FCT - A SYSTEM FOR DEFINING DIFFERENT LEVELSAND PROFILES OF STICKINESS AND ITS CONNECTION TO OTHER CONTAMINANTS SUCH AS SEED COAT FRAGMENTS

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Abstract

FCT - Fiber Contamination Tester, was developed as a commercial tester for heavy duty operation for the laboratory and the industrial level. In 1996, 8 FCT's were installed world-wide and new information was accumulated in regard to its ability to conduct mass testing of contaminants at the mill, gin and classing room.

During 1996, large scale experiments were conducted at a ginning plant in Israel, by testing approx. 15,000 commercial bales and experimental samples. At the classing level, 8,500 commercial bales were tested.

At the ginning site, it was proven that the FCT can identify the level of stickiness, trash, seed coat fragments and Neps, in real time.

By testing samples in different stages of the ginning process, (after ginning; after the first lint cleaning and after the second lint cleaning), the FCT enable the ginner to identify those of the stands which are candidates for lower performance. It was shown that the FCT, while functioning on line at the gin, can help the ginner to choose those of the cotton modules which need better cleaning. When these modules will be identified, the ginning process can be slowed down (from 8 bales to 6 bales per hour) which will probably result in a higher quality performance of less trash and less Neps content, (1-3 trash grades high, depending on the trash level of the seed-cotton). This ability can raise customer's income to about $5-10 per bale. If the cleanliness of the cotton is good, capacity of ginning can be increased without affecting the cotton quality, so the total loss of hours for the low grade cotton will be compensated by saving ginning hours of the high grade cotton.
By conducting mass testing of stickiness and the other contaminants, it was shown that the stickiness varies mostly in different growing zones and growers, and not on individual bales within the modules.

At the cotton classing and trading level, the FCT became a powerful tool for identifying the level of stickiness accurately and objectively. **Some of the buyers in Europe do not buy cotton anymore without pre-testing the cotton with the FCT.**

At the commercial level of the Israeli Classing Institute, for the 1997 season, the FCT will substitute the old system of screening stickiness, in combination with testing of sugar content.

Introduction

FCT, as one of the equipment for fiber testing, represents a new concept in regard to the question, what is the best way for producing better quality cotton. There is no doubt, that the first and the major factor is the level of trash which is brought from the field. The nature of stickiness is too strongly connected to the field level, but its "sticky" nature is still not clear. Some cotton is so sticky, that it even tends to clog the cards. This extremely sticky cotton seems to be related to Aphids, and some times white-fly, and its stickiness is characterized by very big and high levels of deposits. Other cotton samples, behave like sticky cotton but are not related to insects, as farmers strongly report that they do not have any sucking insects in their fields. This cotton probably suffers immaturity or weak seed coats which tend to break during the ginning process, causing a high level of seed coat fragments in the raw cotton. During the last few years, there is more evidence that seed coat fragments are also related to some characteristics of stickiness.

The basic concept behind the FCT operation is based on the fact that some of the major impurities of the cotton are "man made" at the gin level. So this site is considered as the weak point on the chain of fiber for producing high quality of cotton. Although the level of cleanliness arriving from the field is a major factor, a lot can be done to raise the quality of cotton at the gin level.

The gin, as we know, is usually set before the ginning season, and during ginning. Only process changes are done (like temp. or ginning volume). Most of the gins operate at a certain and fixed ginning capacity/volume. The new concept of the FCT is based on the knowledge (which was proven again by using the FCT this season), that low ginning capacity/volume usually results in lower level of trash and Neps. The question remains; how to optimize the level of trash and SCF (seed coat fragments) without loosing too much ginning time. The FCT can give an answer to this question. Clean cotton will be treated relatively fast, while the high trash cotton will be treated more carefully. **The economical meaning of this is the possibility of gaining $5-10 per bale, by increasing the trash grades by 1-3 grades (depending on seed cotton) entering the ginning process**.

At the trading /classing level, the picture is different. The market forces, which are mostly led by the buyers, are seeking better information concerning the probability of the raw material to cause trouble in the spinning process. The need for having information about SCF and stickiness is not a theoretical issue anymore, but becomes a demand of some spinning mills. As the author believes, it is only a matter of

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time before these parameters become part of the classing requirements, as it is too important for the buyer to leave them out of the characteristics of cotton. The trend of including impurities in the classing system will also affected by the existence of different equipment which can provide this information for every bale.

The FCT has become one of these powerful tools to provide accurate and objective information about the impurities of raw cotton.

Materials and Methods

Most of the experimental work was conducted at two sites in Israel, where the FCT was installed. The main activity was conducted at a ginning plant - "Sivey Hadarom" - which installed the FCT in its sampling room. This ginning plant is a modern one, (4 gin stands, where the samples are taken automatically). The tests by the FCT were made manually by taking a 3 gr. sample from every sample produced by the auto sampler. The ID number was taken by using a bar-code device.

Experiment in the Gin for Impurities:

Two kinds of ginning experiments were conducted.

1. Testing the level of impurities in each stand.
2. Testing the level of impurities in different gin capacities. In both experiments, cotton was taken simultaneously from the pipe openings after the ginning stand; the first lint cleaner and the second lint cleaner. (fig. 1). In each experiment, tests on every cotton sample were repeated 5 times, for statistical needs.

Results and Discussion

Mass Testing of Bales:

It was proven without any exception, that mass testing can be done on the ginning level. The testing takes 1.5 minutes (including self-cleaning between samples), while it takes approx. 2 minutes to press a bale in the gin process. Fig.2 represents 9541 commercial bales in which most of the bales were not sticky (80%) and only a small amount, were sticky and very sticky. Trash can be examined the same way (fig.3). Most of the measured cotton was on the level of Strict Middling and Middling, which represents the level which was classed by the classing institute.

Statistics of Bales Within Modules:

It is extremely important to learn the nature of impurities in bales and modules. This will aid future discussions concerning the statistical basis for using impurities as additional criteria in the classing system. Fig. 4-6 represent 5 different modules from two different growers and their bales. It can be seen, that the lower the trash content, the lower the %CV of the data of an individual bale within its module. The most common CV percentage is 6% - 15% (fig.4).

Fig.5 represents the FCT Trash content as tested on cotton samples (20 reps. each) which was classed by the commercial classing system.

The differences in the number of Neps between bales and modules is less than those in trash content. (fig.6). It can seem that good quality cotton also had less Neps, (150-200 vs 200-250). The general level of seed coat fragments of those modules were in the range of 40-80 SCF./gr. Although the poorer quality cotton had 50% more SCF. than the good cotton. (fig.7). A more general picture of SCF. can be seen in fig.8. This graph represents more than 500 bales from 8 different growers. The ranges are still between 30-80 SCF/gr. and they vary on basis of growers.

Stickiness:

A general and realistic picture of stickiness as measured in this gin site, can be seen in fig.9. Since up to 20 deposits/gr. is not considered as cotton which can cause problems in the spinning mill, most of these bales are not sticky. By looking at the statistical nature of the data, we can identity some differences on a basis of growers. The cotton differ on a basis of growers, or growing zones; e.g. non-sticky cotton bales (growers nos. 644, 396, 451), or a mixture of non and moderate sticky cotton (grower no. 691). Grower no. 669 has very sticky cotton on this scale.

Ginning Capacity / volume in Regard to Impurities;

As explained in the material section, 3 levels of ginning capacity / volumes were measured (6 bales/hour, 8 bales/hour and 10 bales/hour) on two different types of cotton (first picking and second picking). The results are represented in figures 10, 11, In both cotton types, the FTC was able to trace the results of the cleaning process with very big differences in the cleaning efficiency. At a volume level of 6 bales/hour the final trash amount, after second cleaning was 37 particles/gr. (Strict Middling), while at a volume of 10 bales/hour it was raised to 53 particles/gr. (Strict Low Middling). When the trash level was high (cotton from second picking), at a capacity of 6 bales/hour, the cotton became commercially valid, while at 10 bales/hour, the cotton was out of the classifying trash scale.

The effect of cleaning is mainly due to the first cleaner. The higher the capacity, the lower the efficiency of the cleaners. The same negative effect on producing Neps can be illustrated in fig.11 The number of Neps increased by 23% (122 to 151 particles/gr.) in the clean cotton and by 54% (244 - 377 particles/gr.) in the second cotton picking. This subject has to be further investigated in the coming year.

The FCT also provide some evidence about the ability of the lint cleaners to clean stickiness In the FCT system there is no direct or indirect connection between stickiness testing (tested by signal analysis) and the impurities measurements (tested by image analysis), therefore, these findings are very interesting and unexpected.

Summary

The FCT is a commercial product for almost a year. During the past year, the customers became aware of the commercial potential of the FCT in assisting the cotton community to overcome the "Old" problems of stickiness, by being able to test all bales easily and accurately. The "New" problem of SCF and Neps is also covered by the FCT, by giving the customers the data on the spot and enabling them to act in improving the raw cotton.

It has been proven again that mass testing of the major contaminants is not a theoretical issue anymore, but a reality which can spread rapidly in the years to come.

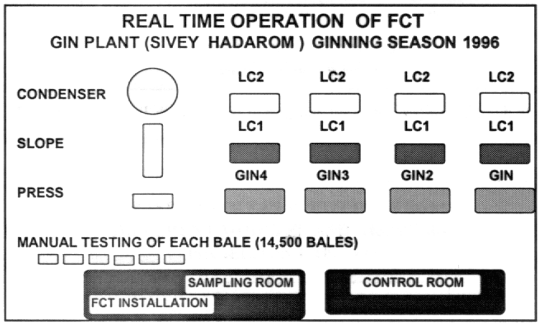

Figure 1: Schematic drawing of the gin site where the real time experiments were conducted.

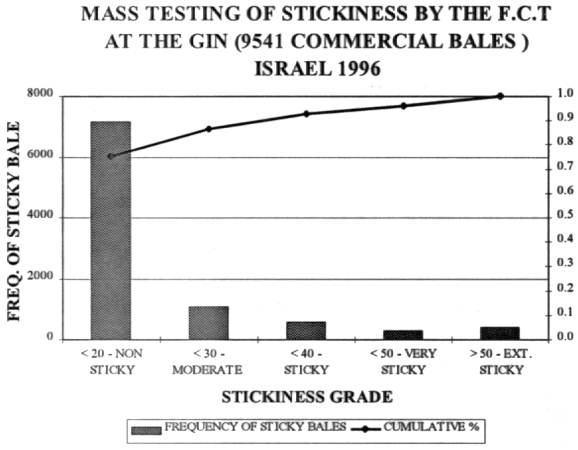

Figure 2: Global distribution histogram for mass testing of stickiness at a gin site.

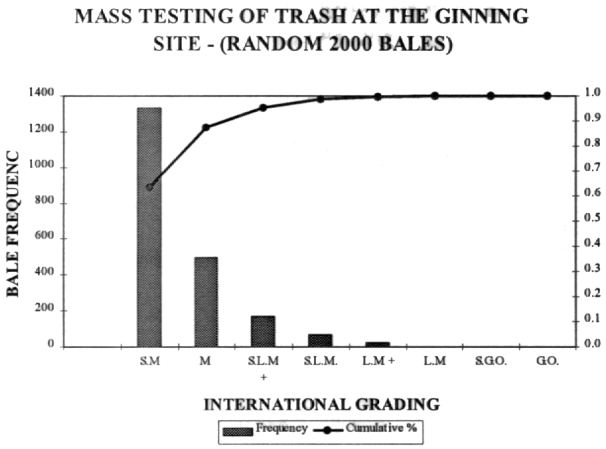

Figure 3: Global distribution histogram for mass testing of trash at a gin site.

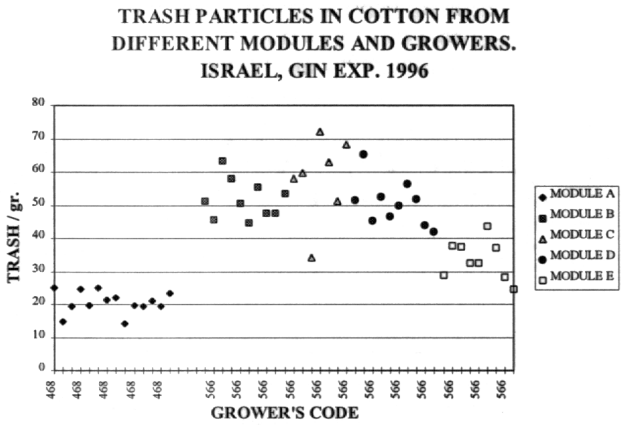

Figure 4: Trash content of individual bales in different modules of two growers.

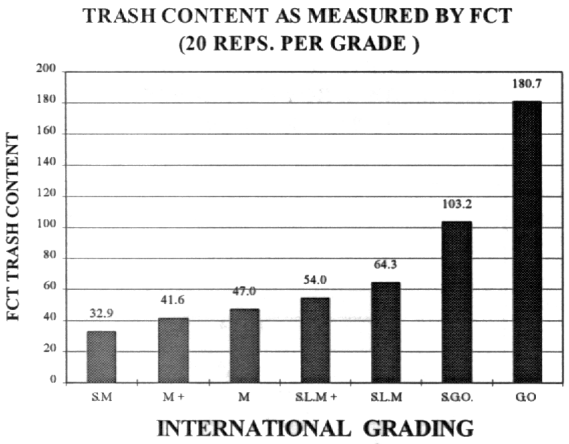

Figure 5: FCT Trash scale for International Trash grading.

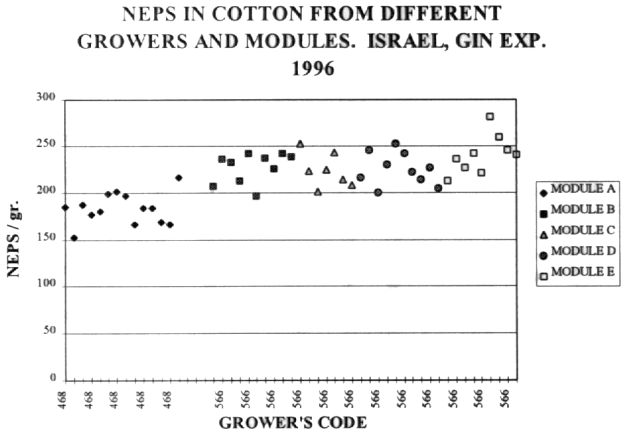

Figure 6: Neps content of individual bales in different modules of two growers.

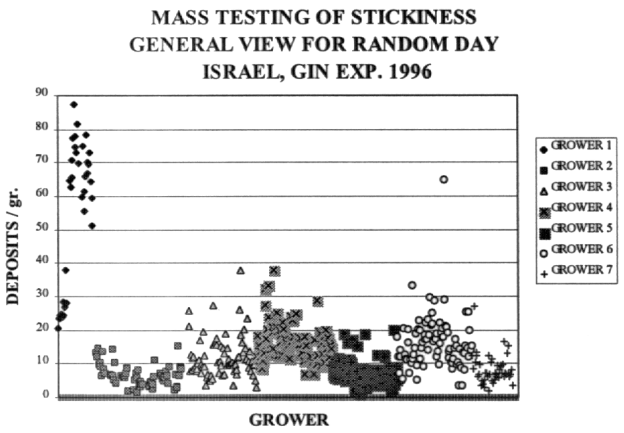

Figure 9: General outlook of stickiness for individual of 8 different growers.

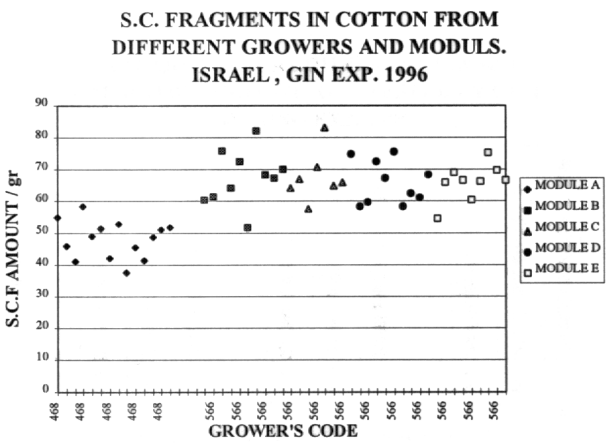

Figure 7: Seed coat content of individual bales in different modules of two growers.

[Figure 8]

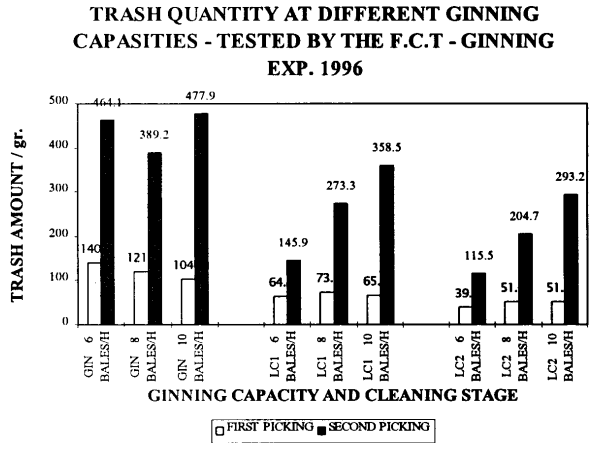

Figure 10: The effect of ginning capacity on Trash content in different cotton.

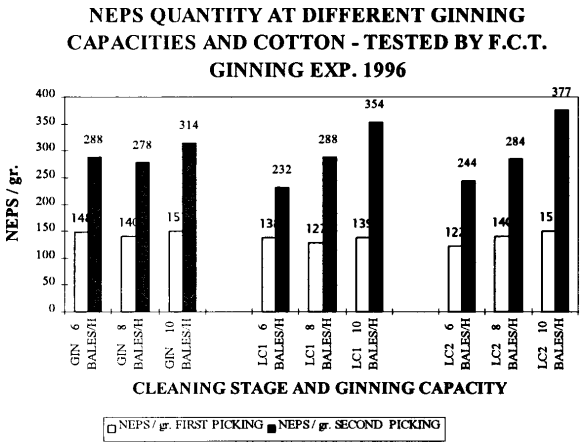

Figure 11: The effect of ginning capacity on Neps content in different cotton.