不同行距对陆地棉品种纤维品质性状的影响

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摘要:本研究于 2006—2007 年度在费萨拉巴德农业大学农业研究试验场进行,试验目的是为了比较三个不同品种陆地棉在不同的行距下的性状质量。试验处理包含三种行间距(60 cm、75 cm 和 90 cm)和三种不同陆地棉品种(NIAB-111, CIM-496 与 FH-901)。所有的实验数据均进行变异系数的统计学分析。试验结果显示,行距显著影响 GOT 值,但是对纤维长度、纤维比强度、纤维整齐度和纤维细度没有影响。三种陆地棉品种之间在纤维长度、纤维比强度和纤维细度上存在显著差异,而在纤维整齐度和 GOT 上没有显著差异。

关键词:棉花;品种;行距;纤维质量性状;GOT

Varietal Comparison of Some Fibre Quality Traits of Cotton (*Gossypium hirsutum* L.) under Different Row Spacings

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Abstract:A field trial was conducted at Agronomic Research Area, University of Agriculture, Faisalabad during cotton season 2006-07 to compare quality traits among three varieties of upland cotton (*Gossypium hirsutum* L) under varying row spacings. The treatments were comprised of three row spacings viz. 60, 75 and 90 cm and three cotton cultivars viz. NIAB-111, CIM-496 and FH-901. Data thus collected were statistically analyzed by conducting analysis of variance. The experimental results revealed that row spacing significantly affected the ginning out turn, while fibre length, fibre strength, fibre uniformity and fibre fineness remained unaffected. The varieties differed significantly in fibre length, fibre strengthand fibre fineness while ginning out turn and fibre uniformity remained unaffected.

Key words: cotton; varieties; row spacing; fibre quality; GOT
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1 INTRODUCTION

Cotton (*Gossypium hirsutum* L.) is the most important textile fiber crop in the world. The areas under this crop are in tropical, subtropical to temperate climate with a growing season of about 150 days (southern states of USA, Uzbekistan, Iran, India, Pakistan and China, etc.).

Cultivar selection, a key management component in any cropping system, is even more critical in ultra-narrow row cotton production. While high yield potential is a predominant consideration, fiber properties are also major factors to consider. In a study of eight transgenic cultivars, yields for cotton planted in ultra-narrow rows were higher than con ventional row spacings[1]. In a 2-yr study in South Carolina gin turnout was different among row spac-

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ings and cultivars[2].

Efficient cotton production for improved net returns is essential for cotton growers to maintain a competitive advantage in a global market. Ultra narrow row (UNR) cotton and skip-row cotton production systems have been used as means for improving profitability[3]. UNR cotton has shown equal or higher yields and net returns than conventional wide rows[4-7].

In an evaluation of 11 cultivars of cotton in ultra-narrow rows, Anthony and Molin suggested that cultivars differ in desirable fiber content [8], but in a study where cotton planted in 76- and 101-cm rows was harvested with a spindle picker and cotton planted in 19- and 38-cm rows was harvested with a stripper equipped with a finger-type head, lint quality was not influenced by cultivar, and HVI analysis indicated all fiber characteristics were in acceptable ranges[1].

Cotton farmers are faced with the difficult task of selecting management strategies under rising production costs and static or declining returns for their crop. One alternative method to combat these problems and to optimize profit is growing cotton in narrow rows. Ultra narrow row (UNR) cotton may negatively affect fiber quality; however, several studies have shown that fiber quality is not significantly affected [9-10]. It was concluded by experimentally that micronaire, consistently lower for ultra-narrow rows, was the only fiber trait affected when comparing fiber quality in ultra-narrow row cotton with conventional row spacing [11]. Differences in fiber properties between narrow and wide-row cotton are expected because boll location on the plant is affected by row spacing as in temporal boll set and development, which influence fiber properties [12]. McAlister concluded that quality parameters were lower for UNR primarily because of ginning influences [13]. Vories et al. reported that fiber quality properties of UNR cotton in Arkansas were less desirable than cotton grown in 97-cm row spacing[14].

Jost and Cothren reported that fiber length tended to be reduced in 19-cm row width compared with wider row widths [15]. Early canopy closure and earlier fruit set associated with ultra narrow row (UNR) cotton may negatively affect fiber quality[16-17]; however, several studies have shown that fiber quality is not significantly affected by varying row spacing[18].

The objective of this study was to investigate the comparative performance of three cotton varieties in relation to fibre quality parameters under three row spacings.

2 MATERIALS AND METHODS

2.1 Experimental site and treatments

The experiment was conducted to determine the effect of row spacing on fiber quality of cotton cultivars at the Agronomic Research Area, University of Agriculture, Faisalabad during cotton season 2006-07. The experiment was laid out in randomized complete block design (RCBD) with factorial arrangement and replicated thrice. The length of each plot was 7 m and width was variable depending upon row spacing treatments. However, 6 rows of cotton crop were grown in each plot. Seed cotton was picked in two pickings, first picking was done after 130 days of sowing and second picking was done after 180 days of sowing. The treatments were three row spacings (S_1 = 60 cm, S_2 = 75 cm and S_3 = 90 cm) applied to three cotton varieties (V_1 = NIAB-111, V_2 = CIM- 496 and V_3 = FH- 901).

Fibre characters like, staple length, strength, fineness, uniformity and elongation of each plant were measured using Spinlab HVI- 900. It measured the fibre characters within a quick period of time. Mean genotypic values of these characters were calculated.

2.2 Crop husbandry

Seedbed was prepared by cultivating the field for 2 times with tractor-mounted cultivator each followed by planking. The crop was sown on sandy clay loam soil. Sowing was done on well prepared seed bed, with the help of single row hand drill by maintaining variable row spacing as per treatment and constant plant to plant distance of 30 cm. Nitrogen was applied at 120 kg·hm^{-2} and phosphorus at 60 kg·hm^{-2}. Whole of P and 1/3rd N was applied at sowing. Remaining 1/3rd N was applied with first and 1/3rd with second irrigation. Overall 9 irrigations were applied and weeds were controlled by hoeing. Insecticides were applied to control the sucking insects (Aphid, Jassid, Whitefly, Thrips and Mites) and bollworm (American bollworm, Pink bollworm and Spotted bollworm). All other agronomic practices were kept normal and uniform for all the treatments.

2.3 Measurement of ginning out turn (GOT %)

Cleaned and dry samples of seed cotton were weighed and then ginned separately with single roller electric ginning machine. The lint obtained from each sample was weighed and ginning out turn % was calculated by the following formula.

$$\text{Ginning outturn (\%)} = \frac{\text{Weight of lint in sample}}{\text{Weight of seed cotton in that sample}} \times 100$$

2.4 Statistical analysis

Data collected on different parameters were analyzed statistically by using M-stat programme and differences among the treatment means were compared by using the least significant difference (LSD) test at 5 % probability level[19].

3 RESULTS AND DISCUSSION

3.1 Ginning out turn (GOT)

The ultimate objective of cotton production is lint production. To increase the lint production, ginning out turn must be increased. As a rough estimate one percent increase in GOT would bring about three percent increase of seed cotton yield.

Data pertaining to ginning out turn as influenced by row spacing and varieties are presented in Table 1, which reveal that row spacing significantly influenced the ginning out turn. Significantly highest ginning out turn (39.97 %) was recorded in crop where cotton was planted in 90 cm apart rows, followed by S2 (75 cm) row spacing. Whereas, significantly minimum ginning out turn (38.19 %) was noted in 60 cm spaced cotton rows. These results are similar to those of Atwell (1996) who reported an average of 28 and 32% gin turnout for ultra-narrow row cotton and conventional cotton, respectively. The varieties were found differing non-significantly from each other in GOT[4].

Table 1 Varietal comparison of some fibre quality traits of cottons under varying row spacings

Treatments	Ginning out turn /%	Fibre length /mm	Fibre strength /(cN·tex^{-1})	Micronaire	Fibre uniformity /%	Fibre elongation /%
Varieties						
V1= NIAB-111	39.08	27.09 a	24.84a	4.46 b	49.87	6.39 a
V2= CIM-496	38.85	28.40 a	25.21a	4.04 c	50.13	6.64 a
V3= FH-901	39.35	24.82 b	23.50b	4.97 a	48.73	5.39 b
LSD (5%)	NS	1.64	0.5775	0.3617	NS	0.7702
Row spacing						
S1= 60 cm	38.19 c	26.51	24.82	4.45	50.19	6.14
S2= 75 cm	39.12 b	27.66	24.73	4.52	49.22	6.06
S3= 90 cm	39.97 a	26.13	24.03	4.50	49.33	6.21
LSD (5%)	0.5573	NS	NS	NS	NS	NS

Note：Any two means not sharing the same letter within the same column differ significantly at 5 % level of probability.

3.2 Fibre length

Fibre length is an important trait of cotton for determining the quality of fibre, as it plays a major role in spinning. The quality of yarn is also associated with fibre length. The data given in Table 1 represent fibre length (mm) as affected by the row spacing and varieties. Fibre length was found to be affected non-significantly by row spacing but significantly by varieties. Maximum fibre length (28.40 mm) was noted in CIM-496, which was statistically at par with the fibre length (27.09 mm) of NIAB-111. Whereas, significantly lower fibre length (24.82 mm) was observed in V_3 (FH-901). These results are in line with earlier findings of Bridge *et al.* and Nichols et al. who reported that fiber length remained unaffected by row spacing[20-21].

3.3 Fibre strength

Fibre strength is an important trait in determining yarn-spinning ability. Cotton varieties, which produce weak fibres (low strength), are difficult to be handled in manufacturing process.

The data regarding fibre strength as affected by row spacing and varieties are given in Table 1, which exhibit that fibre strength was not significantly influenced by row spacing, however, the varieties affected in fibre strength significantly. Maximum value for fibre strength (25.21 $cN \cdot tex^{-1}$) was obtained in CIM-496, which was statistically at par with fibre strength (24.87 $cN \cdot tex^{-1}$) of NIAB-111. Whereas, significantly lower fibre strength (23.50 $cN \cdot tex^{-1}$) was recorded in FH-901. These results are in line with those of Bridge et al. and Nichols et al. who reported that fiber strength was unaffected by row spacing[20-21].

3.4 Fibre fineness (Micronaire)

The data regarding fibre fineness as affected by row spacing and varieties are given in Table-1, which exhibit that fibre fineness was not significantly influenced by row spacing. These results are similar with earlier findings of Jost and Cothren who found no differences in micronaire reading with respect to row spacing[17]. However, all the varieties differed significantly from each other in fibre fineness. Maximum fibre fineness (4.97 micronaire) was obtained in FH-901, followed by the fibre fineness (4.46 micronaire) of NIAB-111. Whereas, minimum fibre fineness (4.04 micronaire) was recorded in CIM-496.

3.5 Fibre uniformity

The data given in Table 1 show that fibre uniformity was affected non-significantly both by row spacing and varieties. Fibre uniformity ranged between 49.22 to 50.19 % among various row spacing and between 48.73 to 50.13 % among various varieties. Jost and Valco et al. also found no differences in uniformity due to row spacing[22-23].

3.6 Fibre elongation

The data regarding fibre elongation as affected by row spacing and varieties are given in Table 1, which exhibit that fibre elongation was not significantly influenced by row spacing. However, it varied between 6.06% to 6.21% among various row spacings. Significant effect of varieties was noted on fibre elongation in present study. CIM-496 gained maximum fibre elongation of 6.64%, however, it was at par with that of NIAB-111 (6.39%). Significantly lower fibre elongation (5.39%) was shown by variety FH-901.

4 CONCLUSIONS

The experimental results carried out for Varietal comparison of some fibre quality traits of Cotton (*Gossypium hirsutum* L.) under different row spacings revealed that row spacing significantly affected the ginning out turn (GOT %) of cotton. While fibre length (mm), fibre strength ($cN \cdot tex^{-1}$), fibre uniformity (%) and fibre fineness remained unaffected. Significantly highest ginning out turn (39.97 %) was recorded in crop where cotton was planted in 90 cm apart rows, followed by S_2 (75 cm) row spacing. Whereas, significantly minimum ginning out turn (38.19 %) was noted in 60 cm spaced cotton rows. The varieties differed significantly in fibre length (mm), fibre strength ($cN \cdot tex^{-1}$) and fibre fineness while ginning out turn (GOT %) and fibre uniformity (%) remaind unaffected.

References:

[1] WITTEN T K, Cothren J T. Varietal comparisons in ultra narrow row cotton (UNRC)[C] //Proc Beltwide Cotton Conf, San Antonio, TX. 2000-01-04－08. Memphis, TN: Natl Cotton Council Am. 2000: 608.

[2] JONES M A. Evaluation of ultra-narrow row cotton in South Carolina[C] //Proc Beltwide Cotton Con, Anaheim, CA. 2001-01-09－13. Memphis, TN: Natl Cotton Council Am, 2001: 522-524.

[3] PARVIN D W, Burkhalter J W, Cooke F T, et al. Three years experience with skip-row cotton production in Mississippi, 1999-2001 [C]//Proceedings 2002 Beltwide Cotton Conference. 2002.

[4] ATWELL S D. Influence of ultra narrow row on cotton growth and development[C] //Proceedings 1996 Beltwide Cotton Conference. 1996:1187-1189.

[5] BUEHRING N W, Willcutt M H, Nice G R, et al. UNR cotton response to seeding rates[R]//2000 North Mississippi Research and Extension Center Annual Report. Mississippi Agricultural and Forestry Experiment Station Information Bulletin, 2001: 125-127.

[6] NICHOLS S P, Snipes C E, Jones M A. Evaluation of varieties and plant population in ultra narrow cotton in Mississipp [C] // Proceedings Beltwide Cotton Conference. 2002.

[7] PARVIN D W, Gentry J, Cooke F T, et al. Three years experience with ultra narrow row cotton production in Mississippi, 1999-2001 [C] //Proceedings 2002 Beltwide Cotton Conference. 2002.

[8] ANTHONY W S, Molin B. Ginning and fiber characteristics of cotton varieties planted in ultra narrow row and conventional patterns[C]. // Proceedings Beltwide Cotton Conf., San Antonio, TX. 2000-01-04－08. Memphis, TN: Natl Cotton Council Am, 2000: 785-792.

[9] HEITHOLT J J, Pettigrew W T, Meredith W R. Growth, boll opening rate, and fiber properties of narrow-row cotton[J]. Agron J, 1993, 85: 590-594.

[10] GERIK T J, Lemon R G, Faver K L, et al. Performance of ultra-narrow row cotton in central Texas [C] //Proceedings Beltwide Cotton Conf, San Diego, CA. 1998-01-05－09. Memphis, TN: Natl Cotton Council Am, 1998: 1406-1408.

[11] VORIES E D, Glover R E, Bryant K J. A three-year study of UNR cotton [C] // Proceedings Beltwide Cotton Conf, Orlando, FL. 1999-01-03-07. Memphis, TN: Natl Cotton Council Am, 1999: 1480-1482.

[12] BRADOW J M, Davidonis G H. Quantitation of fiber quality and the cotton production- processing interface: A physiologist's perspective[J]. J Cotton Sci, 2000(4):34-64.

[13] Mcalister D D. Comparison of ultra-narrow row and conventionally grown cottons[J]. Appl Eng Agric, 2001,17: 737-741.

[14] VORIES E D, Valco T D, Bryant K J, et al. Three year comparison of conventional and ultra narrow row cotton production systems[J]. Appl Eng Agric, 2001,17: 583-589.

[15] JOST P H, Cothren J T. Growth and yield comparisons of cotton planted in conventional and ultra-narrow row spacings[J]. Crop Sci, 2000, 40: 430-435.

[16] HEITHOLT J J, Pettigrew W T, Meredith W R . Light interception and lint yield on narrow row cotton[J]. Crop Sci, 1992, 32: 728-733.

[17] BUXTON D R, Patterson L L, Briggs R E. Fruiting pattern in narrow row cotton[J]. Crop Sci, 1979, 19: 17-22.

[18] JOST P H, Cothren J T. Phenotypic alterations and crop maturity differences in ultra-narrow row and conventionally spaced cotton[J]. Crop Sci, 2001, 41:1150-1159.

[19] STEEL R G D, Torrie J H, Deekey D A. Principles and procedures of statistics: A biometrical approach[M]. 3rd ed. New York: McGraw Hill Book Co Inc, 1997: 400-428.

[20] BRIDGE R R, Meredith W R, Chism J F. Influence of planting method and plant population on cotton (*Gossypium hirsutum* L.) [J]. Agron J, 1973, 65: 104-109.

[21] NICHOLS S P, Snipes C E, Jones M A. Evaluation of row spacing and mepiquat chloride in cotton [J]. J Cotton Sci, 2003, 7: 148-155.

[22] JOST P H. Comparisons of ultra-narrow row and conventionally-spaced cotton [D]. College Station, TX: Texas A&M Univ, 2000.

[23] VALCO T D, Stanley W S, McAllister D D. Ultra narrow row cotton ginning and textile performance results[C] // Proceedings Beltwide Cotton Conf, Anaheim, CA. 2001-01-09－13. Memphis, TN: Natl Cotton Council Am, 2001: 355-357. ●