FIELD EVALUATION UPDATE ON THE VIPR™ SYSTEM – 2020

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Abstract

Since its initial market introduction late in the 2019/20 ginning season, the Lummus VIPR™ (Visual Imaging Plastic Removal) System operated for its first complete season under commercial production conditions. In addition to the original VIPR™ installation in south Georgia (three units), a single VIPR™ unit was evaluated at a commercial gin location on the Texas High Plains during 2020/21 gin season. Results from the commercial validation/evaluation protocol on five colors of plastic module wrap (yellow, pink, blue, and two types of green) from the January/February 2020 testing at the south Georgia site and the fall 2020 evaluation at the Texas site are presented. Additionally, updates as to overall operational performance from all the commercial sites are discussed. The VIPR™ System is the first commercial contamination detection/removal product in the cotton ginning industry, and it is part of the Lummus commitment to address the critical issue of contamination, which continues to challenge the industry.

Introduction

Contamination within seed cotton and lint cotton continues to pose a significant problem within the cotton industry in the USA and around the world. This has manifested itself in a variety of negative effects throughout the marketing chain, whether it is reduced prices for the lint (due to contamination "calls" by the classing office), downtime in textile mills, or production of substandard yarn and fabrics that either cannot be used or result in compromised quality of the finished goods (factory "seconds"). While progress to reduce/minimize contamination is being made, the reality is that much contamination still arrives at the cotton ginning facility and makes its way into the ginning machinery, where it is broken into smaller pieces that can be difficult, if not impossible, to remove.

The VIPR™ System is the first commercial contamination detection/removal product in the ginning industry, resulting from USDA ARS research funded by Cotton Incorporated. The history of the product development and timeline to commercial market introduction, along with the principles of the system's operation were reported by Rutherford and Sweers (2020), including first-season evaluation during the 2019/20 ginning season at Southeastern Gin & Peanut, Inc. in Surrency, Georgia.

This 2020 study was a continuation of the evaluation/testing at Southeastern Gin, including evaluation of the VIPR™ overall performance throughout the 2020/21 ginning season. Additionally, a ginning facility on the Texas High Plains was the site of a second VIPR™ installation and testing.

Materials and Methods

The two sites for the testing reported in this paper were Southeastern Gin & Peanut, Inc. in Surrency, GA (Figure 1) and Spade Co-op Gin, Inc. in Spade, TX (Figure 2). Southeastern Gin has VIPR™ units on all three of its 96" wide Model 700 Feeders, while Spade Co-op had a VIPR™ unit on its #1 Model 700 Feeder.

Figure 1. Southeastern Gin & Peanut, Inc. in Surrency, Georgia.

Figure 2. Spade Co-op Gin, Inc. in Spade, Texas.

TAMA, the manufacturer of round module wrap, provided sheets of five (5) colors of module feeder plastic wraps for use in the 2020 testing. The sample colors were conventional yellow and pink, along with two types of green (non-tacky/opaque and tacky/translucent) and blue (non-tacky). Figure 3 shows the colors used in the study.

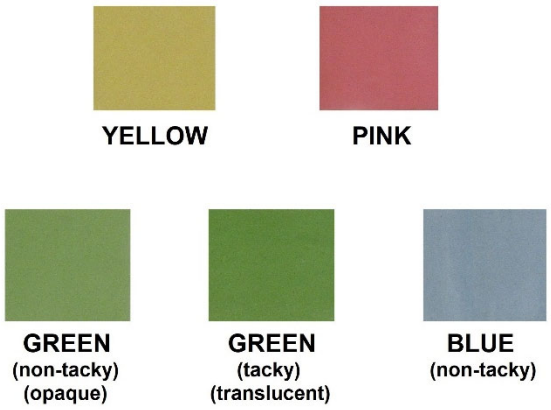

Figure 3. Module wrap colors evaluated in the 2020 VIPR™ Testing.

The 2020 evaluation protocol for both sites was as follows. All module wrap color samples were cut into 2" x 2" squares, three (3) replication per wrap color were performed with eight (8) wrap injections per replication across the Feeder. The test set-up configuration for the machinery at Southeastern Gin and Spade Co-op is shown in Figure 4.

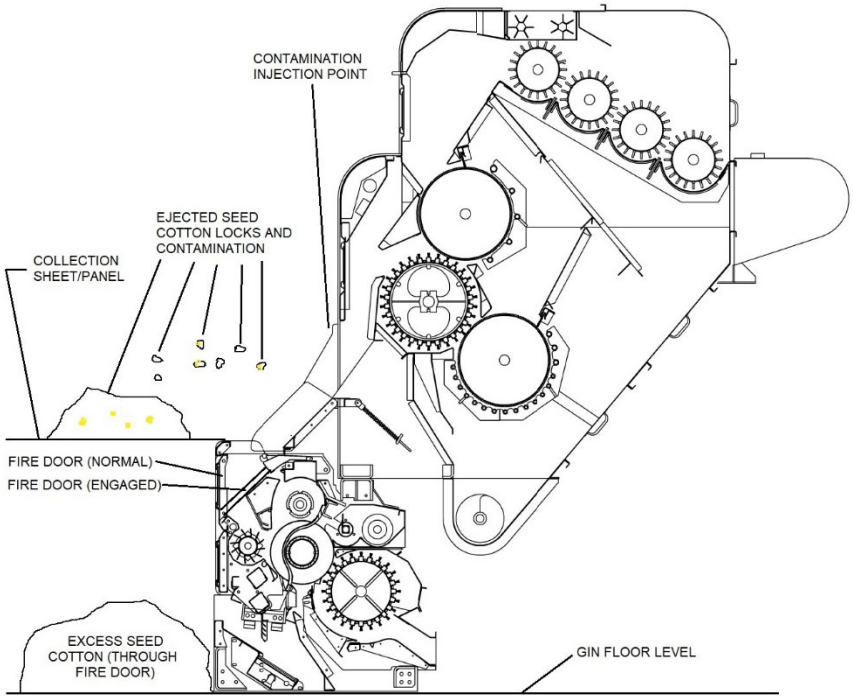

Figure 4. Testing Set-up for VIPR™ Evaluation – 2020.

Each of the lines being tested was isolated, so that the rest of the gin plant could continue commercial operation on the balance of the machinery. On the test line, the fire door on the gin front was engaged, so that the seed cotton and any undetected contamination pieces would fall to the floor, allowing for collection and accounting of the undetected pieces at the end of the replication. A photo of a typical ejection during the testing is shown in Figure 5.

Figure 5. Contamination ejection (circled in yellow) at Spade Co-op Gin.

Results and Discussion

Southeastern Gin & Peanut, Inc.

The results from the testing of all three lines and all colors of wrap from Southeastern Gin are shown in Figure 6.

GIN LINE #1

YELLOW WRAP

Replication	Injected	Captured	
1	8	8	
2	8	8	
3	8	7	
OVERALL	24	23	95.83%

PINK WRAP

Replication	Injected	Captured	
1	8	8	
2	8	8	
3	8	8	
OVERALL	24	24	100.00%

GREEN (non-tacky) WRAP

Replication	Injected	Captured	
1	8	8	
2	8	7	
3	8	6	
OVERALL	24	21	87.50%

GREEN (tacky) WRAP

Replication	Injected	Captured	
1	8	7	
2	8	6	
3	8	7	
OVERALL	24	20	83.33%

BLUE (non-tacky) WRAP

Replication	Injected	Captured	
1	8	6	
2	8	7	
3	8	7	
OVERALL	24	20	83.33%

GIN LINE #2

YELLOW WRAP

Replication	Injected	Captured	
1	8	7	
2	8	6	
3	8	7	
OVERALL	24	20	83.33%

PINK WRAP

Replication	Injected	Captured	
1	8	7	
2	8	6	
3	8	8	
OVERALL	24	21	87.50%

GREEN (non-tacky) WRAP

Replication	Injected	Captured	
1	8	8	
2	8	7	
3	8	8	
OVERALL	24	23	95.83%

GREEN (tacky) WRAP

Replication	Injected	Captured	
1	8	8	
2	8	7	
3	8	6	
OVERALL	24	21	87.50%

BLUE (non-tacky) WRAP

Replication	Injected	Captured	
1	8	8	
2	8	7	
3	8	6	
OVERALL	24	21	87.50%

GIN LINE #3

YELLOW WRAP

Replication	Injected	Captured	
1	8	7	
2	8	8	
3	8	7	
OVERALL	24	22	91.67%

PINK WRAP

Replication	Injected	Captured	
1	8	6	
2	8	7	
3	8	7	
OVERALL	24	20	83.33%

GREEN (non-tacky) WRAP

Replication	Injected	Captured	
1	8	6	
2	8	8	
3	8	7	
OVERALL	24	21	87.50%

GREEN (tacky) WRAP

Replication	Injected	Captured	
1	8	7	
2	8	8	
3	8	7	
OVERALL	24	22	91.67%

BLUE (non-tacky) WRAP

Replication	Injected	Captured	
1	8	8	
2	8	8	
3	8	7	
OVERALL	24	23	95.83%

Figure 6. Test results from Southeastern Gin & Peanut, Inc. – Jan/Feb 2020.

The lowest collection efficiency for any line or color was 83.33%, while in one instance, a 100% collection efficiency was achieved on Gin Line #1 with pink wrap.

The results from all colors (by ginning line) and composite results by wrap color for the testing at Southeastern Gin are presented in Figure 7.

Combined Colors by Gin Line

Line	Injected	Captured	Efficiency
Line 1	120	108	90.00%
Line 2	120	106	88.33%
Line 3	120	108	90.00%
TOTAL	360	322	89.44%

Combined Lines by Wrap Color

Wrap Color	Injected	Captured	Efficiency
Yellow	72	65	90.28%
Pink	72	65	90.28%
Green (non-tacky)	72	65	90.28%
Green (tacky)	72	63	87.50%
Blue (non-tacky)	72	64	88.89%
TOTAL	360	322	89.44%

Figure 7. Composite collection efficiency by gin line and by wrap color at Southeastern Gin – Jan/Feb 2020. Collection efficiency for yellow, pink, and green (non-tacky) were over 90%, and combined (all colors), the overall collection efficiency of the VIPR™ was 89.44%.

Southeastern Gin operated their VIPR™ systems throughout the entire 2020/21 ginning season. Figure 8 shows the various types of contamination that were detected and ejected by the VIPR™ during the processing of 35,000 bales of cotton. While a major rationale for the development of the VIPR™ was to address round module plastic wrap contamination, Figure 8 clearly demonstrates that while module wrap does contribute to some of the contamination, all types and kinds of contamination make their way into the ginning system.

Figure 8. Contamination detected/ejected in 35,000 bales at Southeastern Gin during 2020/21 gin season.

Spade Co-op Gin, Inc.

The results from the testing/evaluation at Spade Co-op Gin in October 2020 are shown in Figure 9.

YELLOW WRAP

Replication	Injected	Captured	
1	8	8	
2	8	8	
3	8	6	
OVERALL	24	22	91.67%

PINK WRAP

Replication	Injected	Captured	
1	8	5	
2	8	6	
3	8	6	
OVERALL	24	17	70.83%

GREEN (non-tacky) WRAP

Replication	Injected	Captured	
1	8	7	
2	8	8	
3	8	7	
OVERALL	24	22	91.67%

GREEN (tacky) WRAP

Replication	Injected	Captured	
1	8	8	
2	8	8	
3	8	8	
OVERALL	24	24	100.00%

BLUE (non-tacky) WRAP

Replication	Injected	Captured	
1	8	7	
2	8	6	
3	8	4	
OVERALL	24	17	70.83%

Combined Colors

Line	Injected	Captured	Efficiency
Line 1	120	102	85.00%

Figure 9. Test results from Spade Co-op Gin, Inc. – October 2020.

While the blue wrap had the lowest detection/ejection efficiency at 70.83%, and the green tacky/translucent wrap had 100% effectiveness, the overall combined color effectiveness was 85.00%, which is better than the baseline desired 75.00% efficiency for the VIPR™.

Observations and Summary

During the two seasons of operation, and especially the commercial operation of the VIPR™ units at Southeastern Gin & Peanut, Inc., a variety of considerations have been brought to the forefront of discussion. Variations in seed

cotton coloration from season to season (and even within a given season) can cause excessive "false positive" seed cotton ejection. These color variations can be caused by weather (high moisture seed cotton, resulting in staining), storage conditions (muddy gin yards), harvesting issues (poor defoliation/high green leaf content), and numerous other reasons. Regardless of the cause, this points to the need to develop pre-configured color recognition calibration profiles for the VIPR™. By doing so, excessive ejections can be minimized, thereby reducing the workload for the gin crew in the cleanup of "falsely" ejected seed cotton.

The variety of round module wrap colors had led to more complexity in detection. While all wrap colors tested in this study were certainly detectable, some can create potential issues. This is especially true for the green wraps. In some cases, green wrap was the most easily detected and ejected of all the shades, and if the cotton is well-defoliated and clean, it could be a good option. However, green is a color that appears in nature, especially in cotton, and in instances where the seed cotton contains excessive green leaf, this could lead to a high level of "false positives" in the detection process. The conventional yellow and pink wraps, along with blue are certainly viable options for the market. Continued development and improvements to the wrap by the manufacturers will help to optimize performance of the wrap for effective module covering/protection, while offering increased detectability by systems like the VIPR™. The work toward development of a round module wrap standard by the American Society of Biological and Agricultural Engineers (ASABE) will only enhance these efforts.

Finally, as with any sophisticated application of technology, cotton ginning facilities that intend to implement a system like the VIPR™ should maintain at least one person on the staff to adjust as necessary to optimize the system throughout the ginning season, as each season's cotton can be different. Open, honest, and constructive feedback from the gin operators to the manufacturers is essential for the continual improvement of these systems, so that the technology can see widespread and successful implementation throughout the cotton ginning industry.

Acknowledgements

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But none of this would be a success without the cooperation of Southeastern Gin and Spade Co-op. To Kent Fountain and Curtis Stewart and your respective staffs, we offer our most sincere thanks for your willingness to work with us on this project and for your leadership in addressing one of the most serious issues we have faced in our industry.

References

Rutherford, R. and G. Sweers. 2020. Field Evaluation of the VIPR™ System. Proceedings Beltwide Cotton Conferences, pp. 575-579.