

Visual inspection and plastic removal system for cleaner cotton

■ By Greg Holt, Research Leader, USDA-ARS Cotton Production and Processing Research Unit, Lubbock, Texas

THE removal of plastic contamination in cotton is a top priority to the cotton industry. The issue of plastic contamination can be especially problematic in countries using mechanical harvesters that wrap cylindrical or 'round' seed cotton modules in plastic.

According to the US Department of Agriculture's cotton classing offices, one of the main sources of plastic contamination showing up in marketable cotton bales is plastic from round modules. Despite diligent efforts by cotton gin personnel to remove all plastic encountered during the unwrapping of the seed cotton modules, plastic still finds its way into the cotton gin's processing system.

US economic studies have identified plastic contamination in cotton to be a major contributor to the loss of a \$0.02 (US)/kg premium that US cotton used to command on the international market due to its reputation as one of the cleanest cottons in the world.

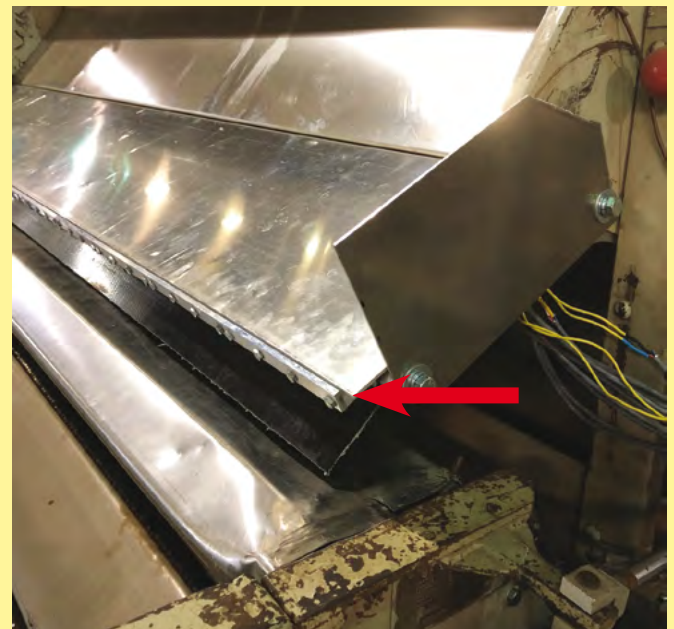
Current data shows US cotton is trading at a \$0.01 (US)/kg discount, relative to the market for a total loss of \$0.034 (US)/kg

with respect to market conditions prior to widespread adoption of plastic wrapped cotton modules. Extrapolating this loss of premium across annual cotton production for a typical year in the US; the cost of this loss to US producers is in excess of \$750 (US) million annually, with cost to a typical producer estimated in

FIGURE 1: (a) Installation of cameras and lighting modules above the feeder apron used in the VIPR (Visual Inspection and Plastic Removal) system



(b) Air knife, at the bottom of the feeder apron, used to create an air blast to eject the detected plastic out of the flow of seed cotton, over the front of the gin stand, onto the floor



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Client feedback:

The drift section was very engaging & interesting. Geoff made the course very enjoyable & thorough – N Dodd.

Great presentation. Good demonstrations. Clear explanations with good examples gained by experience – R Cooper.

Trainer proved to be very well informed in this subject. Great to listen to – G Peters.

Clear, easy to understand. Good material. Great examples. Good props.

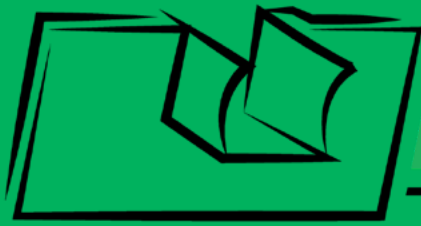
Great presenting – S Rowland.



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FIGURE 2: VIPR system installed on a gin stand at a commercial cotton gin during the 2018–19 ginning season in Meadow, Texas

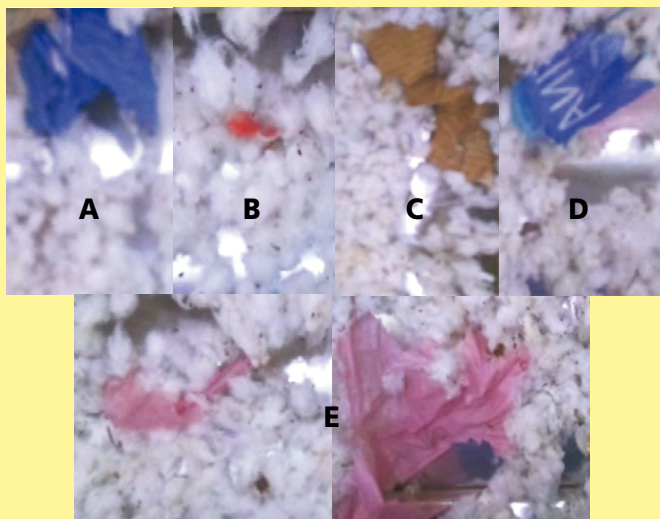


excess of \$100,000 per year. In order to help address this loss and mitigate plastic contamination at the cotton gin, a detection and removal inspection system was developed in a collaborative effort by research engineers at the USDA–ARS’s Cotton Production and Processing Research Unit (CPPRU) in Lubbock, Texas and the Southwestern Cotton Ginning Research Laboratory (SWCGRL), in Las Cruces, New Mexico.

The detection and removal system, known as VIPR (Visual Inspection and Plastic Removal) system, utilises low-cost color cameras, to see plastic on the feeder apron, and an air knife at the bottom of the feeder apron to create a powerful blast of air that ejects the plastic out of the flow of seed cotton, over the front of the gin stand, and onto the floor (Figures 1a and b).

The VIPR system was initially developed and tested at the CPPRU and SWCGRL with a field test on one gin stand at a

FIGURE 3: Some of the images captured by the cameras, above the feeder apron, used in the VIPR system during ginning at a commercial cotton gin during the 2018–19 ginning season in Meadow, Texas. Images are: A blue plastic module wrap, B seed cotton with red module marker paint on cotton, C brown cardboard inside the module, D plastic wrapper from a water bottle, E pink module wrap.



commercial cotton gin in Meadow, Texas during the 2018–19 ginning season (Figure 2). Initial testing showed a detection and ejection efficiency around 50 per cent for yellow and pink wrap, which were the primary colors being targeted in the early stages of development since they comprised 92 per cent of the colored plastic being detected by the US Department of Agriculture’s cotton classing offices. As knowledge and experience gained from the commercial system and laboratory trials grew, new developments boosted system efficiency improvements to 90 per cent.

The processors used in the system can store images of the ‘contaminants’ detected. Some of the items detected at the commercial cotton gin in Meadow, Texas are shown in Figure 3. Included is an image (top left) of seed cotton colored with module marker paint. Even though approved module marker paint is not a contaminant, the system noted the color difference and ejected the seed cotton. We opted to have the system be more aggressive and err on the side of caution by removing all non-cotton items.

During the 2019–20 ginning season, commercial trials at a commercial cotton gin in Surrency, Georgia, all three of the high-capacity gin stands had the VIPR system installed and tested. Replicated efficiency testing of the combined VIPR-FEEDER system, inserting different color and sized plastic pieces into seed cotton prior to the feeder, showed an efficiency of over 90 per cent for all three sizes (50 mm sq., 100 mm sq., 100 x 200 mm) and colors tested (green and yellow).

The VIPR system is currently being manufactured by Bratney Companies, a company specialising in equipment solutions for dry flowable goods, and marketed and serviced, domestically and abroad, by Lummus Corporation, a leading gin manufacturing company, under the same VIPR name.

Research and development associated with contaminant detection and removal continues at CPPRU and SWCGRL with emphasis on developing systems that can detect white and clear plastic as well as other foreign matter such as burs, leaf and sticks. We are also looking at contamination removal systems that are further upstream in the ginning process, prior to the feeder apron, as well as developing systems that could be installed on row units on the harvester.

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This short video shows how the system detects and rejects a contaminant. <https://youtu.be/Zne7RDj3sQY>



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