PLASTIC FATE IN THE GIN

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Abstract

Plastic contaminants that make it through the ginning process, particularly module wrap, reduce the value of cotton lint and cause problems for textile mills. Reducing the amount of plastic present in the cotton lint is critical to ensure higher quality and prices to the grower. The objectives of this study were to determine the fate of module wrap plastic introduced into seed cotton before ginning and the effect of piece size and plastic thickness on its fate. In each of twelve test runs, four sizes of plastic pieces were used: 25.4 mm x 25.4 mm, 50.8 mm x 50.8 mm, 101.6 mm x 101.6 mm, and 101.6 mm x 304.8 mm. Three thicknesses were also tested by varying the number of wrap layers adhered together: 75 microns (single layer), 150 microns (two layers), and 225 microns (three layers). Multiple plastic pieces of these dimensions were embedded in miniature cotton modules made specifically for the test.

The test was conducted at the microgin in the Texas A&M Department of Biological and Agricultural Engineering. Cotton was processed through a module feeder, dryer (no heat was used), inclined cylinder cleaner, stick machine, impact cleaner, extractor-feeder, 35.6-cm (14-in) wide gin stand, and a single lint cleaner. For each roughly 30-minute test run, a contaminated module was followed by non-contaminated module to simulate the effect that continued operation would have on plastic already introduced into the gin. After each run, a thorough inspection of the gin system was conducted to remove any remaining plastic pieces. Plastic pieces were then separated from seeds and material removed by gin machinery. Plastic remaining in the lint was identified by testing at the Cotton Incorporated Fiber Processing Laboratory, which has a Truetzschler plastic detection system installed. An analysis of variance was performed to determine which sizes and thicknesses were more likely to be removed and which were more likely to cause contamination of the lint cotton.

Smaller plastic pieces were removed by cleaning machines with almost 100% success. For the 25.4-mm square pieces, approximately 35% of the pieces were removed by the inclined cylinder cleaner, with most of the remainder removed by the stick machine, regardless of thickness. A lower percentage, around 10%, of the 50.8-mm square pieces were removed by the inclined cylinder cleaner. However, the remaining plastic was mostly removed by the other seed cotton cleaners, specifically the stick machine and extractor-feeder. The stick machine removed a greater percentage of the triple-layer 50.8 mm pieces compared to single-layer pieces; conversely, more single-layer pieces were removed by the extractor-feeder.

Thickness had a larger effect on removal for the two larger sizes. Large pieces were not removed in the inclined cylinder cleaner, while the stick machine removed more of the pieces with multiple layers. Most of multiple-layer 101.6-mm square pieces were removed by the seed cotton cleaners. However, only around 80% of the single layer 101.6-mm square pieces were removed before the gin stand. Most of this plastic was in the lint, only a small amount was removed with the gin stand motes or by the lint cleaner. Even less of the plastic from the 101.6 mm x 304.8 mm pieces was removed. Removal by the seed cotton cleaners was approximately 10%, 35%, and 45% for single, double, and triple layer plastics, respectively. The gin stand and lint cleaner each removed approximately 10% of the plastic. Plastic pieces generally remained intact until the gin stand, where significant size reduction occurred. Even though the TAMU ginning system incorporated a module feeder, these results are similar to the study conducted by Byler et al. (2013), as pieces were not large enough to wrap on the module feeder dispersing cylinders. Analysis of data on plastic contamination found in the lint is ongoing.

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References

Byler, R.K., J.C. Boykin, and R.G. Hardin, IV. 2013. Removal of plastic sheet material with normal cotton ginning equipment. Proc. Beltwide Cotton Conf., pp. 676-685.