



Fiber Contamination and Impurities Tester - FCT: A Powerful Tool to Help the Ginner to Optimize Trash, Neps and Seed Coat Fragment Content during Ginning

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ABSTRACT

For many years, solutions have been sought to the problem contaminants of stickiness, seed coat fragments (SCF), neps and trash. The FCT, currently being used in all sectors of the chain, provides a perfect, fast and accurate solution to the measurement of these parameters. The FCT is a new generation of fiber testing systems that is based on thin web and image analysis techniques for impurities and laser techniques to detect stickiness. It is the only current system that can provide all tests together at a cycle time of 40" per test. Looking at the current situation, 60% of the users are spinners, 30% are textile institutions and classing offices and 10% are ginneries.

Introduction

During the last 10 years, cotton quality, as a raw material, has become the major parameter in trying to avoid problems at the spinning mills, since these industries have become, over the last decade, very fast operated and sophisticated. As the cleaning procedure of the cotton, in the spinning mill, is limited, the quality of the raw material remains the most important parameter in maintaining a high level of yarn quality. The open question remains, how the quality control system for cotton will look like during the next decade, in regard to the fast development of technology, communication and computing? This paper expresses the author's view on the important scope of the ginning stage for improving the overall quality of cotton to benefit the cotton producers and the textile industry.

The FCT (Fiber Contamination Tester) of which 16 units have been installed worldwide, (USA, Italy, Switzerland, Greece, Taiwan, Israel, Turkey) is a hi-tech, automatic, computerized machine, aimed for mass testing of cotton contamination. It is based on unique software, fine fiber mechanics, image & signal processing and electro-optic systems, aimed to test faster and more accurately the amount and characteristics of the cotton samples.

The main advantage of the system lies in its capability of rapid detection (testing time - 35 seconds), of contaminated cotton parameters at different stages through the cotton chain, until it finally becomes a qualified yarn. The product's aim is to test the raw cotton, after or during the ginning process, at the cotton classing offices, or prior to the arrival of the cotton at the spinning mill and during processing at the spinning mills.

At present, the FCT is designed to determine both the amount and size for the following contaminants:

- Stickiness - the sticky deposits that can cause major stoppage of spinning mills (Figure 1).
- Neps - (Figure 2).
- Seed-coat fragments -
- Trash - leaf, dust, and pepper trash particles (Figure 2).

The machine distinguishes, optically, between the above mentioned contaminants and impurities and reports its level.

The future use of the FCT at the gin and at the classing office

Ginning, in contrary to the growing of the cotton in the field, is an aggressive mechanical process, which can maintain, as much as possible, the quality of the natural fibers, which arrived from the field, or damage it if the machines are not set well. Every cotton producer and user knows this. Cotton classing systems are different in their organization, but their common interest is the need for objective and agreed testing procedures by both market sides. The question is how high volume testing machinery, like the FCT, can achieve the goal of being fast, statistically reliable, precise, objective, acceptable by both market sides and helping the ginner to control fiber quality during the ginning process, to achieve the maximum return for the cotton. The biggest breakthrough toward this direction came by the easy access to computerized communication.

One of the most important factors in cotton trading is the statistical reliability in cotton sampling at the gin. High volume testing machinery, like the FCT, operating at-line or on-line at the gin level, can test 1-2 repetitions per each bale (cycle time is 35 seconds and a bale is produced in 1-2 minutes – depending on the ginning rate). Such kinds of equipment, which provides the contaminant and impurities amount, and will provide, in the near future, the most important

parameters of fibers properties, can serve the ginner to be able to detect and to control the quality.

The rudiments for these trends already exist, since the spinners, for the first time, became aware of the possibility of receiving the data of the most problematic contaminants and impurities directly from the producer / ginner.

At the buyers side of the market, hence the spinners, Neps, SCF and STICKINESS still remains a major problem that they pay attention to while trading. The ability to do high volume testing of Neps & SCF and Stickiness, by the spinners as well as by the ginner or the merchants, shortens the time in which these parameters will be a part of the classing procedure, and the contracts in cotton marketing.

More spinners became aware of the need and the ability to reduce the amount of Neps and SCF of the raw material. They also became aware of their ability to avoid stickiness stoppage by buying FCT tested cotton or by layout off the purchased cotton into well prepared mixtures based not only on the fiber characteristics but also on Stickiness and Neps information. This situation cannot be expressed better than by the answer of one of the biggest spinners in Italy, and one of the first users of the FCT who said: "from the moment I started using the FCT, I never had any stickiness stoppage in any of my facilities "

The FCT was designed to be able to serve both goals. Since computers and on-line communication are no longer a limitation for computerized equipment, there is no problem in installing the FCT at the gin level and to use the system by the following possible procedures:

- Testing and setting the gin at the beginning and the end of the cotton season.
- Testing the need for the substitution of ginning and lint cleaner's clothing wires during maintenance of the gin prior to the ginning season.
- Setting gin stands and lint cleaners by testing machinery performance during the ginning season.
- Collection of data for every bale and transferring the data automatically to the authorized cotton classing office.
- Changing the ginning procedure by quality parameters in accordance to seed-cotton cleanliness that arrives from the ginned field.
- Using the system at the ginning laboratory for research and development, such as screening of cotton varieties.

Cotton screening for Trash and Neps as tested by the FCT

As the fastest and heavy-duty Nep & Seed Coat Fragments as well as trash and stickiness tester in the

market, the FCT, as mentioned, is able to test every bale in the gin. For proving this fact, 15,000 bales were screened during ginning. Figure 2 below demonstrates the big advantage in using FCT. The amount of Neps and Trash presented by this figure was taken, during the ginning process, at line, from 29 different growers.

Three "profiles" of cotton can be identified:

1. Low trash – high Neps
2. High trash – lower Neps
3. Higher trash – high Neps

A second fact that can be easily identified in this figure is that most of the growers produce relatively clean cotton (low amounts of trash) but contains a relative "stable" amount of Neps, only 5 growers had a problem of high amounts of trash & SCF.

Quality evaluation in the Gin tested by the FCT

Quality evaluation and control executed during ginning is a missing point towards a complete link between the producer and the user of the cotton. In the following section the author will try to explain the importance of this weak point.

The experiment that is described in Figure 3 shows the ability of the FCT to trace technical changes that were explored at the gin to achieve better quality, therefore providing higher income to the grower.

The experiment was designed to check the possibility of reducing the amount of Neps without the need to reduce the ginning rate, or to bring a dramatic increase of the pepper trash content. Three treatments of the ginning rate (6, 8, 10 bales per hour per ginning stand) were examined by using two different levels of cotton cleanliness (first picking and second picking (Figure 3)).

In both cotton types, the FCT has been able to trace accurately the results of the cleaning process with the results showing very big differences in cleaning efficiency. At a level of 6 bales/hour the final trash amount, after the second cleaning was 37 particles/gr. (Strict Middling), while at 10 bales/hour it was raised to 53 particles/gr. (Strict Low Middling). When the trash level was high (cotton from the second picking), at a rate of 6 bales/hour, cotton became commercially acceptable while at 10 bales/hour, it was out of the trash grade scale.

The effect of cleaning is mainly due to the first cleaner. The higher the ginning rate, the lower the efficiency of the cleaners. The same negative effect on Neps producing can be illustrated in Figure 4. 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 picking cotton. This subject will be investigated in the coming year.

In order to ensure maximum consistency of the trash and SCF amount, a comparison was made between a mechanical separation of trash (by the MDTA) and the optical separation by the FCT. Since there is no definition of the pepper trash and the SCF by the MDTA, the data of the FCT is given as the additive amount of Trash and SCF together. The correlation between the two techniques is given in Figure 5.

Summary

Fiber testing and cotton classing, as in other sectors, are dynamic organizations that probably will change itself in accordance to advances in the next decade. As far as trends can be seen today, communication and computers will substitute manual tests and some of the current tests. New sophisticated machines will lead the process of centralization, and globalization of testing and classing and will be a part of the cotton and textile industry. As far as the author believes and tried to explain, the FCT and its future features is a part of this process.

Figure 1. Stickiness grading of cotton from various sources.

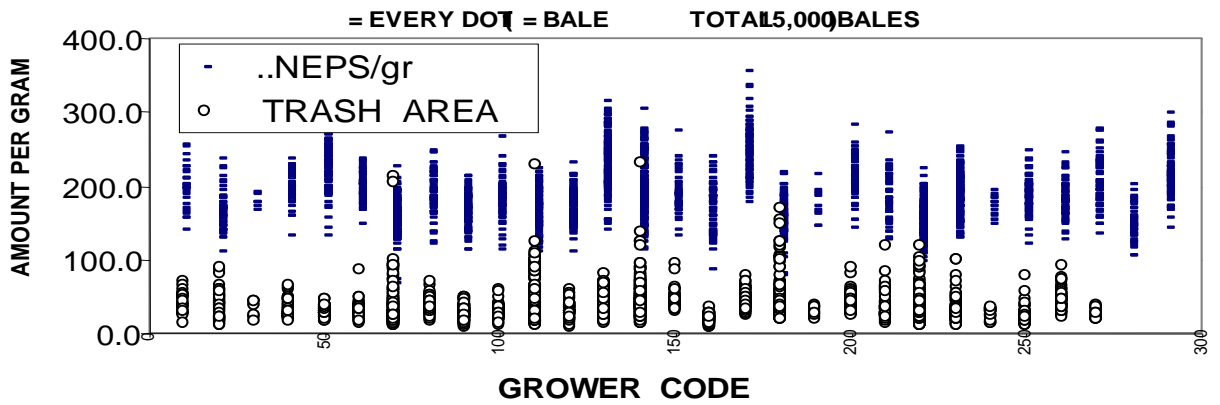


Figure 2. Neps and trash in bales from twenty-nine different growers.

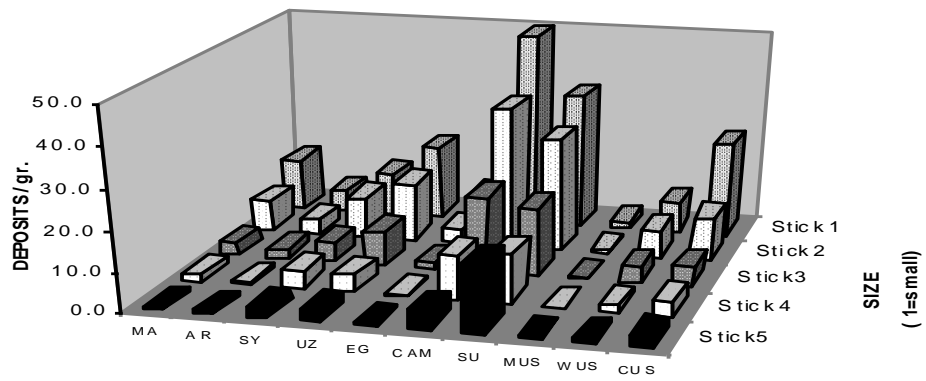


Figure 3. Amount of trash at different ginning capacities.

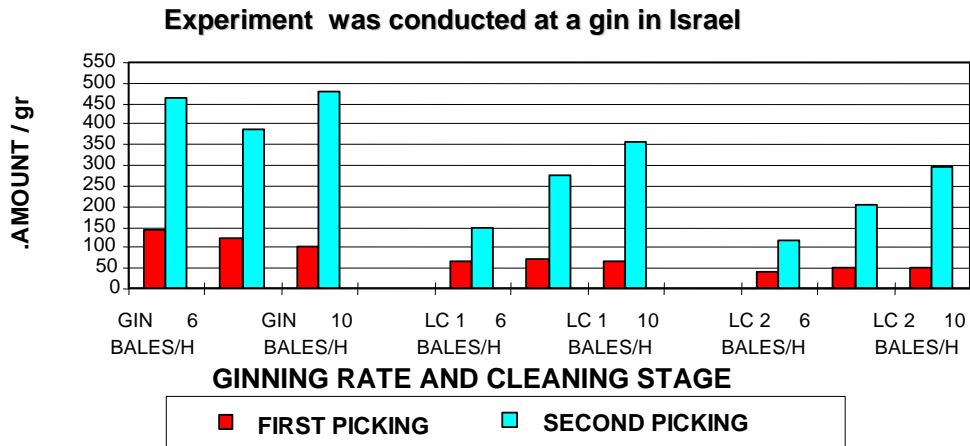


Figure 4. Comparison between different gin stands and their cleaners.

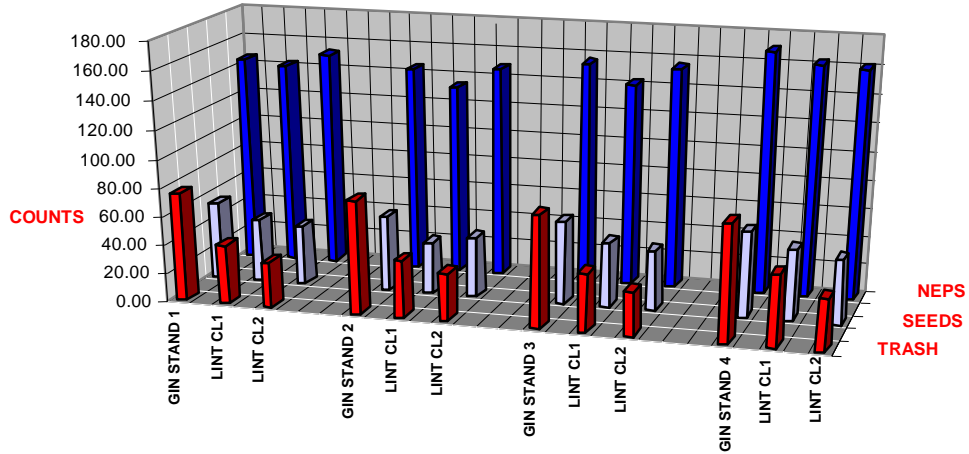


Figure 5. FCT trash vs. Trash percent.

