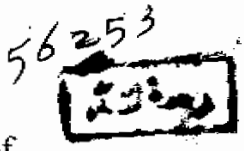
A STUDY ON FIBER MATURITY IN COTTON AND ITS RELATION TO LINT AND YARN PROPERTIES

By

ROKAYA MAHMOUD HASSAN MOHAMED

B.Sc. Agric., Cairo Univ., 1981



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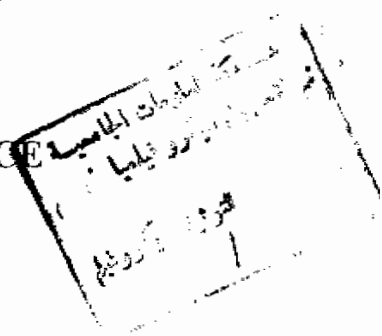

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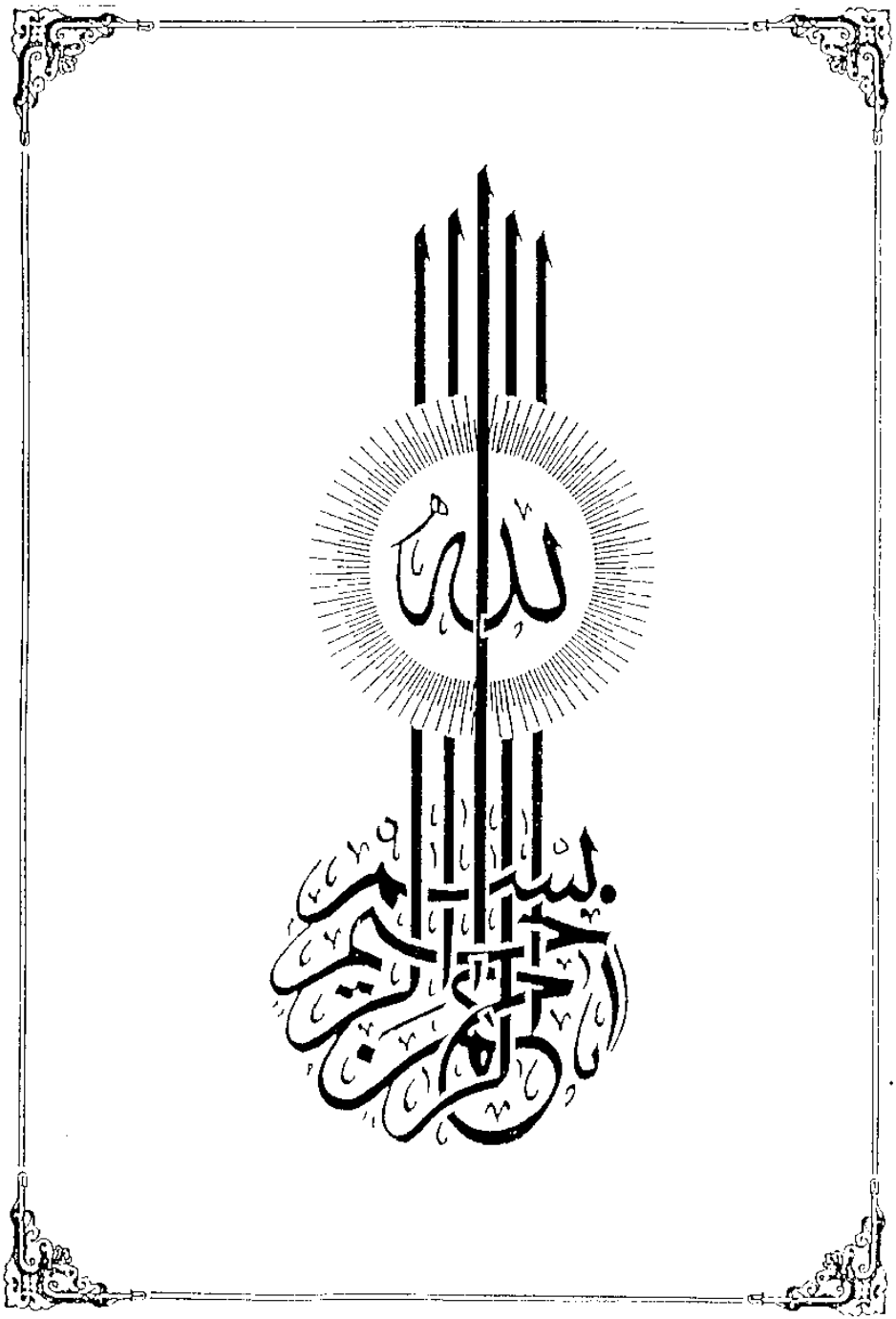

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ABSTRACT

Rokaya Mahmoud Hassan Mohamed. A study on fiber maturity in cotton and its relation to lint and yarn properties Unpublished Master of Agriculture Science, thesis, Ain Shams University, Faculty of Agriculture, Agronomy Department, 1997.

The present study was carried out to investigate: (1) the effect of cultivars, locations, seasons and their interactions on cotton fiber maturity and other fiber and yarn properties, (2) the relationship of fiber maturity to other fiber and yarn properties, and (3) the relative contribution of fiber maturity and other main fiber characters to yarn strength, appearance and evenness. Samples from 12 Egyptian cotton cultivars representing the extra-long staple (ELS) and long staple (LS) categories were taken from the miniature experiments conducted by the Regional Evaluation of Cotton Cultivars Research Department, Cotton Research Institute at ten governorates (locations) in Delta, Central and Upper Egypt in 1992 and 1993 seasons.

"Standard method" for estimating fiber maturity was performed as degree of thickening percent (DTP) by swelling fibers with (Na OH 18%) on different group lengths of samples sorted with the Suter-webb device. Data showed that within the ELS cvs., Giza 45 gave the lowest maturity percent, while Giza 76 gave the highest. Within the LS cvs., Dandera exhibited the lowest maturity, while Giza 75 and Giza 81 exhibited the highest. With regard to locations, Domietta gave the better ELS mature fibers, while El-Sharkieh gave the lowest values. Within LS cvs., El-Dakahlia exhibited the highest maturity, whereas Domietta showed the lowest.

Among the three methods used to estimate fiber maturity, viz., (DTP), Lord (1961) and Shirley F/MT instrument, the F/MT seemed to be preferable by the cotton breeder to be used in routine work, since its measurements were close to the standard method (DTP) and it is rapid and accurate as compared to the (DTP) and Lord (1961) method which are tedious and time consuming.

Positive and significant correlations were found between (DTP) and each of micronaire values, ribbon width and fineness by weight. On the other hand, (DTP) showed negative and significant "r" values with each of fiber length at 2.5% and 50% S.L., fiber strength, Lea and single strand strengths, yarn evenness and nep count, only the latter value was insignificant.

Path-analysis indicated that the total direct contribution of fiber maturity, fiber fineness, fiber length and fiber strength and their joint effects amounted to 88.4%, 85.9% and 84.6% in the total variation of single strand strength, yarn appearance and yarn unevenness, respectively and that fiber maturity coupled with fiber fineness showed their apparent effect on yarn unevenness (39.76%).

Key words :

Cotton , Cultivars, Locations, Fiber properties, Maturity, Fineness, Length, Strength, Yarn strength, Appearance, Unevenness.

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INTRODUCTION

"Variety Zoning" or in other words, the distribution of the currently grown and / or newly released cultivars depends mainly on the yield performance and technological properties of these cultivars in different growing locations. Fiber maturity is a property associated closely with both yield and yarn properties.

Fiber maturity is generally accepted as meaning that the fiber wall has developed to an acceptable level of thickening. Fiber maturity affects markedly the appearance and value of raw cotton, its performance in spinning and quality of the finished textile product. The smaller wall thickness of immature fibers results in a lower fiber rigidity that causes a greater tendency for any mechanical treatment to entangle fibers into small knots or neps. The visible neps in raw cotton is not only a sign that trouble is already present; it often indicates that more trouble will be seen when the cotton is processed in the spinning mill as well as in the dying process.

It is well known that fiber maturity as well as the other fiber properties have a great impact in the construction of yarn and fabric, therefore, quality management, that means controlling these properties consistently to produce the necessary quality for the end use or customer needs, that quality management becomes an essential factor in textile industry.

One of the most significant problems associated with the assessment of the quality of a sample of cotton fibers is developing an accurate and precise measure of the distribution of fiber maturity in the cotton sample. Preferably the method has to be direct, fast and inexpensive. No existing or proposed method meets all these criteria. The new methods have the greatest

potential and its adaptation is the subject of a major research in the world.

Spinners see different micronaire values as express on fiber maturity or fineness, and they do not know if the differences is caused by cell-wall thickness, fiber diameter, or both. Also, cotton fibers used in commerce are of different genetic varieties having significantly different parameters. Thus, the micronaire method does not give a true assessment of the thickness of the cell wall relative to the fiber diameter or perimeter.

Recently, the goal of producing strong, fine and mature cottons is becoming a reality. As the demand for these cottons increases, new and improved cultivars are being developed to supply this demand. Breeders can develop cottons that satisfy the needs of the textile manufacturing industry and adapted to various locations of production.

Since cotton fiber maturity is important to both the farmer by increasing the yield and the textile industry by improving the product, fiber maturity should be a major factor in determining the price premium or discount the farmer will receive for his cotton.

The present study was carried out on twelve commercial Egyptian cotton cultivars, to investigate the effect of cultivars, locations, growing seasons and their interactions on cotton fiber maturity and some important fiber and yarn properties, as well as, to clarify the relation between fiber maturity with the other fiber and yarn properties. Also, to detect the relative importance of fiber maturity and other selected fiber traits contributing to yarn strength, appearance and evenness by the path-coefficient analysis.

REVIEW OF LITERATURE

Literature of the present investigation deals with the assessment of fiber maturity and factors of environment affecting fiber maturity and other fiber characters. Also, the relationship and relative contribution of fiber characters to yarn properties are reviewed as follows:

1. Fiber characters :

1.1. Fiber maturity and fineness :

Verhalen and Murray (1964) cleared that fiber coarseness was influenced significantly by (cultivar x year) interaction.

Bridge *et al.* (1969) found that the differences of genotype x environment interaction was not significant for micronaire reading.

Mahdy (1973) reported that hair weight and fiber maturity differed significantly between Egyptian varieties. However Upper Egypt locations showed slight decrease in hair weight comparing to Delta locations. He added that growing season affected significantly both hair weight and maturity ratio.

Turner *et al.* (1973) showed that the variability in fiber fineness was mainly affected by environments.

El-Hariry (1980) found that varieties, locations and varieties x locations interaction had a statistical significant effect on fiber weight / cm., micronaire value and fiber maturity ratio. He added that these characteristics were generally lower in Central and Upper Egypt as compared to Delta locations.

In 12 Egyptian and American cotton cultivars at successive stages of development, **Moursi *et al.*** (1980) found that the number of convolutions and the average convolution angle

increased with increasing wall thickness.

In studies of the seeds of 3 cultivars of *G. hirsutum* and *G. barbadense* **Kehagia and Mihaelides (1981)** found that from the chalaza to the micropyle there were increases in fiber perimeter from 63 to 75 μ and 55 to 68 μ as well as maturity (relative wall thickness) from 22 to 45 % and 33 to 60 % in *G. hirsutum* and *G. barbadense*; respectively. There were positive relationships between maturity and fiber strength in all cultivars.

Hegab *et al.* (1984) reported that locations exerted highly significant effects on micronaire reading. They ascribed this effect to the variable environmental conditions in these locations which tend to cause appreciable variations in fiber maturity.

Abd El-Salam *et al.* (1985) stated that cottons, cottons x years and cottons x subregions interactions,had significant effect on micronaire value and hair weight. However, the second order interaction cottons x subregions x years was significant for micronaire value only.

Fransen (1985) stated that the results of fiber maturity which obtained by the Causticaire method for measuring the maturity are apparently strongly influenced by the treatment technique. It appears that this is difficult to define in such a way that each operator can carry out exactly the same operations. The Cousticaire method is not reliable if the degree of fiber maturity is low. These judgements are based on an inter laboratory testing of three cultivars each containing samples of different maturity.

El-Marakby *et al.* (1986) stated that Micronaire value affected significantly by genotype x environments interaction.

Peeters *et al.* (1986) studied the never-dried cotton fibers as a meaning- full expression of maturity. Such that, a novel microscopical technique was used for direct measurement of the