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Original Research Article

IMPACT OF DIFFERENT SOWING DATE ON ADVANCED COTTON (*Gossypium hirsutum L.)* VARIETIES

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Abstract: *The purpose of this study was to find out the effect of different sowing dates on advanced cotton (Gossypium hirsutum L.) genotypes. Three different cotton varieties (Sind-1, Th-120, and Star-2) and three sowing dates (May 9, May 16, and May 23) constituted the treatment groups. Current study indicators include plant height (cm), number of branches per plant, number of bolls per plant, ginning percentage, and seed cotton yield kg/ha. The following is a summary of the parameter-wise results. The current study found that the variety Star-2 recorded a maximum plant height of 130.56 cm, while the variety Th-120 recorded a plant height of 122.67 cm. On May 23rd, we recorded a maximum plant height of 136.78 cm, while on May 16th, we recorded a plant height of 132.22 cm. The findings revealed that plant 1 recorded the highest number of sympodial branches at 25.33, with a peak of 29.22 branches per plant on the 23Th-120, while May recorded 25.33 at 23.78, starting from a minimum of Star-2, followed by variety Th-120 at 23.78, and a minimum of 20.00 sympodial branches in variety Sindh-1. However, the 23rd of May recorded a maximum of 29.22 branches per plant. The results revealed that variety Star-2 recorded the maximum (45.11) number of opened bolls per plant, followed by variety Th-120 (41.83). However, the 23rd May sowing date recorded the maximum (45.89) number of bolls per plant, while the 16th May sowing date recorded the lowest (42.22). The 9th May sowing date recorded the minimum of 37.44 bolls per plant. Variety Star-2 recorded the maximum at 38.00, followed by variety Th-2120 at 33.56. However, the crop yielded a maximum of 37.78 GOT% when planted under the 23rd May sowing date. However, the highest seed cotton production was 3429.6 kg ha-1 from variety Star-2, followed by 3066.7 kg ha-1 from variety Th-120. Variety Sindh-1 produced the lowest seed cotton yield: 2577.8 kg ha1. However, variety Sindh-1 produced the highest seed cotton yield (3511.1) on May 23rd and the lowest yield (3133.3 kg ha-1) on May 16th. The 9th of May sowing date yielded the lowest seed cotton yield of 2429.6 kg ha-1. According to the experiment's findings, the yield of seed cotton varied among types, with variety Star-2 and 23rd May planting dates yielding higher yields than other varieties under other sowing dates.*

Keywords: Cotton, Genotypes, Different, Sowing Dates

Introduction

In Pakistan, agriculture is the single most important sector, which has a direct impact on the country's economy and employs about 70% of the population as a major part of their activity (Raza et al., 2023). Cotton is the principal and most vital cash crop cultivated in Pakistan, providing raw material for cotton-based textile products, which contribute 8.5% of the GDP and are highly reliant on cotton, accounting for 60–70% of their raw materials and exports. Cotton provides 40 to 55% of the domestic revenue of the government and is export-oriented (Rana et al., 2020). Due to its significance, it occupies a strategic position, not only in export earnings but also in the foreign exchange reserves of the country (Wenhong, 2023). The area, yield, and production of many crops are directly dependent on the timely availability of improved and high-yielding agricultural inputs, farm machinery, technology, and its backup services. (Kaponda & Chiwaridzo 2024). Timely and proper agricultural inputs bring positive effects on agricultural production. Unfortunately, numerous natural calamities, including soil degradation, environmental pollution, water scarcity, subsistence farming, rising production costs, harmful insects, outdated production technology, and climate change, have impacted cotton (Abbas, 2020). These factors have created a severe impact on the yield and production of cotton. Varieties influenced by different time intervals and responding predictably to temperature and day length, significantly influence crop performance and yield during sowing (Huang et al. 2020). To reduce vulnerability and achieve high yield per unit area, cotton genotypes should have a diverse maturity group suited for the various planting date zones at different locations in the cotton-growing areas. (Iqbal et al., 2023) Timing the sowing of cotton crops is a major agronomic issue, as incorrect sowing timing can lead to yield losses. Cotton is extremely sensitive to environmental factors at every stage of growth and development because of its variable growth habit (Kaur et al., 2020). Temperature variations with varying planting dates significantly impact cotton crop phenology and morphology (Kotecha et al., 2018). It is crucial to choose a suitable sowing time for each genotype in different agroclimatic zones; planting too soon or too late could result in problems with diseases and pests (Farooq et al., 2011). According to Ghazanfar et al. (2007), planting cotton from mid-April to mid-May reduces disease occurrence more than planting later. (Basbagh et al., 2019)

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While Pakistan grows cotton from April to June, the climate in other parts of the world may influence the planting dates. Genetic characteristics that affect yield include boll weight and the number of bolls produced per plant. Early planting in the last part of May yielded more cotton than planting in the middle part of June, according to Iqbal (2011). Higher total dry matter (TDM) yields, more fruiting branches, and bigger, more mature bolls are caused by a longer growth period, better canopy development, and more leaf area index (LAI), leaf area duration (LAD), and photosynthetically active radiation (PAR) reaching the plant. On the other hand, bolls grow at lower temperatures due to delayed flowering from late seeding, which lowers yield (Akhtar et al., 2002). Late-planted cotton usually takes slower to mature and has a shorter fruiting period, which results in lower yields and worse-quality fiber (Bange et al., 2008). They discovered that a mere one-week shift in the ideal planting period significantly reduced the yield. Delaying planting significantly decreased both boll weight and the quantity of bolls per plant. Ali et al. (2012) found that planting after May 10 significantly reduced the yield of seed cotton. Therefore, choosing the optimal time to sow is considered the most crucial management decision for a cotton variety in a specific area (Sekloka et al., 2008).

Methodology

The Cotton Research Substation in Mirpurkhas conducted a field study in 2024 to evaluate the impact of various planting dates on the genotypes of early-maturing cotton (*Gossypium hirsutum* L.). Three replication design (RCBD) factorials, each with a 30 m-2 net plot size of 6 m x 5 m, laid out the experiment. Three distinct cotton varieties—Sindh-1, Th-120, and Star-2—as well as three planting dates—May 9, May 16, and May 23—make up the treatment. A seed drill was used to plant the crop. Plant-to-plant separation of 30 cm and row-to-row spacing of 75 cm were upheld. As usual, the recommended dosage of phosphorus and nitrogen was administered. Three splits of urea were used to apply nitrogen. At the time of planting, the entire dosage of phosphorus was administered in the form of DAP. Crop growth was maintained by following all cultural customs. For tacking observation, five plants were chosen from each plot. The following are the specifics of the treatment:

Experimental Design: Randomized Complete Block Design (Factorial)

Replications: Three

Plot Size (Net Plot): Length = 6 meters, Width = 5 meters, Total Area = 30 m²

Treatments: Two variables (Factor A and Factor B)

- **Factor A (Varieties):** Three levels
  - V1 = Sindh-1
  - V2 = Th-120
  - V3 = Star-2
- **Factor B (Sowing Dates):** Three levels
  - S1 = 9th May
  - S2 = 16th May
  - S3 = 23rd May

Treatment Combinations:

- T1 = S1V1
- T2 = S1V2
- T3 = S1V3
- T4 = S2V1
- T5 = S2V2
- T6 = S2V3
- T7 = S3V1
- T8 = S3V2
- T9 = S3V3

Statistical analysis

To do statistical analysis on the information obtained, ANOVA Computer Software Statistix-8.1 was used (Statistix, 2006). The LSD test was used in situations in which it was deemed necessary to provide a comparison of the relative effectiveness of several treatments.

Results

Three cotton verities (Sindh-1, Th-120, and Star-2) and three planting dates (May 9, May 16, and May 23) were used for the treatments. Plant height (cm), the number of sympodial branches per plant, yield per plant (as a percentage), and seed cotton production (kg per hectare) were among the requirements that were assessed. The following is an explanation of the findings:

Plant height (cm)

The mean value plant height (cm) for various cotton varieties is shown in Figure 1, which also studies at how different sowing dates affect the growth and seed production of new cotton varieties and how they combine. The analysis of variance may be found in Appendix I. The findings are significant for sowing date levels and statistically highly significant for varieties; their interaction is not significant. The findings showed that there were significant variations in plant height across each type. However, variety Star-2 recorded the highest plant height (130.56 cm) compared to variety Th-120, which recorded 122.67 cm, while variety Sindh-1 recorded the lowest plant height (119.00 cm). The data further revealed a significant variation in plant height across sowing dates, with the crop reaching a maximum height of 136.78 cm on May 23rd and a maximum height of 132.22 cm on May 16th. The crop reached its minimum height of 108 cm under the 9th May sowing date. In the interaction (V x S), the variety Star-2x sowing dates (16th May) recorded the maximum plant size of 139.67 cm, while the 9th May sowing dates recorded the lowest plant size across all varieties.

Number of Sympodial branches plant^{-1}

Figure 2 represents the mean number of sympodial branches per plant for several cotton varieties, plantings, and their interactions. The findings are significant at $p<0.05$ for variety, $p<0.07$ for sowing dates, and insignificant for interaction. The findings also reveal that sympodial branches per plant differed, depending on the type Each of the plant types had a different number of sympodial branches per plant. However, with 25.33 sympodial branches, plant 1 of variety Star-2 had the most, followed by variety Th-120 with 23.78 and variety Sindh-1 with at least 20.00 sympodial branches. The findings also showed that the date of sowing significantly affected the number of sympodial branches per plant. On May 23, however, we noticed that each plant had a maximum of 29.22 branches. At least 14.44 sympodial branches were observed in Plant 1. The variety Star-2 and the 23rd May sowing date recorded the maximum of 32.33 sympodial branches per

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plant in the interaction (V x S), while all other varieties recorded the minimum from the 9th May sowing date.

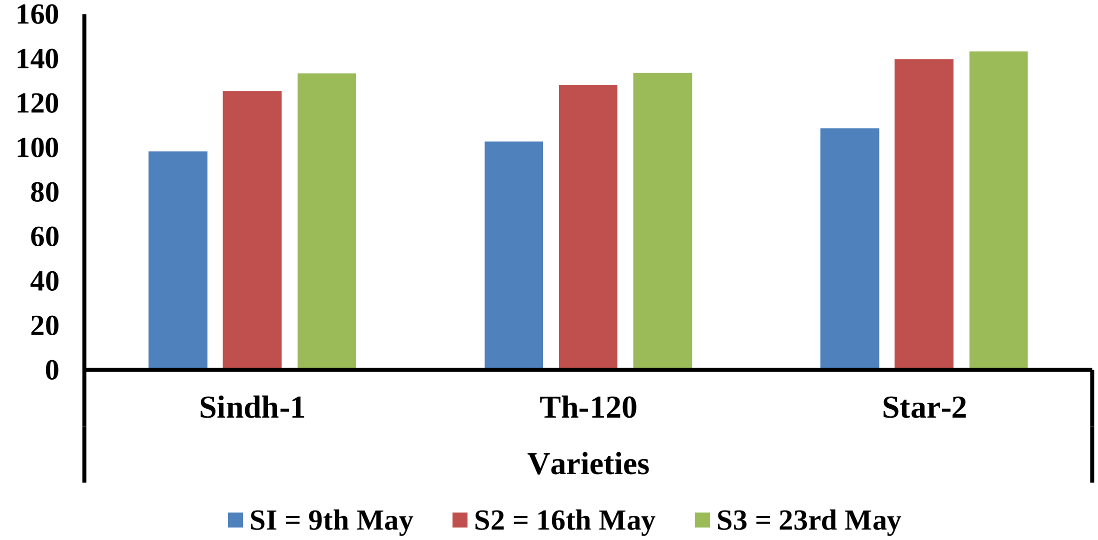

Figure 1: Plant height for advance cotton genotypes as affected by various sowing dates

		Varieties	Sowing dates	V x S
SE	=	4.927	4.937	8.5341
LSD@ 5%	=	10.445	10.445	-

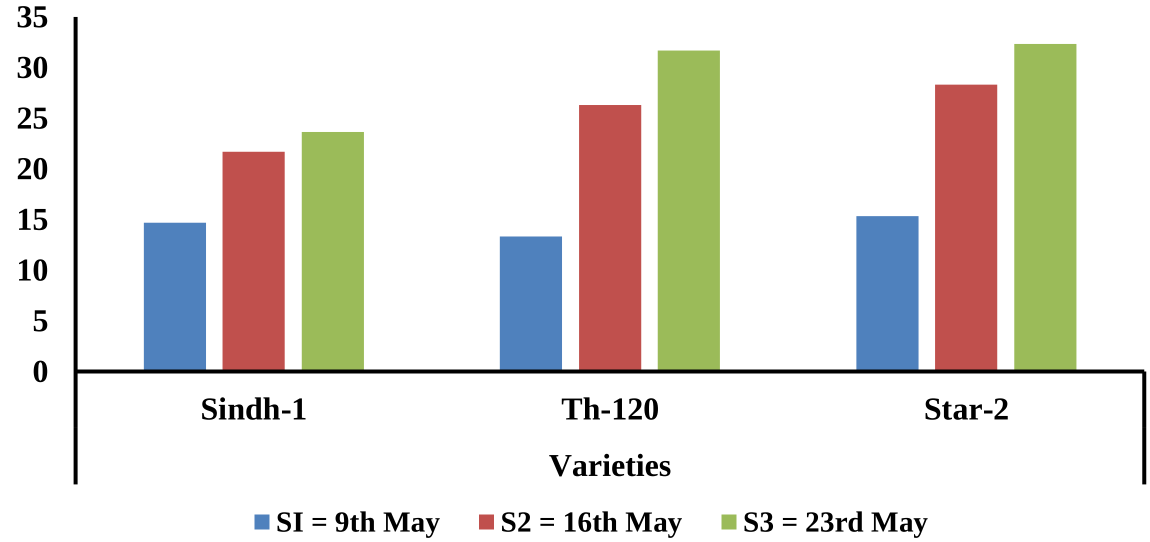

Figure 2. Sympodial branches on advanced cotton genotypes as influenced by different sowing dates

		Varieties	Sowing dates	V x S
SE	=	1.7930	1.7930	3.1056
LSD@ 5%	=	3.800	3.800	-

Number of bolls per plant

Figure 3 is the analysis of variance and Figure 3 depicts displaying the average number of balls per plant with respect to different sowing dates of different cotton varieties. The analysis of variance for planting dates is significant at 0.05 with a coefficient of determination of 0.81, while the analysis of variance for types of dates is significant at 0.05 with a coefficient of determination of

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0.90; however, the test for the interaction of planting dates and types of dates is not significant at 0.05 with a coefficient of determination of 0.40. The data presented in figure 3 revealed that the number of balls per plant varied significantly across varieties. However, variety Star-2 had the highest number of opening bolts per plant (45.11), followed by variety Th-120 (41.83). The variety Sindh-1 has the lowest bolls per plant, at 38.56. Furthermore, the findings indicated that the quantity of bolts per plant changed based on the planting dates. However, on May 16, the number of bolls per plant was at its lowest (42.22), while on May 23, the number was at its greatest (45.89). We found that there were the fewest bolls per plant (37.44) early on May 9. In the interaction (V x S), the variety Stard-2 and the 23rd May sowing dates yielded the highest number of opened bolts per plant (49.67), whereas the 9th May sowing date yielded the lowest amount of opened bolts of any variety.

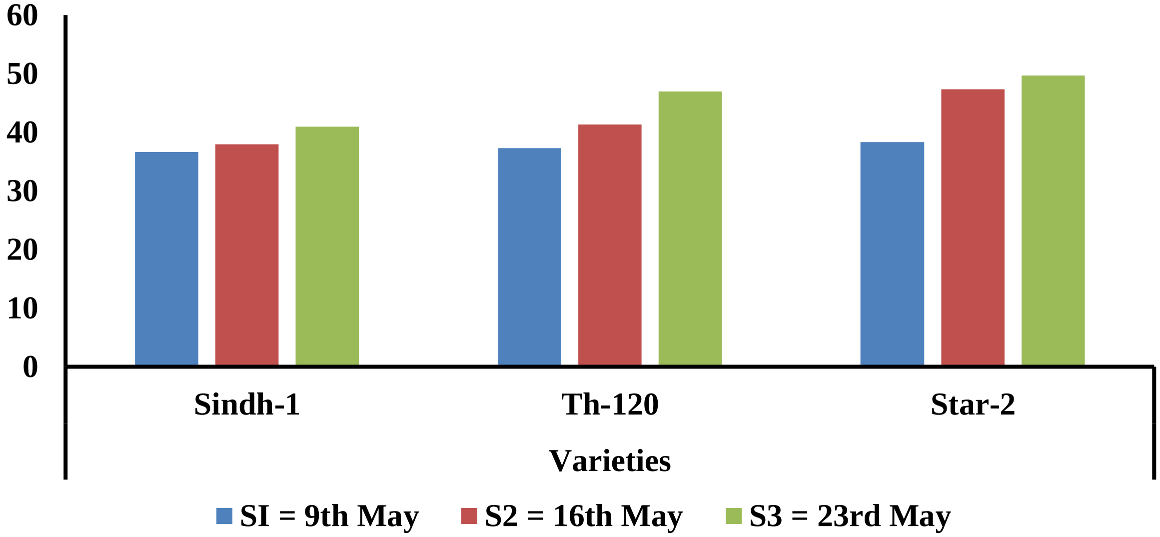

Figure 3 shows how different sowing times for advanced cotton genotypes affect the number of boll plants per plant.

		Varieties	Sowing dates	V x S
SE	=	2.9936	2.9936	5.1852
LSD@ 5%	=	5.3128	6.3463	-

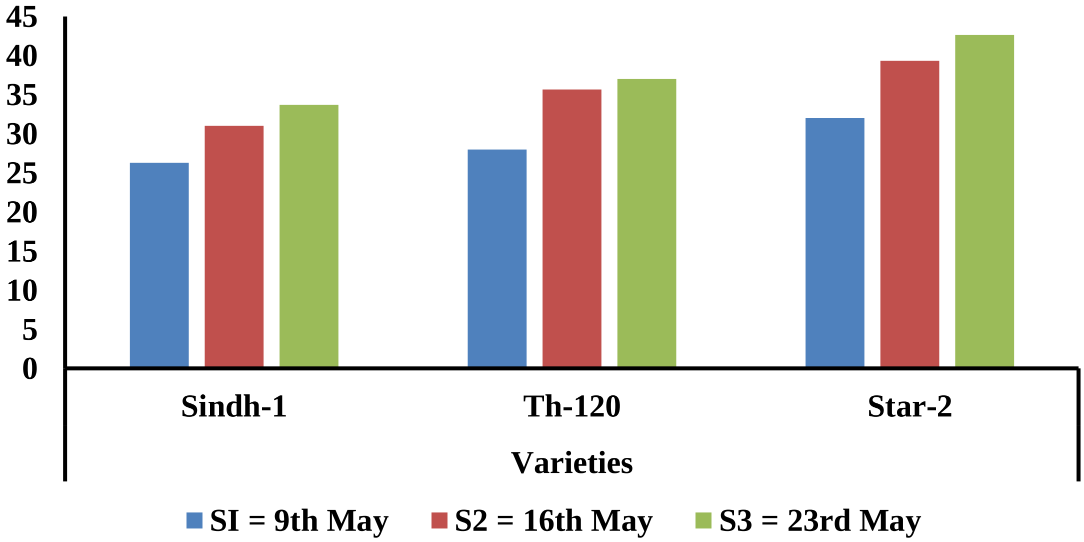

Figure 4: Advance cotton genotypes' ginning out turn (%) by different sowing dates

		Varieties	Sowing dates	V x S
SE	=	1.7679	1.7679	3.0621
LSD@ 5%	=	3.7478	3.7478	--------

The percentage of Ginning Output (GOT)

Figure 4 presents the data on how different sowing dates affect the mean ginning out turn (GOT%) of cotton varieties, and Appendix-IV provides the analysis of variance. The results show statistical significance for both variety and sowing dates, but their interaction is not significant. The data shown in Table 4 indicated that each variety's GOT% varied significantly. However, variety Star-

2 recorded a maximum GOT% of 38.00, followed by variety Th-2120 at 33.56, and variety Sindh-I recorded a minimum GOT% of 30.33. The data further revealed a significant variation in GO% across different sowing dates. However, planting the crop under the 23rd May sowing date yielded a maximum of 37.78 GOT%. On the 9th of May, the minimum GOT% of 28.78 was noted. The variety Star-2 and the 23rd May sowing date recorded the highest GOT% of 42.67 in the interaction (V x S), while the 9th May sowing date recorded the lowest for all other varieties.

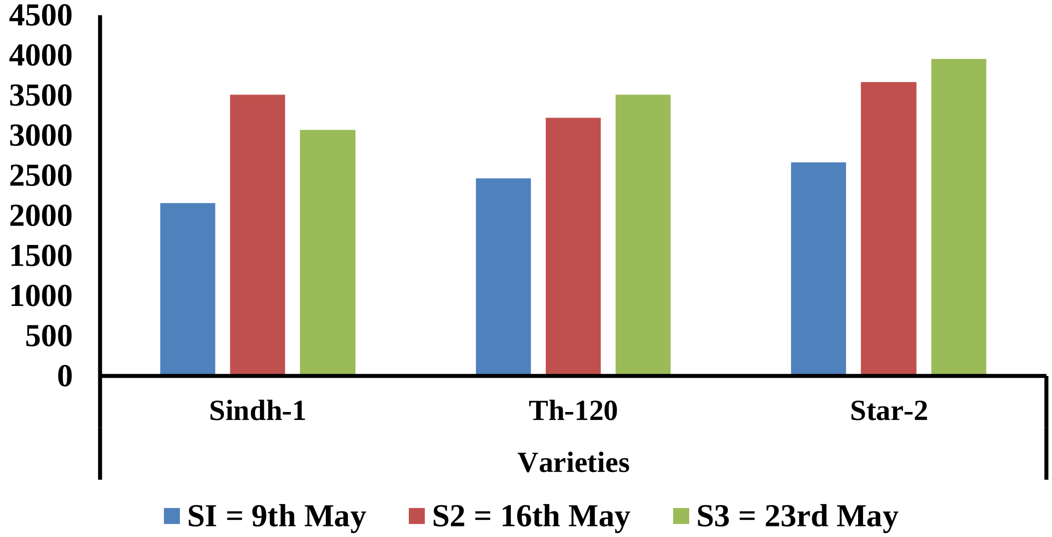

Figure 5 shows the impact of varying planting dates on advance cotton genotypes on seed cotton yield kg ha-1.

Varieties		Sowing dates	V x S	
SE	=	163.37	163.37	282.9622
LSD@ 5%	=	346.33	346.33	-----------

Seed cotton yield kg ha^{-1}

Figure 5 shows how planting dates impact each other and how the seed cotton yield kg ha-1 varies for several cotton types. Appendix V presents the examination of variances. While the results for varieties and sowing dates are statistically significant, the results for their interaction are negative. Seed cotton production kg ha-1 varied significantly between types, according to the data in Table 5. The highest seed cotton production, however, was 3429.6 kg ha-1 from variety Star-2, followed by 3066.7 kg ha-1 from variety Th-120. At 2577.8 kg ha-1, variety Sindh-1 produced the least amount of seed cotton. Additionally, the results showed that the yields of seed cotton varied according to the times of sowing. However, the highest seed cotton yields of 3511.1 kg ha-1 were recorded on May 23rd whiles the lowest of 3133.3 kg ha-1 on May 16th. The 9th of May sowing date had the lowest seed cotton yield of 2429.6 kg ha-1. The variety Star-2 with the 23rd May sowing date had the highest seed cotton yield of 3955.6 kg ha-1 while the 9th May yielded the lowest seed cotton yield for all the varieties.

Discussion

Cotton crop sowing timing is an important agronomic problem for poor sowing timing is related to yield losses. Cotton is very sensitive to environmental factors at all stages of growth and development because of its variable growth habit (Zamin et al., 2020, and Qayyom et al., 2021). The findings showed that each variety's plant height varied considerably. However, variety Sindh-1 had the lowest plant height (119.00 cm), while variety Star-2 had the greatest (130.56 cm), followed by variation Th-120 (122.67 cm). With a maximum of 136.78 cm on May 23 and following maximum of 132.22 cm on May 16, the data also showed an important variance in plant height between sowing dates. When the crop was sown on May 9th, it obtained a minimum height of 108 cm. The maximum number of sympodial branches per plant varies significantly between varieties, according to the data. Variety Sindh-1 showed a minimum of 20.00 sympodial branches, whereas variety Star-2 recorded the highest number of sympodial branches in plant-1 at 25.33, followed by variety Th-120 at 23.78. The results also showed that the number of sympodial branches per plant varied significantly according to when it was sown. However, a maximum of 29.22 branches per plant were reported on the planting date of May 23. At least 14.44 sympodial branches were seen by Plant 1 from the sowing date of May 16. Cotton crop phenology and morphology are significantly impacted by temperature variations with varying planting dates (Wang et al., 2019). In various agroclimatic zones, it is critical to determine the best timing for sowing for each genotype; planting early or too late may result in problems with pests and diseases (Farooq et al., 2011).

The data showed that there were considerable differences in the amount of balls per plant between the varieties. However, variety Th-120 (41.83) had the second highest percentage of opened bolls per plant, after variety Star-2 (45.11). Sindh-1 was the variety with the lowest bolls per plant (38.56). Based on the dates of planting, the data also showed variations in the number of bolls per plant. The highest amount of bolls per plant (45.89) was produced on May 23 and the lowest number (42.22) was produced on

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May 16. With a total of 37.44 bolls per plant, the May 9 planting date had the lowest bolls. The results showed a significant difference in GOT% between each variety. However, variety Star-2 recorded the highest GOT% at 38.00, followed by variety Th-2120 at 33.56, and variety Sindh-I recorded the lowest at 30.33. The data further revealed a significant variation in GOT% across different sowing dates. However, when the crop was planted under the sowing date of 23 rd May it produced a maximum yield of only 37.78 GOT%. This was sown on 9th May, GOT% recorded the minimum 28.78%. Li et al. (2018) reveal that, late sowing is not preferable to plant cotton to minimize the incidence of illness, rather the best time is mid-April to mid-May. However, Pakistan cultivates cotton from April to June but planting time may differ from one region to other part of the world. The yield is affected by the number of bolls formed per plant, which is a polygenic characteristic similar to boll weight. Iqbal (2011) found that early planting in the third stage of May, as compared to the second stage of June, increased cotton yield. This occurred as a result of the plants' extended growth periods, larger canopies, and increased absorption of PAR, LAI, and LAD radiation. As a result, each plant produced bigger, more ripe bolls, more fruit-bearing branches, and more TDM. However, delayed flowering from late planting forces boll development into cooler weather, resulting in a less yield (Khan et al., 2020). The findings showed that the investigated types' seed cotton yields (kg ha^{-1}) varied significantly. The Star-2 variety had the largest seed cotton results, with 3429.6 kg ha^{-1}, however the Th-120 variety followed in second with 3066.7 kg ha^{-1}. On the other hand, the Sindh-1 variety yielded 2577.8 kg ha^{-1}, the lowest amount. The results also showed that the planting date impacted the yield of seed cotton. However, the highest seed cotton yield (3511.1) was obtained on May 23rd, while the lowest yield (3133.3 kg ha-1) was obtained on May 16th. The minimum seed cotton output of 2429.6 kg ha-1 was observed on May 9th. Cotton that is planted late typically has a shorter fruiting season and a later maturity date, which lowers output and degrades fiber quality (Ali et al., 2018). They discovered that yield significantly decreased even when the ideal period was delayed by one week. The quantity of bolls per plant and boll weight also significantly decreased with late planting. When Ali et al. (2012) sowed the cotton crop after May 10th, they saw a notable drop in seed cotton production. Accordingly, the best time to plant is seen to be the most crucial management element for a cotton variety in a given area (Amjadian et al., 2018).

Conclusion

The findings of the experiment showed that various varieties produced varies amounts of seed cotton; variety Star-2 and planting on May 23rd produced more seed cotton than other types planted on other dates.

Declarations

Data Availability statement
All data generated or analyzed during the study are included in the manuscript.
Ethics approval and consent to participate
Approved by the department Concerned.
Consent for publication
Approved
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Not applicable

Conflict of interest

The authors declared absence of conflict of interest.

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