

## COMPARISON OF COTTON (*GOSSYPIUM HIRSUTUM* L.) LINES WITH LOCAL VARIETY OF COTTON FOR HIGHER GROWTH AND YIELD

Muhammad Zahoor Lashari<sup>\*1</sup>, Bakht-Un-Nisa Mangan<sup>2</sup>, Danish Manzoor<sup>3</sup>, Asif Ali Kaleri<sup>4</sup>, Jameel Ahmed Bohar<sup>5</sup>, Waheed Ali Mangi<sup>6</sup>, Laiba Ashfaq<sup>7</sup>, Hafsa Munir<sup>8</sup>, Hilal Kashani<sup>9</sup>, Sher Azam<sup>10</sup>, Sohail Somo<sup>11</sup>

<sup>\*1,2,3,4,5</sup>Department of Agronomy, Sindh Agriculture University, Tandojam, Pakistan.

<sup>6</sup>Department of Agronomy, Balochistan Agriculture College Quetta, Pakistan.

<sup>7</sup>Centre of Agricultural Biochemistry and Biotechnology, University of Agriculture Faisalabad, Pakistan.

<sup>8</sup>Plant Breeding and Genetic, University of Agriculture Faisalabad, Pakistan.

<sup>9</sup>Deputy Director at Directorate of Agriculture Research Panjgur.

<sup>10</sup>Directorate of Agriculture Research Water Management & (HEIS) A.R.I Sariab Quetta.

<sup>11</sup>Department of Horticulture, Sindh Agriculture University, Tandojam, Pakistan

### ABSTRACT

When compared to all other crops, cotton (*Gossypium hirsutum* L.) is a crucial cash crop and plays a significant role. Pakistan produces the fourth-most cotton in the world. In Pakistan, cotton is referred to as both white gold and silver fiber. It is cultivated in significant regions of Sindh and Punjab and provides farmers with financial gain. During the Kharif of 2022, an experiment was set up in RCBD. Five newly developed lines (C-2246, C-2247, C-2248, C-2249, C-2250, and Koonje (check)) were investigated for their different agronomical characteristics, viz. plant heights (cm), monopodial branches plants-1, sympodial branches plants-1, number of bolls plants-1, staple lengths (mm), seed cotton yields plant-1 (g), seed index (100-seed weights, g), and seed cotton yields (kg ha-1). The results showed that extreme plant heights (112.97 cm) were recorded in (T4 = C-2249), while the least plant heights (106.63 cm) were recorded in (T1 = C-2246). The supreme monopodial branches plants-1 (1.6) were recorded in (T5 = C-2250), whereas the least monopodial branches plants-1 (1.0) were recorded from (T1 = C-2246). T5 = C-2250 recorded the supreme sympodial branches plants-1 (15.6), while T3 = C-2248 recorded the lowest sympodial branches plants-1 (13.9). T5 = C-2250 recorded the highest number of bolls plants-1 (48.9), while T3 = C-2248 recorded the lowest number of bolls plants-1 (43.6). The extreme staple lengths (29.5 mm) were recorded in (T5 = C-2250), and the least staple lengths (26.8 mm) were recorded in (T1 = C-2246). The extreme seed cotton yield plant-1 (86.8 g) was recorded in (T5 = C-2250) as compared to all other lines, including the local check. The extreme seed indexes (8.7 g) were recorded in (T5 = C-2250) as compared to other lines and local checks. The maximum seed cotton yields (1004.6 kg ha-1) were recorded in (T5 = C-2250) as compared to other lines and local check. The results showed that the C-2250 strain produced the highest seed and yields of cotton when compared to other strains and the local variety Koonje (check). It is therefore suggested that for higher seed and yield of cotton, the C-2250 strain should be preferred for cultivation in climatic conditions of Tando Jam.

**Keywords:** Cotton, Lines, Local Variety, Growth, Yield

## INTRODUCTION

Cotton (*Gossypium hirsutum* L.) holds significant economic value as a cash crop and occupies a prominent position among all other cultivated crops. Pakistan is the fourth-largest country, global creator of cotton (GoP, 2018). Cotton holds a significant position in Pakistan's agricultural landscape, second only to wheat, with the largest cultivated area among all crops. It serves as a major source of export revenues for the country. Furthermore, cottonseed plays a crucial role, accounting for approximately 80% of the country's oilseed invention, which yields both oil and meal. The cotton sector contributes approximately 10% to Pakistan's gross domestic product (GDP), which is important in generating 55% of the country's foreign exchange earnings. Pakistan stands out as a prominent producer and consumer of cotton worldwide. The significance of cotton production goes beyond generating foreign exchange earnings, as it serves as a crucial component for textile manufacturing, thereby enhancing its competitiveness. Although the cotton plant utilizes various parts, its primary uses are for its seed oil and fiber (Sial et al., 2015) and (Sajid et al., 2024). The agricultural sector holds a pivotal role in Pakistan's economy, serving as a vital and significant sector (Azam et al., 2017). The agriculture sector in Pakistan plays a crucial role by providing employment to 45% of the total labor force, contributing to poverty reduction, and establishing an extensive cash flow chain from growers to consumers. Moreover, it serves as the primary source of raw materials for the industrial sector within the country. Agriculture accounts for a 2.1% share in the Gross Domestic Product (GDP), contributing to the overall economic growth of the nation. Additionally, it serves as a significant source, contributing to 60% of the foreign exchange earnings of the country (Shaheen et al., 2021) and (Khaskheli et al., 2024). Pakistan's silver fiber and white gold nicknames for cotton are both appropriate. It thrives in important areas of Sindh and Punjab, providing farmers with significant financial rewards. Cotton, an essential component of the textile industry, helps provide jobs in both rural and urban areas. Over \$600 billion is the annual economic impact of cotton harvests worldwide.

(Ashraf et al., 2018). Cotton given the demands and significance of the cotton crop, it has become imperative to prioritize the development of cotton genotypes that are high-yielding and of superior quality. Production contributes 4.5% of the value added to the agricultural Gross Domestic Product (GDP), while its overall contribution to the country's GDP stands at 0.8%. Being a crucial substance for textile manufacturing, cotton plays a significant role by employing 17% of the largest agro-industrial market in the country. Furthermore, it accounts for 60% of all foreign currency earnings and contributes 8.5% to the national GDP. (Niamatullah et al., 2019). Cotton holds paramount importance as both a fiber crop for the textile industry and a vegetable oil crop. Over 30 countries worldwide extensively cultivate it, including notable producers such as the United States, China, India, and Pakistan. Water deficits adversely impact cotton's yield and quality, despite its ability to thrive in moderately arid soils. (Snowden et al., 2013). Drought and other challenging environmental conditions have detrimental effects on plants, influencing a range of physiological, molecular, biochemical, and metabolic processes. (Hussain et al., 2018). Given the demands and significance of the cotton crop, it becomes imperative to prioritize the development of cotton genotypes that are high-yielding and of superior quality. (Ahsan et al., 2021).

## MATERIAL AND METHOD

The Cotton Research Institute (CRI) Tando Jam carried out the field experiment to identify the lines with local varieties of cotton for higher growth and yield. The experiment followed a completely randomized block design with a net plot size of 5m x 4m (20m<sup>2</sup>). The land preparation methods recommended for We replicated the study three times, focusing on the local variety. Plantations were implemented. Three replications of the study concentrated on the local variety.

### Cultural Practices

A good seedbed was prepared by two dry plowings and leveling the land. The recommended dose of NPK was applied to all

treatments during the sowing time. The agronomical traits of the plants were observed by selecting five plants in each plot at five-day intervals during the initial 10 days following crop formation.

T1 = C-2246

T2 = C-2247

T3 = C-2248

T4 = C-2249

T5 = C-2250

T6 = Koonje (check)

During the maturity stage, 15 plants were sampled from each experimental unit to measure their plant height (cm) with the help of measuring tape. Monopodial branches plant<sup>-1</sup>, sympodial branches plant<sup>-1</sup>, number of bolls plant<sup>-1</sup>, staple length (mm), seed cotton yield plant<sup>-1</sup> (g), seed index (100-seed weight, g), and seed cotton yield (kg ha<sup>-1</sup>) were recorded.

### Statistical analysis

Statistical analysis was performed on the collected data through ANOVA via Statistix-8.1 Computer Software (Statistix, 2006). In cases where it remained deemed necessary, the LSD test was utilized to compare the superiority of different treatments.

## RESULTS

### Plant height (cm)

Table 1. Cotton plant height (cm) is influenced by many cotton strains, and the variety C-2249 recorded better with maximum plant height (112.97 cm), followed by the variety C-2250 plant height (111.53 cm), whereas the plant height (108.87 cm) was noted from the variety C-2248, although the plant height (107.80 cm) was observed from the variety Koonje (check), and the lowermost plant height (106.63 cm) was observed from the variety C-2246, followed by the plant height (107.57 cm) that was observed from the variety C-2247.

### Monopodial branches plant<sup>-1</sup>

Table 1. The monopodial branches of plant-1 in cotton were found to be pretentious by different cotton strains. The variety C-2250 recorded better with maximum monopodial branches plant<sup>-1</sup> (1.6), followed by in variety C-2249 monopodial branches plant<sup>-1</sup> (1.43), whereas monopodial branches plant<sup>-1</sup> (1.4) were recorded from variety C-2248, while the monopodial branches plant<sup>-1</sup> (1.3) were observed from variety C-2247, and the lowest monopodial branches plant<sup>-1</sup> (1.0) were observed from variety C-2246, followed by monopodial branches plant<sup>-1</sup> (1.23) that were observed from variety Konje (check).

### Sympodial branches plant<sup>-1</sup>

Table 1. Different cotton strains affect the sympodial branches of plant-1 in different ways. The variety Koonje (check) recorded better with maximum sympodial branches plant-1 (15.8), followed by the variety C-2250 sympodial branches plant-1 (15.6), whereas sympodial branches plant-1 (15.0) were recorded from variety C-2249, while the sympodial branches plant-1 (14.8) were observed from variety C-2246, and the lowest sympodial branches plant-1 (13.9) were observed from variety C-2248, followed by sympodial branches plant-1 (14.5) that were observed from variety C-2247.

### Number of bolls plant<sup>-1</sup>

Table 1. The number of bolls per plant-1 of cotton varies depending on the strain. The variety C-2250 recorded the highest number of bolls plant-1 (48.9), followed by variety C-2249 with a number of bolls plant-1 (47.5). Meanwhile, variety C-2246 recorded the lowest number of bolls plant-1 (45.9), variety C-2247 recorded the highest number of bolls plant-1 (44.3), and variety C-2248 recorded the lowest number of bolls plant-1 (43.6), followed by variety Koonje (check).

**Table 1. Comparison of cotton lines with local variety of cotton for higher growth and yield**

Treatments	Plant height (cm)	Monopodial branches plant <sup>-1</sup>	Sympodial branches plant <sup>-1</sup>	Number of bolls plant <sup>-1</sup>
<b>T<sub>1</sub> = C-2246</b>	106.63 b	1.0 c	14.8 b	45.9 b
<b>T<sub>2</sub> = C-2247</b>	107.57 ab	1.3 b	14.5 b	44.3 b
<b>T<sub>3</sub> = C-2248</b>	108.87 ab	1.4 a	13.9 b	43.6 b
<b>T<sub>4</sub> = C-2249</b>	112.97 a	1.43 a	15.0 a	47.5 a
<b>T<sub>5</sub> = C-2250</b>	111.53 a	1.6 a	15.6 a	48.9 a
<b>T<sub>6</sub> = Koonje (check)</b>	107.80 ab	1.23 b	15.8 a	44.1 b
<b>S.E</b>				
<b>LSD 0.05</b>	1.7278	0.3775	0.5927	1.0907
<b>P-value</b>	0.0000	0.0167	0.0003	0.0000

#### Staple length (mm)

Table 2. Cotton's staple length (mm) and how it is impacted by many cotton strains. Variety C-2250 recorded the highest extreme staple length (29.5 mm), followed by variety C-2249 with a staple length of 28.3 mm. Meanwhile, variety C-2248 recorded the longest staple length (28.1 mm), variety Koonje recorded the longest staple length (27.3 mm), variety C-2246 recorded the lowest staple length (26.8 mm), and variety C-2247 recorded the longest staple length (27.0 mm).

#### Seed cotton yield plant-1 (g)

Table 2. Different cotton strains influence the seed cotton yield plant-1 (g). The variety C-2248 recorded better with maximum seed cotton yield plant-1 (85.8 g), followed by in variety C-2250 seed cotton yield plant-1 (85.4 g), whereas the seed cotton yield plant-1 (85.3 g) was recorded from the variety C-2249, while the seed cotton yield plant-1 (85.1 g) was observed from the variety C-2246, and the lowest seed cotton yield plant-1 (83.3 g) was observed from the variety Koonje (check), followed by the seed cotton yield plant-1 (85.0 g), which was observed from variety C-2247.

#### Seed index (100-seeds weight, g)

Table 2. The seed index (g) of cotton was impacted by various cotton strains. The variety C-2250 recorded the highest seed index (8.5 g), followed by the variety C-2249 (8.3 g). The variety C-2248 recorded the lowest seed index (8.0 g), variety C-2246 recorded the highest seed index (7.8 g), variety Koonje (check) recorded the lowest seed index (6.5 g), and variety C-2247 recorded the lowest seed index (7.5 g).

#### Seed cotton yield (kg ha-1)

Table 2. Seed cotton yield (kg ha<sup>-1</sup>) of cotton as affected by different cotton strains. Variety C-2250 recorded the highest seed cotton yield (1004.6 kg ha<sup>-1</sup>), followed by variety C-2249 with a seed cotton yield of 937.6 kg ha<sup>-1</sup>. Meanwhile, variety C-2248 recorded the highest seed cotton yield (908.3 kg ha<sup>-1</sup>), variety C-2247 had the highest seed cotton yield (887.7 kg ha<sup>-1</sup>), variety Koonje (check) had the lowest seed cotton yield (565.1 kg ha<sup>-1</sup>), and variety C-2246 had the lowest seed cotton yield (870.1 kg ha<sup>-1</sup>).

**Table 2. Comparison of cotton lines with local variety of cotton for higher growth and yield**

Treatments	Staple length (mm)	Seed cotton yield plant <sup>-1</sup> (g)	Seed index (100-seed weight, g)	Seed cotton yield (kg ha <sup>-1</sup> )
<b>T<sub>1</sub> = C-2246</b>	26.8 b	85.1 a	7.8 a	870.1 d
<b>T<sub>2</sub> = C-2247</b>	27.0 b	85.0 a	7.5 a	887.7 c
<b>T<sub>3</sub> = C-2248</b>	28.1 a	85.8 a	8.0 a	908.3 b
<b>T<sub>4</sub> = C-2249</b>	28.3 a	85.3 a	8.3 a	937.6 a
<b>T<sub>5</sub> = C-2250</b>	29.5 a	85.4 a	8.5 a	1004.6 a
<b>T<sub>6</sub> = Koonje (check)</b>	27.3 b	83.3 b	6.5 b	565.1 e
<b>S.E</b>				
<b>LSD 0.05</b>	0.1304	9.9841	0.1469	27.78
<b>P-value</b>	0.0011	0.0164	0.0116	0.0017

## DISCUSSION

The results revealed that (T<sub>4</sub> = C-2249) recorded the greatest plant height (112.97 cm), while (T<sub>1</sub> = C-2246) recorded the lowest plant height (106.63 cm). T<sub>3</sub> = C-2250 recorded the maximum monopodial branches plant-1 (1.6), while T<sub>1</sub> = C-2246 recorded the minimum monopodial branches plant-1 (1.0). T<sub>6</sub> = Koonje (check) recorded the maximum sympodial branches plant-1 (15.8), while T<sub>3</sub> = C-2248 recorded the minimum sympodial branches plant-1 (13.9). T<sub>5</sub> = C-2250 recorded the extreme number of bolls plant-1 (48.9), while T<sub>3</sub> = C-2248 noted the lowest number of bolls plant-1 (43.6). T<sub>3</sub> = C-2250 recorded the supreme staple length of 29.5 mm, while T<sub>1</sub> = C-2246 recorded the minimum staple length of 26.8 mm. T<sub>3</sub> = C-2248 recorded the maximum seed cotton yield of 85.8 g, while T<sub>5</sub> = Koonje (check) recorded the minimum yield of 83.3 g. T<sub>1</sub> = C-2250 recorded the maximum seed index of 8.5 g, while T<sub>6</sub> = Koonje recorded the minimum seed index of 6.5 g. T<sub>3</sub> = C-2250 recorded the maximum seed cotton yield of 1004.6 kg ha<sup>-1</sup>, while T<sub>5</sub> = Koonje recorded the minimum yield of 565.1 kg ha<sup>-1</sup>. The results concluded that the C-2250 strain (variety) recorded the highest seed and yield of cotton compared to other cotton strains and a local

variety, Koonje (check). Therefore, to achieve higher seed and yield, cultivators should prefer the C-2250 strain in Tando Jam climatic conditions. Numerous researchers have observed similar results (Conaty et al., 2015). The study's findings revealed that lines with warmer CT yielded the highest yields, indicating more closed stomata. However, some researchers detected a negative correlation between yield and canopy temperature (Karademir et al., 2018). The study's use of different crops and irrigation methods could be the cause of these differences. Tables 1-2 present the minimum and mean values of all the investigated characters in both advanced lines and control varieties. Table 2 demonstrates that the advanced lines (varieties) ranged in seed cotton yield from 565 to 1004 kg ha<sup>-1</sup>. This finding indicates a large variation between advanced lines for seed cotton yields. The Cotton Research Institute (CRI) Tando Jam retested these lines for the fiber features, suggesting that a single plant may undergo testing to enhance fiber quality indicators, which are crucial for the release and approval of varietal programs. Wang et al. (2004) reported that the modification in types impacted the high lint yield and fiber properties. The analysis of variance (sum of squares) in Table 1-2 shows that there are significant differences

between the cotton lines for canopy temperature (preflowering stage, peak flowering stage, and postflowering stage), chlorophyll content (peak flowering stage), ginning percentage, fiber strength, and spinning consistency index. However, there are no significant differences for seed cotton yield, fiber fineness, length, or homogeneity. The outcomes are consistent with Shah et al.'s (2015) evaluation of strains in a national coordinated varietal trial in Sindh province, which recommended high-yield strains for commercial cultivation (Soomro, 2022). They discovered that genotypes and their interactions with different environments can evaluate a variety's yield performance. The yield of seed cotton is determined by the fineness, length, and homogeneity of the fiber. The C-2250 line recorded the highest growth and yield of cotton compared to other cotton lines and the local variety Koonje (Check).

### Conclusions

It is concluded that the cotton growth and yield were influenced significantly ( $p < 0.05$ ) by lines with local varieties of cotton. The C-2250 line recorded the highest growth and yield of cotton compared to other cotton lines and the local variety Koonje (Check). It is therefore suggested that for higher growth and yield of cotton, the C-2250 line should be preferred for cultivation in climatic conditions of Tando Jam.

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