

# **THE INFLUENCE OF BOLL OPENING MATERIALS APPLIED AT 25 AND 50% OPEN BOLL ON COTTON BOLL AND FIBER DEVELOPMENT**

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## **Abstract**

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. 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. Specific objectives of this study were: to determine the efficacy of PREP, FINISH, and COTTONQUIK on boll opening, leaf removal, lint yield, and fiber quality; to determine the time (based on heat units) required for various bolls located on the plant to open after boll openers are applied; and to assess changes in boll development and fiber properties at various fruiting positions in response to premature boll opening. 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 2.67 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). Appropriate boll opening treatments were imposed at the 25 and 50% open boll stage by spraying individual plots with a ground sprayer. Although boll opening rates varied depending on the year and the crop condition, higher rates of boll opening materials usually caused more bolls to open earlier in the season compared to lower rates of the boll opening materials or the untreated check. No differences in lint yield were found among any of the boll opening treatments and the untreated check plots in 1999 or 2000 when applied at either the 25 or 50% open boll stage. Applying boll openers at both 25 and 50% open boll stage reduced boll size of the latest developing bolls. Early applications of boll openers significantly reduced micronaire of late-developing bolls.

## **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 producers base the timing of their defoliation program on subjective criteria, with 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 reduce 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). Specific objectives were: to determine the efficacy of PREP, FINISH, and COTTONQUICK on boll opening, leaf removal, lint yield, and fiber quality; to determine the time (based on heat units) required for various bolls located on the plant to open after boll openers are applied; and to assess changes in boll development and fiber properties at various fruiting positions in response to premature boll opening.

### Materials and 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 were 40 ft. long and grown using standard production practice to optimize yields. Appropriate boll opening treatments were imposed at the 25 and 50% open boll 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 2.67 pt/A (high rate), d) FINISH applied at 1 qt/A (low rate), e) FINISH applied at 2 qt/A (high rate), f) COTTONQUICK applied at 1 qt/A (low rate), and g) COTTONQUICK applied at 2 qt/A (high rate). Defoliation chemicals were not be 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 on a Monday, Wednesday, Friday schedule as they opened. Cotton was separated into branch location and nodal position, and changes in total lint development, yield components (boll size, lint %, seed index), and lint quality (micronaire, strength, length, etc.) was determined for each harvest date, branch location, and nodal position.

### Summary

Surprisingly, the application of all boll opening treatments resulted in significant leaf removal (57 to 95% defoliation) by 100 DD60s after treatment in both years when applied at the 25% open boll stage compared to the untreated (21 to 30% defoliation) plots (**Table 1**). All boll opening treatments applied at the 50% open boll stage were 64 to 99% defoliated by 133 DD60s after treatment, while the untreated plants were only 26 to 46 % defoliated (**Table 2**). Although boll opening rates varied depending on the year and the crop condition, higher rates of boll opening materials usually caused more bolls to open earlier in the season compared to lower rates of the boll opening materials or the untreated check (**Tables 3 and 4**). When applied at 25% open boll, Prep at 2.67 pt/acre increased the number of bolls opening at 141 DD60s after treatment compared to the other boll opening treatments and the untreated check. The application of boll openers at 25% open boll in 2000 caused more bolls to open between 125 and 145 DD60s after treatment when compared to the untreated plots. When applied at the 50% open boll stage, Finish at 2 qt/acre increased the number of bolls that opened between 54 and 232 DD60s after treatment in 2000, but no differences were found among any of the boll opening treatments and the untreated check in 1999 when applied at 50% open boll. No differences in lint yield were found among any of the boll opening treatments and the untreated check plots in 1999 or 2000 when applied at either the 25 or 50% open boll stage. 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 and the untreated. However, early applications of boll openers significantly reduced micronaire of late-developing bolls in 1999 only.

### References

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

Year	Treatment	DD60's Accumulated after Treatment				
		0	99	141	232	271
		----- % Defoliation -----				
<u>1999</u>	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	***	***	***	***

  

Year	Treatment	DD60's Accumulated after Treatment		
		0	125	224
		----- % Defoliation -----		
<u>2000</u>	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.

Year	Treatment	DD60's Accumulated after Treatment			
		0	42	133	172
		----- % Defoliation -----			
<u>1999</u>	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	***	***	***

  

Year	Treatment	DD60's Accumulated after Treatment		
		0	34	133
		----- % Defoliation -----		
<u>2000</u>	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.

Year	Treatment	DD60's Accumulated after 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

  

Year	Treatment	DD60's Accumulated after 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

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

Year	Treatment	DD60's Accumulated after 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

  

Year	Treatment	DD60's Accumulated after Treatment					
		0	34	54	141	232	271
		----- Bolls/m2 -----					
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	***