PRELIMINARY THERMAL DEFOLIATION TRIALS

P. A. Funk, B. E. Lewis and S. E. Hughs
USDA ARS
Southwestern Cotton Ginning Research Laboratory
Mesilla Park, NM

Abstract

Cotton defoliation is practiced for a variety of reasons including late season insect control and crop termination. In sensitive areas defoliation by conventional means may not be desirable. This study attempted to adopt a dry steam defoliation device designed for viniculture to cotton. Desiccation was successful, but leaf drop was minimal. No statistically significant difference in trash content or fiber properties was found. Seed germination was reduced 3 percent. HVI color improved slightly. More research is required before any conclusions can be drawn.

Introduction

Fiber quality can be improved by employing defoliation where green stain streaking and trash content would otherwise be problems, such as in regions where UNR or dry farming necessitate stripper harvesting. In certain very limited growing areas immediately adjacent to urban populations or special ecological zones, or in organic production, alternatives to chemical defoliation are sought. While waiting for a killing frost has traditionally been employed, in some growth areas changing weather patterns make this method increasingly unreliable. High temperatures are as effective as a frost. Defoliation of cotton by thermal energy was first attempted as early as 1963 (Kent and Potterfield, 1967). This present experiment used dry steam instead of hot air. As a preliminary investigation, the primary questions addressed in this study were, "Does it work," and "Does it change the cotton?"

Objectives

The overall goal is to develop an alternative defoliation method for sensitive areas and organic production. The objective of this study was to qualify a system adopted from another application and quantify differences in the end product.

Materials and Methods

Four-row strips of an early maturing Upland variety were planted on an irrigated field adjacent to the Rio Grande River with three skip-rows between each strip. The skip rows provided a passageway for equipment. Normal cultural practices for the Mesilla Valley were followed. Boll weevil eradication required several treatments with Baythroid. Insecticide for pink bollworms and growth regulators were also applied.

Agricultural Industrial Manufacturing, Inc. loaned a diesel-fired steam generator to the project. Designed to defoliate the lower part of grape vines, the steam generator came mounted on a trailer. It was a self-contained system with an electric generator to power its feed water pumps and controls. The steam generator produced superheated dry steam. The set point during the trial was 750 F (400 C), at approximately 400 pounds per hour. The vineyard nozzle was bypassed, and the steam went to nozzles at the bottom of either side of a one-row crop shroud. A special toolbar was fabricated to carry the crop shroud. Hydraulic cylinders moved the shroud from the inner to the outer row and back, and lifted it above the crop canopy for turning (Figure 1).

The original experiment design called for replicates of two levels of thermal treatment and a control treatment with chemical defoliants. Unfortunately, crop maturity, weather, and equipment availability conspired against a complete trial. Several rows were defoliated thermally and the rest of the field was picked green. Defoliation at various levels was accomplished by varying crop contact time while steam rate remained constant.

The following analyses were performed or will be completed soon: 1) field inspection, 2) wagon sample fractionation, 3) ginning machinery trash quantification, 4) Shirley method trash analysis (Shepherd, J. V. 1972), 5) seed germination and 6) HVI classing.

Results

Field results were disappointing. While brown leaves (desiccation) appeared after two days on thermally treated rows, there was very little leaf drop (defoliation). Consequently there was no statistical difference in trash content as determined by wagon sample fractionation and gin machinery catch. Shirley method fractionation has not been completed yet. The New Mexico Department of Agriculture State Seed Laboratory performed seed germination tests to determine the impact exposure to heat might have. After twelve days (the standard germination test) the difference between the control and treatment was small, but statistically significant. Seventy-eight percent of the seeds exposed to heat germinated, compared to eighty-one percent for the control. There was also a slight difference in HVI color. Both the treatment and the control were white strict middling, but steam defoliated cotton was whiter, averaging 21-1, compared to untreated cotton at 21-3. There was no measure made of green stain. However, with the steam treatment turning all the leaves brown, we expect it was less.

Conclusions

Thermal defoliation by dry steam appears to cause no harm to the cotton. Unfortunately, its effectiveness at dropping leaves has not been demonstrated. More tests are planned using other methods. Insect mortality will also be quantified next season.

References

Kent, James D. and Jay G. Potterfield. 1967. Thermal defoliation of cotton. Transactions of the ASAE 10:1 (24-27).

Shepherd, J. V. 1972. Standard procedures for foreign matter and moisture analytical tests used in cotton ginning research. US Government Printing Office, Washington, DC. Stock No. 0100-1509.

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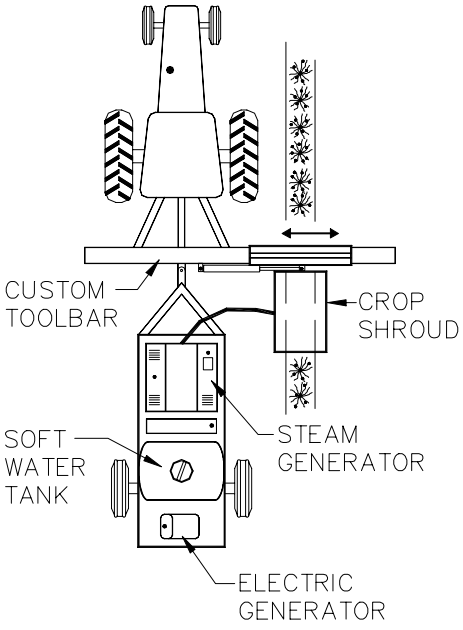

Figure 1. Apparatus used in the first thermal defoliation experiment. The crop shroud can move to the right to cover an adjacent row.