

Determination of Sowing Time of Muslin Cotton Phuti Karpas (*Gossypium arboreum*)

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Md. Akhteruzzaman is a highly experienced professional with a commendable career spanning approximately 25 years of service with the Cotton Development Board. Throughout his employment, he has held significant and demanding positions, demonstrating his expertise and dedication in the field. One of his key contributions has been his instrumental role in motivating farmers and stakeholders in Bangladesh to cultivate and utilize local cotton. His efforts have played a pivotal role in driving the expansion of cotton production and facilitating research activities.

With a solid background in soil and agroecology, Md. Akhteruzzaman has accumulated 9 years of valuable experience in the subjects in Bangladesh. His expertise extends to the realm of land use planning as well. As a member of the expert team involved in the revival of Muslin fabric production, he brings his extensive knowledge and insights to the table, contributing to the overall success of the endeavor. Md. Akhteruzzaman's commitment and contributions have helped transform cotton production into a tangible and beneficial enterprise for farmers and all stakeholders involved in the cotton supply chain.

Mrs. Milia Bente Momtaz is a dedicated professional who has completed her MSc in Agriculture and Development from the University of Reading, UK. Since 2016, she has been serving as a Cotton Development Officer in the Cotton Development Board, where she has made noteworthy contributions to the field of cotton research and development. Her expertise and commitment have played a significant role in advancing the objectives of the board and furthering the growth and development of the cotton industry.



Abstract

The study aimed to assess the influence of different sowing dates on the yield and characteristics of Phuti Karpas: SR-25 (*Gossypium arboreum*) tree cotton during the 2021-22 season at the Cotton Research Farm in Gazipur, Bangladesh. Phuti Karpas is a perennial cotton plant known for producing the raw cotton used in the renowned ultra-fine Dhakai Muslin fabric. The experiment employed a randomized complete block design with three replications. Seedlings, twenty days old, were transplanted into the experimental plots on various dates: April 15, May 1, May 15, June 1, June 15, and July 1. The different sowing times had a notable impact on plant height, with significant variations observed. Additionally, the weight of individual bolls and overall yield were significantly influenced by the sowing time, while the number of sympodial branches per plant and the number of bolls per plant were found to be insignificant factors. Notably, the highest seed cotton production (1.32 t/ha) and the finest quality were achieved when cotton was sown on April 15.

Keywords: *Gossypium arboreum*, sowing time, muslin, seed cotton yield.

Background

The legacy of Dhakai Muslin traces back to the cotton plants that flourished along the banks of the old Brahmaputra, Meghna, and Shitalakshya rivers. Among these plants, there is a timeless Asiatic cotton *Gossypium arboreum* variety known locally as "Phuti Karpas." We collected this perennial tree cotton, a tropical and subtropical plant native to Bangladesh, from the vicinity of Kapasia in Gazipur. Although Phuti Karpas is one of the four commercially grown cotton types, it is yet to be cultivated on a large scale in Bangladesh. Nevertheless, Bangladesh's association with the exquisite Muslin fabric, renowned worldwide, remains intact. Muslin is a fine-quality, handwoven cotton textile with its origins rooted in the capital city of Dhaka. Historically, this fabric was crafted from the fibers of the tree cotton plant exclusively cultivated in the southern regions of Dhaka (Rezwan, 2021). The historical significance of Bangladesh's cotton cultivation for the production of the magnificent Muslin cloth has unfortunately faded over time (Hamid, et. al., 2020). To revive this golden heritage of Muslin manufacturing technology, we have embarked on a mission to collect and conserve the germplasm (SR-25) of Phuti Karpas, sourced from

Kapasias in Gazipur. This endeavor aligns with the honorable Prime Minister Sheikh Hasina's vision to restore the magnificence of Muslin in our country.

The timing of planting and plant population management are crucial factors in the successful commercial cultivation of cotton, as they directly impact crop yield and fiber quality. Numerous experts worldwide have emphasized the significance of sowing time when selecting cotton cultivars (Salih, 2019). Additionally, Soomro et al. (2000) have highlighted the critical role of sowing timing in achieving optimal seed cotton output, particularly in unpredictable weather conditions. Cotton plants exhibit high sensitivity to environmental factors such as temperature, humidity, precipitation, and soil moisture, which can significantly influence yield and quality (Bradford and Davidonis, 2000).

To develop effective management systems, it is important to understand the intricate interaction between the cotton plant and its environment. Moreover, meteorological conditions during the squaring, blooming, and boll development stages play a decisive role in determining seed cotton yield. Planting dates also impact plant establishment and the occurrence of pests and diseases, affecting different crop varieties in distinct ways. Consequently, early or late planting dates can lead to various morpho-anatomical, physiological, and biochemical changes in the plant, ultimately affecting growth, development, and yield (Shrestha et al., 2018). Thus, the adaptability of cotton crops is closely tied to the timing of key growth stages, ensuring reduced stress and optimal resource utilization (Sankaranarayanan, 2020).

Adjusting sowing times has proven to be an effective management strategy for maximizing seed cotton output. The determination of the optimal sowing time for cultivars aims to identify the most favorable planting period, aligning with the prevailing environmental conditions to facilitate germination and survival (Hore and Rathic, 2002). Therefore, the objective of this study is to determine the optimum sowing time, a crucial factor for the successful production of tree cotton.

Materials and Methods

Study Sites and Experimental Design:

The experiment was conducted at the Cotton Research Training and Seed Multiplication Farm in Sreepur, Gazipur, situated within the Agro-Ecological Zone (AEZ)-28 known as Madhupur Tract. The geographical coordinates of the farm are approximately 24.180N latitude and 90.420E longitude. The soil at this location is strongly acidic, with a pH ranging from 4.5 to 5.5. It is characterized as red-brown soil with a clay loam texture and exhibits a low to medium nutrient content.

The region experiences summer temperatures ranging from 28 to 32 degrees Celsius, which decrease to around 20 degrees Celsius in the winter, with occasional extreme lows of 10 degrees Celsius. The annual rainfall in the area ranges between 1,000 to 1,500 mm, but it is distributed unevenly throughout the year. The field at the experimental site is moderately drain-

able, as per the classification provided by the Bangladesh Agricultural Research Council (BARC, 2005).

To determine the optimum sowing time for SR-25 (Muslin) cotton, the experimental site was laid out using a Randomized Complete Block Design (RCBD) with replications. The size of each unit plot was 4 m x 3.6 m, and the spacing between plants was maintained at 90 cm x 30 cm.

Seedling raising and transplanting:

The seeds were sown in polybag soil within a greenhouse environment, maintaining a fifteen-day interval between sowings. Consequently, seedlings of the same age were transplanted into the prepared field on the specified dates. The seedlings germinated approximately four days after being placed in the polybags. They were then grown in the greenhouse for a duration of 20 days before transplantation. The transplanting took place on April 15th, May 1st, May 15th, June 1st, June 15th, and July 1st of the year 2021.

Crop management:

To ensure optimal nutrient and pest management practices, fertilizers and pesticides were applied from both organic and inorganic sources. Fertilization was carried out based on the specific requirements of the crop. In addition, commercial pesticides were used at recommended doses to manage sucking and chewing pests. Organic tools such as pheromone traps for bollworm management and yellow sticky traps for Jassid management were also installed at a rate of 40 traps per hectare. Furthermore, weed infestation was managed manually at four different instances, depending on the extent of infestation.

Sample collection:

To determine the optimum sowing time for SR-25 (Muslin) cotton, ten plants were randomly selected from each plot. The average number of monopodial branches per plant, sympodial branches per plant, bolls per plant, single boll weight, and yield were recorded from these selected plants.

Statistical analysis:

The data pertaining to yield and yield-contributing factors were analyzed using the Statistical Package for Social Science (SPSS) software. The Least Significant Differences (LSD) were calculated to determine significant differences between treatments.

Results

Analysis of Variance:

In order to assess the significance of the variables, analysis of variance (ANOVA) was conducted, and F statistics were computed. The results indicated that for plant height, the p-value (P) was 0.16, which was less than the critical F value (0.75), suggesting that there is a significant difference. Similarly, for the number of bolls per plant and yield, the p-values (P) were 0.60 and 0.45, respectively, both of which were less than the critical F value (1.05), indicating significant differences. However, ANOVA alone does not provide information about which

specific comparisons are significant. Therefore, post hoc LSD tests were performed to determine the significance of the interactions among the variables, using a reference level of $p \leq 0.05$.

From the multi-pair comparison, significant differences were observed in plant height, single boll weight, and yield. Regarding plant height, the transplanted plants on April 15 showed a significant difference compared to those transplanted on July 1, with a mean height of 208.87 cm and 174.70 cm, respectively. However, the differences in plant height means for other sowing dates were statistically insignificant. The tallest plant height (208.87 cm) was observed when the plants were transplanted on May 15, while the lowest height (174.70 cm) was recorded for the plants transplanted on July 1 (Table-1).

Table-1: Effect of sowing time on yield and yield contributing characters of SR-25 (Muslin).

Sowing Time	Plant Height (cm)	Sympodial Branches per plant	Number of bolls/plant	Boll weight (gm)	Yield (t/ha)
15 April	198.50ab	4.16a	11.20a	3.53a	1.32a
01 May	189.07ab	5.46a	10.33a	3.50ab	1.21a
15 May	208.87a	5.03a	8.00a	3.20c	0.85b
01 June	185.20ab	5.06a	9.10a	3.26bc	0.98a
15 June	183.00ab	5.90a	9.80a	3.43abc	1.11a
01 July	174.70b	5.33a	11.50a	3.46ab	1.30a
LSD	27.04	2.38	4.79	0.25	0.57
SE	12.13	1.06	2.14	0.11	0.18
CV	7.83	25.36	26.36	4.19	27.94

Table -2: Effect of sowing time on Ginning Out Turn (GOT)

Sowing Time	GOT (%)
15 April	30.76
01 May	30.67
15 May	29.26
01 June	30.20
15 June	30.00
01 July	28.75

Similarly, for single boll weight, statistically significant differences were observed when the plants were transplanted on April 15 (3.53 g) and May 15 (3.20 g). However, the mean values of single boll weight for other sowing dates did not show significant differences. In terms of yield, the highest yield (1.32 t/ha) was statistically different from the yield obtained from the May 15 sowing (0.85 t/ha) (Table-1). The yields from the other sowing times did not show statistically significant differences. Additionally, the ginning out turn varied between approximately 28% and 30% across the different sowing times (Table-2).

Discussion

Numerous studies have reported similar findings regarding the optimal sowing dates for cotton cultivation. Arain et al. (2001) observed that cotton sown between May 1st and April 15th in Nawab Shah, Sindh, Pakistan, resulted in the highest seed cotton yield. Similarly, Qayyum et al. (1990) found that crops sown on April 15th showed a progressive increase in seed cotton yield, attributed to an increase in fruiting branches, productive bolls, and yield per plant. Bala et al. (2020) reported that the crop seeded in the second week of April exhibited significantly higher plant height, dry matter output, leaf area index, bolls per square meter, sympodial branches, boll weight and yield (4,556 kg/ha) compared to the other sowing dates.

However, the generally accepted optimum planting date has been around May 1st (Killi, 2006). Farid et al. (2017) found that early May planting led to a 45% increase in cotton seed production compared to late June planting, along with improved yield components. Jamro et al. (2017) observed higher ginning out turn for cotton crops seeded on May 1st compared to those planted later. Similarly, Khan and Gill (1982) reported significantly higher yields for early-sown cotton compared to late-sown crops. Sultan et al. (1980) noted that early-sown crops exhibited increased plant height, number of bolls, single plant yield, and total seed cotton yield. Khan and Khan (1992) found that crops sown between April 20th and May 5th yielded the highest under normal climatic conditions.

Regarding fiber quality, Bilbro and Ray (1973) observed that as the planting date was delayed, lint percentage, fiber length, and micronaire values decreased, while fiber strength increased. Cathey and Meredith (1988) stated that late seeding led to lower micronaire and lint output but did not significantly affect fiber length, strength, or elongation. Mukundan et al. (1993) also found that late sowing increased the concentration of short fibers and immature fibers. However, Fransen and Verschraege (1985) emphasized that short fiber content is influenced by various factors such as genotype, growing conditions, harvesting, ginning, and processing procedures. Furthermore, limited information is available regarding pre-harvest short fiber content levels or sources.

Figure-1. Super fine muslin cloth woven from phuti karpas grown in Dhaka, Bangladesh.



Figure-2. Muslin cloth woven from phuti karpas SR-25 grown in Dhaka, Bangladesh.



Figure-3. Dr Md. Akhteruzzaman in a field Phuti Karpas: SR-25 (*Gossypium arboreum*) tree cotton during the 2021-22 season at the Cotton Research Farm in Gazipur, Bangladesh.



CONCLUSION

The findings of this study hold significant importance for the commercial cultivation of “Phuti Karpas” SR-25 cotton in Bangladesh, given the fabric’s esteemed golden heritage and global reputation.

The identification of the optimal sowing time and its impact on the yield and yield-contributing characteristics of Muslin cotton can assist farmers in mitigating stress-related challenges during adverse weather conditions and maximizing their yields.

Specifically, transplanting 20-day-old seedlings on April 15th resulted in higher single boll weight and yield, making it a favorable choice for cotton cultivation.

References

- Arain, M.H., Arain, S., Balcho, M.J., Kalwar, G.H. and Memon, A.A. 2001. Performance of newly developed cotton strain under different sowing dates, Pak J.Bio. Sci. (Suppl.) 1: 1-2.
- Bala, R., Shweta, Malik, K., Sewhag, M. and Priyanka. 2020. Effect of Sowing Dates on Yield of Cotton Genotypes under Hisar Conditions. Journal of cotton research and developments. 34(1), p-72-77.
- Bilbro, J.D. and Ray, L.L. 1973. Effect of planting date on the yield and fibre properties of three cotton cultivars. Agronomy Journal, 65: p. 606-609.
- Bradlow, J.M. and Davidonis, G.H., 2000. Quantitation of fiber quality and the cotton production-processing interface: a physiologist's perspective. J. Cotton Sci, 4(1), p.34-64.
- Farid, M.A., M. Ijaz, S. Hussain, M. Hussain, O. Farooq, A. Sattar, A. Sheraz, A. Wajid, A. Ullah and M.R. Faiz. 2017. Growth and yield response of cotton cultivars at different planting dates. Pak. J. Life Soc. Sci., 15(3), p. 158-162.
- Fransen, T.J.F. and Verschraege, L. 1985. Origins of short fibres. Textile Horizons, 5: 40-42
- Hamid, A., Neogi, M. H., Marma, M. S., Biswas, J. C., Marma, A. S. S., Mollah, M. A. M., Uddin, M. F. and Islam, M. M. 2020. Determining Planting Window for Growing Upland Cotton (*Gossypium hirsutum*) during dry season in Bandarban, Bangladesh. Ann.Bangladesh Agric. 24 (2): 1-14
- Jamro, S.A., M.U. Ali, M. Buriro, M.I. Ahmad, G.M. Jamro, A. Khan, F.A. Shah, W.A., Siddique A. Sher and M.I. Jakhro. 2017. Impact of various sowing dates on growth and yield parameters of different cotton varieties. J. Appl. Environ. Biol. Sci., 8(7): 135-143
- Khan, K. and S. Khan, 1992. The effect of dates of planting on the yield of promising cotton cultivars under climatic conditions of D. I. Khan. Pak. Cottons, 16: 29-33.
- Khan, W.S. and A.R. Gill, 1982. How different times affect the cotton yield in Jhang district. Pak. Cottons, 26: p. 73-87.
- Killi, F. and Bolek, Y. 2006. Timing of planting is crucial for cotton yield, Acta Agriculturae Scandinavica, Section B — Soil and Plant Science, 56:2, p.155-160.
- Mukundan, S., Janardhanam, K.V. and Reddy, A.S. 1993. Effect of sowing dates and spacing on yield and fibre quality in cotton. Journal of Indian Society of Cotton Improvement, 18: p. 87-88
- Qayyum, S.M., A.H. Ansari, N.A. Choudhri and M.M.A. Baig, 1990. Seed cotton yield its components and their inter relation response of six upland cotton cultivars with regard to sowing dates. Pak. Cottons, 34: 59-73.
- Rezwan, 2021. Bangladesh moves to revive production of muslin, fabric of legend. Available at: [https://globalvoices.org/2021/01/11/bangladesh-moves-to-revive-production-of-muslin-fabric-of-legend/\(date: 20/5/2022\)](https://globalvoices.org/2021/01/11/bangladesh-moves-to-revive-production-of-muslin-fabric-of-legend/(date: 20/5/2022))
- Salih, R. F. 2019. Effect of Sowing Dates and Varieties of Cotton (*Gossypium hirsutum* L.) on Growth and Yield Parameters. Journal of Pure and Applied Sciences. 31(3), p. 64-70.
- Sankaranarayanan, K., Prakash, A. and Rajendran, K. 2020. Effect of sowing time on productivity of Bt and non Bt cotton under climate change. Bull Natl Res Cent 44, p.146.
- Shrestha, J., Kandek, M., Chaudary, A. 2018. Effects of planting time on growth, development and productivity of maize (*Zea mays* L.), Journal of Agriculture and Natural Resources, 1(1): 43-50.
- Soomro, A.R., Channa, A. A. Channa, M.H., Kalwar, G.H. Dayo, G.N. and Memon, A.H. 2000. The effect of different sowing dates on the yield of newly developed strain under climatic conditions of Ghotki, Sindh. The Pak Cottons. 44, p. 25-31
- Sultan, W., M. Hanif and K. Ahmed, 1980. Studies on the effect of sowing dates cum irrigation and level of fertilizers on the yield of American cotton (*G. hirsutum*). Pak. Cottons, 24: 75-87