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ENHANCING GROWTH, YIELD, AND QUALITY POTENTIAL OF PROMISING COTTON VARIETIES THROUGH SOWING DATE VARIATIONS

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ABSTRACT

In a field trial, the impact of varying sowing dates on growth, yield, and quality of chosen cotton varieties was investigated, employing three-replicated Randomized Complete Block Design. Study evaluated Shahbaz-95, Sindh-1, and Malmal cotton varieties across six distinct sowing dates (1-April, 15-April, 1-May, 15-May, 1-June and 15-June). There was substantial influence of both varieties and sowing dates on growth and yield attributes. This effect was apparent across all traits except monopodial branches. Notably, 15-April sown cotton displayed the most vigorous performance, with a plant height of 127.93 cm, 1.56 monopodia, 21.44 sympodia, 47 bolls, 130.67 g seed cotton weight plant⁻¹, 36.02% G.O.T., 27.4 mm staple length, and a seed cotton yield of 3586.1 kg ha⁻¹. The 1-April sowing ranked 2nd, resulting plant height of 126.67 cm, 1.56 monopodia, 21.33 sympodia, 46.44 bolls, 128.89 g seed cotton weight plant⁻¹, 35.66% G.O.T., 27.28 mm staple length, and a seed cotton yield of 3561.8 kg ha⁻¹. Cotton sown on 1-May, 15-May, 1-June and 15-June displayed reduced overall performance. Among varieties, Shahbaz-95 exhibited improved performance with plant height of 127.39 cm, 1.61 monopodia, 21.22 sympodia, 46.78 bolls, 129.72 g seed cotton weight plant⁻¹, 35.71% G.O.T., 26.30 mm staple length, and a seed cotton yield of 3539.40 kg ha⁻¹. In conclusion, the study underscores that sowing cotton up to 15-April optimally enhances growth, yield, and quality traits, with each subsequent fortnight delay resulting in simultaneous decline across all evaluated attributes. Shahbaz-95 is recommended for superior crop yields, while Malmal is preferred for promising staple length.

Keywords: Cotton, varieties, sowing dates, growth, yield, quality enhancement

INTRODUCTION

Cotton, scientifically known as *Gossypium hirsutum* L., is widely acknowledged as the "economic backbone" of Pakistan. This versatile fiber crop holds a significant position in the country's agricultural landscape, contributing substantially to its economy. The potential of cotton cultivation to drive sustainable development at the national level has drawn considerable research attention, encompassing various facets of its progress (Rehman, 2019). The significance of cotton transcends its role as a mere crop, acting as an essential cornerstone for multiple sectors. It serves as the primary raw material for the thriving textile industry, and plays a pivotal role in the global edible oil supply, holding a notable share within this domain. In the realm of cotton production, Pakistan holds the prestigious rank of fifth on a global scale. Notably, it produced 1306 thousand tons,

following the leading producers China, India, the United States, and Brazil, which yielded 5879, 5334, 3815, and 2678 thousand tons, respectively (Shahbandeh, 2022). Within Pakistan's economic landscape, cotton and textile product exports command a substantial share, constituting approximately 60 percent of the country's overall export earnings. However, a notable shift has been observed in cotton cultivation trends over the past decade. In the face of competition from alternative crops like sugarcane, maize, potato, and rice, the area dedicated to cotton cultivation has diminished. In the most recent agricultural season, spanning 2021-22, the cultivated cotton area contracted to 1,937 thousand hectares, marking a decline of 6.8 percent compared to the preceding year's 2,079 thousand hectares. Paradoxically, this decline in cultivation area was accompanied by an increase in cotton production,

reaching 8.329 million bales, a notable surge of 17.9 percent from the previous year's 7.064 million bales. The augmentation in cotton yield was attributed to a synergy of favorable weather conditions, streamlined input supply chains, improved agronomic practices, and propitious cotton prices both in the international and domestic markets (GoP, 2022).

The sowing time plays a crucial role in determining the success and productivity of cotton (*Gossypium* spp.) cultivation, exerting a profound influence on growth, development, and yield outcomes. Cotton is globally recognized as a vital cash crop due to its significant contributions to the textile industry and economy. Achieving optimal growth, yield, and fiber quality hinges upon the judicious selection of sowing dates that align with the prevailing environmental conditions and the physiological requirements of the crop (Ali *et al.*, 2018; Amjadian *et al.*, 2018; Basbag *et al.*, 2019; Kaur & Sandhu, 2020). Sowing date impacts various agronomic and physiological aspects of cotton cultivation. Factors such as temperature, photoperiod, moisture availability, and pest dynamics interact with the chosen sowing date to orchestrate a sequence of events that span plant emergence, vegetative growth, flowering, boll development, and eventual fiber yield (Qayyum *et al.*, 2021). Temperature is a principal factor that influences the growth and development of cotton plants. Strategic sowing date selection allows growers to take advantage of favorable temperature conditions for germination, emergence, and subsequent growth. By ensuring that sowing coincides with optimal thermal conditions, cotton plants establish robustly, leading to healthy vegetative growth and vigorous reproductive development (Khan *et al.*, 2020; Kotecha & Sarap, 2018).

The duration of daylight exposure, known as photoperiod, regulates flowering initiation in cotton. Selecting appropriate sowing dates that align with the photoperiod requirements of the chosen cotton variety helps synchronize flowering with optimal growth stages, maximizing boll formation and subsequent fiber yield (Li *et al.*, 2018; Qayyum *et al.*, 2021; Sadiq *et al.*, 2017; Wang *et al.*, 2019; Zaman *et al.*, 2020). Water availability is critical, particularly during the early growth stages of cotton. By selecting sowing dates that correspond with periods of higher soil moisture availability, cotton growers can facilitate successful germination, root establishment, and minimize water stress during crucial growth stages (Khan *et al.*, 2016; Wang *et al.*, 2019). Furthermore, the choice of sowing date can impact pest and disease dynamics. Optimal sowing dates can help avoid peak periods of pest activity, thereby reducing the need for excessive pesticide application and promoting sustainable integrated pest management practices (Musa *et al.*, 2014). In light of the changing climatic patterns and the need for sustainable agricultural practices, understanding the importance of cotton sowing date becomes pivotal. A

well-informed selection of sowing dates can optimize cotton crop performance by ensuring suitable growth, flowering, and yield under evolving environmental conditions (Reddy & Hodges, 2009; Zaman *et al.*, 2020; Qayyum *et al.*, 2021).

Evaluating cotton varieties is a critical aspect of modern agricultural practices, aimed at identifying superior genetic traits that contribute to enhanced yield, fiber quality, and overall crop performance. The varietal evaluation in cotton allows farmers to identify high-yielding varieties that are better suited to their specific growing conditions. This leads to increased crop productivity and higher economic returns. Varieties with superior fiber quality attributes such as length, strength, and fineness can be selected through evaluation. This is vital for meeting the quality requirements of the textile industry (Shahzad & Ali, 2019). Varietal evaluation helps identify genotypes with natural resistance to common pests and diseases, reducing the need for chemical inputs and promoting sustainable pest management practices. Different cotton varieties exhibit varying levels of adaptability to diverse environmental conditions. Evaluating varieties aids in selecting those that perform optimally under local climate and soil conditions (Ali *et al.*, 2017). With changing climatic patterns, evaluating varieties for their resilience to extreme weather events like drought or excessive rainfall becomes crucial for maintaining stable yields. Certain varieties might require less water, fertilizer, or other resources to achieve optimal yield and quality. Evaluating these traits contributes to efficient resource management (Raza *et al.*, 2020). By selecting varieties with built-in resistance or tolerance to specific pests or diseases, farmers can reduce the reliance on chemical pesticides, benefiting both the environment and human health. Varietal screening encourages the cultivation of diverse genetic resources, reducing the risk of large-scale crop failure due to disease outbreaks or environmental challenges (Basal *et al.*, 2018). Varietal testing helps researchers and breeders understand the genetic basis of desirable traits, leading to continuous innovation and development of improved cotton varieties. Informed variety selection empowers farmers to make decisions based on local conditions and market demands, ultimately leading to more successful and profitable farming operations (Qayyum & Riaz, 2018). Undoubtedly a lot of work has been conducted globally regarding the growth and yield performance of cotton cultivars under different sowing times. However, up to now, no work has been documented pertaining to performance of cotton varieties under different sowing dates under agro-climatic conditions of Tandojam. Considering the above discussion, the study was carried out to investigate the impact of varying sowing dates on growth, yield, and quality of three promising cotton varieties.

MATERIALS AND METHODS

This trial was conducted in 2021 cotton season, to assess the influence of varying sowing dates on the growth, yield and quality attributes of promising cotton varieties. The experimental design adopted was a three-replicated Randomized Complete Block Design. The study site, situated within the experimental fields of the Crop Research Institute at Agriculture Research Center, Tandojam, developed plots measuring 3.90m × 3.75m (14.63m²). Ensuring the establishment of a favorable seedbed, meticulous land preparation was executed, adhering closely to recommended practices for cotton cultivation. Sowing operations were executed utilizing a cotton seed drill, with rows spaced at 60 cm. The initial treatment of the experimental soil involved the deployment of a disc plow to effectively disintegrate any hardpan formations. Following this initial phase, the land underwent a process of leveling and compaction. Subsequently, as conditions grew conducive post-soaking, a sequence of further refinements was carried out. This encompassed crafting a seedbed using a combination of a disc harrow followed by a rotavator. Diligent clod pulverization was achieved through a clod crusher, with the area subsequently undergoing compacting via planking. Integral to the experiment were three prominent cotton varieties, each sown on six distinct dates, with intervals of 15 days. To facilitate precise monitoring of germination processes, proper attention was paid to clearing the margins of the experimental block. Additionally, encircling the experimental area was a two-foot-wide strip, effectively serving as a perimeter and rendering separation bunds and channels redundant. Study evaluated Shahbaz-95, Sindh-1, and Malmal cotton varieties across six distinct sowing dates (1-April, 15-April, 1-May, 15-May, 1-June and 15-June). The experimental soil was treated with the established and recommended NPK fertilizer composition. Urea (46% N) was used to supply nitrogen, Single Super Phosphate (SSP) with an 18% P₂O₅ concentration served as the source of phosphorus, and muriate of potash was employed for potassium supplementation. During the sowing phase, entire dose of P and K fertilizers, along with one-third of the total N-dose, was applied as basal dose. The remaining N was divided into two equal portions for subsequent

application. The initial one-third of N was administered at sowing, followed by another one-third at flowering stage, and the final one-third was introduced at the boll formation stage. Irrigation was carried out systematically according to a predefined schedule in accordance with recommended protocols. Conscientious adherence to prescribed cultural practices was ensured across all sub-plots. The data were obtained for the traits that encompassed plant height, monopodial branches, sympodial branches, number of bolls, seed cotton yield, ginning out turn %, staple length and seed cotton yield. For data collection purposes, five plants were randomly selected from each treatment. These designated sample plants were assigned unique labels and numbers to facilitate differentiation.

Data Analysis: The acquired data were subjected to statistical analysis through employment of the Statistix (8.1 version) computer software package. In cases where deemed necessary, the Least Significant Difference (LSD) test, as delineated by Steel et al. (1997), was employed to assess the comparative superiority of the treatments.

RESULTS

Plant height (cm): Varieties, sowing dates, and their interaction exerted a significant influence on this trait ($P < 0.05$). The pinnacle of cotton plant height was attained during the final picking, registering at 127.93 cm for the 15th April sowing, closely followed by 1st April sowing at 126.67 cm (Figure. 1). Notably reduced plant height, measuring 124.13 cm and 122.87 cm, were recorded for the 1st May and 15th May sowing, respectively. In contrast, the 15th June sowing yielded lowest plant height, measuring 115.27 cm. Within the variety spectrum, Shahbaz-95 attained the greatest plant height (127.39 cm), while a similar stature was observed for the varieties Sindh-1 (120.93 cm) and Malmal (120.28 cm). Among interactive effects, the combination of variety Shahbaz-95 with 15th April sowing yielded the utmost plant height at 132.65 cm (Figure. 1). Variety Malmal × 15th June sowing minimized plant height (112.84 cm). Statistically, the effect of 1st April and 15th April sowings, or 1st May and 15th May sowings for this trait was non-significant ($P > 0.05$).

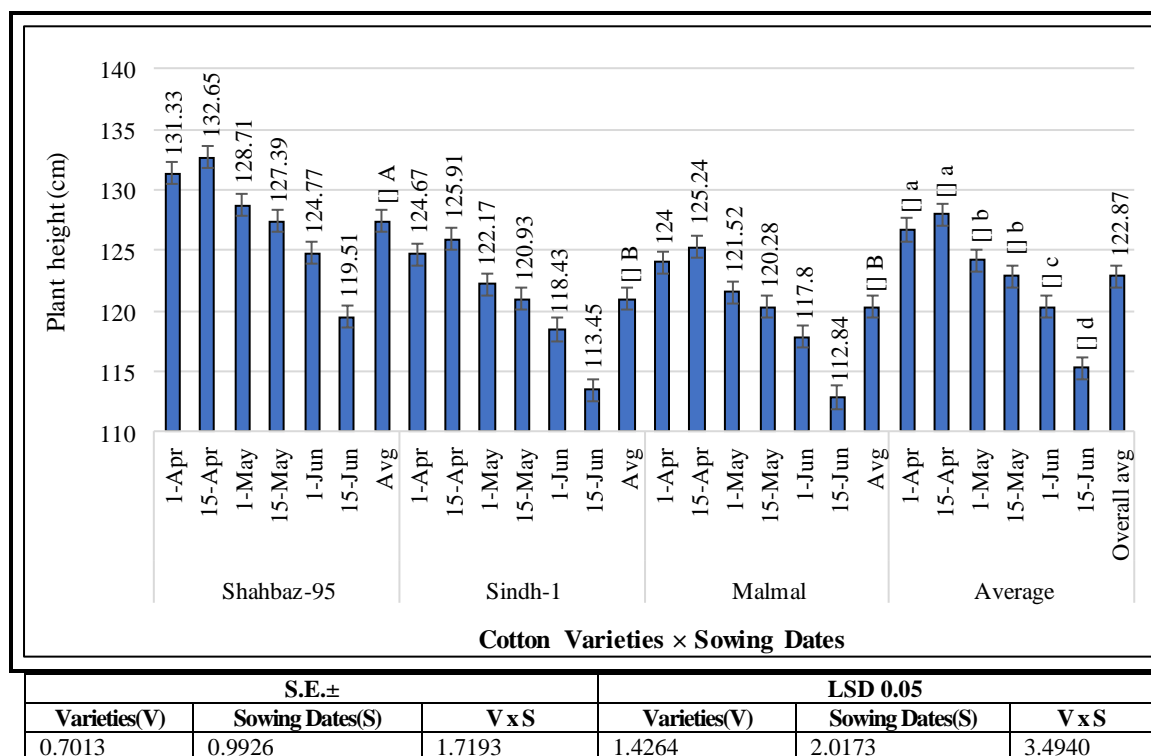


Figure 1. Sowing date effect on the plant height of different cotton varieties

Monopodial branches plant⁻¹: The highest count of monopodial branches (1.56) plant⁻¹ was consistently observed in plots sown on the 1st April, 15th April, and 15th June, closely followed by 1st June sowing (1.44). Conversely, the lowest monopodial branches (1.33) plant⁻¹ was recorded in plots sown on 1st and 15th of May (Figure. 2). This indicates that monopodial branches showed limited response to variations in sowing dates. Across the range of varieties, variety Shahbaz-95 exhibited the highest count of monopodial branches (1.61) per plant, followed by Malmal (1.44), while variety Sindh-1 displayed the lowest count (1.33) of monopodial branches per plant. In terms of interactive effects, the interaction between variety Shahbaz-95 and the 1st June sowing yielded the highest count of monopodial branches (2.00) per plant. Conversely, the interaction between variety Sindh-1 and the 1st May or 1st June sowings resulted in the lowest count of monopodial branches (1.00) per plant. Although statistically insignificant differences were observed regarding monopodial branches among different sowing dates and varieties, Shahbaz-95 exhibited a relatively greater number of monopodial branches compared to Sindh-1 and Malmal.

Sympodial branches plant⁻¹: Significant impact (P<0.05) of sowing dates and varieties on sympodial branches plant⁻¹ was recorded; while non-significant interactive effect (P>0.05) of variety × sowing date was seen (Figure. 3). Maximum sympodial branches (21.44) were observed in plots sown on 15th April, closely followed by 1st April (21.33). Sympodial branches decreased to 20.55 and 20.44 in plots sown on 1st and 15th May, respectively. Minimum sympodial branches were observed in plots sown on

15th June. Variety Shahbaz-95 exhibited maximum sympodial branches plant⁻¹ (21.22), followed by Sindh-1 (20.16); while variety Malmal showed the minimum sympodial branches (20.11 plant⁻¹). Variety Shahbaz-95 × 15th April sowing interaction resulted in maximum sympodial branches (22.33) plant⁻¹; while interaction of varieties Sindh-1 and Malmal with 15th June sowing resulted in equally minimum sympodial branches (19) plant⁻¹. Differences in sympodial branches between 1st April and 15th April or 1st May and 15th May sowings were statistically non-significant (P>0.05). Early sowing up to 15th April showed benefits for sympodial branches; and delayed sowing beyond 1st May adversely impacted this trait.

Number of bolls plant⁻¹: The study assessed the impact of sowing dates and varieties on bolls plant⁻¹. Both sowing dates and varieties significantly influenced this trait (P<0.05), while the variety × sowing date interaction was not significant (P>0.05). The highest bolls plant⁻¹ occurred for 15th April sowing (47), closely followed by 1st April sowing (46.44). Bolls plant⁻¹ decreased with later sowing, reaching 45.55 and 45.11 for 1st and 15th May, respectively (Figure 4). The lowest bolls plant⁻¹ was observed for 15th June sowing (42.44). Among varieties, Shahbaz-95 exhibited the most bolls plant⁻¹ (46.78), followed by Sindh-1 (44.52), and Malmal had the fewest (44.12). Interactive effects showed that the interaction of variety Shahbaz-95 with 15th April sowing resulted in highest bolls plant⁻¹ (48.67), while variety Malmal with 15th June sowing yielded the lowest (41.33). LSD test revealed significant differences between certain sowings and varieties. Sowing up to 15th April positively affected this trait,

while further delays had a negative impact. Among performance compared to Sindh-1 and Malmal varieties, Shahbaz-95 exhibited better bolls-bearing

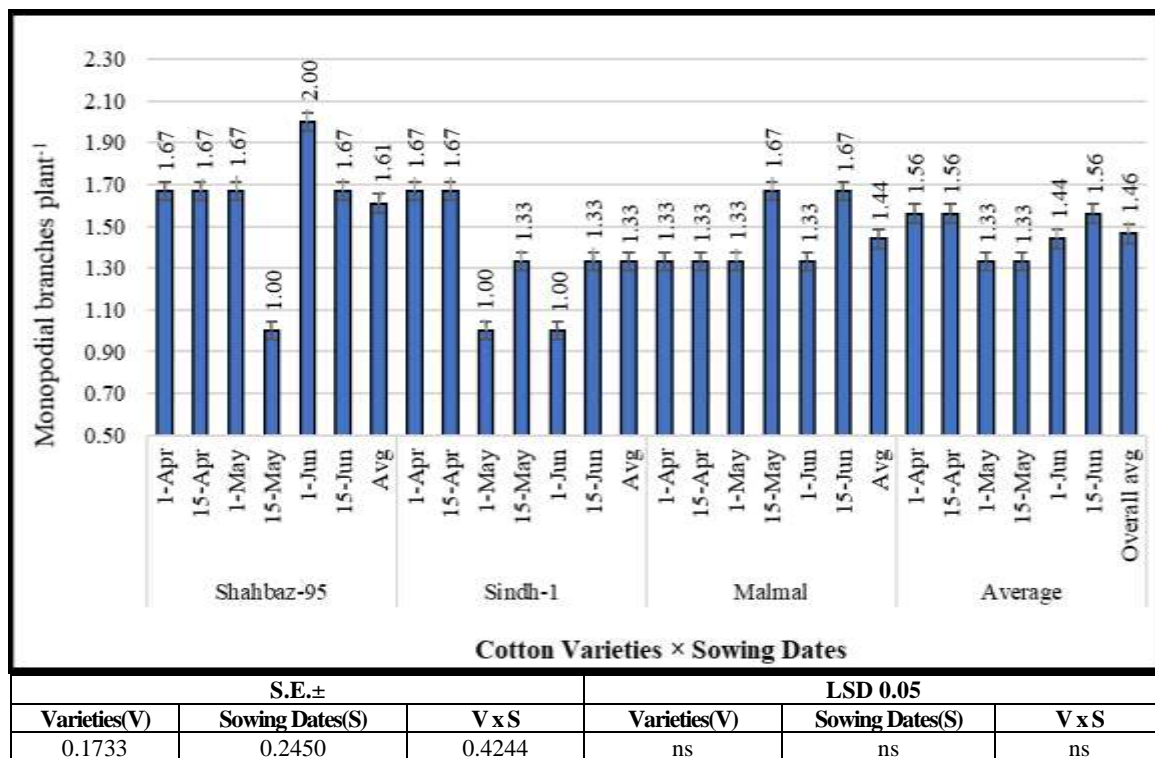


Figure 2. Sowing date effect on the monopodial branches plant⁻¹ of different cotton varieties

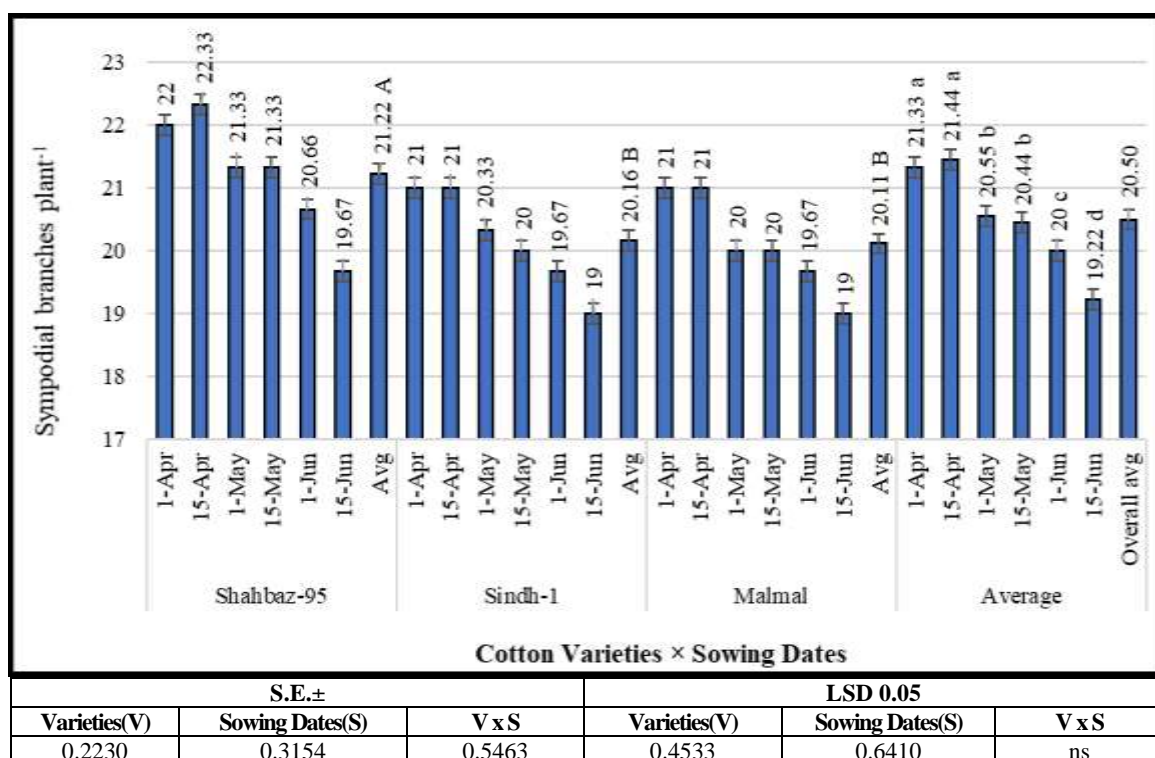


Figure 3. Sowing date effect on the sympodial branches plant⁻¹ of different cotton varieties

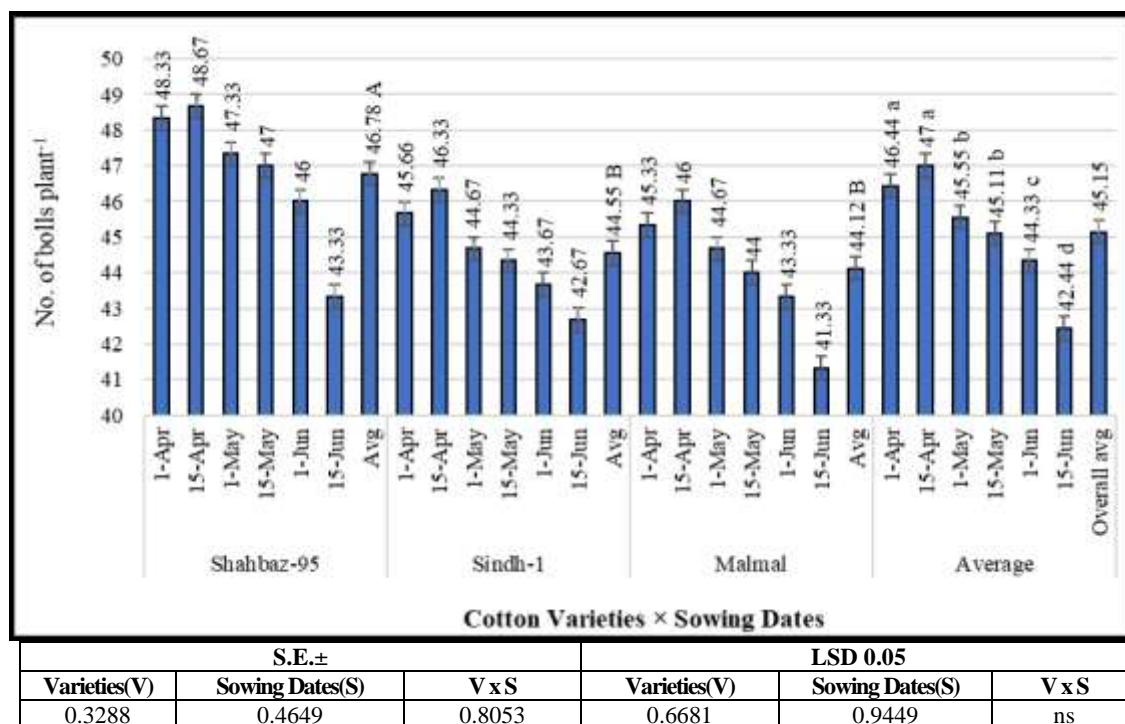
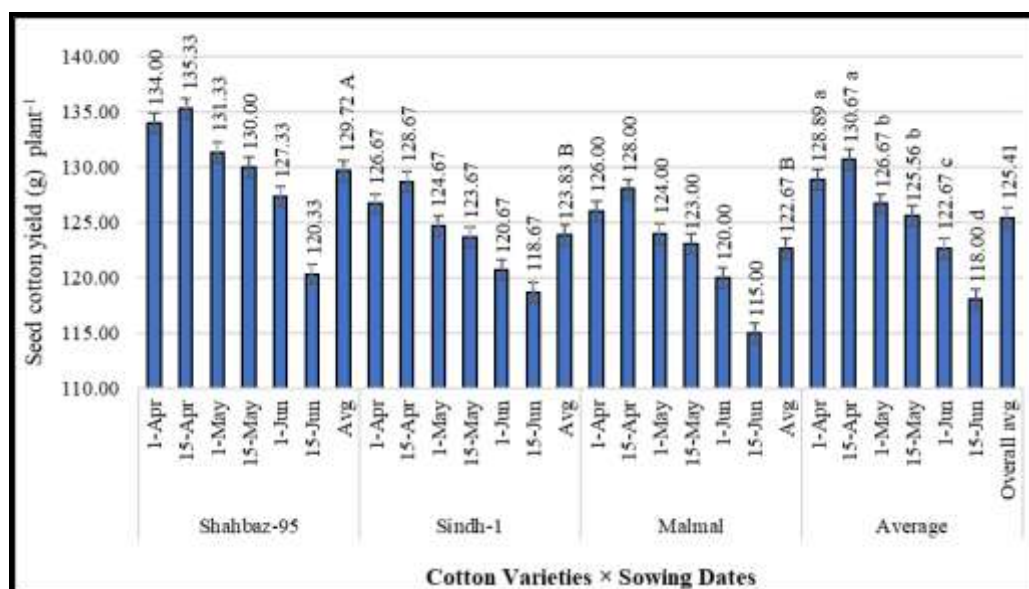


Figure. 4. Sowing date effect on the bolls plant⁻¹ of different cotton varieties

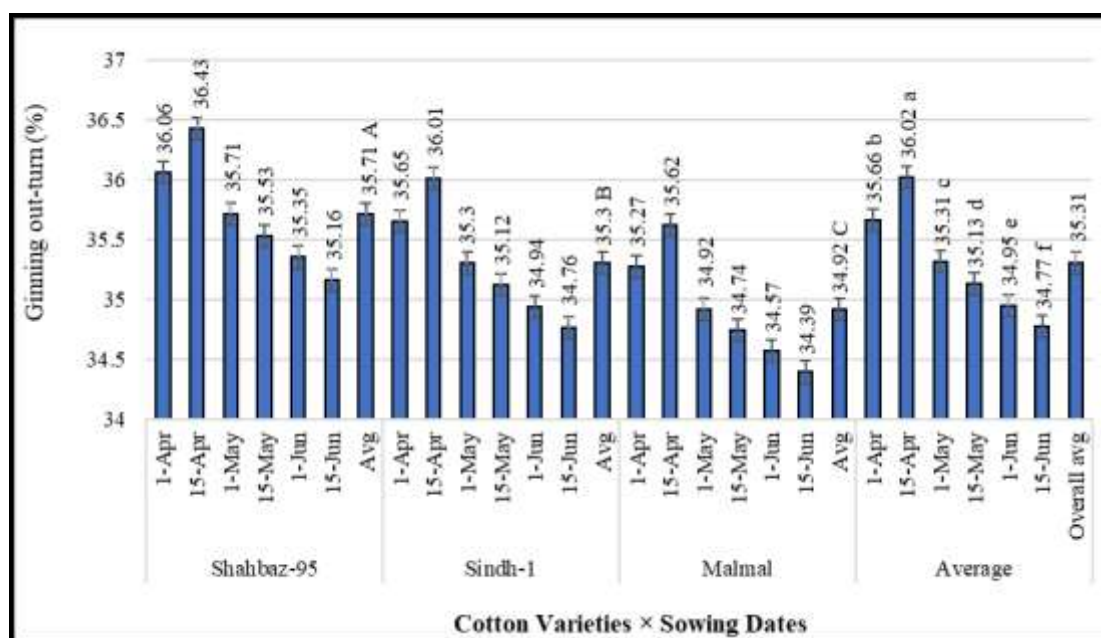
Seed cotton yield plant⁻¹ (g): The variations in seed cotton yield per plant exhibited statistical significance ($P < 0.05$) attributed to both varieties and sowing dates, while the interaction between variety and sowing date did not yield significant results ($P > 0.05$). Among the sowing dates, the highest seed cotton yield per plant (130.67 g) was recorded for 15th April sowing, closely followed by 1st April sowing (128.89 g). However, the seed cotton yield decreased to 126.67 g and 125.56 g for 1st May and 15th May sowings, respectively (Figure. 5). On the other hand, the lowest yield (118.00 g) was observed in plots sown on 15th June. In terms of cotton varieties, variety Shahbaz-95 yielded the maximum seed cotton yield plant⁻¹ (129.72 g), followed by Sindh-1 (123.83 g), while variety Malmal showed the lowest yield (122.67 g). Analyzing interactive effects, variety Shahbaz-95 × 15th April sowing interaction maximized seed cotton yield (135.33 g), whereas Malmal × 15th June sowing minimized the yield (115 g) plant⁻¹. Notably, sowing up to 15th April was identified as an optimal sowing time, as further sowing delays led to a simultaneous adverse impact on this trait (Figure. 5).

Ginning out-turn (G.O.T. %): The influence of sowing dates and varieties on the GOT (ginning outturn) showed significance ($P < 0.05$) and non-significance ($P > 0.05$) for their interaction. GOT percentages varied with sowing dates, being the highest (36.02%) for 15th April and lowest (34.77%) for 15th June (Figure/ 6). Among varieties, Shahbaz-95 exhibited the highest GOT (35.71%), followed by Sindh-1 (35.30%), and the lowest (34.92%) in Malmal. The interaction between variety Shahbaz-95 and 15th April sowing maximized GOT (36.43%), while variety Malmal with 15th June sowing interaction minimized it (34.39%) (Figure 6). Sowing cotton up to 15th April was found to be beneficial for achieving better GOT, with delays leading to a negative impact. Shahbaz-95 emerged as the superior variety in terms of GOT. The LSD test demonstrated linear and significant ($P < 0.05$) differences in GOT across all sowing dates and cotton varieties and it was linked to the number of sympodial branches, bolls and seed cotton yield plant⁻¹. Overall, sowing cotton up to 15th April positively affected GOT, with Shahbaz-95 performing the best among varieties



S.E.±			LSD 0.05		
Varieties(V)	Sowing Dates(S)	V x S	Varieties(V)	Sowing Dates(S)	V x S
0.8761	1.2389	2.1459	1.7804	2.5178	4.3610

Figure 5. Sowing date effect on seed cotton yield plant⁻¹ of different cotton varieties



S.E.±			LSD 0.05		
Varieties(V)	Sowing Dates(S)	V x S	Varieties(V)	Sowing Dates(S)	V x S
0.0254	0.0360	0.0623	0.0517	0.0731	ns

Figure 6. Sowing date effect on ginning outturn of different cotton varieties

Staple length (mm): The staple length exhibited significant variations due to both selected varieties and sowing dates ($P < 0.05$), while interactions between these factors did not yield statistically significant effect ($P > 0.05$). The maximized staple length (27.41 mm) was observed in 15th April sown cotton, followed by 1st April sowing (27.28 mm) and 15th June sown cotton had fibers of minimum staple

length (26.80 mm) (Figure 7). Among varieties, Malmal exhibited notably superior staple length (28.29 mm), followed by Sindh-1 (26.77 mm), and Shahbaz-95 displayed the lowest (26.30 mm). Interactive effects of variety Malmal and 15th April sowing maximized staple length (28.59 mm); while Shahbaz-95 and 15th June sowing minimized it (25.98 mm) (Figure 7). Outcomes of the LSD test indicated

that differences in staple length between 1st April and 15th April or 1st May and 15th May sowings were not statistically significant ($P>0.05$), but notable

significant ($P<0.05$) differences emerged when comparing these treatment groups amongst themselves or against other treatments (Figure 7).

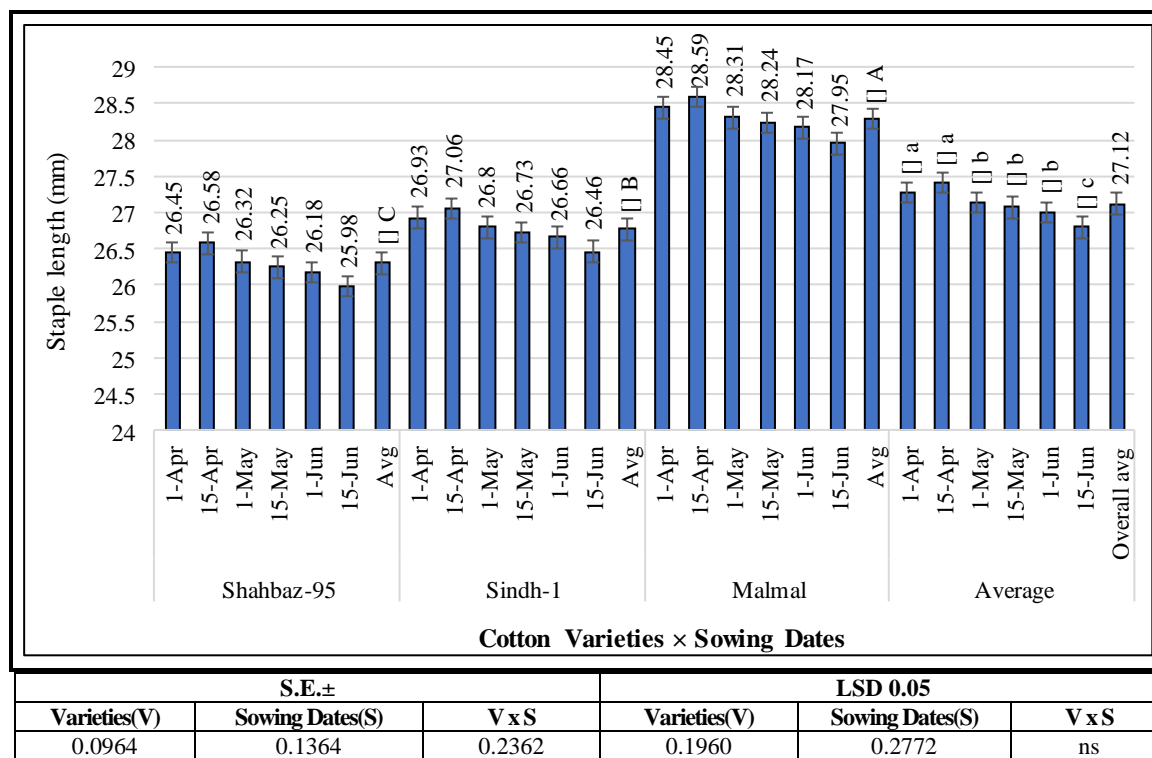


Figure 7. Sowing date effect on staple length of different cotton varieties

Seed cotton yield (kg ha⁻¹): The variations in seed cotton yield ha⁻¹ showed statistical significance ($P<0.05$) attributed to the combined effects of varieties, sowing dates, and the interactive relationship between variety and sowing date. The highest seed cotton yield (3586.10 kg ha⁻¹) was observed in plots sown on 15th April, closely followed by 1st April sowing (3561.80 kg). The seed cotton yield declined to 3479.70 kg and 3444.10 kg for 1st May and 15th May sowings, respectively, while 15th June sowing minimized the yields (3242.80 kg) (Figure. 8). Among varieties, Shahbaz-95 achieved highest seed cotton yield (3539.40 kg), followed by variety Sindh-1 (3403.30 kg), while it was lowest

(3370.90 kg) in variety Malmal. The combination of variety Shahbaz-95 and 15th April sowing maximized seed cotton yield (3718.30 kg), while Malmal and 15th June sowing interaction minimized the yield (3160.00 kg ha⁻¹) (Figure. 8). LSD test suggested similarities in seed cotton yield for 1st and 15th April sowings, as well as between 1st and 15th May sowings ($P>0.05$). Furthermore, similarity was identified between varieties Sindh-1 and Malmal for seed cotton yield ($P>0.05$). Nonetheless, sowing up to the 15th of April emerged as the optimal timeframe, as extended delays in cotton sowing led to detrimental effects on seed cotton yield

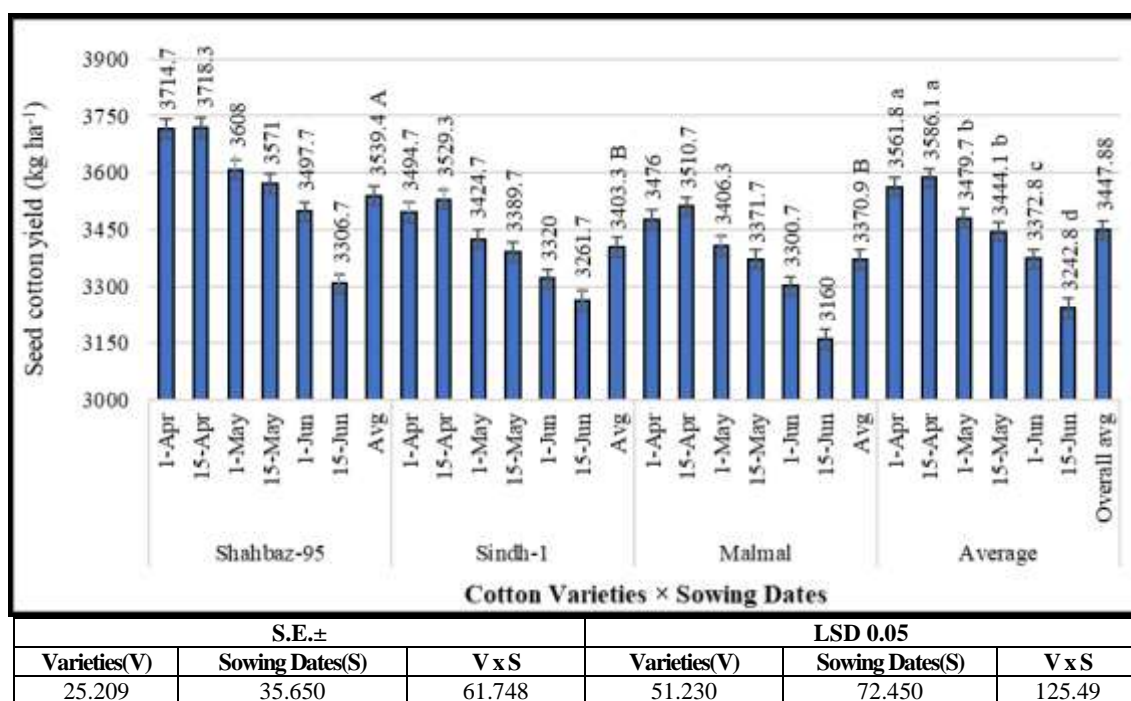


Figure 8. Sowing date effect on seed cotton yield (kg ha⁻¹) of different cotton varieties

DISCUSSION

The comprehensive analysis of this study revealed that the time of cotton sowing significantly impacts overall crop performance. Sowing cotton on the 15th of April resulted in the most favorable outcomes, showcasing a remarkable plant height of 127.93 cm. This elevated height can be attributed to the longer growth period afforded by the early sowing, which facilitates more extensive vegetative growth. The 15th April sowing also fostered the development of 1.56 monopodial branches plant⁻¹, signifying a robust branching pattern. Additionally, 21.44 sympodial branches plant⁻¹ were observed, indicating a well-branched and prolific growth habit that contributes to higher yield potential. The impressive count of 47.00 bolls plant⁻¹ further accentuates the efficacy of this sowing time, indicative of improved fruiting and reproductive performance.

Moreover, this prime sowing window led to a significant seed cotton weight of 130.67 g plant⁻¹, indicating enhanced fiber accumulation and cotton lint production. The G.O.T. percentage of 36.02% underscores the favorable fiber quality achieved, which is essential for textile processing and manufacturing. The staple length of 27.41 mm is particularly noteworthy, as it directly influences the textile industry's processing efficiency and final product quality. These collective attributes culminated in an outstanding seed cotton yield of 3586.10 kg ha⁻¹, highlighting the economic viability and potential profitability of cotton cultivation during this period. The subsequent early sowing, performed on the 1st of April, secured the second-best performance. A plant height of 126.67 cm was achieved, accompanied by 1.56 monopodial branches and 21.33 sympodial

branches plant⁻¹. While these metrics were slightly lower than the 15th April sowing, they still reflect robust growth and development. The 46.44 bolls plant⁻¹ denote a healthy reproductive outcome, contributing to an impressive seed cotton weight of 128.89 g per plant. The G.O.T. of 35.66% and staple length of 27.28 mm met the industry's quality standards, further affirming the viability of this sowing time. The resulting seed cotton yield of 3561.80 kg ha⁻¹ reinforces the economic significance of early sowing.

Conversely, sowing cotton on the 1st of May, 15th of May, 1st of June, and 15th of June demonstrated a noticeable reduction in overall crop performance. This decline can be attributed to the shorter growth period and less favorable environmental conditions during these delayed sowing dates. The lack of sufficient time for vegetative and reproductive growth contributed to suboptimal outcomes across all growth and yield parameters. In conclusion, this investigation underscores the critical importance of sowing timing in cotton cultivation. Early sowing up to the 15th of April was found to be the optimal period, ensuring favorable crop performance across various growth and yield attributes. The variety Shahbaz-95 emerged as a leader in seed cotton yield, while Malmal exhibited superior staple length. These findings align with previous research by Qayyum et al. (1990), Tunio et al. (2000), Soomro et al. (2000), Soomro et al. (2001), Hassan et al. (2003), Itnal et al. (2004), and Saraz (2008), confirming the consistent impact of sowing timing on cotton performance. Notably, variations in crop performance observed in comparison to earlier studies can be attributed to changes in climatic conditions, further emphasizing the sensitivity of cotton growth to environmental factors. The impact of

sowing date on various growth, yield, and quality traits of cotton has been extensively explored in the literature. Studies by Zaman et al. (2020) and Qayyum et al. (2021) have provided valuable insights into how different sowing dates influence cotton performance. These investigations highlight the significance of selecting appropriate sowing times to optimize crop growth and yield potential. Furthermore, the research conducted by Wang et al. (2019) has underscored the intricate relationship between sowing date and cotton traits. Their findings reinforce the notion that the timing of sowing plays a pivotal role in shaping plant height, branching patterns, boll development, fiber quality, and overall cotton yield. Moreover, the combined work of Qayyum & Riaz (2018) and Raza et al. (2020) has delved into the intricate interplay between sowing date and cotton attributes. Their studies emphasize the necessity of aligning sowing schedules with optimal environmental conditions to attain desirable outcomes in terms of both quantity and quality of cotton production. In addition, the research by Basal et al. (2018) contributes to this understanding by shedding light on how sowing date affects cotton performance. Their investigations further highlight the necessity of strategically selecting sowing times to enhance growth, yield, and fiber characteristics, ultimately impacting the economic viability of cotton cultivation. Collectively, the studies conducted by Zaman et al. (2020), Qayyum et al. (2021), Wang et al. (2019), Qayyum & Riaz (2018), Raza et al. (2020), and Basal et al. (2018) elucidate the intricate and multifaceted relationship between sowing date and various

parameters influencing cotton growth, yield, and fiber quality. These findings provide valuable guidance for cotton growers and researchers aiming to optimize crop performance through informed sowing date decisions.

CONCLUSIONS

In conclusion, the findings of this study firmly establish that sowing cotton up to the 15th of April represents the optimal sowing time, irrespective of the selected cotton varieties. A compelling argument emerges from the observed trend of each successive fortnight delay in sowing causing a synchronous adverse impact on all growth and yield parameters. Within the range of cotton varieties evaluated, Shahbaz-95 demonstrated the highest seed cotton yield, while Malmal caused superior staple length. Consequently, for achieving elevated seed cotton yields, it is strongly recommended to complete sowing by the 15th of April, favoring the utilization of the Shahbaz-95 variety. Similarly, for attaining enhanced staple length, the Malmal variety emerges as the preferred choice. These conclusions are highlighted by a vigorous body of evidence presented in the study, which collectively supports the strategic significance of sowing date and variety selection in optimizing both yield and fiber quality in cotton cultivation.

AUTHORS CONTRIBUTION

All the authors equally contributed in conducting the study and preparation of the manuscript

CONFLICTS OF INTEREST

The authors have declared no conflict of interest

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