



Fiber Maturity as Measured by the Degree of Thickening Percent, Lord Method and Shirley FMT Instrument in Egyptian Cotton Cultivars

M.T. Nawar, A.M. El-Marakby, M.H. El-Agroudy and R.M. Mohamed
Cotton Research Institute, Agric. Res. Center, Giza, Egypt; and Faculty of Agriculture, Ain Shams University, Egypt

ABSTRACT

Samples of twelve commercial Egyptian cotton cultivars were taken from the miniature experiments conducted by CRI, ARC, Giza, during the two successive seasons, 1992 and 1993 from ten growth regions in Egypt. "Standard Method" for estimating fiber maturity was performed as degree of thickening percent (DTP) by swelling fibers with NaOH 18% on different group lengths of samples, sorted by the Suter-Webb device. Three methods were used to estimate fiber maturity, DTP, Lord (1961) and Shirley F/MT instrument. The F/MT seemed to be preferred by the cotton breeder for routine work, since its measurements were close to the standard "DTP" method and it is rapid and accurate compared to the "DTP" and Lord methods that are tedious and time consuming.

Introduction

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 major research in the world. Fiber maturity assessed by the Causticaire method is apparently strongly influenced by the treatment technique. It is difficult to define this in such a way that each operator carries out exactly the same operation. The method is not reliable if the degree of fiber maturity is low. These judgements are based on inter laboratory testing of three cultivars, each containing samples of different maturity (Fransen, 1985). Thibodeaux and Evans (1986) applied the image analysis techniques to measuring cotton fiber maturity. Vuljanic *et al.* (1986) found that the microscope and polarized light techniques give equally objective results. The Causticaire method gives no real picture of fiber maturity while Thibodeaux and Price (1989) stated that the F/MT method has proven to be most useful.

Material and Methods

Twelve commercial Egyptian cotton cultivars were used in this study, six, Giza 45, Giza 76, Giza 77, Giza 70, Giza 84 and Giza 87 representing ELS and six, Giza 75, Giza 81, Giza 85, Giza 80, Giza 83 and Dendera, representing LS. Lint samples of these cultivars were taken from the miniature experiments conducted by Regional Evaluation of Cotton Cultivars Research Department, CRI, ARC, Giza, Egypt; during the two seasons 1992 and 1993. The different growth regions were Kafr El-Sheikh, El-Beheira, Dommietta,

Dakahlia, Al-Sharkeih, Al-Gharbia, El-Fayoum, El-Menya, Assuit and Sohag. All tests were carried out in the Lab. of the Cotton Fiber Research Dept., CRI, ARC, Giza, Egypt. Three methods of maturity were used:

- 1) Maturity method described by Lord (1961): About 200 fibers are laid parallel on a microscope slide and, covered with a cover glass. Two to three drops of 18% solution of sodium hydroxide is added to the fibers. Visopan microscope is used for classifying fibers at a magnification of 400X into:
 - a) Normal fibers (N).
 - b) Half-mature fibers.
 - c) Dead fibers (D).
 - d) Maturity ratio (M) was as follows:

$$M = \frac{N\% - D\%}{200} + 0.7$$

This value M was used in the following formula to calculate Mature Percent, (Pm):

$$Pm = (M - 0.2) (1.565 - 0.47 M) \times 100$$

- 2) Degree of wall thickening and lumen for the fibers of the different group lengths were used to represent the whole fibers in the cotton sample. Each sample was sorted into different length groups with the help of Suter Webb Sorter. Fifteen fibers of each group were taken and laid parallel on a microscope slide and covered with a glass cover slip. Two to three drops of 18% solution of sodium hydroxide were added to each slide. Ribbon width (RW) (μ), Lumen (L) (μ) and wall thickness WT (μ) were measured by Visopan at a magnification of 500X. Maturity was calculated by the following formula:

- 3) Maturity percent was determined by Shirley Fineness/Maturity Tester (F/MT) according to

$$\text{Maturity \%} = \frac{\text{WT}}{\text{RW}} \times 100$$

ASTM, 1992 Designation (D-3818-79).

Results and Discussion

The values of fiber maturity (DTP), Lord method, and F/MT method (Table 1) gave mean values of 81.6%, 92.3% and 79.0%, respectively. The mean value of Lord was the highest, DTP moderate and F/MT were the lowest. The differences between fiber maturity percent measured by each method varied from one cotton cultivar to another. Conversely, the variation of differences was lower in Lord method than in the other two methods. Degree of thickening (DTP) of the ELS and LS Egyptian cotton was significantly affected by cultivars and by location.

There is a consistent trend in each cultivar for the maturity values measured by Lord method to be higher than those measured by DTP while F/MT values were closer to DTP but consistently lower. The DTP method is the standard method for estimating fiber maturity percent, hence its inclusion in this investigation. Since this method is tedious, time consuming and not adapted to routine tests, the cotton technologists and breeders should depend on F/MT; a rapid, accurate instrument when the sample is well prepared and the instrument is correctly calibrated. Other investigators have expressed the opinion that swelling methods are not accurate.

References

- ASTM. (1992): Annual Book of ASTM Standards, American Society for Testing Materials-Designation : D-3818-79. Sec. 7. 07-02. Textiles (11), Philadelphia.
- Fransen, T., S. Verschrage and L. Kiekens. (1985): Critical study of the Causticaire method for measuring cotton fiber maturity. *Coton-et-Fibers-Tropical*, 4 (1):9-27.
- Lord, E. (1961): Manual of Cotton Spinning, Part 1: The Characteristics of Raw Cotton. Vol. II: Textile Inst., Butterworths and Textile Institute, Manchester and London.
- Thibodeaux, D.P. and J.P. Evans. (1986): Cotton fiber maturity by Image Analysis. *Text. Res. J.*, 56 (2):130-139.
- Thibodeaux, D.P. and J.B. Price. (1989): Reference method for determination of the maturity of cotton fibers. The 19th International Cotton Test in Bremen, *Mellian Textile Bericht.*, 70 (4):243.

Table 1. Fiber maturity percent as measured by degree of thickness percent, Lord method and F/MT in Egyptian cotton cultivars.

Cultivars	Degree of thickening %		Lord method %		F/MT %	
	1992	1993	1992	1993	1992	1993
Giza 45	79.7	79.9	90.3	89.8	71.5	79.8
Giza 70	80.0	80.4	90.6	92.3	76.3	80.2
Giza 76	81.8	81.4	89.2	89.3	77.4	79.8
Giza 77	81.0	81.4	89.4	93.7	77.7	81.2
Giza 87	81.0	81.9	90.2	92.0	76.7	81.7
Giza 84	80.7	81.5	92.2	92.8	78.7	81.4
Giza 75	82.8	82.7	91.1	92.0	79.4	86.7
Giza 80	82.2	82.5	91.9	92.1	77.8	77.6
Giza 81	82.5	83.1	90.8	91.3	78.1	81.5
Giza 83	82.5	82.9	90.4	89.8	78.1	76.9
Giza 85	81.8	81.8	90.9	92.2	78.7	81.9
Dendera	79.2	80.4	91.0	91.9	78.5	77.4
Mean	81.3	81.7	90.7	91.6	77.4	80.5
Overall Mean	81.5		91.1		78.95	