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Interspecific Hybridization between *Gossypium hirsutum* (American Cotton) and *Gossypium barbadense* (Egyptian Cotton) for Quality Improvement

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Authors' contributions

This work was carried out in collaboration among all authors. All authors read and approved the final manuscript.

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ABSTRACT

Cotton (*Gossypium spp.*) is a globally important cash crop, valued for its fiber and economic contributions to the textile industry. This study investigated the variability, heritability, and genetic

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advance of yield-related traits in interspecific hybrids of American (*G. hirsutum*) and Egyptian (*G. barbadense*) cotton. Using a randomized complete block design, 28 hybrids were evaluated for traits such as seed cotton yield, plant height, bolls per plant, and boll weight. Significant genetic variability was observed among hybrids, with high heritability estimates for seed cotton yield (96.84%), plant height (93.51%), and bolls per plant (76.44%), coupled with moderate genetic advance, suggesting additive gene action. Regression analysis revealed that the number of bolls emasculated and pollinated significantly influenced total seed production, with coefficients of determination (R^2) of 0.5924 and 0.5102, respectively. The hybrid JA-08/A × JA-12/203 demonstrated superior crossability (100%) and seed production, making it a promising candidate for breeding programs. These findings emphasize the potential for exploiting genetic variability and hybrid vigor to develop high-yielding and high-quality cotton varieties.

Keywords: Gossypium hirsutum; Gossypium barbadense; cotton; interspecific hybridization.

1. INTRODUCTION

"Cotton, a major fibre crop with high commercial value, is grown in the temperate and tropical regions of over 70 countries (Biology of *Gossypium* spp.,). The term 'cotton' refers to species in the genus *Gossypium* (Malvaceae) such as *G. hirsutum*, *G. barbadense*, *G. arboreum*, and *G. herbaceum*, which were independently domesticated for textile fibre" (Brubaker et al., 1999). The origin of Gossypium is unclear, but primary diversity centers include Mexico, northeast Africa, Arabia, and Australia (Wendel and Albert 1992, Seelanan et al, 1997). Cotton, often called the "king of fibre," is a significant cash crop influencing global economics and social affairs. "The genus *Gossypium* includes 39 species, with 33 diploid and six tetraploid. Cultivated species are *G. arboreum, G. herbaceum, G. hirsutum*, and *G. barbadense"* (Gurmeet - Dhaliwal, et al., 2002) *G. hirsutum and G. barbadense* are natural allotetraploids from interspecific hybridization between African and American species (Chen 2007) *G. barbadense*, known for its extra-long staple (ELS) cotton, generally has a staple of at least 1⅜" or longer, whereas *G. hirsutum* has shorter staple (Goggin and Brian 1991). "Most commercial varieties of G. hirsutum are relatively resistant to yield reduction, unlike *G. barbadense*" (Shtienberg 1993). A study in Turkey demonstrated high yields and good fibre characteristics in hybrids of *G. hirsutum and G. barbadense* (Basbag and Gencer 2007). Interspecific hybrids can spin up to 80 counts (Singh and Kairon 2007). Cotton is the most widely used plant fibre and a key raw material for the textile industry, grown in over 80 countries. World cotton fibre consumption is about 115 million bales annually. Pima or Egyptian cotton (*Gossypium barbadense*), cultivated in less than 2% of the world, is known for its superior fibre properties (Chen 2007). India leads in cotton area but ranks second in production, following China.In Pakistan, cotton is grown on about 2.98 million hectares, with Sindh contributing 0.63 million hectares (Laghari et al., 2003). It significantly impacts the country's economy, covering 2.820 million hectares and yielding 713 kg/ha, contributing about 1.6% value in GDP (Economic Survey 2015-16). "Bangladesh has a historical reference in growing superfine cotton, emerging as a leading textile exporter during the Industrial Revolution. Despite its importance, local cotton production meets only about 3% of the country's raw cotton demand. In 2015-16, Bangladesh produced 153,280 bales of cotton, with an area of 42,800 hectares harvested in 2016" (BTMA 2017).

"In Bangladesh, cotton is primarily rain-fed, with upland cotton (*Gossypium hirsutum*) and hill cotton (*Gossypium arboreum*) being grown. American upland cotton is cultivated in more than 32 districts. The annual raw cotton requirement for Bangladesh's textile industry is around 2.5 million bales, with local production meeting 4-5% of this demand. The remainder is imported from countries like the USA, CIS, Australia, Pakistan, and South Africa" (BTMA 2017). "The area under cotton cultivation ranges between 0.08% and 0.27% of the total cropped area" (BBS 2017). Crop yield, a complex character, is influenced by various components. Heritability indicates the transmissibility of traits to future generations, essential for selecting yield improvement traits. "Genetic advance measures the improvement in mean genotypic value of selected plants over the parental population. Regression analysis helps understand the association between variables, contributing to the prediction and improvement of crop yield" (Dewey and Lu 1959; Alan 1993). The present study highlights the Interspecific Hybridization between Gossypium hirsutum

(American cotton) and Gossypium barbadense (Egyptian cotton) for Quality Improvement.

Objectives:

1. To evaluate the seed cotton yield potential and yield-enhancing traits in American *(Gossypium hirsutum*) and Egyptian (*Gossypium barbadense*) cotton lines, considering their significant economic and textile value.
2. To estimate the crossability of two cotton species, understanding the genetic transfer and hybridization potential between *G. hirsutum and G. barbadense*, aiming for superior agronomic and fibre traits.
3. To combine quantitative and qualitative characteristics from American and Egyptian cotton species, facilitating the development of high-quality hybrid cotton varieties or inbred cotton lines with improved yield, fiber quality, and adaptability to diverse environmental conditions.

2. MATERIALS AND METHODS

2.1 Experimental Site

The present research work was situated conducted at Hajee Mohammad Danesh Science and Technology University, Dinajpur, Bangladesh, at the experimental plot of the Department of Genetics and Plant Breeding from July 2016 to Feb 2017 the Rabi season.

2.2 Experimental Layout

The experiment was laid out in the Randomized Complete Block Design (RCBD) with three replications. The layout of the experiment was prepared for distributing the genotypes into the every plot of each block. The individual plot size was 12.8 m x 6 m. Each replication contained 48 lines. Each line contains 15 plants. The distances between the rows were 80cm and plant to plant distances 40 cm. The distance between the block was 1 m.

2.3 Planting Materials

In this research work, the seeds of cotton were used. The source all of the genotypes used in this experiment was collected from Bangladesh Cotton Development Board, Jessore. The genotypes of four American cotton (JA-08/A, JA-08/BJA-08/D andJA-08/E) and four Egyptian cotton (JA-10/201, JA-10/202, JA-12/203 and JA-12/204) were used. The purity and germination percentage were leveled as around 98 and above 95, respectively each of the genotypes.

2.4 Parameter Studied

Data on different yield and yield contributing characters were recorded on plot and plant basis as per experimental requirement. Data were recorded on the following crop characters;

1. Vegetative branches plant -1
2. Number of fruiting branches plant -1:
3. Primary fruiting branches plant -1
4. Secondary fruiting branches plant -1
5. Days to (50%) flowering
6. Days to (50%) boll splitting
7. Bolls plant-1
8. Un-burst bolls plant-1
9. Single boll weight (g)
10. Plant height at harvest (cm)
11. Seeds boll-1
12. Seed cotton yield (g/plant)

2.5 Hybridization

Four genotypes, JA-08/A, JA-08/B, JA-08/D and JA-08/E under the American cotton *(Gossypium hirsutum)* and JA-10/201, JA-10/202, JA-12/203 and JA-12/204 under Egyptian cotton *(Gossypium barbadense)* were included in the experiment to produce interspecific hybrids. Hybridization was done in half diallel [p(p-1)/2] mating design. A set of 28 hybrids were produced. The hybrids were produced on the basis of synchronization of flowering.

2.6 Statistical Analysis

2.6.1 Analysis of Variance

The data on various growth and quality traits were recorded by using standard procedure. The data collected were analyzed statistically using analysis of variance (ANOVA) test.

“The analyses of variances for most of the characters under consideration were performed by F variance test. The significance of difference among the means was evaluated by least significant difference (LSD) test for interpretation of results” (Gomez and Gomez 1984).

2.6.2 Estimation of genotypic and phenotypic variances

Genotypic and phenotypic variances were estimated according to the formula given by Johnson et al. (Johnson et al., 1955).

2.6.3 Estimation of genotypic and phenotypic co-efficient of variations

Genotypic and phenotypic co-efficient of variations were calculated according to the formula given by Burton, and Singh and Chaudhary (Burton 1952; Singh and Chaudhury 1985).

3. RESULTS AND DISCUSSION

3.1 Analysis of Variance for Different Yield Contributing Characters

The mean sum squares and the co-efficient of variation for the studied characters from the analysis of variance are summarized in the Table 1.

It was observed that the mean sum of squares of the varieties for all the characters were significant, indicating substantial genetic variation among the genotypes. However, no significant variation was found among the three replications for all the characters. This demonstrates the reliability of the experimental design and the consistency of results.

The coefficient of variation for all the characters was equal to or less than 10.83%, except for un-burst bolls per plant (12.28%), boll weight (11.35%), and plant height at harvest (15.78%). These moderate-to-low coefficients of variation further affirm the validity of the observed genetic variability.

The results of the analysis of variance (Table 1) revealed significant differences among the genotypes for all the studied characters, indicating the presence of genetic variance. This highlights the potential for selecting superior genotypes for hybridization and developing high-quality cotton varieties. These findings align with the principles of quantitative genetics as outlined by Fisher and Kempthorne, who emphasized the role of ANOVA in identifying genetic differences (Fisher 1925; Kempthorne 1957). Singh and Chaudhary further underscored the importance of ANOVA in detecting variability and guiding selection decisions in breeding programs (Singh and Chaudhury 1985).

Similar studies on cotton have shown that genetic variability provides opportunities for selecting high-yielding and stress-tolerant genotypes (Reddy & Khan, 2001; Patel & Patel, 2010). Additionally, Falconer and Mackay emphasized the role of variance components, including genotypic and phenotypic variance, in estimating heritability and guiding breeding strategies (Falconer & Mackay 1996).

3.2 Mean Performances of Different Yield Contributing Characters

Significant variation was observed in yield and yield contributing characters for different cotton inbred lines. Mean performances of different parameters are presented in Table 2.

Table 1. Analysis of variance (MS) on different characters in cotton

Sl. No.	Characteristics	Sources of variation with mean sum of squares			
		Replication (2df)	Genotype (7df)	Error (14df)	CV%
1.	Vegetative branches plant $^{-1}$	0.3	1.92**	0.14	10.58
2.	Node number of first fruiting branches (NFB) plant $^{-1}$	0.63	5.774**	0.85	9.19
3.	Primary fruiting branches plant $^{-1}$	2.02	20.64**	1.3	8.64
4.	Secondary fruiting branches plant $^{-1}$	0.56	5.73**	0.7	5.08
5.	Days to (50%) flowering	4.50	29.14**	0.5	9.63
6.	Days to (50%) boll splitting	0.87	92.94**	1.018	3.78
7.	Bolls plant^{-1}	7.12	205.60**	19.15	5.51
8.	Un-burst bolls plant^{-1}	0.5	0.923**	0.065	12.28
9.	Single boll weight (g)	0.9	2.108**	0.26	11.35
10.	Plant height at harvest	1.87	207.98**	4.7	15.78
11.	Seeds boll^{-1}	0.13	2.48**	0.15	7.22
12.	Seed cotton yield ((g/plant))	0.03	267.02**	2.87	10.83

*Here, ** indicates significant at 1% level of probability and d.f. indicates degrees of freedom*

Table 2. Mean performance of different characters

Genotypes	VBP	NFBP	PFBP	SFBP	DFF	DBS	BPP	UBPP	SBW	PH	SPB	SCY
JA-08/A	2.74b	7.27a	15.18c	8.17c	55b	110e	28.14g	1.56h	5.5b	124.2c	27.3d	110.4c
JA-08/B	2.64b	6.3c	12.38f	8.62b	54bc	112de	29.54e	1.93e	5.46b	126b	28.5b	112.1b
JA-08/D	1.98c	5.87d	16.23b	9.28a	54bc	115c	27.03h	1.84f	5.13c	127.8a	26.35g	109.3d
JA-08/E	3.14a	6.9b	17.4a	9.31a	52c	113cd	28.81f	1.66g	6.23a	120.9d	26.81f	116.2a
JA-10/201	1.35e	4.17f	14.82d	6.58e	60a	120b	70.03a	2.7b	4.12f	105.6h	27.11e	77.3f
JA-10/202	1.5d	3.42g	13.17e	6.76d	59a	125a	68.77b	3.12a	4.42d	111.5f	28.3c	81.37e
JA-12/203	1.24f	5.48e	12.17g	5.92g	58a	118b	65.95d	2.59c	3.87g	113e	28.85a	65.85h
JA-12/204	1g	4.26f	9.18h	6.3f	60a	124a	67.15c	2.28d	4.17e	110.4g	26.9f	68.21g
LSD	0.107	0.266	0.105	0.078	2.03	2.90	0.146	0.073	0.046	0.625	0.106	0.400

VBP=Vegetative branches plant $^{-1}$ | *NFBP=Node number of first fruiting branches plant $^{-1}$*
PEBP=Primary fruiting branches plant ^{1} | *SFBP=Secondary fruiting branches plant $^{-1}$*
DFF=Days to (50%) flowering | *DBS=Days to (50%) boll splitting*
BPP=Bolls plant^{-1} | *UBPP=Un-burst bolls plant^{-1}*
SBW=Single boll weight | *PH=Plant height at harvest*
SPB=Seeds boll^{-1} | *SCY=Seed cotton yield*

Recent studies have highlighted significant genetic variability in cotton (*Gossypium hirsutum* L.) inbred lines, particularly concerning yield and its contributing traits. "For instance, research has demonstrated substantial differences in plant height, monopodial branches, boll weight, and seeds per boll among various genotypes, all of which have direct positive effects on seed cotton yield" (Sahar et al., 2021). "Additionally, analyses of genetic variability and interrelations among yield components have underscored the importance of traits such as bolls per plant, seeds per boll, and lint per seed in determining overall yield" (Manning, 1956). Furthermore, studies focusing on the genetic improvement of Egyptian cotton (*Gossypium barbadense* L.) have emphasized the efficiency of selection for yield and its components, reinforcing the role of genetic factors in yield variability (Lamlom et al., 2024). These findings align with observations of significant variations in traits such as vegetative branches, fruiting branches, days to flowering, bolls per plant, boll weight, plant height, seeds per boll, and seed cotton yield among different cotton inbred lines. Such variability is primarily attributed to genetic differences, offering valuable opportunities for breeders to enhance cotton yield and quality through targeted selection and hybridization strategies.

3.3 Genetic Parameters on the Selected Characters in Cotton

Genetic parameters on the selected characters in cotton are shown in Table 3. Variability in seed cotton yield and its components was assessed using parameters such as genotypic variance ($\sigma^2 g$), phenotypic variance ($\sigma^2 p$), genotypic coefficient of variation (GCV), phenotypic coefficient of variation (PCV), heritability ($h^2 b$), genetic advance (GA), and genetic advance as a percent of the mean (GAM). High genotypic and phenotypic variances were observed for seed cotton yield (88.05, 90.92), plant height (67.76, 72.46), and bolls per plant (62.15, 81.3), while lower values were recorded for un-burst bolls, vegetative branches, and single boll weight. Phenotypic variance exceeded genotypic variance for all traits, consistent with previous studies.

The highest heritability (96.84%) was recorded for seed cotton yield, while the lowest (65.88%) was for the number of first fruiting branches. Traits with high heritability coupled with high GAM, such as vegetative branches and bolls per plant, indicate additive gene action, making them suitable for selection in early generations. "Moderate genetic advance was observed for seed cotton yield (19.02), plant height (16.39), and bolls per plant" (14.19).

These findings highlight the potential for improving seed cotton yield through selection based on GCV, heritability, and GAM. This variability provides opportunities for breeders to exploit additive gene effects and heterosis, supporting the development of efficient cotton breeding programs.

Table 3. Genetic parameters for different characteristics in Upland cotton

Characters	$б^2g$	$б^2p$	GCV%	PCV%	H^2b	GA	GAM
VBP	0.59	0.73	39.70	44.14	80.90	1.42	73.57
NFBP	1.64	2.49	23.50	28.96	65.88	2.14	39.30
PEBP	6.44	7.74	18.38	20.15	83.21	4.77	34.55
SFBP	1.67	2.37	17.01	20.25	70.54	2.24	29.44
DFF	9.54	10.04	5.46	5.60	95.02	6.20	10.98
DBS	30.64	31.65	4.72	4.80	96.78	11.21	9.57
BPP	62.15	81.3	16.36	18.71	76.44	14.19	29.47
UBPP	0.286	0.351	24.19	26.80	81.48	0.99	44.99
SBW	0.616	0.876	16.14	19.25	70.31	1.35	27.89
PH	67.76	72.46	7.01	7.24	93.51	16.39	13.96
SPB	0.77	0.926	3.20	3.49	83.81	1.66	6.04
SCY	88.05	90.92	10.13	10.29	96.84	19.02	20.54

VBP=Vegetative branches plant $^{-1}$ *NFBP=Node number of first fruiting branches plant $^{-1}$*
PEBP=Primary fruiting branches plant $^{-1}$ *SFBP=Secondary fruiting branches plant $^{-1}$*
DFF=Days to (50%) flowering *DBS=Days to (50%) boll splitting*
BPP=Bolls plant^{-1} *UBPP=Un-burst bolls plant^{-1}*
SBW=Single boll weight *PH=Plant height at harvest*
SPB=Seeds boll^{-1} *SCY=Seed cotton yield*

Recent studies corroborate these observations. “For instance, research on genetic variability for yield and fiber-related traits in genetically modified cotton has revealed that the highest genotypic coefficient of variation for seed cotton yield was followed by the number of bolls per plant, indicating substantial variability for these characters” (Sahar et al., 2021). “Additionally, studies on genetic variability and heritability in upland cotton have reported high heritability coupled with high genetic advance for traits like lint index, number of bolls per plant, and seed cotton yield per plant, suggesting that these traits are predominantly controlled by additive gene action and can be effectively improved through selection” (Ahsan et al., 2015).

3.4 Cross Ability of Parental Genotypes in Experimental Hybrid Seed Production

Recent studies have further elucidated the crossability between American cotton (*Gossypium hirsutum*) and Egyptian cotton (*Gossypium barbadense*), with crossability rates ranging from 66.67% to 100%. A total of 28 interspecific hybrids were successfully produced, yielding sufficient hybrid seeds for evaluation. Among the parental lines, JA-08/D exhibited superior performance, producing promising hybrids with Egyptian cotton genotypes.

From the Table 4, the key findings are:

- **Number of Buds Emasculated:** The highest number of emasculated buds (20) was observed in crosses such as JA-08/A × JA-10/202, while the lowest (10) were recorded in JA-08/B × JA-08/E.
- **Number of Buds Pollinated:** Pollination success was slightly lower than emasculation, with JA-08/A × JA-10/202 and similar crosses achieving 18 pollinated buds, while others like JA-08/E × JA-10/201 recorded the lowest (10).
- **Days to First Boll Splitting:** Boll splitting varied from 110 days (JA-08/B × JA-12/204) to 125 days (JA-08/A × JA-10/202). Early splitting bolls were associated with lower yields.
- **Single Boll Weight:** Boll weight ranged from 2.84 g (JA-08/A × JA-10/201) to 5.15 g (JA-08/D × JA-12/204), reflecting yield potential.
- **Seeds per Boll:** Crosses like JA-08/A × JA-08/E produced the highest number of seeds per boll, while JA-10/201 × JA-12/203 had the lowest (15.89).
- **Total Hybrid Seeds:** Hybrid seed production ranged from 58.71 to 417.24, with JA-08/A × JA-12/203 producing the highest number of seeds, making it ideal for hybrid programs.
- **Crossability:** Crossability ranged from 66.67% to 100%, with JA-08/A × JA-12/203 demonstrating the highest potential for producing hybrids efficiently through manual pollination.

These findings underscore the potential of interspecific hybrids in developing high-yielding cotton varieties, with promising parental combinations identified for future breeding programs. Recent research supports these observations, highlighting the significance of interspecific hybridization in cotton improvement. For instance, a study published in Agronomy MDPI emphasizes the role of interspecific hybridization in enhancing crop resilience and productivity (Anwar et al., 2022). Additionally, research in Scientific Reports discusses the genetic compatibility and potential of interspecific grafting between G. hirsutum and G. barbadense (Karaca et al., 2020). These studies, along with the current findings, provide valuable insights for cotton breeding programs aiming to develop superior cultivars through interspecific hybridization.

3.5 Character Association in Hybrid Cotton Seed Production

Regression analysis is a widely used statistical tool to investigate relationships between variables and predict outcomes. In this study, linear multiple regression analysis was employed to evaluate the effects of the number of bolls emasculated (NBE) and the number of bolls pollinated (NBP) on total seed production (TS) in cotton. From Fig. 1 and Fig. 2, scatter plots and regression equations depicted these relationships, with coefficients of determination (R^2) of 0.5924 and 0.5102, indicating that over 50% of seed production variability could be explained by these factors.

The regression coefficients revealed that for each additional boll emasculated, total seed production increased by 22.76, while each additional boll pollinated contributed to an increase of 22 seeds. This highlights the critical role of effective emasculation and pollination in successful hybridization. These findings align with earlier research by Patel et al., who reported that hybrid seed production is highly dependent on efficient emasculation and pollination techniques, which influence seed-setting efficiency (Patel & Patel 2010). Similarly, Naqib et al. highlighted the importance of optimizing these techniques to maximize seed production (Naqib et al., 2009). Moreover, Fisher et al. emphasized the utility of regression analysis in quantifying relationships among agricultural traits, further validating the use of such approaches in this study (Fisher 1925).

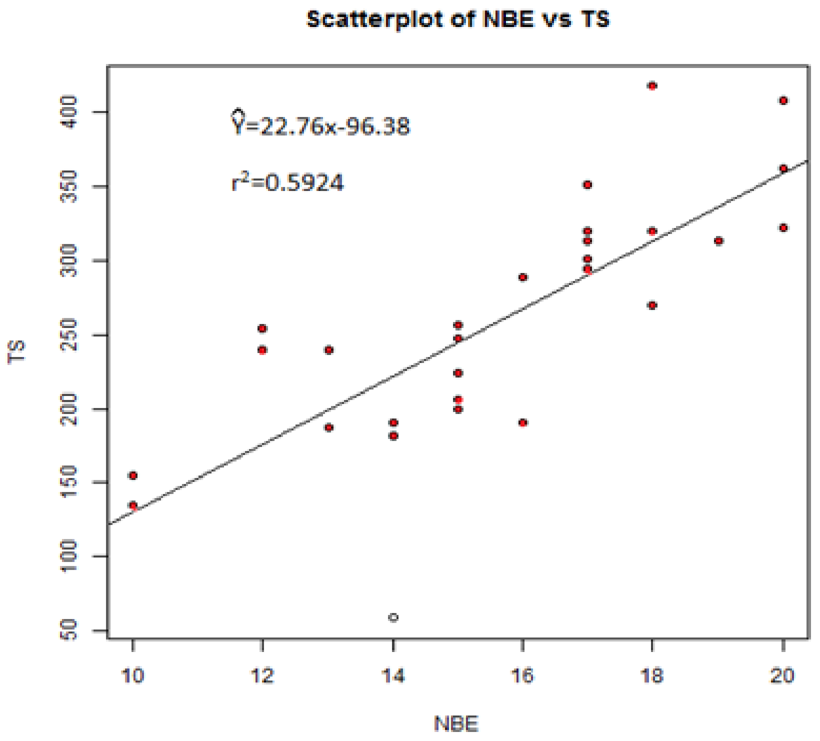

Fig. 1. Confidence interval of total seed (TS) with number of bolls emasculated (NBE

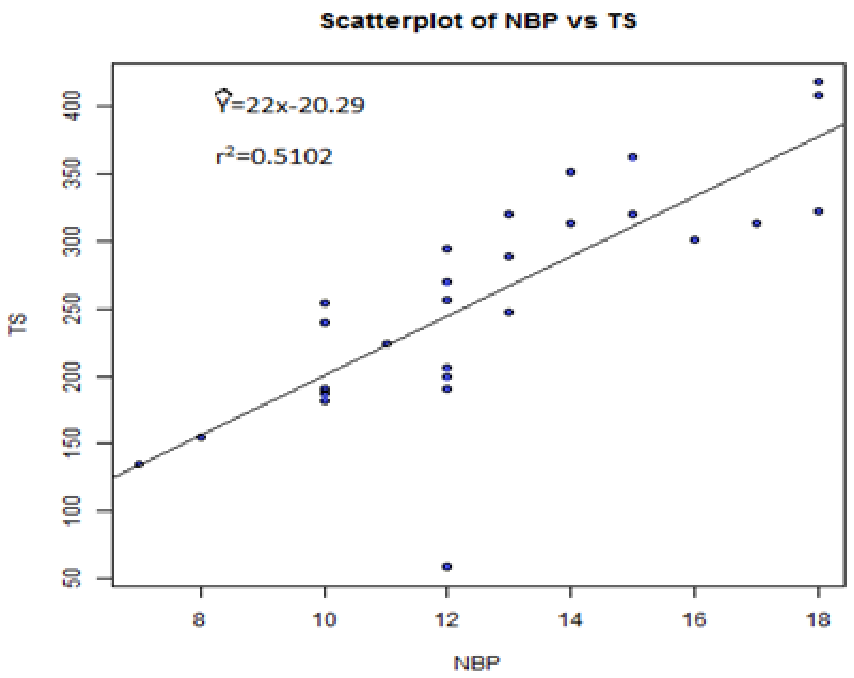

Fig. 2. Confidence interval of total seed (TS) with number of bolls pollinated (NBP)

Table 4. Crossability of parental genotypes in experimental hybrid seed production

Crosses	NBE	NBP	DBS	SBW	SPB	TS	Crossability(%)
JA-08/A X JA-08/B	15	12	120	4.92	21.36	256.32	80.00
JA-08/A X JA-08/D	16	13	112	5.00	22.18	288.08	81.25
JA-08/A X JA-08/E	12	10	118	4.37	25.37	253.70	83.33
JA-08/A X JA-10/201	17	16	124	2.84	18.80	300.60	94.12
JA-08/A X JA-10/202	20	18	125	3.49	22.64	407.52	90.00
JA-08/A X JA-12/203	18	18	117	4.72	23.18	417.24	100
JA-08/A X JA-12/204	17	12	115	5.02	24.49	293.88	70.06
JA-08/B X JA-08/D	12	10	121	4.98	24.00	240.00	83.33
JA-08/B X JA-08/E	10	8	121	3.71	19.41	155.28	80.00
JA-08/B X JA-10/201	13	10	119	4.00	18.73	187.30	76.69
JA-08/B X JA-10/202	15	11	122	4.56	20.38	224.18	73.33
JA-08/B X JA-12/203	18	12	125	4.14	22.46	269.52	66.67
JA-08/B X JA-12/204	20	15	110	4.22	24.11	361.65	75.00
JA-08/D X JA-08/E	19	17	116	4.79	18.39	312.63	89.47
JA-08/D X JA-10/201	17	14	110	3.98	25.07	350.98	82.35
JA-08/D X JA-10/202	15	13	121	3.32	18.99	246.87	86.67
JA-08/D X JA-12/203	14	12	123	4.49	21.58	58.96	85.71
JA-08/D X JA-12/204	13	10	123	5.15	24.01	240.10	76.92
JA-08/E X JA-10/201	10	7	125	4.28	19.25	134.75	70.00
JA-08/E X JA-10/202	20	18	120	3.56	17.90	322.20	90.00
JA-08/E X JA-12/203	17	14	118	3.77	22.38	313.32	82.35
JA-08/E X JA-12/204	15	12	117	4.11	17.15	205.80	80.00
JA-10/201 X JA-10/202	14	10	111	4.16	18.10	181.10	71.14
JA-10/201X JA-12/203	16	12	113	3.99	15.89	190.68	75.00
JA-10/201X JA-12/204	17	15	122	3.56	21.32	319.80	88.24
JA-10/202X JA-12/203	18	13	119	4.18	24.58	319.54	72.22
JA-10/202X JA-12/204	15	12	123	4.73	16.66	199.92	80.00
JA-12/203X JA-12/204	14	10	118	3.89	19.09	190.90	71.43

NBE= Number of boll emasculated, NBP= Number of ball pollinated,
DBS= Days to ball splitting, SBW=Single boll weight,
SPB= Seeds per boll, TS= Total seeds

4. CONCLUSION

The present study highlights the genetic variability and heritability of key yield-related traits in interspecific hybrids of cotton. High heritability estimates for traits such as seed cotton yield and bolls per plant, combined with moderate genetic advance, indicate that selection for these traits in early generations could lead to substantial genetic improvement. Regression analysis underscored the importance of emasculation and pollination in maximizing hybrid seed production, demonstrating their critical roles in successful hybridization programs. Among the hybrids, JA-08/A × JA-12/203 emerged as the most promising cross, with the highest seed production and crossability. These findings provide valuable insights for cotton breeders, offering strategies to exploit genetic diversity and hybrid vigor for enhancing cotton productivity and fiber quality. Future research should focus on refining these hybridization techniques and evaluating their performance under diverse agro-climatic conditions to support sustainable cotton production globally. This research will help in leveraging the genetic diversity and hybrid vigor of these cotton species to produce commercially viable and high-quality cotton varieties, contributing to global cotton production and textile industries.

DISCLAIMER (ARTIFICIAL INTELLIGENCE)

Author(s) hereby declare that NO generative AI technologies such as Large Language Models (ChatGPT, COPILOT, etc.) and text-to-image generators have been used during the writing or editing of this manuscript.

COMPETING INTERESTS

Authors have declared that no competing interests exist.

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