

MODIFICATIONS TO IMPROVE BUR EXTRACTOR PERFORMANCE

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Abstract

Cotton strippers equipped with field extractors have experienced a high incidence of fires in seed cotton. To help alleviate this problem the lay-down bar on the top saw cylinder of the field extractor has been replaced with a brush. There have been indications that the brush has been effective in reducing these fires, but its effect on cleaning efficiency and seed cotton has not been determined. This study was conducted to determine the effect on cleaning efficiency and seed cotton loss by replacing the lay-down bar on the top saw cylinder with a brush. Total foreign matter increased 11.9% when the brush was used while bur content increased 14.3%, stick content increased 22.6% and fine trash increased 6.2%. Seed cotton removed with foreign matter increased 41.5% when the brush was used. Replacing the lay-down bar with the brush had the greatest effect on sticks and the least effect on fine trash. The largest effect on foreign matter removal by weight was on burs with 32 lb/bale less burs being removed when the brush was used.

Introduction

Field extractors are an effective method for reducing foreign matter in stripper harvested cotton. These extractors reduce ginning costs to the producer and provide significant increases in the amount of cotton stored in modules. Several studies have been conducted to improve the cleaning efficiency of these cleaners. These studies also demonstrated the importance of uniformly feeding the seed cotton onto the saw cylinders. Brashears (1994) developed methods that significantly improved the cleaning efficiency of the field cleaner. Factors other than cleaning efficiency have resulted in modifications of the field extractor. The recent increase in seed cotton fires from harvest to ginning has caused significant losses to the insurance industry. Brashears (1998) reported that the causes of these fires can be related to many factors but a significant number have been traced to machines equipped with field extractors. One problem is the lodging of large foreign particles between the lay-down bar and the saw cylinder or between the grid bars and saw cylinder. Some producers have found that replacing the bar with a brush significantly reduced the incidence of fires. The brushes will flex leaving a wider space above the saw cylinder thus allowing the larger foreign material to pass through without lodging. The

increased use of the brush has raised concerns by some producers as to the potential reduction in cleaning efficiency and seed cotton loss. The objective of the study was to determine the effect on cleaning efficiency and seed cotton loss by replacing the lay-down bar on the top saw cylinder of field extractors with a brush.

Discussion

The lay-down bar on the top saw cylinder is a pressed steel channel made from 8 gauge steel. The channel is 3 in. wide with a 1 1/4 in. flange and is mounted at a 51° angle from horizontal plane, (Fig 1a). The brush is 3 in. long and made from 0.050 in. diameter polypropylene mounted in a bracket that utilizes the same mounting holes as the lay-down bar, (Fig. 1b). The mounting bracket of the brush has 1 hole slotted which allows the pressure of the brush on the saw cylinder to be adjusted. This study was conducted on a John Deere field extractor set up in the laboratory. The field extractor is fed by a continuous belt 12 in. wide and 20 ft long. A 17 lb sample of seed cotton is uniformly spread on a 17 ft belt length. The seed cotton is fed at a rate of 381 lb/min or 76 lb/min/ft which is equivalent to harvesting cotton yielding 1.5 bale/a with a 4-row stripper operating at 4.5 mph. After each test run the clean seed cotton and foreign matter is collected and weighed. Three 200 gram samples of seed cotton are collected prior to cleaning along with three 200 gram samples of seed cotton after cleaning by the field extractor. These samples were fractionated to determine bur, stick, fine trash and seed cotton content. Three samples were also collected from the extracted foreign matter and any seed cotton that was separated with the foreign matter was weighed. The cotton variety used in the study was Paymaster HS26. Each treatment was replicated 5 times. Comparative studies were also conducted using the conventional lay-down bar instead of the brush.

The seed cotton fractionation expressed in lbs/bale of lint is shown in Table 1. The total foreign matter in the seed cotton prior to cleaning by the field extractor was 605 lbs/bale. After cleaning by the field extractor there was 270 lbs of foreign matter per bale in the seed cotton using the lay-down bar compared to 301 lbs of foreign matter using the brush. This resulted in a 55.4% cleaning efficiency for the bar and a 50.1% cleaning efficiency for the brush. This indicates that the field extractor will remove approximately 18% less foreign matter when the brush is used in place of the bar. Total amount of burs in the seed cotton before cleaning was 364 lbs/bale while total burs after cleaning was 126 lbs/bale and 144 lbs/bale for the bar and brush, respectively. The bar removed 65.4% of the burs while 60.4% of the burs were removed by the brush. The stick content of the seed cotton prior to cleaning was 83 lbs/bale while the stick content after cleaning was 31 lb/bale for the bar and 38 lb/bale for the brush indicating that 62.7% of the sticks were removed when the bar was used compared to 60.4% when the brush was used. The bar removed 22.6%

more sticks than the brush. The cleaning efficiency for the bar for sticks was 62.7% while the brush had only a 54.2% cleaning efficiency. Fine trash in seed cotton prior to cleaning was 158 lbs/bale. Before replacing the bar, there was 113 lbs/bale of fine trash in the seed cotton but 120 lbs/bale of fine trash in the seed cotton when the brush was used resulting in a 6.2% increase in fine trash due to the brush. The cleaning efficiency of burs by the bar was 28.5% and 24.1% for the brush. The much lower cleaning efficiency for the fine trash is to be expected since it is the most troublesome to remove by seed cotton cleaning equipment whether the cleaner is used in the field or the gin. The change from the bar to the brush had the largest effect on stick separation with 22.6% less sticks being removed; the use of the brush had the least effect on fine trash removal with 6.2% less fine trash being removed. The largest effect of the brush in terms of weight change was shown in bur removal where 32 lbs/bale less burs were removed.

Seed cotton removed along with the foreign matter by the field extractor was 21.4 lbs/bale or 7.3 lbs/bale of lint for the bar and 34.1 lbs/bale or 11.6 lbs/bale of lint for the brush, (Fig. 2). This resulted in 1.5% of the seed cotton removed using the bar and 2.4% for the brush.

Summary

This study indicates that significantly less total foreign material is removed when the brush is used. Total foreign matter increased 11.9% when the brush was used while bur content increased 14.3%. Stick content increased 22.6% and fine trash increased 6.2% using the brush. Seed cotton removed with foreign matter increased 41.5% when the brush was used. Replacing the lay-down bar with the brush had the greatest effect on sticks and the least affect on fine trash where 22.6% less sticks were removed by the brush and 6.2% less fine trash were removed respectively. The largest effect on foreign matter removal by weight was on burs where 32 lb/bale less burs were removed when the brush was used. Although there are reports of significant reduction in seed cotton fires, the trade off has resulted in increased seed cotton loss and less foreign matter being removed by the field extractor. Continued use of the brush will necessitate improved design or mounting to maintain the cleaning efficiency and seed cotton loss compared to that obtained when the lay-down bar is used.

Disclaimer

Mention of a trade name, propriety product or specific equipment does not constitute a guarantee of warranty by the U.S. Department of Agriculture and does not imply approval of a product to the exclusion of others that may be suitable.

Acknowledgments

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References

1. Brashears, A.D. and Baker, R.V. 1994. Effect of field cleaner adjustments on efficiency. ASAE paper no. 94-1013. Kansas City, MO.
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Table 1. Foreign matter content of seed cotton before and after cleaning.

Seed Cotton Sample	Foreign Matter Fraction			
	Total	Burs	Sticks	Trash
Before Cleaning lb/bale	605	364	83	158
After Cleaning, lb/bale				
Bar	270 b ¹	126 b	31 b	113 b
Brush	302 a	144 a	38 a	120 a
Increase due to brush, %	11.9	14.3	22.6	6.2
Cleaning Efficiency, %				
Bar	55.4	65.4	62.7	28.5
Brush	50.1	60.4	54.2	24.1

¹Means within data column for seed cotton after cleaning followed by the same letter are not significantly different at the 10% level of DMRT.

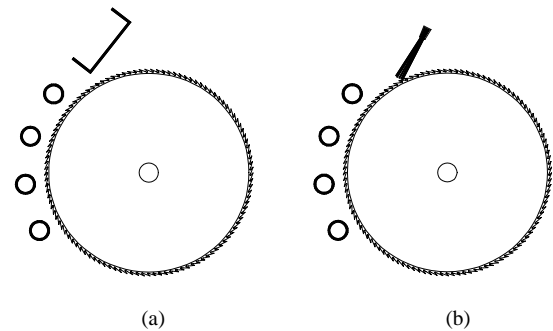


Figure 1. Saw cylinder with (a) bar and saw cylinder with (b) brush.

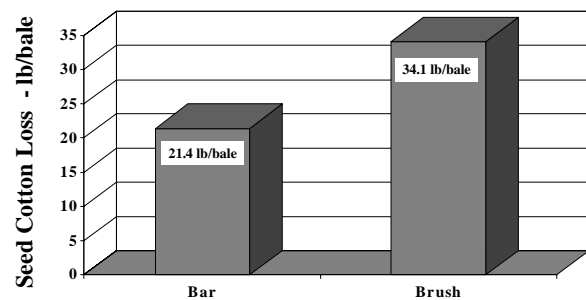


Figure 2. Seed cotton loss for bar and brush.