EFFECT OF GINNING ON FIBER PROPERTIES AND YARN QUALITY OF SOME EGYPTIAN COTTONS

BY

ABDEL-HAMEED ABDEL-LATEEF NOMEIR

B.Sc. (Agri.). Cairo University, 1961

Thesis

Submitted in partial fulfillment of the requirements

for the degree of

MASTER OF SCIENCE

in

Agronomy

Agronomy Department

Faculty of Agriculture

Ain-Shams University

1971

EXAMINATION AND THESIS REPORT

Major field : Agronomy

Title of thesis : Effect of Ginning on Fiber Properties and Yarn Quality of Some Egyptian Cottons.

By : Abdel-Hameed Abdel-Lateef Nomeir

Approved by :

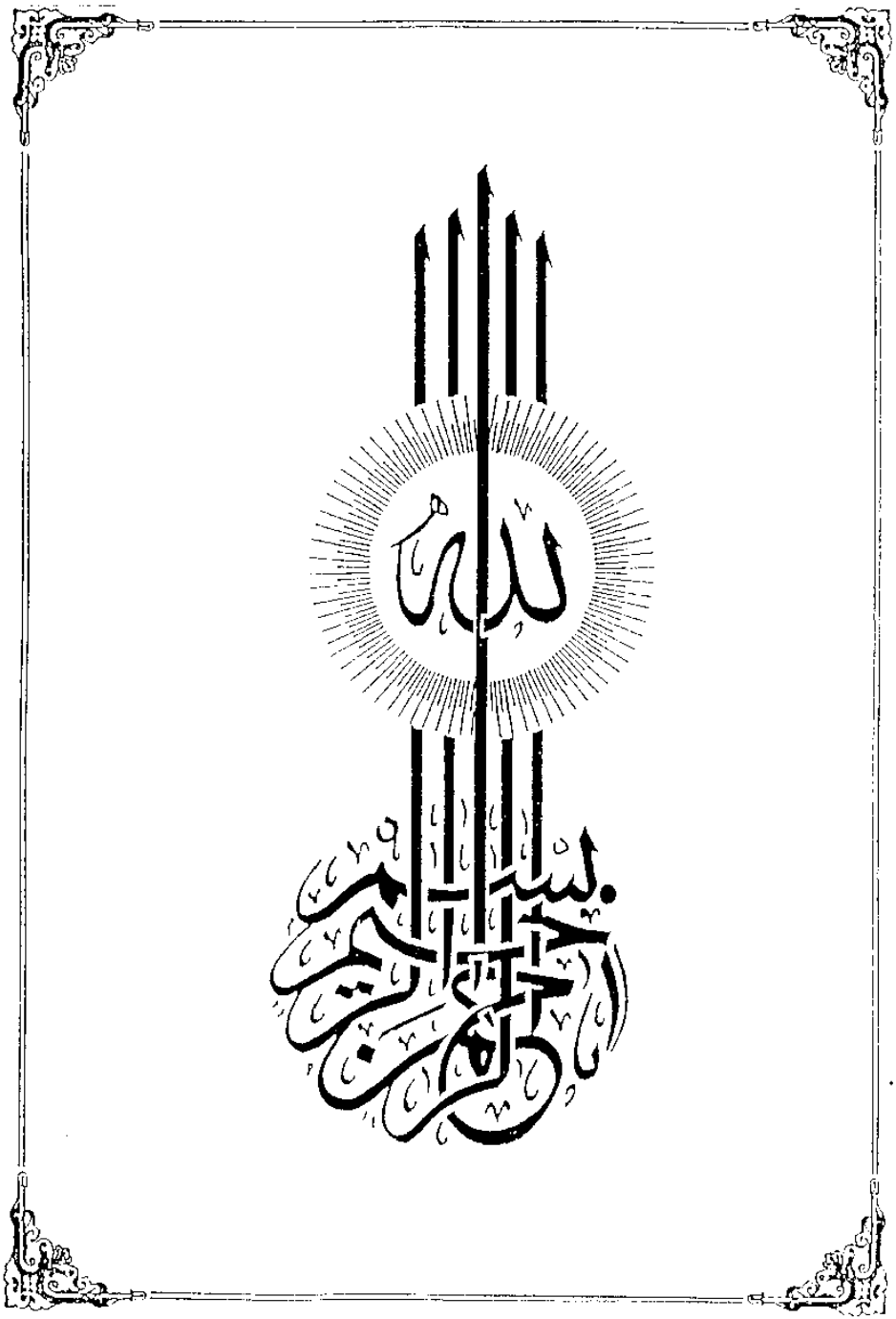
.....

.....

.....

(Committee in Charge)

Date : / /1971.



The writer wishes to express his deep appreciation and gratitude to Dr. [illegible] El-Hawary, Professor of Plant Breeding, Faculty of Agriculture, University of Ain-Shams, Dr. K.A. El-Shouny, Lecturer of Agronomy, Faculty of Agriculture, University of Ain-Shams, and Dr. M.E. Abdel-Salam, Cotton Technologist, Cotton Technology Research Division, Ministry of Agriculture for their supervision advice, valuable guidance and helpful criticism throughout the investigation and during the preparation of the manuscript.

Thanks are also due to Mr. A.H. Abu-Sehly, Head of Cotton Fiber Research Section, and the staff of the Cotton Technology Research Division for their encouragement and help.

The writer is very grateful to Mr. Z.T. Abdel-Fattah, President of the Egyptian Cotton General Organization, and the staff members of the ginning sector for their useful help with regard to raw material and the permission to carry out part of this work at their gineries.

I N T R O D U C T I O N

For over a hundred years cotton has been the most important cash crop in the U.A.R., and more recently it became the main raw material for the largest national industry, the textile industry.

The last step in seed-cotton production is accomplished when seed-cotton is delivered to the ginnery, while for the spinning industry the starting point is ginned raw lint. In between, the ginning process plays the important role of converting seed-cotton into lint and seed suitable for further industrial processing. In doing so, the ginnery is required to effect the complete separation of lint and seed, and also to maintain the inherent qualities of both, This last objective is of paramount importance especially for Egyptian cottons, universally distinguished for their high quality.

As ginning is the first mechanical process to which cotton fibers are subjected, the preservation of the inherent qualities of cottons depends to a large extent upon the efficiency of the ginning process. While ginning cotton remained largely based on experience, scientific research could undoubtedly help a great deal in finding ways to

improve its efficiency. The first step in such an endeavor is the clarification of the realities of the ginning situation as it actually is at present and, finding areas in which improvement might be possible.

In the U.A.R., there are 101 ginneries, 66 in the Delta and 35 in Upper Egypt, comprising 6161 of the McCarthy-type roller gin-stands. Their capacity is sufficient to gin the annual cotton crop in the appointed time. The ginning process, as it is actually done in the U.A.R., can be summarized in; receiving seed-cotton, weighing, estimating the grade and storing seed-cotton sacks in the open cotton storage yard, blending similar or different grades in the blending room to form a homogenous grade, hand feeding seed-cotton to the gin-stands, blending ginned lint, moistening and finally hydrolic pressing into bales.

The purpose of this investigation is to find out what actually happens to cotton quality during ginning, and consequently to obtain interpretable information, on the basis of which improved ginning service may be possible in order to maintain the good qualities of Egyptian cottons.

Eight commercial ginneries in which five cotton varieties representing the whole range of Egyptian cottons are ginned were selected for this investigation. The quality

of commercially ginned lint of these ginneries was compared with hand-ginned cotton samples as well as with samples experimentally ginned using the gin-stand adjustments proposed by the Cotton Arbitration and Testing Organization (C.A.T.O.).

In addition, this work was also intended to find the magnitude of variation in efficiency among the gin-stands in each of the ginneries under investigation, and thereupon to examine the possibility of improving the efficiency level of each ginnery without altering the traditional equipment in use.

REVIEW OF LITERATURE

I. Cotton fiber properties affected by Ginning :

(a) Fiber length, length uniformity, and short fiber content :

Because length is the most obvious feature of cotton fiber and, therefore, could be easily observed and judged, it has attracted considerable attention since the early days of the cotton industry. More recently, Lord (1961) re-asserted the well established opinion about the importance of length in these words; " of all the characteristics of raw cotton, staple length has possibly the most value to the spinner, other things being equal, finer yarns can generally be spun from the longer cottons, and in any one count the longer cottons lead to greater strength than shorter cottons". In view of its importance, staple length plays a large part in determining the commercial value of raw cotton.

If a bunch of commercial lint is carefully examined, it will be seen that it consists of fibers of different lengths covering a wide range possibly from few millimeters up to thirty or fourty or even fifty millimeters in some varieties. The difference in length is due to the position of the fibers on the seed. Differences in length also exist between different seeds in the same boll, between different

bolls on the same plant, and between plants. ([illegible] and Ahmad 1952, Iyengar 1947, Krishnam and Iyengar 1960, and Ali et, al., 1964).

Spinning quality elements, particularly yarn strength, and yarn appearance, and spinning end breakage, all are affected by length uniformity and, therefore, by the proportion of short and broken fibers. The effect of short fiber content on spinning performance and yarn quality had been the subject of intensive investigations. (Wakeham 1955, Tallant et al. 1962, and Waters et al., 1964). Increase of short fiber content in a cotton is determintal to virtually all yarn and fabric properties. In general, the presence of a large number of short fibers in cotton causes the following.

a- An increase in both neps in the card web, twist insertion in the roving to attain constant hardness, and processing wastes.

b- Reduced spinning efficiency, yarn strength, elongation, appearance and evenness.

c- Inferior properties of fabrics, both grey and finished.

Cotton possesses its highest fiber quality and best potential spinning performance when it is on the stalk.

Any [illegible] preserve [illegible] and characteristics [illegible] inherent in the cotton. Anwir et al., (1964) studied sea-island cotton quality and ginning through experimental ginning tests at the U.S. Cotton Ginning Laboratory, Stonville, Miss. They found that the mean fiber length, as measured by fiber array, was reduced by 1/16 of an inch by saw ginning as compared with roller ginning. Also staple length as determined by cotton classers differed by this amount on the average. Length uniformity was greatly reduced by saw ginning.

Bennett (1956) showed that fiber length was seldom affected by ginning methods except when the cotton was brought-in too dry or was overdried at the gin. However, when moisture content was lowered to as little as 2 or 3 per cent, shrinkage of as much as one-sixteenth of an inch in fiber length may occur. On the other hand, cotton ginned with too high a moisture content may produce gin-cut fiber and cause the length to be penalized. Mechanical reductions in staple length frequently cause a lowering in the uniformity of staple length.

Montgomery and Nissing (1957) showed that overhead treatments significantly influenced certain properties such as upper half mean length, mean length, and uniformity

[illegible] ing had no [illegible] staple length.

[illegible] and Merrell (1954), studying excessive drying and fiber damage, found that the permanent changes in mean length and quantity of short fibers seem to be responsible for the major effects on product qualities. These fiber length changes were attributed to breakage resulting from mechanical working of fibers temporarily weakened because of low moisture content.

Brown et al. (1959) studied the effect of roller ginning and saw ginning on Pima S-1 cotton. They found that the roller-ginned cotton had a slightly longer fiber mean length and better length uniformity than the saw ginned stock.

Chapman and Stedronsky (1959) showed that the most noticeable effects caused by various ginning treatments are the shorter lengths for all treatments which included excessive drying. Maximum cleaning alone did not affect staple length.

Nelson et al. (1959) examined the effect of heat drying on the physical and chemical properties of cotton, and found that the proportion of short fibers was increased

Little et al. (1960) found the percentage of long fibers lost during ginning decreased in some treated lots. They denied that this change in length distribution is the result of excessive fiber breakage when lint is subjected to mechanical agitation at too low a moisture content.

Little et al. (1960) stated that rough preparation and fiber damage particularly fiber breakage may result in ginning moist cotton less than ginning overdried cotton.

Luscombe (1960) reported that the early experimentation of the U.S.D.A. Cotton Ginning Investigation showed that the average length of ginned fibers at the lint slide decreased as the fiber moisture at the lint slide was decreased.

Griffin and Mangial-ardi (1961) showed that fiber length tended to lower with increased drying, when studying automatic control of seed cotton drying at the cotton gin.

Moss et al. (1961) studied cotton fiber and spinning properties as affected by certain ginning practices. They showed that upper half mean length and uniformity as measured by the Fibrograph were not affected while mean length showed some adverse effects. The adverse effects of normal and extra-drying on the pattern of length distribution were

[illegible] significant. Lint cleaning had no tendency to increase variability under normal drying conditions. The proportion of fibers shorter than one-half inch was significantly lower for cotton which had been subjected to lint cleaning and no drying as compared with normal and extra-drying, with or without lint cleaning.

In a study on the origin of short fibers in American Cottons, Grant et al. (1962) found that the short fiber content of commercially ginned lint is related to the drying and cleaning procedures. They also showed that short fibers originate in almost every mechanical process which requires the mechanical working of the fibers.

Calkins and Ross (1963) showed that modern ginning practices, involving excessive drying and cleaning to improve cotton grade result in fiber breakage and inferior processing characterestics.

Gutknecht and Rochricht (1963) established a relationship between cotton fineness and the percentage of short fibers, the more severe the ginning process the greater the amount of broken short fibers. Very fine fibers only escape damage in hand ginning.

Looney et al. (1963) studied the effects of multiple lint cleaning at the cotton gin on bale value, fiber properties, and spinning performance. They showed that length

[illegible] number.

[illegible] (1963) reported that experience with comb-sorter diagram tests made on mechanically ginned cotton, and on fibers removed from seeds by careful hand stripping indicated that there is generally a sensible reduction in mean fiber length caused by passage through a gin. The reduction was usually between 1/16 inch and 1/8 inch; for an Uganda cotton. Cotton fibers break during ginning if the force applied to overcome the attachment to the seed exceeds the fiber breaking load.

Shanklin (1963) found that array tests on ginned lint and card sliver indicated that high, moisture lint had significantly greater mean fiber length and lower coefficient of length variation than both ginned lint and card sliver from low-moisture lint. Low moisture lint produced a significant increase of short fibers in card sliver. Additional lint cleaning caused a significant decrease in array mean fiber length and an increase in short fiber content. The average upper quartile of the card sliver was 0.[illegible] inch shorter than for the ginned lint.

Williams (1963) studied ginning on field damaged cotton, and pointed out that the affected locks fail to

fluff fully, and are discolored, and the fibers previously are weakened considrably. Also a decrease in length is often associated with the nonfluffy locks. These non fluffed locks are often referred to as "light locks".

Alberson and Stedronsky (1964) studied the effect on fiber quality of saw ginning Pima Cotton as compared to roller ginning. They showed that both classer's staple length and the fibrograph upper half mean measurement show a shortening of staple by saw ginning.

Chapman (1964) stated that the inherent strength of attachment of fibers to seed affects ginning capacity, cottons with relatively weak tenacity, or strength of attachment, gin with greater capacity.

Griffin (1964) recorded that, for a fixed quantity of gin machinery, increased drying may increase fiber breakage and thus reduce length uniformity. Below the 5 per cent moisture level, the rate of fiber breakage increases rapidly. He also stated that the lint cleaners remove some short fibers. Hand stapling and machine measurements often show a slight increase in length. This length increase usually reduces manufacturing waste but has little, if any, effect on yarn strength.