s (2016) report that days to maturity is not significantly influenced by plant spacing.

3.5. Cob length

Significant differences were evident in cob length between varieties (Fig. 4). V1 (PSC-121) exhibited the maximum cob length at approximately 17.011 cm, while V1 (KS-510) recorded the minimum at 15.906 cm. Plant spacing had a notable impact on cob length (cm) (Fig. 5). Among the plant spacing treatments, S3 yielded the longest cob (17.367 cm), while S1 produced the shortest (15.50 cm). S2 fell in between S3 and S1, with a cob length of about 16.508 cm. In the interaction of variety and spacing (Fig. 6), V1S3 treatments displayed the highest cob length (17.867 cm), statistically significant compared to all other combinations. Following V1S3, V1S2 showed a cob length of 17.06 cm, statistically significant with V2S3 (16.867 cm). The shortest cob was observed in V2S1 (14.90 cm), maintaining a statistically significant relationship with all other interactions. Similarly, V2S2 recorded the fourth-highest cob length (15.95 cm), statistically similar to V1S1 (16.10 cm). These findings align with Konuskan (2000) and Gozubenli et al. (2001), who noted that maize ear characteristics vary based on both genotype and environmental conditions.

3.6. Cob breadth

Various white maize varieties, plant spacing configurations, and their combinations were employed to investigate their effects on cob breadth (cm) (Fig. 4, 5, and 6). The experiment reported a significant variety effect on cob breadth. V1 (PSC-121) exhibited a higher cob breadth (16.444 cm) compared to V2 (KS-510) with a breadth of about 15.689 cm. Regarding plant spacing, S3 provided the maximum cob breadth (16.45 cm), followed by S2 (16.13 cm). S3 and S2 were statistically identical. In contrast, S1 recorded the minimum cob breadth at about 15.167 cm, statistically significant over S3 and S2. Among the combination treatments, V1S3 displayed the maximum cob breadth (16.833 cm), statistically similar to V1S2. Conversely, the minimum cob breadth of 15.233 cm was observed in V2S1, statistically significant over all other combinations. Similarly, V2S2 (15.767 cm) exhibited the immediate shortest cob breadth, statistically similar to V2S3 (16.067 cm). These findings contribute to understanding the diverse effects of varieties, plant spacing, and their interactions on cob breadth, supporting previous studies in the field.

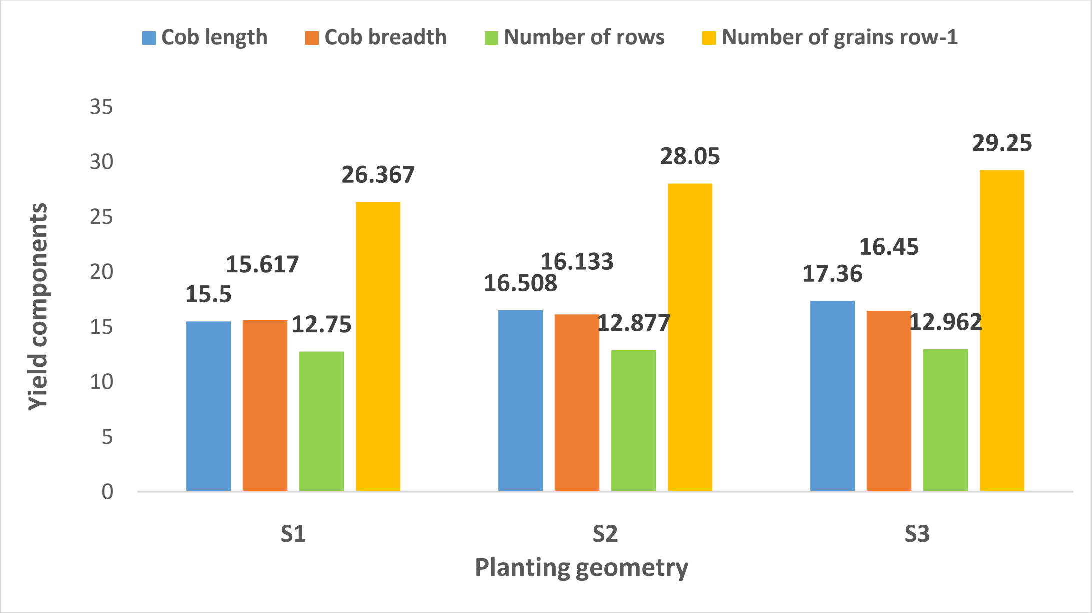


Here, V_1 = PSC -121, V_2 = KS -510

Fig.4. Effect of variety on cob length (cm); cob breadth (cm), number of rows per cob and number of grains per rows

3.7. Number of rows cob^{-1}

The experimental outcomes regarding the impact of variety, spacing, and their interactions are depicted in Figures 4, 5, and 6. Variety exhibited a significant effect on the number of rows per cob, with V1 (PSC-121) reporting a comparatively higher number of rows per cob (13.181) than V2 (KS) (12.544). Concerning the effect of spacing on the number of rows per cob, S3 yielded the highest number of rows per cob (12.962), followed by S2 (12.87) and S1 (12.75) consecutively. Despite numerical variations among treatments, there was no statistically significant difference, indicating an insignificant effect of spacing on the number of rows per cob. However, in the combination of variety and spacing, V1S3 exhibited the highest grain rows per cob (13.27), statistically identical to V1S2 with 13.20 grain rows per cob. Both V1S2 and V1S3 were statistically similar to V1S1 (13.067). On the other hand, the lowest number of rows per cob (12.433) was observed in V2S1, statistically similar to V2S2 (12.553). Likewise, V2S3 (12.647) fell in between the highest and lowest results. Hashemi et al. (2005) documented a progressive reduction in the number of kernel rows per ear with increasing plant density, attributing increased barrenness percentage at higher densities to the lack of a typical sink for assimilate supply. This limitation at elevated plant densities hindered the plants from producing viable ears. Ritchie and Alagarswamy (2003) highlighted that barrenness was more prevalent when plant densities surpassed 10 plants/m2.



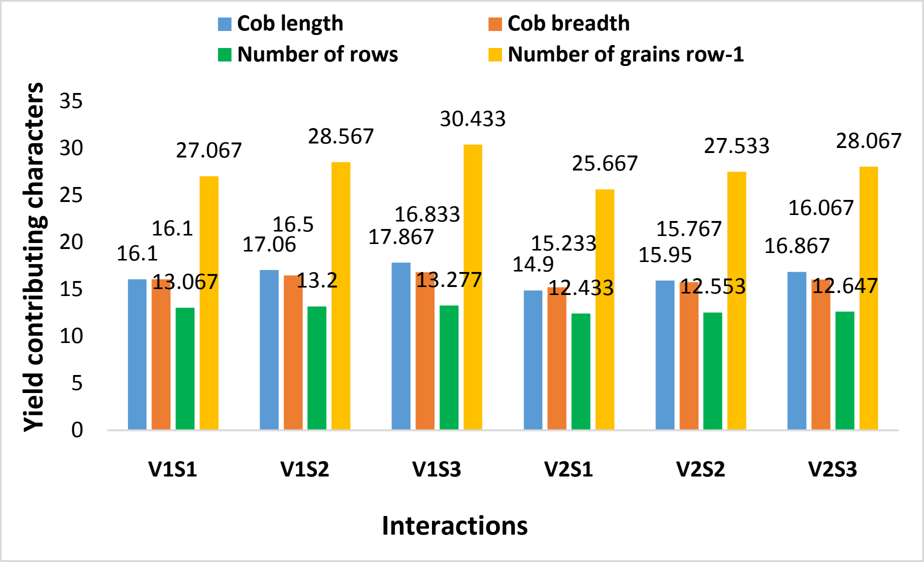
Here, S_1 = 50 cm x 25 cm; S_2 = 60 cm x 25 cm; S_3 =70 cm x 25 cm

Fig.5. Effect of spacing on cob length; cob breadth number of rows per cob and number of grains per rows

3.8. Number of grains row^{-1}

Experimental findings unveiled a significant effect of variety on the number of grains per row (Fig. 4). V1 (PSC-121) demonstrated a comparatively higher number of grains per row (28.689) than V2 (KS) (27.089). Furthermore, spacing treatments exhibited significant effects on the number of grains per row in white maize (Fig. 5), with an increase observed as spacing levels increased. Among the various spacing treatments, S3 produced the highest number of grains per row (29.250), followed by S2 (28.05), and S3 and S2 were statistically similar. Conversely, the lowest number of grains per row was observed in S1 (26.36), maintaining a statistically significant relation with S3 and S2. The combination of variety and spacing (Fig.6) revealed that V1S3 exhibited the highest number of grains per row (30.433), statistically similar to V1S2 (28.567). Among the treatments, V2S1 showed the minimum number of grains per row (25.667), statistically similar to V2S2 (27.533) and V1S1 (27.067). Additionally, V2S3 recorded the third-highest number of grains per row (28.067). Comparable findings were documented by Seyed Sharifi et al. (2009) and Zhang et al. (2006), indicating a substantial impact of maize hybrids on the number of grains per row in corn.

Here, V_1= PSC -121; V_2 = KS-510

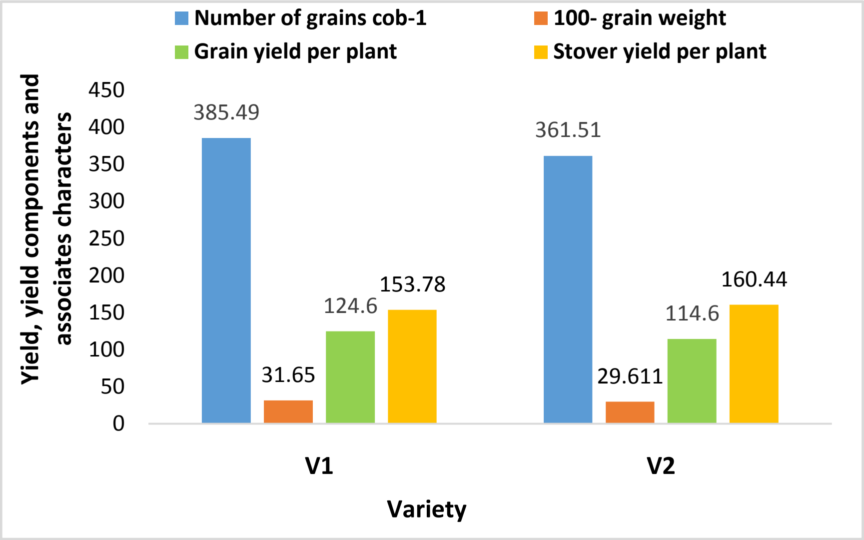


S_1= 50 cm x 25 cm; S_2 = 60 cm x 25 cm; S_3 =70 cm x 25 cm

Fig.6. Interaction effect of variety and spacing on cob length; cob breadth, number of rows per cob and number of grains per row of white maize

3. 9. Total number of grains cob^{-1}

Total grains per cob were significantly influenced by varieties, spacing, and their combinations (Fig. 7, 8, and 9). V1 (PSC-121) reported the highest number of grains per cob (385.49), surpassing V2 (KS) with 361.51 grains per cob. In the case of white maize spacing treatments, S3 yielded the maximum number of grains per cob (392.83), followed by S2. Conversely, S1 recorded the lowest number of grains per cob (352.20). The combination of variety and spacing highlighted that V1S3 exhibited the highest number of grains per cob (406.27), statistically significant over all other combinations. Following V1S3, V1S2 showed 385.47 grains per cob, statistically similar to V2S3 (379.49) and V2S2 (365.47). V2S1 provided the minimum grains per cob (339.67), statistically significant over all other combinations. Similarly, V1S1 resulted in the immediate minimum (364.73), statistically similar to V2S2 and V2S3. This aligns with Eskandarnejada et al.'s (2013) findings, stating that inter-row spacing of 30 cm produced more kernels per ear compared to 20 cm plant spacing.

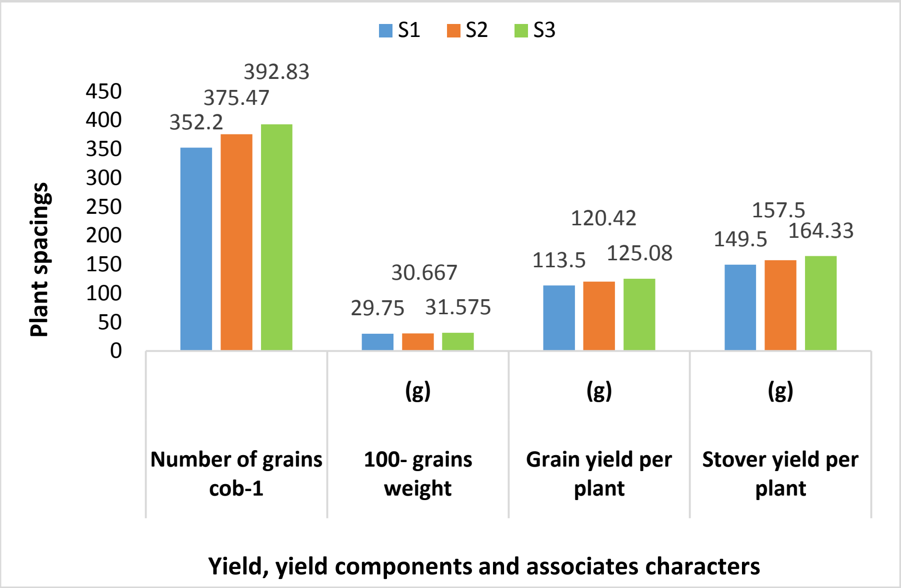


Here, V_1 = PSC -121; V_2 = KS -510

Fig.7. Effect of variety on number of grains cob^{-1}, 100-grain weight; grain yield per plant and stover yield per plant of white maize

3.10. 100-grain weight (g)

Variety, plant spacing, and their combinations significantly influenced the 100-grain weight in white maize (Fig. 7, 8, and 9). V1 exhibited the maximum 100-grain weight (31.650 g), surpassing V2 (29.611 g). Plant spacing treatments demonstrated significant effects on 100-grain weight, with S3 producing the highest (31.575 g), followed by S2 (30.667 g), and S2 was statistically similar to S3. Conversely, S1 yielded the lowest 100-grain weight (29.75 g), statistically similar to S2. In combination, the highest 100-grain weight (32.450 g) was achieved with V1S3, statistically similar to V1S2 (31.667 g). The minimum 100-grain weight (28.667 g) was observed in V2S1, maintaining a statistically similar relation with V2S2 (29.667 g). Similarly, V1S1 (30.833 g) and V2S3 (30.50 g) were statistically similar to V1S2 (31.667 g). This aligns with the findings of Ogunlela et al. (2005), Arif et al. (2010), and Mukhtar et al. (2012), indicating that 1000-kernel weight decreases with an increase in plant density.



Here, S_1 = 50 cm x 25 cm; S_2 = 60 cm x 25 cm; S_3 = 70 cm x 25 cm

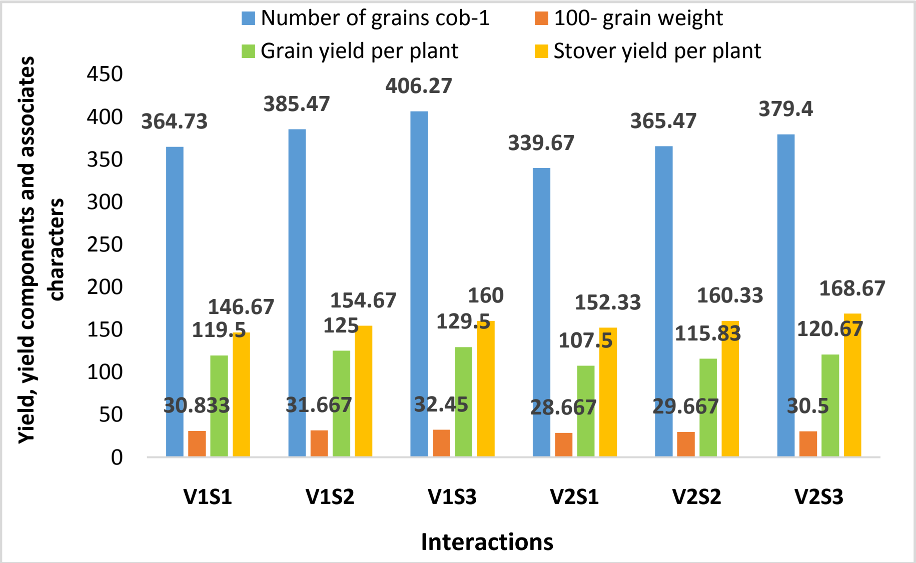
Fig.8. Effect of spacing on number of grains cob^{-1},100-grain weight; grain yield per plant and stover yield per plant of white maize

3.11. Grain yield plant^{-1}(g)

Variety, plant spacings, and their combination significantly influenced grain yield per plant (g) in white maize (Fig. 7, 8, and 9). The highest grain yield per plant (124.6 g) was significantly achieved with variety V1, while the lowest (114.6 g) was significantly obtained with V2. Among plant spacing treatments, S3 resulted in the maximum grain yield per plant (125.08 g), statistically similar to S2 (120.42 g), and S1 exhibited the significantly lowest yield per plant (113.50 g). In combinations, the maximum grain yield per plant (129.50 g) was significantly observed in V1S3, statistically similar to V1S2 (125.00 g), whereas the minimum was significantly noted in V2S1 (107.50 g). This study aligns with Ahmad et al. (2006), indicating that increasing plant population reduces yield per individual plant but increases yield per unit area of maize.

3.12. Stover yield plant^{-1} (g)

Variety, plant spacings, and their combination significantly influenced stover yield per plant (g) in white maize (Fig. 7, 8, and 9). The highest stover yield per plant (160.44 g) was significantly achieved with variety V2, while the lowest (153.78 g) was significantly produced with V1. Among plant spacing treatments, S3 resulted in the maximum stover yield per plant (164.33 g), statistically similar to S2 (157.50 g), and the minimum was significantly observed with S1 (149.50 g). In combinations, the maximum stover yield per plant (168.67 g) was significantly recorded in V2S3, statistically similar to V2S2 (160.33 g) and V1S3 (160.00 g), while the minimum was observed in V1S1 (140.67 g). Consistent with this study, Gozubenli et al. (2004) reported that above-ground dry biomass yield per plant increased with increased inter and intra-row spacing. Similarly, Miko and Manga (2008) noted that above-ground dry biomass per plant significantly increased with decreased maize plant density.



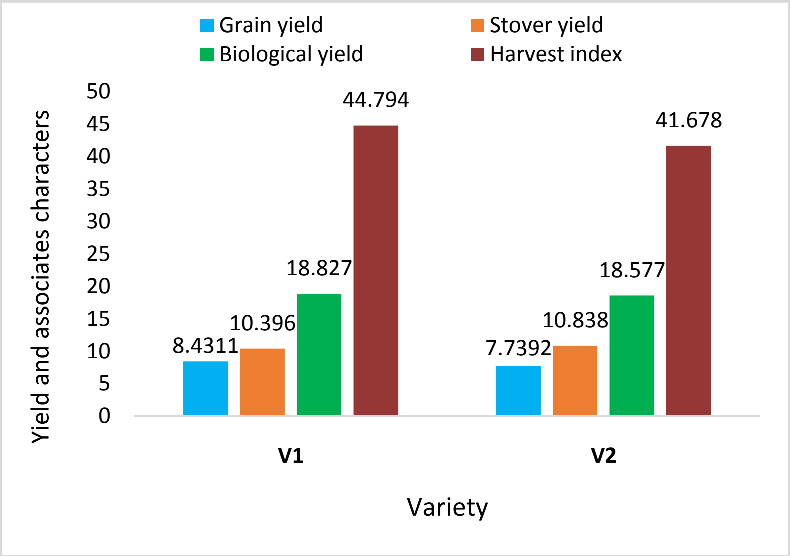
Here, V_1 = PSC - 121; V_2 = KS- 510

S_1 = 50 cm x 25cm; S_2 = 60 cm x 25cm; S_3 = 70 cm x 25 cm

Fig.9. Interactions effect of variety and spacing on number of grains cob^{-1}, 100-grain weight; grain yield per plant and stover yield per plant

3.13. Grain yield (t ha^{-1})

Variety, spacing, and their combination significantly influenced grain yield in white maize (Fig. 10, 11, and12, respectively). The highest grain yield (8.431 t ha-1) was significantly achieved with treatment V1, while the lowest (7.739 t ha-1) was observed with V2, potentially due to consistent soil moisture during the growing period. Among plant spacing treatments, the maximum grain yield (9.08 t ha-1) was obtained with S1, and the lowest (7.15 t ha-1) was recorded from S3, with S2 in between (8.02 t ha-1), all showing statistically significant differences. In combinations, the highest grain yield (9.1467 t ha-1) was observed in V1S1, statistically significant over all other combinations. Following V1S1, V2S1 (8.60 t ha-1) was statistically similar to V1S2 (8.33 t ha-1), while the minimum grain yield (8.0000 t ha-1) was observed in V1S2. The lowest grain yield (6.895 t ha-1) came from V2S3, and the immediate lowest (7.222 t ha-1) was reported from V1S2, statistically identical to V1S3 (7.40 t ha-1). This aligns with findings by Naraqanaswamy et al. (1994), Baron et al. (2001), and Arif et al. (2010) in maize spacing experiments, emphasizing the notable impact of plant density on grain yield, attributed to increased harvested ears and a higher number of plants per unit area (Dawadi and Sah, 2012).

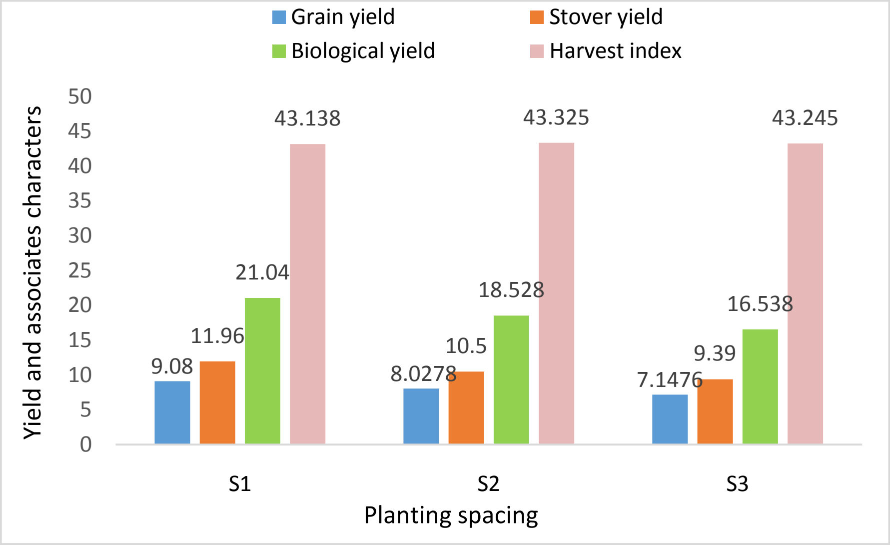


Here, V_1 = PSC -121; V_2 = KS -510

Fig.10. Effect of variety on grain yield; stover yield; biological yield and harvest index of white maize

3.14. Stover yield (t ha^{-1})

Stover yield in white maize was significantly influenced by variety, plant spacing, and their combinations (Fig. 10, 11, and 12). Among varieties, V2 exhibited a higher stover yield of approximately 10.838 t ha-1, followed by V1 with 10.396 t ha-1. Regarding plant spacing, significant differences were noted, with S1 producing the highest stover yield (11.96 t ha-1), followed by S2 at 10.50 t ha-1. Conversely, S3 recorded the lowest stover yield (9.390 t ha-1), possibly due to increased vegetative growth facilitated by sufficient water. In combination, the maximum mean stover yield (12.187 t ha-1) was observed in V2S1, statistically identical to V1S1 (11.733 t ha-1). The second-highest stover yield (10.689 t ha-1) came from V2S2, statistically similar to V1S2 (10.311 t ha-1), while the lowest (9.143 t ha-1) was recorded in V1S3, statistically similar to V2S3 (9.638 t ha-1). Similar findings were reported by Gobeze et al. (2012), indicating that the highest biomass occurred at a row spacing of 25 cm with a plant density of 10 plants m2, while Dawadi and Sah (2012) observed an increase in stover yield with higher plant densities due to an increase in the number of plants and dry matter yield.



Here, S_1 = 50 cm x 25cm; S_2 = 60 cm x 25 cm; S_3 = 70 cm x 25 cm

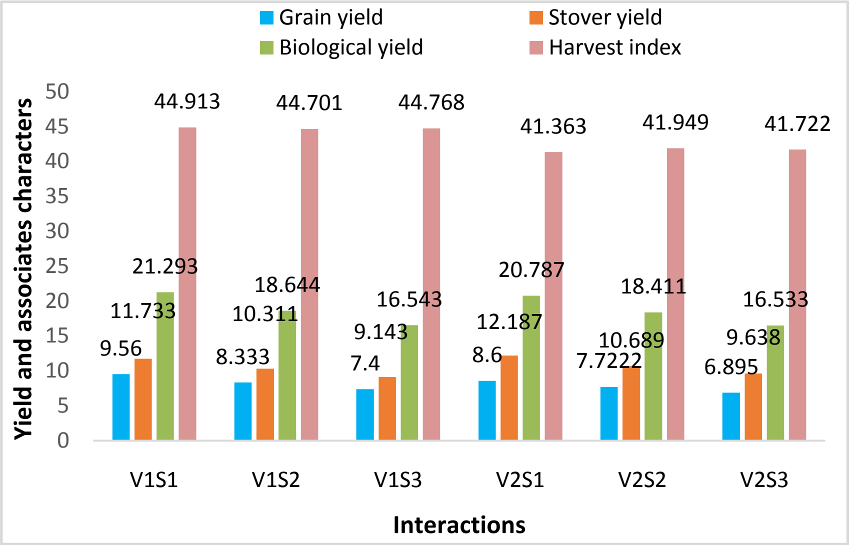
Fig.11. Effect of spacing on grain yield; stover yield; biological yield and harvest index of white maize

3.15. Biological yield (t ha^{-1})

Biological yield in white maize was significantly influenced by plant spacing and their combinations (Fig. 11 and 12), while the varietal effect (Fig. 10) was found to be insignificant. In terms of biological yield, V1 exhibited a comparatively higher yield of about 18.827 t ha-1 compared to V2 with 18.577 t ha-1. Plant spacing treatments had a significant impact, with S1 showing the highest biological yield (21.04 t ha-1), followed by S2 at 18.528 t ha-1. Conversely, the lowest biological yield (16.53 t ha-1) was observed from S3, with statistical significance among the treatments. In combination, V1S1 displayed the maximum biological yield (21.293 t ha-1), statistically identical to V2S1 (20.787 t ha-1). V2S1 was followed by V1S2 (18.644 t ha-1), statistically similar to V2S2 (18.411 t ha-1). The lowest biological yield (16.533 t ha-1) was obtained from V2S3, maintaining a statistically identical relationship with V1S3 (16.543 t ha-1). This finding aligns with Tajul et al. (2013), who observed a progressive increase in biological yield with higher planting densities.

3.16. Harvest index

Varietal treatments significantly influenced harvest index (Fig. 10), with V1 exhibiting a higher index (44.794%) compared to V2 (41.678%). Plant spacing treatments, despite numerical variations, were statistically identical in terms of harvest index (Fig. 11). Among treatments, S2 (43.325%), S3 (43.245%), and S1 (43.138%) consecutively showed the highest to lowest harvest index (%). In combination, V1S1 demonstrated the highest harvest index (44.913%), statistically identical to V1S2 (44.701%) and V1S3 (44.768%) (Fig. 9). The lowest harvest index was observed from V2S1 (41.363%), statistically identical to V2S2 (41.949%) and V2S3 (41.722%) (Fig. 12). Consistent with this result, Eskandarnejada et al. (2013) indicated that intermediate inter-row spacing significantly yields a higher harvest index in maize than both lower and higher inter-row spacing.



Here, V_1 = PSC -121; V_2 = KS-510

S_1 = 50 cm x 25cm; S_2 = 60 cm x 25cm; S_3 =70 cm x 25 cm

Fig.12. Interactions effect of variety and spacing on grain yield; stover yield; biological yield and harvest index

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4. Conclusion

Two varieties (V_1 = PSC-121 and V_2 = KS-510) were tested under threeplantspacing (S_1 = 50cm x 25cm, S_2 = 60cm x 25cm and S_3 = 70cm x 25cm) in randomized complete block design (RCBD) in the rabi season of 2015-16. Results showed that out of two varieties, the PSC-121 (V_1) gave significantly the highest seed yield (9.080 t ha^{-1}) than other when planted at 50cm x 25cm plant spacing. The variety KS-510 (V_2) had the lowest seed yield (7.140 t ha^{-1}) at 70 cm x 25 cm (S_3) plant spacing. PSC-121 with 50 cm x 25 cm (S_1) also had the highest biological yield (21.293 t ha^{-1}) and harvest Index (44.913 %).

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