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EFFECT OF SOWING DATES AND PICKING INTERVALS AT BOLL OPENING PERCENT, YIELD AND FIBER QUALITY OF COTTON CULTIVARS

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Abstract

With rising temperature and changing raining patterns, climate change brings forward new threats for cotton cultivation in Sindh. During 2010-11, unexpected rains caused damage to the ripe cotton crop and caused heavy losses in seed cotton, cottonseed germination and lint quality. An experiment was conducted on different sowing dates viz. 15th April, 01st May, 15th May and 01st June and four picking at various boll opening percent. The sowing on May 1st produced the highest boll weight (2.83g) seed index (8.74g), seed cotton yield (3032 kg ha^{-1}), micronaire (4.19) and seed germination percentage (64.86%). In varieties, Sadori produced more boll weight (2.57 g) with seed index (7.46 g), ginning out turn (38.01%), micronaire (4.19) and seed germination (66.35%); whereas picking at various boll opening percent showed higher boll wt. (3.63 g), seed index (8.72), seed cotton yield (3302 kg ha^{-1}), ginning out turn percent (35.79%) in 50% boll opening. The higher seed germination percent was recorded in 70% boll opening.

Keywords: *Gossypium hirsutum*, Boll opening, Seed maturity, Fiber quality.

Introduction

Cotton, *Gossypium hirsutum* L., is a soft, fluffy staple fiber plant of the genus *Gossypium* and belongs to family *Malvaceae* (Dorothy and Stolton, 1999). The plant is a shrub native to tropical and subtropical regions around the world including United States of America, Africa, India and Pakistan. The fiber is spun into yarn or thread and used to make a soft, breathable textile which is the most widely used natural-fiber cloth in clothing today (Stephen, 2004). The greatest diversity of wild cotton species is found in Mexico followed by Australia and Africa (Moseley and Gray, 2008). One of the most important agronomic considerations for growers to optimise yield and quality is to select an appropriate sowing time for cotton crop. Choosing the best time of sowing in a particular region can often be difficult, as it is a decision that must strike a balance between sowing too early and enduring problems associated with cold weather or sowing too late and losing potential yield. Sowing too early when the weather is cold can predominantly slow crop growth, often leading to poor establishment and poor early growth. Furthermore, the crop is exposed to many seedling diseases (Bange and Milroy, 2004). Sowing time has very important role in realising maximum seedcotton yield in a country like Pakistan where the climatic conditions differ from province to province (Saraz, 2008; Soomro et al., 2000). Yield of cotton can be sufficiently increased if the optimum time for sowing in particular zone is well known. Delayed sowing increase the period between sowing to seedling emergence, (1st square, first flower, first open boll) and plant survival decreases as observed by Hosny and Shahine (1995). Ansari and Mahey (2003) evaluated the effects of sowing dates (May 1st and 29th) on the growth and yield of cotton cv. F846 and desi cotton cv. LD327. Desi cotton recorded higher values for plant height, stem dry matter, chlorophyll content and seed yield than American cotton. Late sowing resulted in significantly lower seed yield than normal sowing. Ali et al. (2004) indicated that the highest seed cotton yield of 2039 kg ha^{-1} was obtained on May 15th sowing followed by 1847 kg ha^{-1} and 1669 kg ha^{-1} sown on May 1st and May 30th, respectively. For getting better seed cotton yield, cotton may be planted in the month of May. Sowing done in the month of June resulted in low yield. Reddy et al. (1991) observed a 50% decline in total shoot biomass for Upland cotton

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plants grown under a 40/30°C day/night temperature regime relative to plants grown under the optimal day/night temperature condition (30/20°C). Reddy et al. (1996) reported that young bolls shed when grown at average daily temperatures of 32°C or higher.

Materials and Methods

A field experiment was conducted during *kharif* season 2010-2011 at Nuclear Institute of Agriculture (NIA), Tando jam, to determine the response of three cotton varieties viz. Sadori, Chandi-95 and Malmal under sowing dates viz. April 15th, May 1st, May 15th and June 1st and four picking at various boll opening percent to determine seed maturity and fiber quality. Land preparation was done accordingly. The sowing was done on ridges with a row-to-row distance of 75 cm on well-prepared seedbed in the experimental plots. The seeding rate was four kg ac^{-1}. The recommended fertilisers were applied; 2.5 bags of urea and one bag di-ammonium phosphate (DAP) per acre, respectively. P_2O was incorporated before seed sowing, whereas, N was applied in three splits. First nitrogen application was after 30 days of sowing whereas the second was at on flowering and third at boll formation stage of the crop. The experiment was laid out in split-split plot design having three replicates. The net plot size was maintained at 6.1 x 6.1 m^2 (37.21m^2). Local intercultural practice called as thinning were made followed to keep distance of one feet between plant to plant to maintain plant populations. Weeding, fertiliser, irrigation, and insecticide application were also applied as usual. Five plants per replication were selected. The data were recorded and analysed using programme student edition of Statistix 8.1. (Analytical software 2006).

Results and discussion

Temperature plays a critical and complicated role in the growth and development of cotton. Much of the understanding of the impacts of low temperature on cotton crop growth and development is based on experimental work undertaken in the past with technology and cultivars quite different than those used commercially today (Siddiqui et al., 2004). Meteorological data showed that the maximum temperature remained high (42°C) in the month of June, which caused flower shading in cotton and increased pest population. Therefore, the crop remained under stress. Reddy et al. (1991) observed that temperatures in excess of a 30/20°C day/night temperature regime resulted in significantly lower boll retention due to enhanced abortion of squares and young bolls. Leaf extension growth in upland cotton declined significantly at temperatures above 35°C (Bibi et al., 2010). High temperature (35 to 40 ^{0}C) observed in the months of June to July caused flower shedding (Figure 1). High humidity (87-90%) was observed in the months of October and November, which caused low cottonseed maturity and viability (Figure 2). Unexpected rains (70mm) observed during the months of August and September 2011 damaged cotton crop at the stage of seed cotton maturity when the crop was ready for picking; hence caused heavy losses in seed cotton, cottonseed germination and lint quality (Figure 3).

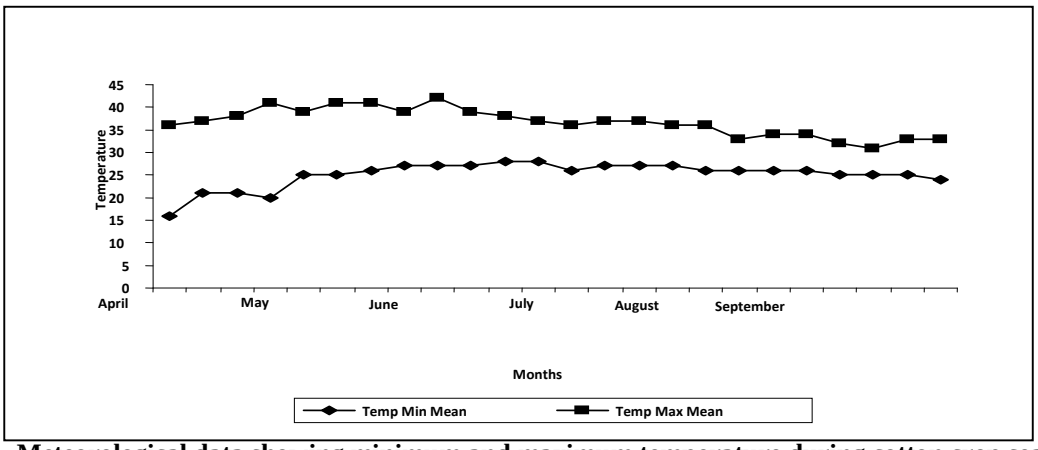

Fig. 1. Meteorological data showing minimum and maximum temperature during cotton crop season at NIA Tando Jam.

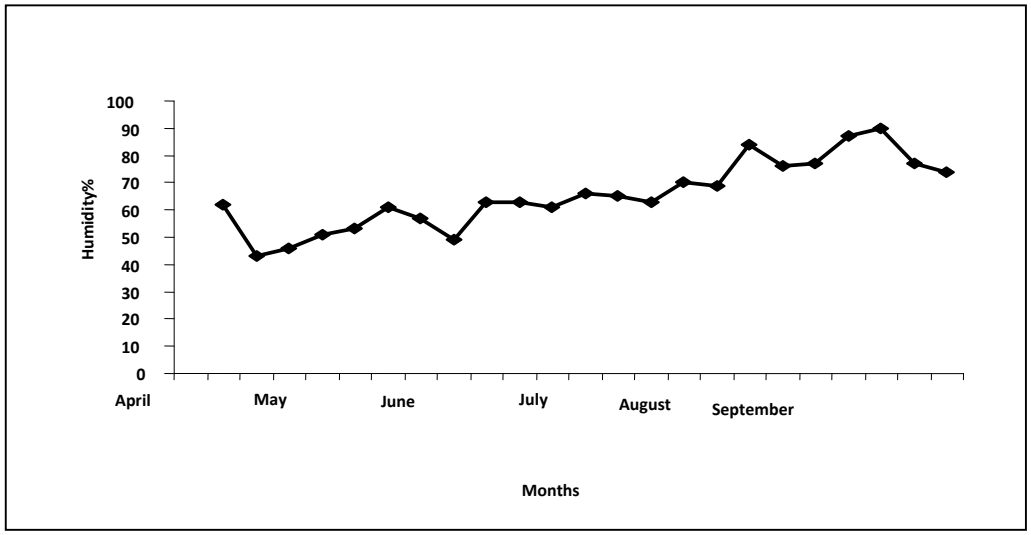

Fig. 2. Meteorological data showing minimum and maximum humidity (%) during cotton crop season at NIA Tando Jam.

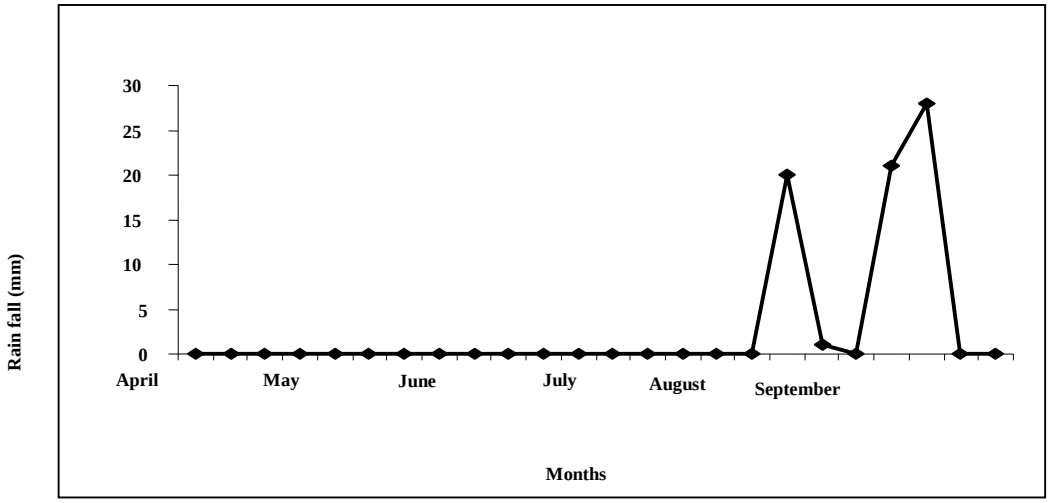

Fig. 3. Meteorological data showing date of rainfall during cotton crop season at NIA Tando Jam.

The results given in Table 1 showed various agronomic, physiological and fiber quality traits of cotton studied in response to different sowing dates. Statistically, the effect of sowing dates on almost all the traits investigated were highly significant ($P<0.05$) except sympodial branches plant^{-1}, boll weight (g), seed index and seed germination percentage.

The plant height was noted at crop sown on April 15th. The highest sympodial branches plant^{-1} (17. 94) were recorded in May 15th sowing crop. The highest boll weight (2.83 g) was observed in May 1st sown crop whereas the lowest boll weight (1.76 g) and the highest seed index (8.74 g) was achieved at May 1st sowing date. The highest seed cotton yield (3032.3 kg ha^{-1}) was observed on May 1st sowing. Maximum seed cotton yield was produced when it was sown on April 15th and May 1st, as noted by Arain et al. (2001).

The ginning out turn was highest (37.31g) for the June 1st sowing date. The results further suggested that the staple length was increased (29.51mm) when crop sown on June 1st. Micronaire was also highest (4.28) for sowing on May 15th while the seed germination was highest (64.86%) for crop sown on May 1st. The seed germination was measured after harvesting seedcotton. The recommended sowing period of cotton for central Sindh area is the first fortnight of May (Soomro et al., 2001).

Table 1. Effect of sowing dates on agronomic, fiber quality and physiological traits of cotton.

Plant traits	Sowing dates				± S.E	LSD (5%)
	15th April	1st May	15th May	1st June		
Plant height (cm)	116.14 a	115.83 b	116.13 a	115.85 b	0.0316	0.0772
Sympodial branches plant $^{-1}$	17.90 a	17.78 b	17.94 a	17.73 b	0.0439	0.1075
Boll weight $^{-1}$ plant (g)	1.92 c	2.83 a	2.35 b	1.76 d	0.0105	0.0257
Seed Index (100 seed wt: g)	6.95 c	8.74 a	7.80 b	5.40 d	0.0489	0.1196
Seed cotton yield (kg ha^{-1})	1794.9 c	3032.3 a	2427.8 b	1559.7 d	11.596	28.374
Ginning out turn (%)	36.37 c	36.55 c	36.79 b	37.31 a	0.0866	0.2118
Staple Length (mm)	28.12 c	28.20 bc	28.21 b	29.51 a	0.0313	0.0767
Micronaire	3.69 b	4.19 a	4.28 a	3.65 b	0.0761	0.1861
Seed germination (%)	62.81 b	64.86 a	63.01 ab	61.48 b	0.8285	2.0272

The varietal effects on certain agronomic, physiological and fiber quality characters were estimated and the results are presented in Table 2. The results suggested that the effect of varieties on all the characters studied was statistically highly significant ($P<0.05$). The plant height was highest (120.19cm) in Sadori variety and lowest (110.75cm) in Malmal variety. Similarly, the highest sympodial branches plant^{-1} (19.41), boll weight (2.57g), seed index (7.46 g) and seed cotton yield (2930.8 kg ha^{-1}) were recorded in Sadori and lowest in almost all traits in Malmal. It is apparent from the results that high ginning out-turn (38.01%), micronaire (4.19) and harvested seedcotton seed germination percent (66.35%) were recorded in Sadori and lowest in Malmal. In fiber quality and other yield traits, the highest (29.84mm) staple length was recorded in Chandi-95. Ahmad and Razi (2011) concluded that early or late picking of cotton must not be done. In case of early picking, small staple length with shrinking quality would be obtained, which will result in sub-standard fabrics and immature fiber obtained from bolls would immediately be darkened.

The impact of picking at various boll opening percent on the agronomic, physiological and fiber quality characters of cotton was examined. The results are presented in Table 3. Statistically, the effect of picking at various boll opening percent on all the parameters was determined with highly significance ($P < 0.05$).

Table 2. Effect of varieties on agronomic, fiber quality and physiological traits of cotton

Plant traits	Varieties			± S.E	LSD (5%)
	Sadori	Chandi-95	Malmal		
Plant height (cm)	120.19 a	117.02 b	110.75 c	0.0282	0.0598
Sympodial branches plant $^{-1}$	19.41 a	18.84 b	15.26 c	0.0385	0.0816
Boll weight $^{-1}$ plant (g)	2.57 a	2.22 b	1.84 c	0.0109	0.0230
Seed Index (100 seed weight g)	7.46 a	7.45 a	6.76 b	0.0570	0.1207
Seed cotton yield (kg ha^{-1})	2930.8 a	2359.2 b	1321.0 c	11.510	24.401
Ginning out turn (%)	38.01 a	36.63 b	35.63 c	0.0867	0.1839
Staple Length (mm)	28.36 b	29.84 a	27.32 c	0.0286	0.0606
Micronaire	4.19 a	3.86 b	3.81 b	0.0648	0.1373
Seed germination (%)	66.35 a	66.07 a	56.70 b	0.6048	1.2820

The data showed that plant height was the highest (116.92cm) when picking was done at 30% boll opening and the lowest (112.94cm) at 90% boll opening. The highest sympodial (19.57) branches plant^{-1} were observed when cotton was picked at 90% boll opening. The boll weight

(3.63g), seed index (8.72 g), seed cotton yield (3302.07 kg ha^{-1}) and ginning out turn were recorded when picking was done at 50% boll opening. The staple length (mm) was highest (28.76mm) when picking was done at 90% boll opening while the highest micronaire (3.87) at 30% picking at various boll opening percent was recorded whereas harvested seedcotton seed germination of (90.36%) was recorded when picking was done at 70% boll opening. Lowest for these traits when picking was done at 90% boll opening.

Table 3. Effect of picking at various boll opening percent on agronomic, fiber quality and physiological traits of cotton.

Plant traits	Picking at various boll opening percent				± S.E	LSD (5%)
	(30%)	(50%)	(70%)	(90%)		
Plant height (cm)	116.92 a	115.99 b	114.46 c	112.94 d	0.1669	0.3326
Sympodial branches $plant^{-1}$	18.23 c	18.86 b	18.47 c	19.57 a	0.1578	0.3147
Boll weight $plant^{-1}$ (g)	2.95 c	3.63 a	3.28 b	2.77 d	0.0542	0.1081
Seed Index (100 seed wt g)	6.94 c	8.72 a	7.81 b	5.41 d	0.0792	0.1578
Seed cotton yield $(kg\ ha)^{-1}$	2480.3 d	3302.7 a	3137.9 b	2803.0 c	63.703	126.99
Ginning out turn (%)	35.22 b	35.79 a	35.25 b	35.73 a	0.0990	0.1974
Staple Length (mm)	27.98 c	28.09 c	28.33 b	28.76 a	0.1027	0.2047
Micronaire	3.87 a	3.76 b	3.76 b	3.70 b	0.0316	0.0629
Seed germination (%)	67.13 c	88.76 b	90.36 a	35.48 d	0.4407	0.8786

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