EVALUATION OF THE EFFICACY OF BOLL OPENING MATERIALS FOR LATE-SEASON COTTON MANAGEMENT

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Introduction

Deciding when to defoliate is one of the most difficult decisions producers have to make in cotton management. The process is a balancing act between the weather, crop maturity, and percent open bolls. However, most producer's base the timing to their defoliation program on subjective criteria, with the biases leaning toward delayed action in order to avoid yield loss due to treatment. Research has shown that defoliating too early can cause lower yields and reduced micronaire (Snipes and Baskin, 1994). However, defoliating too late also causes yield losses because boll rot increases and lint may be damaged or lost due to late-season hurricanes and weathering (Williford, 1992). Since late-season crop management has the potential to cause significant reductions in fiber yield and quality, research into end-of-season management practices is essential in increasing the profitability of South Carolina cotton producers.

Boll opening materials are often used in combination with defoliation materials to increase the percentage of the crop harvested during first picking or to possibly eliminate the need for a second picking. PREP (registered trademark of Rhone Poulenc Ag Company) or ethephon (2-chloroethyl phosphonic acid) is an effective harvest-aid chemical which causes bolls to open and leaves to abscise from the plant by increasing ethylene synthesis that normally occurs at boll opening. This ability to cause bolls to open is important to increase the harvestability and to promote earliness in the crop (Smith et al., 1986). The downside to this trend, however, is that bolls which are unopened at treatment are often smaller and of lower micronaire than those which are allowed to develop further (Cathey and Luckett, 1980). Williford (1992) reported PREP significantly reduced lint yield and quality if applied at the 40 to 60% open stage, but had no detrimental effect on yield or quality if applied at the 80% open stage.

FINISH is a new boll opening material developed by Rhone Poulenc Ag Company that consists of PREP and a synergistic compound called cyclanilide. COTTONQUIK is a new boll opening material developed by Griffin Corporation that consists of PREP and a synergistic compound called AMADS. These new boll openers are reported to increase defoliation and boll opening. However, little information is available to producers on the efficacy of these materials for use as a harvest-aid material. Moreover, common questions often asked by South Carolina cotton producers is how much time is required for bolls to open after boll opening materials are applied, how long is required until a certain percentage of bolls are opened after chemical treatment, and how many unopened bolls should be opened by boll openers in order for the chemical treatment to be profitable. Research has shown that mature bolls usually open 3 to 14 days after application; however, boll opening appears to be highly temperature dependent. By conducting this research, I hope to address many of the questions cotton producers have about the efficacy of boll opening materials and the time requirement necessary for bolls to open after chemical application by relating these events to heat units (DD60's).

Methods

Replicated field experiments were conducted at the Pee Dee Research & Education Center in Florence, SC, during the 1999 and 2000 growing seasons. Cotton was planted in 38 inch rows that are 40 ft. long and grown using standard production practice to optimize yields. Appropriate boll opening treatments were imposed at the 25 and 50% open stage by spraying individual plots with a ground sprayer. Boll opening treatments consisted of : a) control - no boll opening materials, b) PREP applied at 1.33 pt/A (low rate), c) PREP applied at 2.66 pt/A (high rate), d) FINISH applied at 1 qt/A (low rate), e) FINISH applied at 2 qt/A (high rate), f) COTTONQUIK applied at 1 qt/A (low rate), and g) COTTONQUIK applied at 2 qt/A (high rate). Defoliation chemicals were not used in this study in order to avoid confounding the results with boll opening materials.

Leaf removal was determined before and after chemical treatments by removing the leaves from plants in a 0.5 m section of row and measuring leaf area. Boll opening was determined by counts from one of the middle two rows of each plot before and after treatment. Boll opening patterns and times (based on heat units) were determined by hand-harvesting bolls as they opened (MWF schedule) after each treatment. Cotton was separated into branch location and nodal position. Changes in total lint development, yield components (boll size, lint %, seed index), and lint quality (micronaire, strength, length, etc.) was determined.

Results

Surprisingly, all boll opening materials caused significant leaf removal when applied at the 25 and 50% open boll stage (Tables 1 and 2, respectively). Although boll opening rates varied depending on the year and the crop condition, higher rates of boll opening materials caused more bolls to open earlier in the season compared to the untreated check (Tables 3 and 4). No differences in lint yield were found among the boll opening treatments and the untreated check (data not shown). Applying boll openers at both 25 and 50% open boll stage reduced boll size of the latest developing bolls. Few differences in fiber properties existed among the treatments. However, early applications of boll openers significantly reduced micronaire of late-developing bolls in 1999 (data not shown).

References

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Table 1. Percent defoliation of various dates after bolll opening treatments were applied at 25% open boll, PDREC, Florence, SC.

		DD60's Accumulated after Treatment				
Year	**Treatment**	**0**	**99**	**141**	**232**	**271**
		% Defoliation				
1999	Untreated	0	21	35	46	69
	Prep @ 1.33 pt/A	0	78	82	78	81
	Prep @ 2.67 pt/A	0	80	86	87	88
	Finish @ 1 qt/A	0	95	91	85	91
	Finish @ 2 qt/A	0	89	92	87	84
	CottonQuik @ 1qt/A	0	92	93	84	81
	CottonQuik @ 2qt/A	0	58	78	86	84
	(Pr.> 0.05)	ns	***	***	***	***

		DD60's Accumulated after Treatment		
Year	Treatment	0	125	224
		% Defoliation		
2000	Untreated	0	30	26
	Prep @ 1.33 pt/A	0	57	64
	Prep @ 2.67 pt/A	0	59	81
	Finish @ 1 qt/A	0	86	87
	Finish @ 2 qt/A	0	91	88
	CottonQuik @ 1 qt/A	0	74	61
	CottonQuik @ 2qt/A	0	87	74
	(Pr>0.05)	ns	***	***

Table 2. Percent defoliation at various dates after boll opening treatments were applied at 50% open boll, PDREC, Florence, SC.

		DD60's Accumulated after Treatment			
Year	**Treatment**	**0**	**42**	**133**	**172**
		% Defoliation			
1999	Untreated	21	35	46	69
	Prep @ 1.33 pt/A	31	86	98	94
	Prep @ 2.67 pt/A	42	80	92	82
	Finish @ 1 qt/A	40	92	96	98
	Finish @ 2 qt/A	41	96	96	99
	CottonQuik @ 1qt/A	39	93	97	98
	CottonQuik @ 2qt/A	29	92	99	98
	(Pr.> 0.05)	ns	***	***	***

		DD60's Accumulated after Treatment		
Year	Treatment	0	34	133
		% Defoliation		
2000	Untreated	26	30	26
	Prep @ 1.33 pt/A	24	25	64
	Prep @ 2.67 pt/A	9	16	88
	Finish @ 1 qt/A	21	32	88
	Finish @ 2 qt/A	20	25	98
	CottonQuik @ 1 qt/A	28	35	82
	CottonQuik @ 2qt/A	18	18	84
	(Pr>0.05)	ns	ns	***

Table 3. Number of open bolls at various dates after boll opening treatments were applied at 25% open boll, PDREC, Florence, SC.

		DD60's Accumulated after Treatment				
Year	**Treatment**	**0**	**39**	**141**	**214**	**271**
		bolls/m2				
1999	Untreated	0	6	7	15	0
	Prep @ 1.33 pt/A	0	6	7	14	1
	Prep @ 2.67 pt/A	0	5	13	16	0
	Finish @ 1 qt/A	0	6	10	11	0
	Finish @ 2 qt/A	0	6	10	17	0
	CottonQuik @ 1qt/A	0	6	8	11	1
	CottonQuik @ 2qt/A	0	5	6	18	0
	(Pr.> 0.05)	ns	ns	***	ns	ns

		DD60's Accumulated after Treatment								
Year	Treatment	0	26	77	125	145	162	190	223	224
		bolls/m2								
2000	Untreated	0	8	6	3	5	6	4	1	1
	Prep @ 1.33 pt/A	0	8	8	10	8	2	1	2	1
	Prep @ 2.67 pt/A	0	10	9	11	6	3	3	2	1
	Finish @ 1 qt/A	0	10	6	12	10	1	3	3	2
	Finish @ 2 qt/A	0	8	9	16	4	3	2	1	0
	CottonQuik @ 1qt/A	0	11	7	9	11	2	2	3	1
	CottonQuik @ 2qt/A	0	9	7	14	9	2	2	1	1
	(Pr.> 0.05)	ns	ns	ns	***	***	***	ns	ns	ns

Table 4. Number of open bolls at various dates after boll opening treatments were applied at 50% open boll, PDREC, Florence, SC.

		DD60's Accumulated after Treatment			
Year	**Treatment**	**0**	**42**	**115**	**172**
		Bolls/m2			
1999	Untreated	0	7	15	0
	Prep @ 1.33 pt/A	0	9	10	0
	Prep @ 2.67 pt/A	0	7	21	0
	Finish @ 1 qt/A	0	8	20	1
	Finish @ 2 qt/A	0	8	22	0
	CottonQuik @ 1qt/A	0	8	21	0
	CottonQuik @ 2qt/A	0	7	18	1
	(Pr.> 0.05)	ns	ns	ns	ns

Year	Treatment	0	34	54	141	232	271
		% Defoliation					
2000	Untreated	0	3	5	6	4	1
	Prep @ 1.33 pt/A	0	4	6	4	4	3
	Prep @ 2.67 pt/A	0	3	7	6	8	2
	Finish @ 1 qt/A	0	2	7	6	7	4
	Finish @ 2 qt/A	0	3	11	8	16	5
	CottonQuik @ 1qt/A	0	3	7	8	3	6
	CottonQuik @ 2qt/A	0	3	5	8	6	4
	(Pr.> 0.05)	ns	ns	***	ns	***	*