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Technological Studies on the Spinning Performance of Cultivated Cotton Species and Varieties

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Abstract: Eight varieties of cotton from all cultivated species viz. *Gossypium barbadense, Gossypium hirsutum, Gossypium herbaceum* and *Gossypium arboreum* were collected from Ayub Agriculture Research Institute, Faisalabad. The yarn of 20's count was spun on Shirley miniature spinning unit and tested for count, lea-strength, Count Lea Strength Product value (CLSP) and unevenness (U%). The data was analyzed statistically using DMR test and presented in tabular form. The results showed that *G. barbadense* from long staple group and *G. herbaseum* from short staple cotton species presented better spinning performance.

Key words: Cotton Species, Yarn, Spinning

Introduction

Cotton is one of the most important cash crops of our country; the importance of this crop is due to the fact that it meets the demand of local textile industry and plays a major role in the promotion of our textile exports to earn a big amount of foreign exchange. Because of its good thermal properties, cotton is excellent for use both in summer and winter. Its superior natural physical, mechanical and chemical properties are incomparable with other natural and synthetic fibers. There are four important spinnable cotton species in the world viz. *Gossypium herbaceum, Gossypium arboreum, Gossypium hirsutum* and *Gossypium barbadence.*

Afzal (1969) stated that *G. Arboreum* varieties can be spun up to 10^s count and *G. hirsutum* up to 20^s-70^s count.

El-Mogahzy and Broughton (1992) investigated that longer fibers tend to increase yarn density consequently reducing yarn diameter. Likewise, Alphen (1982) narrated that as raw cotton differ in grade, properties and uniformity, which effect yarn quality.

Smith (1947) stated that CLSP values of yarn were largely dependent upon the fibre strength, staple length and fineness of the cotton.

Grover and Hamby (1966) stated that greater the uniformity of a spun yarn, the higher is its strength and more unevenness a yarn the lower is its strength.

Ali (1970) reported that higher CLSP values were observed in long stapled cottons. Similarly, Iqbal (1989) reported that mean values of yarn strength showed highly significant differences among varieties. The mean values of Desi cotton for strength was 139.92 to 95.75 pounds.

Materials and Methods

The present research work was conducted in the Department of Fibre Technology, University of Agriculture, Faisalabad, in collaboration with, Central Cotton Research Institute, Multan and the Shadman Cotton Mills Ltd., Sheikhupura, during the year 1999.

Samples from different varieties from all cultivated species of cotton (one kilogram per variety) were collected from Ayub Agriculture Research Institute, Faisalabad of cotton season, 1998-99.

Cotton specimens from all treatments were converted into 20^s yarn on Platt's Bros "Shirley Miniature Spinning Plant" and yarn thus spun was tested for the following parameters.

Yarn count: Yarn count was determined by "Skein Method" according to ASTM Standard (1997a) on Uster Autosorter.

Description of Varieties

Species	Variety	Designation
Gossypium barbadense		S_1
	Giza-66	V_1
	Tadla-12	V_2
	Giza bar 14/55	V_3
Gossypium hirsutum		S_2
	FH-634	V_4
	FVH-53	V_5
Gossypium arboreum		S_3
	HR-Desi	V_6
	FDH-170	V_7
Gossypium herbaceum		S_4
Herbaceum red		V_8

Yarn Strength: Yarn strength was expressed in terms of lea strength and was determined on Good-brand pendulum type tensile tester by "Skein Method" as suggested by ASTM Committee (1997b).

Count Lea Strength Product: Count lea strength product was derived by multiplying the actual count value with the respective lea strength value (Breaking load of the yarn) according to British Standards (Anonymous, 1963).

Yarn Unevenness and Imperfection: Yarn unevenness (U%) was determined by measuring the mass variation occurring the yarn passes through the condenser and record in co-efficient of variation in yarn mass and mean linear irregularity (CV%), (U%). The equipment employed was Uster-tester III, which simultaneously measures the yarn imperfection thick, thin places and neps per 1000 meters of yarn. The procedure of testing was derived from ASTM standards (1997c).

Results and Discussion

Yarn count: Comparison of individual mean values for species and varieties show significant differences among all species and varieties. The maximum yarn count values are recorded by S_4 followed by S_1, S_2 and S_3 with their respective mean values as 20.59, 20.52, 20.47 and 19.99 percent. This data shows that maximum values for count are given by S_4 and its variety V_8 whereas the lowest values for count is indicated by S_3 and its variety V_6. The range of

Table 1: Comparison of individual means by DMR test

Cotton Species	Yarn Count	Strength (lbs.)	CLSP	U%
S_1	20.52 b	115.2 a	2329 a	13.28 c
S_2	20.47 c	115.5 a	2388 b	13.01 d
S_3	19.99 d	91.96 b	1863 d	18.57 a
S_4	20.59 a	93.08 c	1905 c	18.08 b
Cotton Varieties				
V_1	20.46 d	117.8 a	2460 a	12.45 h
V_2	20.88 a	116.0 b	2279 c	13.01 f
V_3	20.23 f	111.2 d	2249 c	14.39 d
V_4	20.18 g	117.8 a	2445 a	12.70 g
V_5	20.75 b	113.2 c	2331 b	13.33 c
V_6	19.64 h	92.25 e	1877 de	20.84 a
V_7	20.34 e	91.67 e	1850 e	16.31 c
V_8	20.59 c	93.08 e	1905 d	18.08 b

Any two means not sharing a letter in common differ significantly at p = 0.05
Letters a, b, c .....,h are used separately for each column.

mean values are 20.46, 20.88, 20.23, 20.18, 20.75, 19.64, 20.34 and 20.59 percent for V_1, V_2, V_3, V_4, V_5, V_6, V_7 and V_8 respectively.
It is evident from these results that fibre physical properties and cotton grade have significant effect upon yarn quality. Similarly Alphen (1982) narrated that as raw cotton differ in grade, properties and uniformity, it affect yarn quality. While El-Mogahzy and Broughton (1992) investigated those longer fibers tend to increase yarn density consequently reducing yarn diameter.

Yarn strength: Comparison of individual treatment mean values indicate that species S_3, S_4 differ significantly from each other and from S_1 & S_2 while S_1 and S_2 are at par. Similarly varieties V_2, V_3 show significant difference from each other and from remaining varieties. While V_1, V_4 and V_6, V_7, V_8 are at par.
It is evident from the results of species and varieties that highest yarn strength for 20^s count is recorded by species S_2 followed by S_1 and S_3 with their respective mean values as 115.5, 115.2, 93.08 and 91.96 pounds. Similarly variety V_1 and V_4 have maximum strength whereas V_7 have the lowest value of yarn strength. The mean values of strength are 117.8, 116.0, 111.2, 117.8, 113.2, 92.25, 91.67 and 93.08 pounds for varieties V_1, V_2, V_3, V_4, V_5, V_6, V_7 and V_8 respectively. It is clear from these results that the physical parameters of fibre effected the yarn strength more fine the fibre stronger is the yarn. These observations are in conformity with the views forwarded by Grover and Hamby (1966) who stated that finer fibers give greater yarn strength than coarse fibers into a given yarn size. Likewise Bargeron and Shaw (1985) claimed that fibre fineness might result in improved yarn strength. Similarly Sheikh (1991) described that the fibers properties such as length, uniformity of length, fineness, fibre strength and elongation along with spinning conditions contribute to yarn strength. Ahmed (1987) reported lea strength for 20^s yarn as 109 lbs, while Irfan (1995) reported lea strength of 20^s yarn as 111.2 to 114.80 lbs. Similarly Iqbal (1989) reported that mean values of yarn strength showed highly significant differences among varieties. The slight variation in results might be due to seasons. Khan (1972) observed significant seasonal effect on yarn strength.

Count lea strength product value: Comparison of individual mean values for species and their varieties indicate that there are significant differences among species. The highest values of CLSP are recorded by S_2 followed by S_1, S_4 and S_3 with their mean values as 2388, 2329, 1905 and 1863 hanks respectively. Variety V_1 (S_1) recorded maximum and V_7 (S_3) minimum CLSP values. The respective mean values of CLSP are found as 2460, 2249, 2445, 2331, 1877, 1850 and 1905 hanks for varieties gradually from V_1 to V_8. These results indicate that CLSP values mainly depend upon fibre length and fineness. As S_1 and S_2 have longer lengths and fineness than S_3 and S_4. So they record maximum CLSP values. These observations are confirmed by Smith (1947) who noted that CLSP values of yarn largely depend upon the fibre strength, staple length and fineness of the cotton. Identically Ali (1970) reported that higher CLSP values were observed in long stapled cottons. Irfan (1995) noted the CLSP values for 20^s yarn as 2251-2294 hanks.

Yarn unevenness: Comparison of individual mean values for species and varieties indicate significant differences among all species and varieties *G. barbadense* recorded maximum evenness followed by *G. hirsutum, G. herbaceum* and *G. arboreum* with their respective mean values as 13.01, 13.28, 18.08 and 18.57 percent. It is evident from this data that S_2 and its variety V_4 have the highest evenness whereas S_3 and its variety V_6 are the lowest evenness. The mean values for U-percentage are 12.45, 13.01, 14.39, 12.70, 13.33, 20.84, 16.31 and 18.08 percent for V_1, V_2, V_3, V_4, V_5, V_6, V_7 and V_8 respectively. Rusca (1970) reported that yarn uniformity, strength and appearance all become poor as the percentage of short fibre increased. Likewise Xu and Huang (1997) stated that presence of trash in cotton degrades yarn evenness and strength.

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