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Influence of Different Planting Scheduling and Cultivar on the Growth and Yield of Cotton Crop

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ABSTRACT
A field study was conducted to evaluate the effect of planting schedule on the growth and yield of cotton crop at Cotton Section, Agriculture Research Institute, Tandojam during Kharif 2013. The experiment was laid out in a three replicated factorial randomized complete block design. The treatments consisted of three cotton cultivars, i.e. Star-2, NIAB-78 and Sindh-1, and three planting schedulings, viz. 20th April, 10th May and 30th May. The statistical analysis showed that different planting schedules significantly ($P<0.05$) affected the growth and yield parameters of cotton varieties. Among planting schedulings, planting of cotton varieties on 20th April resulted in maximum seed germination, plant height, sympodial branches per plant, days to first flowering, bolls per plant, seedcotton yield plant^{-1}, seedcotton yield, GOT, staple length and minimum monopodial branches per plant, followed by planting of cotton varieties on 10th May in all the traits studied, particularly seedcotton yield. However, minimum growth and yield attributes, particularly seedcotton yield was observed when cotton crop was sown on 30th May. In case of varieties, maximum growth and yield traits were produced by cotton cultivar Sindh-1, followed by cotton cultivar NIAB-78 in all the parameters studied. However, minimum performance were observed by cotton cultivar Star-2. As regards interactive effects, the interaction of 20th April x cotton cultivar Sindh-1 resulted in maximum output, whereas minimum output were recorded under the interaction of 30th May x cotton cultivar Star-2. Hence, results concluded that the interaction of 20th April x cotton cultivar Sindh-1 proved to be the most feasible for obtaining maximum seed cotton yield (3177.5 kg ha-1) of cotton crop under agro-ecological conditions of tandojam.
Keywords: Planting schedule, Growth, Yield, Cotton cultivar

INTRODUCTION

Pakistan vitally needs sustained agricultural development to cope with the social and economic obligations that are the normal consequences of the continued high rates of population growth. Cotton (Gossypium hirsutum L.) is an important cash crop of Pakistan known as "white gold". Cotton contributes 8.6% of the value added in agriculture and about 1.8% in GDP. The area under cotton crop in 2009-10 was 3106 thousand hectares with production of 12698 thousand bales, and average yield was 695 kg ka-1 (GOP, 2010). Around 2/3 of the country's export earnings come from the cotton made products and textile mills. Life of millions of farmers is also dependent on this crop. In addition to that millions of people are employed along the entire cotton value chain from weaving to yarn manufacturing (Karam et al., 2006).Cotton is grown chiefly for its fibre used in the manufacture of cloth for the mankind (Rank, 2007). It is also used for several other purposes like making threads, for mixing in other fibres and extraction of oil from the cottonseed. The oil content in the cottonseed ranges from 15-25 percent depending on the varieties. Cotton seed cake after extraction of oil is good organic manure and contains about 6 percent nitrogen, 3 percent phosphorus and 2 percent potash. Cottonseed, cotton linters and pulp obtained during oil extraction and cotton meal are good concentrated feed for cattle (Muhammad et al., 2006). Besides, Pakistan being the world's fourth-largest cotton producer and the third largest exporter of raw cotton and a leading exporter of yarn in the world, our yield ha-1 ranks 13th in the world. Therefore, it has become vital for Pakistan to increase yield unit-1 area (Saleem et al., 2010).

The seedcotton yield unit-1 area is affected by a number of factors including land selection, sowing time, weeding, irrigation, chemical fertilizers etc. Of these, sowing period plays significant role in crop production process (Varlev et al., 2000). Cotton has its own definite requirements for temperature and light for emergence, growth and flowering. Too early sowing produces weak plants with poor root system as temperature is below the optimum. Temperature above optimum leads to irregular germination and the embryo frequently dies and the cotyledon may undergo decomposition. In Pakistan, the cotton is grown from April to June. Cotton sown earlier or later than its optimum time shows significant decrease in yield (Soomro et al., 2000). Niazi (2005) concluded that the cotton crop sown on 25th April recorded 93.26 cm plant height, 1.59 monopodial branches per plant, 24.60 sympodial branches per plant, 38.73 bolls per plant, 35.19 % G.O.T, 28.33 mm staple length,

38.40 g seed cotton yield per plant and 2291.18 kg seed cotton yield ha-1. The crop when sown on 15th May, it produced 86.53 cm plant height, 1.19 monopodial branches per plant, 19.66 sympodial branches per plant, 34.66 bolls per plant, 35.18 % G.O.T, 28.72 mm staple length, 37.19 g seed cotton yield per plant and 2232.80 kg seed cotton yield ha-1. The late sowing of 5th June remained least in values for all characters. Among cultivars, Niab-78 out yielded remaining cultivars and produced 88.55 cm plant height, 1.22 monopodial branches per plant, 23.55 sympodial branches per plant, 40.77 bolls per plant, 35.59 % G.O.T, 27.64 mm staple length, 40.01 g seed cotton yield per plant and 2416.12 kg seed cotton yield ha-1. Cultivar Shahbaz-95 recorded 85.55 cm plant height, 1.66 monopodial branches per plant, 21.22 sympodial branches per plant, 37.66 bolls per plant, 34.39 % G.O.T, 28.56 mm staple length, 39.06 g seed cotton yield per plant and 2217.55 kg seed cotton yield ha-1. 25th April - 15th May proved to be the optimum period for cotton sowing, further delay in sowing resulted significant deterioration in yield and its contributing characters. Among cultivars, NIAB-78 and Shahbaz-95 ranked first and second and good performance was also noted in cultivar TH-198/85. All the cultivars gave their best performances under early sowing of 25th April.

In another study, Hassan et al. (2003) revealed that 15th May and 1st June sown cotton produced significantly maximum seed cotton yield of 2998 and 2883 kg ha-1 in 1998 and 4027 and 3894 kg ha-1, respectively in 1999 as compared to 595 and 253 kg ha-1 (1998) and 1269 and 223 kg ha-1 (1999) from crop sown on 1st and 15th July, respectively. The increase in both sowing dates in seed cotton yield was associated with boll weight and bolls per plant. Hence, 15th May produced highest seed cotton yield of 3513 kg ha-1, whereas the lowest figure was 238 kg ha-1 (15th July). Comparing varietal performance MNH552 (2310 kg ha-1) yielded higher as compared to MNH554 (2288 kg ha-1). However two cultivars declined the yield in late planting. Shaikh et al. (2006) reported that ginning outturn was significantly affected by varieties and sowing dates. The yield of cotton can be sufficiently increased if optimum time for sowing in particular zone is known. Keeping in view the facts stated above, a study was designed under the agro-ecological conditions of Tandojam with the aims, to evaluate the suitable sowing scheduling to maximize the cotton yield and to determine the most appropriate variety of cotton under different sowing periods for getting maximum yield.

MATERIALS AND METHODS

The field study to evaluate the "Influence of planting scheduling on the growth and yield of cotton crop was carried out at Cotton Section, Agriculture Research Institute, Tandojam during Kharif 2013. The experiment was laid out in three replicated randomized complete block design (RCBD) factorial, having net plot size 6mx3m (18 m2). The treatments consisted of three cotton varieties i.e. Star-2, NIAB-78 and Sindh-1, and three planting schedulings viz. 20th April, 10th May and 30th May.for preparation of seedbed, disc plow was run in the off-season to remove the soil hard pan, and later the land was leveled and planked. After soaking dose, when the land came in condition, the disc harrow was used, followed by rotavator. Clods were also crushed by clod crusher. A total of 27 plots were prepared and the treatments were managed in such a way to separate the treatments and replications easily, while the channels and bunds were developed to facilitate the irrigation water application and interculturing. Sowing of cotton seed was done as per planting schedulings with the help of single row hand drill. The row to row spacing of 75 cm and plant to plant distance 30 cm were maintained. Recommended dose of nitrogen and phosphorus was applied as usual. Nitrogen was applied in the form of Urea in three splits. The first split application of nitrogen (1/3 N) was done at the time of sowing, the second (1/3 N) at first irrigation and the final split application (1/3 N) was done at 3rd irrigation. Full dose of phosphorus in the form of DAP was applied at the time of sowing. First irrigation was applied 20 DAS while subsequent irrigations was applied keeping in view crop need and soil moisture condition. In all 6-7 irrigations were applied. The weeds were controlled by interculturing at 1st and 2nd irrigations. The crop was sprayed against sucking complex and bollworms as per the recommendations of Entomologist, Agriculture Research Institute, Tandojam.

Statistical analysis

The data thus collected was subjected to statistical analysis using MSTAT-C. The LSD test was applied to compare treatments superiority, where necessary (Russel and Eisensmith, 1983).

RESULTS

Seed germination (%) and Plant height (cm)

The data regarding seed germination (%) of cotton cultivars as influenced by different planting scheduling are presented in Table-1 and their analysis of variance as Appendix-I. The analysis of variance showed that effects of planting scheduling and cotton cultivars were significant ($P<0.05$) on seed germination (%), whereas non-significant ($P>0.05$) for their interaction. The results showed that seed germination of cotton cultivars was maximum (93.56 %) under the planting scheduling of 20th April, followed by planting scheduling of 10th May with seed germination of 89.00 %. However, minimum (86.44 %) seed germination was recorded under planting scheduling of 30th May. Among cultivars, maximum (90.89 %) seed germination was noted in cotton cultivar Sindh-1, followed by cotton cultivar NIAB-78 with seed germination of 89.78 %, whereas minimum (88.33 %)

seed germination was observed in cotton cultivar Star-2. The interactive effects illustrated that seed germination was maximum (95.00 %) under the interaction of 20th April x cotton cultivar Sindh-1, whereas minimum (85.33 %) seed germination was noticed under the interaction of 30th May x cotton cultivar Star-2. The overall data suggested that maximum seed germination under the interaction of 20th April x cotton cultivar Sindh-1 was possibly due most suitable sowing time which explored the potential of particular variety.

The data regarding plant height (cm) of cotton cultivars as influenced by different planting schedulings are presented in Table-2 and their analysis of variance as Appendix-II. The analysis of variance showed that effects of planting schedulings and cotton cultivars were significant (P<0.05) on plant height (cm), whereas non-significant (P>0.05) for their interaction. The results showed that plant height of cotton cultivars was maximum (115.05 cm) under the planting scheduling of 20th April, followed by planting scheduling of 10th May with plant height of 106.83 cm. However, minimum (103.32 cm) plant height was recorded under planting scheduling of 30th May. Among cultivars, maximum (110.22 cm) plant height was noted in cotton cultivar Sindh-1, followed by cotton cultivar NIAB-78 with plant height of (108.33 cm), whereas minimum (106.66 cm) plant height was observed in cotton cultivar Star-2. The interactive effects illustrated that plant height was maximum (117.27 cm) under the interaction of 20th April x cotton cultivar Sindh-1, whereas minimum (102.54 cm) plant height was noticed under the interaction of 30th May x cotton cultivar Star-2. The overall data suggested that maximum plant height under the interaction of 20th April x cotton cultivar Sindh-1 was possibly due most suitable sowing time which explored the potential of particular variety.

Table 1. Seed germination (%) of cotton cultivars as influenced by planting scheduling

Planting schedulings	Cotton cultivars			Mean
	Star-2	NIAB-78	Sindh-1	
20th April	92.33	93.33	95.00	**93.56 a**
10th May	87.33	89.33	90.33	**89.00 b**
30th May	85.33	86.67	87.33	**86.44 c**
Mean	**88.33 c**	**89.78 b**	**90.89 a**	-

Means not sharing the same letter in a column differ significantly at 0.05 probability level.

Table 2. Plant height (cm) of cotton crop as influenced by planting scheduling

Planting schedulings	Cotton cultivars			Mean
	Star-2	NIAB-78	Sindh-1	
20th April	113.05	114.83	117.27	**115.05 a**
10th May	104.39	106.61	109.50	**106.83 b**
30th May	102.54	103.56	103.88	**103.32 c**
Mean	**106.66 b**	**108.33 ab**	**110.22 a**	-

Means not sharing the same letter in a column differ significantly at 0.05 probability level.

Monopodial and Sympodial branches per plant

The results regarding monopodial branches per plant of cotton cultivars as influenced by different planting schedulings are presented in Table-3 and their analysis of variance as Appendix-III. The analysis of variance showed that effects of planting schedulings, cotton cultivars and their interaction were non-significant (P>0.05) on monopodial branches per plant. The results showed that monopodial branches per plant of cotton cultivars were minimum (1.33) under the planting scheduling of 20th April, followed by planting scheduling of 10th May with monopodial branches per plant of 1.56. However, maximum (1.89) monopodial branches per plant were recorded under planting scheduling of 30th May. Among cultivars, minimum (1.33) monopodial branches per plant were noted in cotton cultivar Sindh-1, followed by cotton cultivar NIAB-78 with monopodial branches per plant of 1.67, whereas maximum (1.78) monopodial branches per plant were observed in cotton cultivar Star-2. The interactive effects illustrated that monopodial branches per plant were minimum (1.00) under the interaction of 20th April x cotton cultivar Sindh-1, whereas maximum (2.00) monopodial branches per plant were noticed simultaneously under the interaction of 30th May x cotton cultivar Star-2 and 30th May x cotton cultivar NIAB-78. The overall data suggested that minimum monopodial branches per plant under the interaction of 20th April x cotton cultivar Sindh-1 was possibly due most suitable sowing time which explored the potential of particular variety.

The data regarding sympodial branches per plant of cotton cultivars as influenced by different planting schedulings are presented in Table-4 and their analysis of variance as Appendix-IV. The analysis of variance showed that effects of planting schedulings and cotton cultivars were significant (P<0.05) on sympodial branches per plant, whereas non-significant (P>0.05) for their interaction. The results showed that sympodial branches per plant of cotton cultivars were maximum (22.48) under the planting scheduling of 20th April,

followed by planting scheduling of 10th May with sympodial branches per plant of 18.67. However, minimum (17.19) sympodial branches per plant were recorded under planting scheduling of 30th May. Among cultivars, maximum (20.26) sympodial branches per plant were noted in cotton cultivar Sindh-1, followed by cotton cultivar NIAB-78 with sympodial branches per plant of 19.44, whereas minimum (18.63) sympodial branches per plant were observed in cotton cultivar Star-2. The interactive effects illustrated that sympodial branches per plant were maximum (23.19) under the interaction of 20th April x cotton cultivar Sindh-1, whereas minimum (16.52) sympodial branches per plant were noticed under the interaction of 30th May x cotton cultivar Star-2. The overall data suggested that maximum sympodial branches per plant under the interaction of 20th April x cotton cultivar Sindh-1 was possibly due most suitable sowing time which explored the potential of particular variety.

Table 3. Monopodial branches per plant of cotton crop as influenced by planting scheduling

Planting schedulings	Cotton cultivars			Mean
	Star-2	NIAB-78	Sindh-1	
20th April	1.67	1.33	1.00	**1.33**
10th May	1.67	1.67	1.33	**1.56**
30th May	2.00	2.00	1.67	**1.89**
Mean	**1.78**	**1.67**	**1.33**	-

Means not sharing the same letter in a column differ significantly at 0.05 probability level.

Table 4. Sympodial branches per plant of cotton crop as influenced by planting scheduling

Planting schedulings	Cotton cultivars			Mean
	Star-2	NIAB-78	Sindh-1	
20th April	21.41	22.83	23.19	**22.48 a**
10th May	17.97	18.19	19.85	**18.67 b**
30th May	16.52	17.30	17.74	**17.19 c**
Mean	**18.63 c**	**19.44 b**	**20.26 a**	-

Means not sharing the same letter in a column differ significantly at 0.05 probability level.

Days to first flowering and Bolls per plant

The data regarding days to first flowering of cotton cultivars as influenced by different planting schedulings are presented in Table-5 and their analysis of variance as Appendix-V. The analysis of variance showed that effects of planting schedulings and cotton cultivars were significant ($P<0.05$) on days to first flowering, whereas non-significant ($P>0.05$) for their interaction. The results showed that days to first flowering of cotton cultivars were maximum (69.11) under the planting scheduling of 20th April, followed by planting scheduling of 10th May with 66.67 days to first flowering. However, minimum (64.33) days to first flowering were recorded under planting scheduling of 30th May. Among cultivars, maximum (67.56) days to first flowering were noted in cotton cultivar Sindh-1, followed by cotton cultivar NIAB-78 with 66.67 days to first flowering, whereas minimum (65.89) days to first flowering were observed in cotton cultivar Star-2. The interactive effects illustrated that days to first flowering were maximum (70.00) under the interaction of 20th April x cotton cultivar Sindh-1, whereas minimum (63.33) days to first flowering were noticed under the interaction of 30th May x cotton cultivar Star-2. The overall data suggested that maximum days to first flowering under the interaction of 20th April x cotton cultivar Sindh-1 was possibly due most suitable sowing time which explored the potential of particular variety.

The data regarding bolls per plant of cotton cultivars as influenced by different planting schedulings are presented in Table-6 and their analysis of variance as Appendix-VI. The analysis of variance showed that effects of planting schedulings and cotton cultivars were significant ($P<0.05$) on bolls per plant, whereas non-significant ($P>0.05$) for their interaction.

The results showed that bolls per plant of cotton cultivars were maximum (48.89) under the planting scheduling of 20th April, followed by planting scheduling of 10th May with bolls per plant of 46.22. However, minimum (43.89) bolls per plant were recorded under planting scheduling of 30th May. Among cultivars, maximum (47.00) bolls per plant were noted in cotton cultivar Sindh-1, followed by cotton cultivar NIAB-78 with bolls per plant of 46.44, whereas minimum (45.56) bolls per plant were observed in cotton cultivar Star-2. The interactive effects illustrated that bolls per plant were maximum (49.33) under the interaction of 20th April x cotton cultivar Sindh-1, whereas minimum (43.00) bolls per plant were noticed under the interaction of 30th May x cotton cultivar Star-2. The overall data suggested that maximum bolls per plant under the interaction of 20th April x cotton cultivar Sindh-1 was possibly due most suitable sowing time which explored the potential of particular variety.

Table 5. Days to first flowering of cotton crop as influenced by planting scheduling

Planting schedulings	Cotton cultivars			Mean
	Star-2	NIAB-78	Sindh-1	
20th April	68.33	69.00	70.00	**69.11 a**
10th May	66.00	66.67	67.33	**66.67 b**
30th May	63.33	64.33	65.33	**64.33 c**
Mean	**65.89 c**	**66.67 b**	**67.56 a**	-

Means not sharing the same letter in a column differ significantly at 0.05 probability level.

Table 6. Bolls per plant of cotton crop as influenced by planting scheduling

Planting schedulings	Cotton cultivars			Mean
	Star-2	NIAB-78	Sindh-1	
20th April	48.33	49.00	49.33	**48.89 a**
10th May	45.33	46.33	47.00	**46.22 b**
30th May	43.00	44.00	44.67	**43.89 c**
Mean	**45.56 b**	**46.44 ab**	**47.00 a**	-

Means not sharing the same letter in a column differ significantly at 0.05 probability level.

Seedcotton yield (g plant^{-1}) and Seedcotton yield (kg ha^{-1}):

The data regarding seedcotton yield (g plant^{-1}) of cotton cultivars as influenced by different planting schedulings are presented in Table-7 and their analysis of variance as Appendix-VII. The analysis of variance showed that effects of planting schedulings and cotton cultivars were significant (P<0.05) on seedcotton yield (g) per plant, whereas non-significant (P>0.05) for their interaction. The results showed that maximum seedcotton yield (108.28 g) plant^{-1} of cotton cultivars was under the planting scheduling of 20th April, followed by planting scheduling of 10th May with seedcotton yield of (104.06 g) plant^{-1}. However, minimum seedcotton yield (99.50 g) plant^{-1} was recorded under planting scheduling of 30th May. Among cultivars, maximum seedcotton yield (105.28 g) plant^{-1} was noted in cotton cultivar Sindh-1, followed by cotton cultivar NIAB-78 with seedcotton yield (104.06 g) plant^{-1}, whereas minimum (102.50 g) seedcotton yield per plant was observed in cotton cultivar Star-2. The interactive effects illustrated that seedcotton yield per plant was maximum (109.72 g) under the interaction of 20th April x cotton cultivar Sindh-1, whereas minimum (98.06 g) seedcotton yield per plant was noticed under the interaction of 30th May x cotton cultivar Star-2. The overall data suggested that maximum seedcotton yield per plant under the interaction of 20th April x cotton cultivar Sindh-1 was possibly due most suitable sowing time which explored the potential of particular variety.

The data regarding seedcotton yield (kg ha^{-1}) of cotton cultivars as influenced by different planting schedulings are presented in Table-8 and their analysis of variance as Appendix-VIII. The analysis of variance showed that effects of planting schedulings and cotton cultivars were significant (P<0.05) on seedcotton yield (kg ha-1), whereas non-significant (P>0.05) for their interaction. The results showed that seedcotton yield of cotton cultivars was maximum (3074.77 kg ha-1) under the planting scheduling of 20th April, followed by planting scheduling of 10th May with plant height of 2839.62 kg ha-1. However, minimum (2690.00 kg ha-1) seedcotton yield was recorded under planting scheduling of 30th May. Among cultivars, maximum (2942.53 kg ha-1) seedcotton yield was noted in cotton cultivar Sindh-1, followed by cotton cultivar NIAB-78 with seedcotton yield of 2871.80 kg ha^{-1}, whereas minimum (2790.06 kg ha^{-1}) seedcotton yield was observed in cotton cultivar Star-2. The interactive effects illustrated that seedcotton yield was maximum (3177.45 kg ha^{-1}) under the interaction of 20th April x cotton cultivar Sindh-1, whereas minimum (2658.33 kg ha^{-1}) seedcotton yield was noticed under the interaction of 30th May x cotton cultivar Star-2. The overall data suggested that maximum seedcotton yield under the interaction of 20th April x cotton cultivar Sindh-1 was possibly due most suitable sowing time which explored the potential of particular variety.

Table 7. Seedcotton yield (g plant^{1}) of cotton crop as influenced by planting scheduling

Planting schedulings	Cotton cultivars			Mean
	Star-2	NIAB-78	Sindh-1	
20th April	106.72	108.39	109.72	**108.28 a**
10th May	102.72	104.39	105.06	**104.06 b**
30th May	98.06	99.39	101.06	**99.50 c**
Mean	**102.50 c**	**104.06 b**	**105.28 a**	-

Means not sharing the same letter in a column differ significantly at 0.05 probability level.

Table 8. Seedcotton yield (kg ha^{-1}) of cotton crop as influenced by planting scheduling

Planting schedulings	Cotton cultivars			Mean
	Star-2	NIAB-78	Sindh-1	
20th April	2958.52	3088.33	3177.45	**3074.77 a**
10th May	2753.33	2838.72	2926.82	**2839.62 b**
30th May	2658.33	2688.33	2723.33	**2690.00 c**
Mean	**2790.06 c**	**2871.80 b**	**2942.53 a**	-

Means not sharing the same letter in a column differ significantly at 0.05 probability level.

Ginning out turn (%) and Staple length (mm)

The data regarding GOT (%) of cotton cultivars as influenced by different planting schedulings are presented in Table-9 and their analysis of variance as Appendix-IX. The analysis of variance showed that effects of planting schedulings and cotton cultivars were significant (P<0.05) on GOT (%), whereas non-significant (P>0.05) for their interaction. The results showed that GOT of cotton cultivars was maximum (35.33 %) under the planting scheduling of 20th April, followed by planting scheduling of 10th May with plant height of 32.56 %. However, minimum (30.11 %) GOT was recorded under planting scheduling of 30th May. Among cultivars, maximum (33.56 %) GOT was noted in cotton cultivar Sindh-1, followed by cotton cultivar NIAB-78 with GOT of 32.67 %, whereas minimum (31.78 %) GOT was observed in cotton cultivar Star-2. The interactive effects illustrated that GOT was maximum (36.33 %) under the interaction of 20th April x cotton cultivar Sindh-1, whereas minimum (29.33 %) GOT was noticed under the interaction of 30th May x cotton cultivar Star-2. The overall data suggested that maximum GOT (%) under the interaction of 20th April x cotton cultivar Sindh-1 was possibly due most suitable sowing time which explored the potential of particular variety.

The data regarding staple length (mm) of cotton cultivars as influenced by different planting schedulings are presented in Table-10 and their analysis of variance as Appendix-X. The analysis of variance showed that effects of planting schedulings and cotton cultivars were significant (P<0.05) on staple length (mm), whereas non-significant (P>0.05) for their interaction. The results showed that staple length of cotton cultivars was maximum (27.57 mm) under the planting scheduling of 20th April, followed by planting scheduling of 10th May with staple length of 27.20 mm. However, minimum (26.37 mm) staple length was recorded under planting scheduling of 30th May. Among cultivars, maximum (27.26 mm) staple length was noted in cotton cultivar Sindh-1, followed by cotton cultivar NIAB-78 with staple length of 27.04 mm, whereas minimum (26.85 mm) staple length was observed in cotton cultivar Star-2. The interactive effects illustrated that staple length was maximum (27.73 mm) under the interaction of 20th April x cotton cultivar Sindh-1, whereas minimum (26.11 mm) staple length was noticed under the interaction of 30th May x cotton cultivar Star-2. The overall data suggested that maximum staple length under the interaction of 20th April x cotton cultivar Sindh-1 was possibly due most suitable sowing time which explored the potential of particular variety.

Table 9. Ginning out turn (%) of cotton crop as influenced by planting scheduling

Planting schedulings	Cotton cultivars			Mean
	Star-2	NIAB-78	Sindh-1	
20th April	34.33	35.33	36.33	**35.33 a**
10th May	31.67	32.33	33.67	**32.56 b**
30th May	29.33	30.33	30.67	**30.11 c**
Mean	**31.78 c**	**32.67 b**	**33.56 a**	-

Means not sharing the same letter in a column differ significantly at 0.05 probability level.

Table 10. Staple length (mm) of cotton crop as influenced by planting scheduling

Planting schedulings	Cotton cultivars			Mean
	Star-2	NIAB-78	Sindh-1	
20th April	27.43	27.54	27.73	**27.57 a**
10th May	27.00	27.23	27.37	**27.20 b**
30th May	26.11	26.33	26.67	**26.37 c**
Mean	**26.85**	**27.04**	**27.26**	-

Means not sharing the same letter in a column differ significantly at 0.05 probability level.

DISCUSSION

The seedcotton yield is affected by a number of factors including sowing period. Cotton has its own definite requirements for temperature and light for emergence, growth and flowering. Too early sowing produces weak plants with poor root system as temperature is below the optimum. Temperature above optimum leads to

irregular seed germination and the embryo frequently dies and the cotyledon may undergo decomposition. In Pakistan, the cotton is grown from April to June. The yield of cotton can be sufficiently increased if we know the optimum time for sowing in particular zone. It has been observed that cotton sown earlier or later than its optimum time shows significant decrease in yield, even a delay of week in sowing may result in a marked decreased in yield (Soomro et al., 2000). The sowing of cotton without consideration of optimum season, the desired seed cotton yields could not be achieved. The sowing time also affects most of the growth and yield components of cotton.

The results of this study exhibited that different planting schedulings significantly ($P<0.05$) affected the growth and yield parameters of cotton, particularly seedcotton yield. Among planting schedulings, planting of cotton cultivars on 20th April produced maximum seed germination (93.56 %), plant height (115.05 cm), sympodial branches per plant (22.48), days to first flowering (69.11), bolls per plant (48.89), seedcotton yield per plant (108.28 g), seedcotton yield (3074.77 kg ha-1), GOT (35.33 %) and staple length (27.57 mm), whereas minimum growth and yield attributes, particularly seedcotton yield (2690.00 kg ha-1) was observed when cotton crop was sown on 30th May. In case of cultivars, maximum seed germination (90.89 %), plant height (110.22 cm), sympodial branches per plant (20.26), days to first flowering (67.56), bolls per plant (47.00), seedcotton yield per plant (105.28 g), seedcotton yield (2942.53 kg ha-1), GOT (33.56 %) and staple length (27.26 mm) were produced by cotton cultivar Sindh-1, whereas minimum growth and yield traits, particularly seedcotton yield (2790.06 kg ha-1) were produced by cotton cultivar Star-2. As regards interactive effects, maximum growth and yield parameters, particularly seedcotton yield (3177.45 kg ha-1) were obtained in the interaction of 20th April x cotton cultivar Sindh-1, whereas minimum growth and yield traits, particularly seedcotton yield (2658.33 kg ha-1) were noted under the interaction of 30th May x cotton cultivar Star-2.

In this study, highest values for seedcotton yield and yield contributing parameters under planting scheduling of 20th April could possibly be due to optimum sowing time for seed germination and subsequent growth and reproductive stage of cotton. The results are in line with the findings of Niazi (2005) who reported that cotton crop sown on 25th April produced significantly maximum plant height (cm), monopodial branches per plant, sympodial branches per plant, bolls per plant, seed cotton weight per plant (g) seed cotton yield (kg ha-1), G.O.T (%) and staple length (mm). Hence, 25th April - 15th May were found the optimum periods for cotton sowing, further delay in sowing recorded significant decline in yield and its contributing characters. Among cultivars, NIAB-78 resulted in maximum growth and yield attributes particularly seedcotton yield (2416.12 kg ha-1) as compared to Shahbaz-95 and TH-198/85. In another study, Hassan et al. (2003) revealed that 15th May and 1st June sown cotton produced significantly maximum seed cotton yield than crop sown on 1st and 15th July, respectively. Similarly, Shaikh et al. (2006) reported that ginning outturn of cotton varieties was significantly affected by varieties and sowing dates. The results are partially in agreement with those of El-Debaby et al. (2004) who explored that seed germination, plant height and node number of the first fruiting branch increased with delay in sowing, while early sowing resulted in a longer period to first flowering. In another study, Hassan et al. (2007) reported that delaying sowing date significantly decreased seed cotton yield and cotton cultivar NIAB-78 is relatively more sensitive to sowing time under Sakrand climatic conditions.

CONCLUSION

The results concluded that growth and yield traits of cotton cultivars were significantly ($P<0.05$) affected by all the planting schedulings. Among planting schedulings, planting of cotton cultivars on 20th April produced maximum values for almost all the parameters, particularly seedcotton yield. In case of cultivars, cotton cultivar Sindh-1 resulted in maximum values for all parameters, particularly seedcotton yield. As regards interactive effects, the interaction of 20th April x cotton cultivar Sindh-1 resulted in maximum seedcotton yield and was found most suitable for obtaining optimum yield of cotton.

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