Propane-Fueled Cotton Defoliation

Timely harvesting with improved leaf kill and insect control

To ensure an efficient harvest, cotton growers must defoliate their plants, removing the green leaves that hamper harvesting efforts. Leaves hide valuable cotton fibers from harvesting machines, lowering crop yield. Leaf sap can adhere to picker spindles, increasing downtime. It can also stain cotton fibers, lowering the price grade of the cotton.

While cotton growers traditionally have used chemicals to defoliate plants, chemicals are difficult to apply in wet or windy weather, and their use must be scheduled 10 to 14 days in advance. Good farming practices and environmental regulations also restrict the use of chemicals near urban areas and sensitive crops.

Advances in thermal defoliation with propane are creating a new option for farmers looking to effectively remove leaves for a more timely harvest. This technology increases efficiency while reducing insect populations and fiber degradation. It is of particular interest to organic growers (who cannot use harvest-aid chemicals) but may also offer benefits to conventional growers.

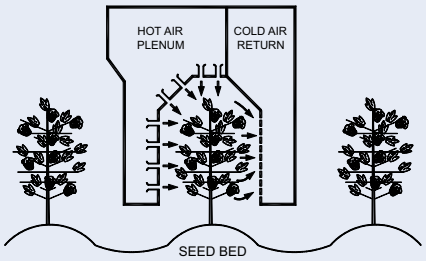
Propane-fueled cotton defoliation may be a key avenue for increasing the annual volume of off-peak propane sales. If just two percent of the U.S. cotton crop were defoliated by propane-fueled machines, late-summer propane consumption would increase by 7 to 10 million gallons each year.

Convection Speeds Defoliation

The greatest challenge in thermally defoliating cotton is working quickly without scorching the crop.

A new propane defoliator improves on slow-moving designs that relied on still air for radiant heat transfer.

The new defoliator propels a stream of moving air, heated to 380°F (193°C), through the cotton canopy. The moving air more efficiently transfers heat to kill the leaves while preserving the cotton. The design includes a return air path that boosts air penetration while reducing fuel consumption.



Project Goals and Description

To realize this opportunity, the Propane Education & Research Council initiated a research effort, *Harvest Preparation Demonstrations and Tests Using Prototype Thermal Defoliator* (**Docket 11729**), and *Cotton Defoliation* (**Docket 11416**), to field-test a two-row and a larger, commercial thermal defoliator in eight demonstrations in four states. The project's goal is to increase the efficiency of the thermal defoliation process to offer growers a more profitable alternative to using chemical defoliation methods. The project builds on previous research, supported by **Dockets 10746** and **11038**, to determine the effects of thermal defoliation on cotton physiology, yield, and fiber value.

USDA-ARS photo by P. Funk.

Propane Defoliation System

The two-row prototype defoliator is a self-propelled machine that incorporates a steering and power platform, which includes a six-cylinder gasoline engine that has been converted to burn propane fuel.

The defoliation apparatus, which hangs below the platform, includes crop dividers, treatment tunnels, two fans, a burner, and distribution and return air duct work. A 30 hp (22.4 kW) motor turns the fans, which supply air to the propane burner. The burner heats the air to 380°F (193°C) and forces it through the cotton plants.

Key Results

In 2004 and 2005, a two-row propane defoliator was tested in eight fields at six locations.

The machine successfully defoliated seven cultivars grown in four climate zones. Thermal treatment prepared cotton for harvest 24 hours after application, without damaging fiber or yarn properties, and was slightly more effective in clay soil than in light sandy soil.

Key Benefits

Propane-fueled thermal defoliation offers major benefits over chemical treatments:

- **Speed**. Thermally defoliated crops may be harvested 24 hours after treatment.
- **Effectiveness**. Thermal defoliation works in a single application in all weather conditions.
- **Insect control.** Thermal defoliation provides immediate and continuous suppression of aphid and silverleaf whitefly populations.
- **Cost.** The cost of propane is equivalent to that of defoliation chemicals, with potentially lower environmental risk.

As compared to standard chemical treatments, thermal defoliation produced greater leaf kill and drier, more crumbly leaves. Thermal defoliation also suppressed aphid and silverleaf whitefly populations.

Looking Ahead: Testing in 2006

Agricultural Industrial Manufacturing will develop and test the larger commercial machine in 2006. Researchers from various centers within the USDA's Agricultural Research Service, University of California, Clemson University, and New Mexico State University will take post-harvest processing measurements.

The tests will pursue the following objectives:

- Assess the economics of applying propane-fueled thermal defoliation to commercial-scale cotton and chile harvesting.
- Explore the profitability of thermal defoliation in conventional and organic farming.
- Measure the efficacy of thermal defoliation in terms of cotton and chile crops' physiological response, insect mortality, insect sugar stickiness, crop yield, and fiber properties.

January 2006

For More Information:

Propane Education & Research Council
Mark Leitman
Director of Agriculture Programs
1140 Connecticut Avenue
Suite 1075
Washington, DC 20036
202-452-8975

www.propanecouncil.org
www.agpropane.com
www.usepropane.com

Project Partner:

USDA Agricultural Research Service,
Southwest Cotton Ginning Research Laboratory
Dr. Paul Funk
Agricultural Engineer
300 East College Drive, P.O. Box 578
Mesilla Park, NM 88047
pfunk@nmsu.edu

University of California Shafter Research Center, Shafter, CA
New Mexico State University, Plant Science Research Center, Las Cruces, NM
Clemson University, Clemson, SC