Quantifying cotton cleanliness:
stickiness and seed coat fragments

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Cotton fibres contain various impurities such as pieces of leaves, stems or seeds. They may also be contaminated by insect honeydew. Although it is easy to remove the stem and leaf fragments, sticky particles and seed coat fragments (SCF) are difficult to extract. These two contaminants remain in the cotton up to the spinning process where they cause production losses. They have now become the main contaminants present in cotton.

Since the spinners are penalized, they become more demanding with regard to cotton cleanliness. Today, these new requirements concern both producers and ginners.

Sticky cottons

Causes and consequences

The stickiness of cottons in the spinning process is primarily due to honeydew produced by aphids and white flies whose honeyed excretions fall onto the fibres as soon as the bolls open (Figure 1). The negative consequences appear during spinning as production losses caused by sticky deposits on the machines, leading to web, sliver and yarn breaks. Yarn quality is also affected by sticky neps (Figure 2).

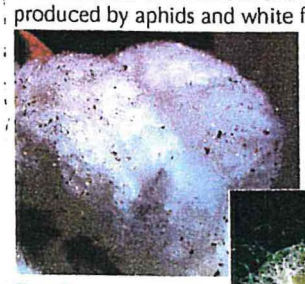

Figure 1. Boll contaminated by insect honeydew. (credit J.L. Chanselme)

Figure 2. Honeydew on a cotton yarn. (credit R. Frydrych, I. Erwin)

Moreover, these stinging-sucking insects cause production losses by attacking the cotton plants early in the growing season. Specific insecticide treatments are then necessary. Productivity losses are also noted during ginning.

Control methods and recommendations

Integrated control methods have been contemplated to reduce this contamination in the field. This combines several practices:
- choice of favourable sewing dates and of appropriate spacing between cottons rows;
use of new varieties with determined growth cycle and low leaf area;
- reasoned use of supplementary chemical treatments (from an infestation threshold) to reduce insect resistance;
- manual or mechanical topping of the cotton plants at the end of their life cycle, or application of defoliants, and early cotton harvest.

Figure 3. The Cirad Sticky Cotton Thermodetector SCT. (credit R. Frydrych)

To reduce stickiness in spinning mills, it is recommended to identify the sticky bales. This requires stickiness measurements using instruments such as the Sticky Cotton Thermodetector (SCT, Figure 3) and the High Speed Stickiness Detector (H2SD, Figure 4). Quantifying the stickiness means that:
- the sticky part of the production in the producing zones can be identified and the non-sticky part sold at a higher price;
- spinners can manage their supplies and prepare cotton bale mixes to reduce average stickiness and thereby decrease disruptions.

Stickiness may also be reduced during spinning by lowering the relative humidity in the premises.

Figure 4. The Cirad High Speed Stickiness Detector H2SD. (credit C. et R. Frydrych)

Seed coat fragments

Causes and consequences

Figure 5. The chalaza torn off the seed (credit B. Bachelier)

SCF are created during ginning when the fibres are separated from the seeds (Figure 5). Some weak parts of the seed, mainly at the chalaza, are separated or broken. SCF often carry fibres or linters, and this makes them difficult to remove during the spinning process. These fragments end up in the yarn and the fabric, and constitute a major source of defects (Figure 6).

This contamination has economic repercussions:
- during ginning, where more intense cleaning operations are required, with the risk of reducing fiber technological characteristics;
- during spinning, by reducing yarn yield and quality;
- during fabric processing, by increasing costs.

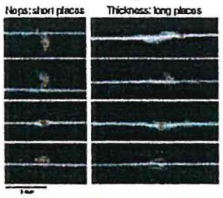

Figure 6. Seed coat fragments in the yarn. (credit M. Krifa)

Control methods and recommendations

The SCF content can be reduced through breeding and technology. Because this character has a significant level level of heritability, a breeding programme led by Cirad was successful in obtaining varieties producing fibres with a low SCF content and showing good agronomical and technological behaviour.

As far as technology is concerned, Cirad developed methods and counting devices such as the Trashcam (Figure 7). These methods are mainly used by researchers to evaluate the negative effects of these fragments on yarn quality (evenness and strength). They show that the higher the quality of the fibres, the more negative the effects of SCF.

Figure 7. Counting seed coat fragments on a web or yarn using the Cirad Trashcam. (credit R. Frydrych)

Conclusion

The results obtained for stickiness and seed coat fragments can today be used in the overall management of these two contaminants: in the field and during processing.

If stickiness persists, it is possible to propose solutions in the field level and reduce its negative effects during spinning.

Seed coat fragments should be well controlled through breeding.

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