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PRE-CONDITIONING EFFECTS ON BOLL OPENING, DEFOLIATION, FIBER QUALITY, AND YIELD

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Abstract

In 2002, a field study was conducted on the Glenn Emshoff farm (Wharton County) located in the Texas Upper Gulf Coast region. This study was implemented to evaluate the application of low rates of defoliants prior to conventional practices and their impact on boll opening, defoliation, yield, and fiber quality. Four pre-conditioning treatments were applied at 650 heat units (HU) accumulated from cutout (NAWF=5) followed by a defoliation treatment at either 850, 950, or 1050 HU. Percent open bolls for the 650, 850, 950, and 1050 accumulated heat units were 10.66%, 54.85%, 70.15%, and 79.94%, respectively. Pre-conditioning treatments consisted of low rates of Prep, Dropp, Harvade, and Aim. All treatments were followed with a defoliation application that consisted of a tank-mix of Dropp and Def. Pre-conditioning treatments did not hasten boll opening or the number of days to harvest was not accelerated. Percent defoliation for 850 HU accumulated was less when compared to 950 and 1050 HU accumulated; however, defoliation was more than acceptable and did not reduce harvest efficiency or quality grades. At harvest, percent defoliation for the pre-conditioning treatments were not superior to the treatment that was not pre-conditioned (untreated check); therefore, no advantage was gained by preparing the field for defoliation and harvest. Yield was not reduced by initiating defoliation at 850 HU accumulated (55% open boll) compared to 950 HU accumulated (70% open boll) and 1050 HU accumulated (80% open boll). Three of the pre-conditioning treatments (Aim, Dropp, and Harvade) significantly reduced yields and micronaire values.

Introduction

Defoliation timing is an issue that is very important to cotton producers located along the Texas Upper Gulf Coast and can have a significant impact on the 250,000 acres that is planted annually in the seven counties that encompass this region. High amounts of rainfall from tropical storms and hurricanes can lower yield and fiber quality. In some years, discounts are received from high micronaire values from as much as 35% of the crop that is produced from the region. Whitwell et al., (1987) found that terminating the crop prior to 60 percent open boll may decrease yield and adversely affect fiber quality. Applications of harvest-aid materials reduced yields and lowered micronaire if applied at 20 and 40 percent open bolls (Snipes and Baskins, 1994). Stringer et al. (1989) found that yields and micronaire values were reduced with crop termination earlier than 750 or 850 HU accumulations after cutout. The objective of this study was to evaluate low rates of defoliants prior to conventional practices and their impact on boll opening, defoliation, fiber quality, and yield.

Materials/Methods

A field study was conducted at the Glenn Emshoff farm located in Wharton County during the 2002 season. DPL 20B was planted at 60,000 seed/acre on the 29 of March into a Lake Charles Clay. Four pre-conditioning treatments were applied at 650 HU accumulated from cutout (NAWF=5) followed by a defoliation treatment at either 850, 950, or 1050 HU. An upper limit threshold of 95°F was used in calculating daily heat units. The field study was arranged as a split-plot design, with the whole plot being the heat unit accumulations and sub-plot being the pre-conditioning treatments. Treatments were replicated four times and plots sizes were four rows (40-inch centers) by thirty feet. Pre-conditioning treatments consisted of Prep 6EC (4 oz/A), Aim 2EC (.33 oz/A), Dropp 50WP (.02 lbs/A), and Harvade 5F (8.16 oz/A). All treatments were defoliated with a tank-mix of Dropp 50WP (0.1 lb/A) and Def 6EC (6 oz/A) and machine picked 10 days after application. Pre-conditioning and defoliation treatments were applied with a Lee Spyder sprayer and harvested with a IH 422 two-row cotton picker, which was modified, to harvest small research plots.

Treatments effects were assessed by determining percent open boll counts from plant mapping data at pre-conditioning, defoliation, and at harvest. Defoliation ratings were recorded three and eight days following pre-conditioning treatments and five and ten days after the harvest defoliation application. Top and basal regrowth ratings were determined fourteen and twenty-one days after the harvest defoliation application. To determine lint yield, seed cotton was processed by using a 10-saw small plot gin. Fiber quality measurements were determined by sending samples to the International Textile Center at Lubbock, Tx. Statistical analysis used was the general linear model in SAS and means were separated using Fisher's Protected LSD at the 5% significant level for defoliation ratings, regrowth ratings, yield, and fiber quality. Percent open boll counts were separated at the 10% significant level.

Results

No differences were observed in percent open bolls when the pre-conditioning treatments were initiated at 650 HU accumulated (Table 1). Furthermore, there was no accumulated heat unit by treatment interaction, meaning that all three accumulated heat units exhibited the same response to all treatments. Percent open boll counts were significantly different at defoliation and harvest for the 850, 950, and 1050 HU accumulations. However, no differences were observed in percent open bolls at defoliation and harvest for the five pre-conditioning treatments (Table 2, 3).

Following the initial pre-conditioning treatments at 650 HU accumulated, percent defoliation was significantly higher for Harvade at three and eight days after treatment (Table 4). Five days after treatment, percent defoliation was significantly less for 850 HU accumulated versus 950 and 1050 HU accumulated. Percent defoliation was significantly higher for the pre-conditioning treatments Harvade and Dropp compared to Prep and the untreated check. However, there were no significant differences in percent defoliation between the Harvade, Dropp, and Aim treatments (Table 5). Differences in top and basal regrowth ratings were not observed 14 and 21 days after defoliation with the exception of basal regrowth being significantly less for Harvade after 21 days.

No differences were observed in lint yield and micronaire when comparing the 850, 950, and 1050 HU accumulations. However, when the preconditioning treatments were compared, lint yield and micronaire were reduced significantly by Aim, Harvade, and Dropp (Table 6, 7). Heat unit accumulations or the pre-conditioning treatments did not affect length, uniformity, strength, elongation, color, and leaf.

Conclusions

Pre-conditioning treatments did not hasten boll opening; therefore, number of days to harvest was not shortened. Percent defoliation for 850 HU accumulated was less when compared to 950 and 1050 HU accumulated, however defoliation was more than acceptable and would not impact harvest efficiency or quality grades. At harvest, percent defoliation for the pre-conditioning treatments were not superior to the treatment that was not pre-conditioned (untreated check); therefore, no advantage was gained by preparing the field for defoliation and harvest. Yield was not sacrificed by initiating defoliation at 850 HU accumulated (54.8 % open boll) even though there were less open bolls at harvest compared to 950 and 1050 HU accumulated. Three of the pre-conditioning treatments (Aim, Dropp, and Harvade) significantly reduced yields and micronaire values. Pre-conditioning could possibly serve as a management tool in managing high micronaire values in certain years. Caution would have to be exercised in not sacrificing excessive yield, which would offset the added value from lowering micronaire and staying out of the discount range.

Future Research

Initiation of pre-conditioning treatments could be applied prior to 650 HU accumulated from cutout and different rates of the defoliation products used in this study should be evaluated to determine their effect on boll opening, defoliation, fiber quality, and yield. In years when the potential exists for high micronaire problems, an area-wide early warning strategy should be developed to alert producers. The area-wide early warning strategy could include sampling fields at early open boll and/or the development of computer-aid crop management tools that are able to predict micronaire values.

Literature Cited

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Table 1. Percent open bolls at pre-conditioning – heat units x pre-conditioning treatments.

Pre-Condition @ 650	Defol. @ 850	Defol. @ 950	Defol. @ 1050	Pr>F 0.9854
Prep	10.4	10.8	12.8	11.4 a
Dropp	12.0	10.8	9.7	10.8 a
Harvade	12.4	9.6	10.3	10.8 a
UTC	10.9	8.3	11.6	10.3 a
Aim	7.6	10.1	12.5	10.0 a
Pr>F 0.4558	10.7 a	9.9 a	11.4 a	

Table 2. Percent open bolls at defoliation – heat units x pre-conditioning treatments.

Pre-Condition @ 650	Defol. @ 850	Defol. @ 950	Defol. @ 1050	Pr>F 0.4901
Harvade	59.37	73.50	87.43	73.43 a
Prep	52.17	74.67	76.64	67.83 a
Dropp	55.50	62.32	84.67	67.50 a
Aim	51.99	72.04	75.59	66.54 a
UTC	55.22	68.24	75.35	66.27 a
Pr>F 0.0003	54.85 c	70.15 b	79.94 a	

Table 3. Percent open bolls at harvest – heat units x pre-conditioning treatments.

Pre-Condition @ 650	Defol. @ 850	Defol. @ 950	Defol. @ 1050	Pr>F 0.1189
Harvade	94.09	91.43	96.83	94.12 a
Aim	91.51	93.09	92.75	92.45 a
UTC	88.90	93.67	94.43	92.33 a
Dropp	86.76	96.26	93.11	92.04 a
Prep	87.15	91.43	90.77	89.78 a
Pr>F 0.0806	89.68 b	93.18 a	93.58 a	

Table 4. Percent defoliation for pre-conditioning applications at 3 and 8 days after treatment.

	3 DAT		8 DAT	
Treatment	% Defol.	% Dess.	% Defol.	% Dess.
Harvade	25.00 a	12.50 b	75.00 a	8.75 b
Dropp	6.25 b	00.00 c	42.08 b	00.00 c
Aim	4.25 bc	20.00 a	9.58 c	14.58 a
Prep	2.25 bc	00.00 c	4.50 cd	00.00 c
UTC	1.83 c	00.00 c	2.00 d	00.00 c
Pr>F	< .0001	< .0001	< .0001	< .0001
C.V.	61.39	81.89	25.86	28.23

Table 5. Percent defoliation for harvest application at 5 days after treatment – heat units x pre-conditioning treatments.

Pre-Condition @ 650	**Defol. @ 850**	**Defol. @ 950**	**Defol. @ 1050**	**Pr>F .0094**
Harvade	94.5	97.5	98.5	96.8 a
Dropp	89.5	97.8	98.0	95.1 a
Aim	84.8	96.3	97.5	92.8 ab
Prep	81.0	95.3	94.5	90.3 b
UTC	77.5	95.5	96.8	89.9 b
Pr>F .0022	85.5 b	96.5 a	97.1 a	

Table 6. Lint yield – heat units x pre-conditioning treatments.

Pre-Condition @ 650	**Defol. @ 850**	**Defol. @ 950**	**Defol. @ 1050**	**Pr>F 0.0194**
UTC	1640	1598	1532	1590 a
Prep	1601	1528	1532	1554 ab
Aim	1554	1569	1425	1516 bc
Harvade	1546	1450	1494	1497 bc
Dropp	1466	1481	1447	1465 c
Pr>F 0.0709	1561 a	1525 a	1486 a	

Table 7. Micronaire values – heat units x pre-conditioning treatments.

Pre-Condition @ 650	**Defol. @ 850**	**Defol. @ 950**	**Defol. @ 1050**	**Pr>F 0.0034**
UTC	4.78	4.60	4.68	4.69 a
Prep	4.61	4.56	4.58	4.58 ab
Aim	4.56	4.53	4.41	4.50 bc
Harvade	4.36	4.48	4.38	4.41 cd
Dropp	4.35	4.25	4.35	4.32 d
Pr>F 0.5894	4.53 a	4.48 a	4.48 a	