

SURVEY OF Bt COTTON BOLL DAMAGE BY REFUGE OPTION IN NORTHEAST LOUISIANA

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Introduction

Bt-transgenic cotton varieties that are active against several caterpillar pests, have been grown in Louisiana since 1996. In 2001, approximately 855,000 acres of cotton was grown in Louisiana with an expected average yield of 578 pounds per acre. Approximately 84 percent of the cotton acreage was planted to a Bt-transgenic variety. Seventy-five percent of the cotton producers that grew these Bt-transgenic varieties used the 95:5 embedded refuge option (Bt:non-Bt), while the remaining producers opted for either the 80:20 (predominate), or the 95:5 untreated option.

Boll sample surveys were taken to compare the amount of damage caused by worms in Bt and non-Bt varieties on six farms in northeast Louisiana. Comparisons were made between Bt cotton planted under either the 95:5 embedded, or the 80:20 option and their associated refuge.

Methods and Materials

Six cotton production farms in northeast Louisiana were surveyed to compare the amount of worm damage in Bt and non-Bt cotton. Farms were classified by refuge option (95:5 embedded or 80:20). A total of 97 fields were sampled for percent worm damaged bolls. Of the 97 fields sampled, 15 fields were 20 percent non-Bt refuge, 18 fields were five percent non-Bt embedded refuge, 26 fields were 80 percent Bt, and 38 fields were 95 percent Bt. The percentage Bt cotton planted at the two 80:20 option farms was 50 percent at farm number five, and 80 percent at farm number six. Each farm represents a different geographic location in Northeast Louisiana, and none of the farms used the same crop consultant.

All fields were sampled at, or after defoliation. At four randomly selected sites in each field, three feet of row were sampled, with exception of farm number one. Total number of bolls, and number of worm damaged bolls were recorded at each site.

At farm number one, samples were taken on specific rows in both the 95 percent Bt field, and the five percent non-Bt embedded refuge. Two refuge sizes were planted for experimental purposes, an 80 row wide and a 24 row wide refuge. In the 24 row wide five percent non-Bt embedded refuge, rows one, six, 12, 18, and 24 were sampled. In the 80 row wide five percent non-Bt embedded refuge, rows one, 20, 40, 60, and 80 were sampled. Four samples were taken on each row to total 12 row feet, or three row feet sampled at each site. In the 95 percent Bt fields, samples were taken at row one (which was adjacent to the five percent non-Bt embedded refuge field), rows eight, 16 and 32. Again, 12 feet of row was sampled in four three feet sections.

Records were attained from each farm to determine what types of insecticides were used for worm control. Only applications made specifically for worms were documented for control against these pests.

Results and Discussion

Comparison of the two refuge types with their associated Bt cotton indicated that there were more damaged bolls in the five percent non-Bt (embedded refuge) than the 95 percent Bt cotton, and there was more damage in the 20 percent non-Bt cotton than the 80 percent Bt cotton (Table 1). Boll damage was higher in both the 95 percent Bt cotton and its associated five percent refuge than in either the 80 percent Bt cotton, or its associated refuge. The highest percent boll damage was at farm number four (95:5 refuge option) where 9.2 percent the total bolls were damaged in the non-Bt cotton five percent embedded refuge fields, but only 2.6 percent of the total bolls were damaged in the 95 percent Bt cotton fields (Table 2). Boll damage by worms in the five percent refuge was similar to its associated 95 percent Bt cotton field at all other farms.

Both farms using the 80:20 refuge option had greater damage in the 20 percent non-Bt refuge than in the associated 80 percent Bt. Percent damage ranged from 23 percent greater damage in the Bt cotton at two farms that used the 95:5 embedded refuge to, 72 percent greater damage in the five percent embedded refuge than the 95 percent Bt cotton. At the two farms using the 80:20 refuge option, boll damage was 38 to 50 percent higher in the refuge than in the associated Bt cotton.

Boll damage was also compared between irrigated and non-irrigated fields (Table 3). Percent boll damage was higher in the 95:5 refuge options, compared to the 80:20 refuge option, for both the irrigated and the non-irrigated cotton fields. In both refuge options (95:5 and 80:20) for irrigated and non-irrigated fields, the non-Bt cotton fields had a higher percent worm damaged bolls compared to their associated Bt cotton fields.

The most common Bt cotton variety was Delta Pine 33B, and the most common non-Bt cotton variety was Fiber Max 832 (Table 4). The 80:20 refuge option had nine fields of Delta Pine 33B sampled, with 1.3 percent of the total bolls damaged by worms. The 95:5 refuge option had 19 fields sampled that were planted in Delta Pine 33B with 5.2 percent of the total bolls sampled damaged by worms. Worm damage in Delta Pine 33B in a 95:5 refuge option appears high, but may be an artifact of most samples coming from farm number one which had a high amount of damage. In the 20 percent refuge option, five fields sampled were planted in Fiber Max 832 with 2.5 percent of the total bolls sampled damaged by worms. In the five percent embedded refuge option eight fields sampled were planted in Fiber Max 832 with 3.8 percent of the total bolls damaged by worms. Variety damage ranged from a low of 0.8 percent for Delta Pine 458BR to a high of 10 percent for PhytoGen 355.

Acknowledgements

The authors would like to thank student workers from the Scott Research, Extension and Education Center. The authors would also like to thank the LSU AgCenter, and Cotton Incorporated for financial support.

Table 1. Percent of Bolls Damaged by Bt Cotton Refuge Type.

Refuge Option	% Bt	No. Of Fields	Bolls		
			Total	Damaged	% Damaged
95:5	0	18	3249	145	4.4
95:5	95	38	7844	265	3.3
80:20	80	26	5966	110	1.8
80:20	0	15	3485	103	2.9

Table 2. Percent of Bolls Damaged by Farm and Bt Cotton Refuge Type.

Farm	Refuge Option	% Bt	Bolls		
			Total	Damaged	% Damaged
1	95:5	0	1757	77	4.3
1	95:5	95	2888	172	5.3
2	95:5	0	202	2	0.9
2	95:5	95	1063	12	1.1
3	95:5	0	933	33	3.5
3	95:5	95	1704	22	1.2
4	95:5	0	357	33	9.2
4	95:5	95	2189	59	2.6
5	80:20	0	1493	51	3.4
5	80:20	80	3751	81	2.1
6	80:20	0	1992	52	2.6
6	80:20	80	2215	29	1.3

Table 3. Percent of Bolls Damaged by Irrigation and by Bt Cotton Refuge Type.

Irrigated	Refuge Option	% Bt	#/12 ft. row	Bolls		
				Total	Damaged	% Damaged
No	95:5	0	15	2544	109	4.2
Yes	95:5	0	15	705	36	5.1
No	95:5	95	16	5016	195	3.8
Yes	95:5	95	20	2828	70	2.4
No	80:20	0	20	3251	6	2.5
Yes	80:20	0	19	463	97	2.9
No	80:20	80	19	5503	11	2.3
Yes	80:20	80	20	5016	99	1.7

Table 4. Percent of Bolls Damaged by Variety and Bt Cotton Refuge Type.

Variety	No. Fields	Refuge Option	Bolls		
			Total	Damaged	% Damaged
DP33B	9	80:20	2215	29	1.3
DP33B	19	95:5	3527	183	5.2
DP422BR	3	95:5	625	10	1.6
DP429RR	1	95:5	202	2	1.0
DP458BR	3	95:5	659	5	0.8
DP20B	6	80:20	1307	31	2.4
DP5415	8	80:20	1992	52	2.6
FM832	5	80:20	1079	27	2.5
FM832	13	95:5	2321	87	3.8
PM1199RR	2	95:5	357	33	9.2
PM1218BR	7	95:5	1634	49	3.0
Phy 355	1	80:20	180	18	10.0
SG215BR	3	95:5	747	7	0.9
SG501RB	1	95:5	240	5	2.1
ST4691B	5	80:20	1090	23	2.1
ST4793RR	2	95:5	369	23	6.2
ST4892BR	2	95:5	412	6	1.5
ST4892BR	6	80:20	1354	27	2.0
ST474RR	1	80:20	234	6	2.6

DP= Deltapine, FM= Fiber Max, PM= Paymaster, Phy= Phytogen, SG= Suregrow, and ST= Stoneville.

Table 5. Percent of Bolls Damaged (per 12 ft. of row) by Row, and Bt Cotton Refuge Size.

Refuge Size (Rows)	Row #	% Bt	Variety	Bolls		
				Total	Damaged	% Damaged
24	1	0	FM832	334	30	8.9
	6	0	FM832	305	22	7.2
	12	0	FM832	336	14	4.1
24	1	95	DP33B	288	25	8.6
	8	95	DP33B	340	21	6.1
	16	95	DP33B	371	37	9.9
	32	95	DP33B	402	26	6.4
80	1	0	FM832	409	8	1.9
	20	0	FM832	361	9	2.4
	40	0	FM832	330	2	0.6
80	1	95	DP33B	354	15	4.2
	8	95	DP33B	388	13	3.3
	16	95	DP33B	402	14	3.4
	32	95	DP33B	394	21	5.3