Evaluation of Thermosanitation for Control of Cotton Boll Rot

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ABSTRACT

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Destruction of plant debris beneath cotton plants by flames from a hand-held or tractor-mounted burner significantly reduced boll rot and increased cotton yields. Inoculum of boll-rotting *Fusarium* spp. decreased as a result of flame treatment.

Boll rot of cotton (*Gossypium hirsutum* L.) is a destructive problem in warm, rainy areas. The disease is caused by many fungi and bacteria, predominantly *Diplodia gossypina* Cke. and *Fusarium* spp. in Louisiana (2).

Plant debris (flowers, bolls, and squares) shed during the growing season serves as a substrate for the growth of fungi, particularly *Fusarium* spp. (4). Inoculum levels rise as the amount of debris on the soil surface increases. Spores are carried primarily by air currents to lower bolls where rot is initiated.

We attempted to determine if boll rot could be controlled by flaming infested plant debris on the soil surface to destroy or reduce fungal inoculum.

MATERIALS AND METHODS

1977 studies. A field of cv. Stoneville 213 cotton at Pride, LA, was divided into 16 plots, each 14 rows wide and 12 m long, for a paired comparison test. In eight plots, the current season plant debris was flamed three times (on 23 July, 1 August, and 10 August) with a hand-held, kerosene-fueled sprayer (Chapin Flame Sprayer, Batavia, NY). The check plots were not flamed. The percent boll rot (1) in each plot was determined on 28 October. Four 3-m sections from the inside two rows of each plot were hand-harvested to determine yield of seed cotton.

1978 studies. Flame heads from a flame cultivator (Afco Flame Cultivator Co., Little Rock, AR) were attached to the five drops of a herbicide boom on a high-boy spray tractor. Flame heads were directed toward the rear of the tractor, 15 degrees from horizontal (Fig. 1). Each flame head

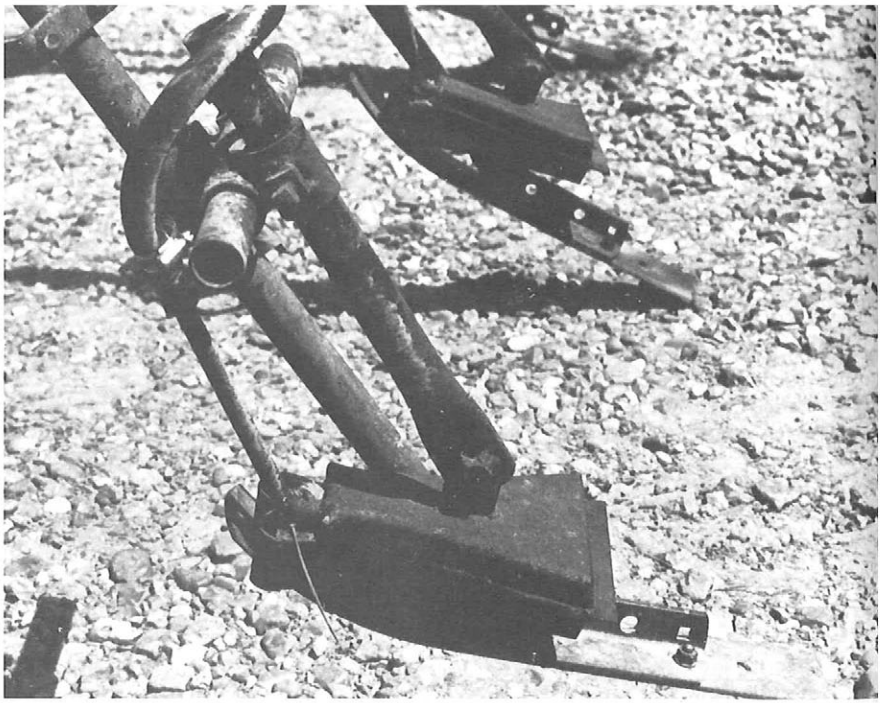

Fig. 1. Flame head for thermosanitation attached to drop of herbicide boom.

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was connected by flexible hose to a manifold, which was connected to a 21-L tank of butane. The tractor was operated at 3.2 km/hr with the lower edge of the flame heads 20 cm from the soil surface and centered between rows. The flame heads produced a visible 25 × 50 × 10 cm flame.

The test was conducted on a 1.5-ha field of Stoneville 213 cotton divided into 16 randomized blocks containing four treatments: the untreated control; one flaming (3 August); two flamings (28 July and 10 August); and three flamings (28 July, 3 August, and 10 August). Percent boll rot was determined on 11 October. The inside two rows of each plot were harvested with a one-row spindle picker to determine yield.

Effect of treatment on inoculum. On 5 August and 12 August (about 48 hr after treatment), 100 obviously infested flowers were collected from the soil surface in each plot, placed in a plastic bag, and stored at −4 C until spores could be identified. To each bag was added 100 ml of sterile water containing 1 drop of Tween 20. The bags were shaken vigorously for 30 sec to dislodge spores from the flowers. The average number of macroconidia of *Fusarium* spp. on each flower was determined (5) by direct microscopic observation of flower washings. *Fusarium* was selected as the test organism because of its boll-rotting ability, production of large numbers of conidia on shed debris, and ease of identification.

Table 1. Effects of flame treatments on boll rot and yield of seed cotton

Flame treatments (no.)	Boll rot[a] (%)	Yield[a] (kg/ha)
Pride, LA (1977)		
3	35.2**	1,546**
0 (check)	59.4	869
Alexandria, LA (1978)		
1	17.8**	2,353
2	17.7**	2,584*
3	20.6**	2,575*
0 (check)	34.1	2,174

[a] ** = significant at $P = 0.01$; * = significant at $P = 0.05$.

RESULTS AND DISCUSSION

Flame treatments reduced the percentage of boll rot in all field trials compared to check plots (Table 1). Yield of seed cotton was higher in plots receiving two or three flame treatments, but was not significantly increased in plots treated only once.

Flame treatments reduced the numbers of macroconidia of *Fusarium* spp. on shed flowers (Table 2). Spore populations were lowest after the third flame treatment. The hand-held, kerosene-fueled burner destroyed the debris more efficiently than the tractor-mounted apparatus because the kerosene burner could be held in position as long as needed to completely burn the debris. However, the butane burner produced a much hotter flame.

These studies indicate that attacking the boll-rotting organisms sporulating on shed plant debris may reduce boll rot. Applications of any control procedure directed at the boll-rotting organisms on shed plant debris must be timed appropriately (3). Applications should begin after flowers begin to accumulate on the soil surface.

Table 2. Effects of flame treatments on numbers of macroconidia of *Fusarium* on shed flowers in tests at Alexandria, LA, 1978

Flame treatments (no.)	Date of application	Number of macroconidia (× 10^3) per flower[a]	
		August 5	August 12
1	8/3	597.0**	521.5**
2	7/28, 8/10	473.0**	381.5**
3	7/28, 8/3, 8/10	439.5**	295.0**
0 (check)		1,125.5	1,384.5

[a] ** = significant at $P = 0.01$.

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