PERFORMANCE OF NuCOTN WITH BOLLGARD™

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Abstract

NuCOTN 33™ and NuCOTN 35™ contain the Bollgard gene *Bacillus thuringiensis* (Bt), developed by Monsanto. Delta and Pine Land Company has field tested these two new varieties in paired comparisons at 52 locations during the past two years. NuCOTN varieties were not sprayed for tobacco budworm, cotton bollworm, or pink bollworm. Averaged over all tests, NuCOTN varieties had a yield of 1041 lbs/A lint compared to 885 for the recurrent parents sprayed according to scouting recommendations. Seed size was increased 9 percent and seedling vigor increased 15 percent for NuCOTN 33^B compared to DP 5415. Both NuCOTN varieties showed increased retention of early bolls, but still had increased vegetative growth during the season resulting in taller plants at the end of the year than their recurrent parents. NuCOTN 33^B produced fiber with lower micronaire than DP 5415. Value of fiber from NuCOTN varieties trended higher than the recurrent parents.

Introduction

Limited field tests were conducted with NuCOTN 33^B and NuCOTN 35^B in 1993. Broad field testing during 1994 and 1995 by Delta and Pine Land Company and public agencies allowed many growers, consultants, and public servants to experience the new technology first hand. Delta and Pine Land Company multiplied the seed as fast as possible utilizing Southern hemisphere bulk increases. Sufficient seed should be available to plant between 2.0 and 2.5 million acres in 1996. Emphasis was placed on data collection in field tests to document growth habits and yield performance of these genetically engineered varieties.

Materials and Methods

Large scale field tests were conducted at 25 locations in 1994 and 27 locations in 1995 from North Carolina to Texas. Plots were 4 to 6 rows the length of the grower fields. NuCOTN varieties were not sprayed for budworms, bollworms, or pink bollworms. The recurrent parents (not containing Bollgard) were sprayed for worm pests according to scouting guidelines. Seedling vigor ratings were taken during the first two weeks of emergence using a scale of 1 to 5 with 1 representing high vigor and 5 poor vigor. Plant monitoring data was collected at early square, early bloom, late bloom and at the end of the season. Plots were harvested with grower commercial equipment and seed cotton weighted by plot. A 12 pound sample of seed cotton was ginned on an experimental gin to determine lint percent and report yield results on the basis of lint. Fiber quality samples were sent to USDA-AMS for classing.

Results and Discussion

Seed Size and Seedling Vigor

Seed size was compared for all seed grown in Arizona by Delta and Pine Land Company in 1994. Seed size was 9 percent greater for NuCOTN 33^B compared to DP 5415 while there were no differences between NuCOTN 35^B and DP 5690. Seedling vigor was rated on a scale of 1 to 5 (1 = good; 5 = poor) within the first two weeks of emergence. NuCOTN 33^B showed improved vigor over DP 5415 while and NuCOTN 35^B was only slightly more vigorous than DP 5690.

Plant Monitoring

It took more time for NuCOTN 33^B and DP 5415 to produced new nodes compared to NuCOTN 35^B and DP 5690. The difference averaged just over one node on July 15. NuCOTN 33^B retained 60.3 percent of all first positions on the bottom five fruiting branches compared to 53.3 for DP 5415. A smaller improvement was noted for NuCOTN 35^B compared to DP 5690. This increased early boll retention is a significant improvement for NuCOTN 33^B and places it equal to DP 20 and DP 50 (59.5 and 59.8, respectively) in early boll retention. Retention of all first positions in the 95 percent zone (the zone containing 95 percent of all harvestable bolls) showed equal improvements for NuCOTN varieties as did retention of the bottom five first positions.

Even though early boll retention increases with NuCOTN varieties, height is greater than the recurrent parents at the end of the year. The capacity to maintain vegetative growth even with a good boll load demonstrates the vigor of these varieties. This has important management implications. If the season is short, NuCOTN 33^B will set as many bolls as does DP 20. However, if growth conditions remain favorable (ample water and nutrients), the NuCOTN varieties will sustain vegetative growth and boll setting longer than "short" season varieties. This provides the yield production of a short season variety when the season is short, but the flexibility to take advantage of a longer growing season if it is available. If adverse conditions such as drought stress occur, NuCOTN varieties are not as prone to premature cutout as are determinate varieties. On fertile soils with high water holding capacity or under irrigated conditions (conditions that produce strong growth), the

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value of Pix® application will be slightly greater for NuCOTN varieties because of their good vigor.

Fiber Quality

There were no differences among varieties in fiber length. NuCOTN 35^B and DP 5690 were stronger than NuCOTN 33^B and DP 5415. Both NuCOTN varieties had decreased micronaire compared to the recurrent parents. The difference was greatest between NuCOTN 33^B and DP 5415. This is an important improvement for these varieties when grown in areas where high micronaire discounts have been common. The loan value integrates the perceived value based upon fiber length, fiber strength, micronaire, and grade. NuCOTN 35^B averaged 0.9 cents per pound greater than DP 5690 and NuCOTN 33^B 0.4 cents per pound greater than DP 5415.

Lint Yield

Yield improvement of NuCOTN varieties averaged 9.0 percent in 1994 and 30 percent in 1995. Across all tests, NuCOTN 33^B yielded 20.6 percent more than DP 5415 and NuCOTN 35^B yielded 14.7 more than DP 5690. The average increase of NuCOTN varieties over their recurrent parents by regions was 29, 12, and 20 for the picker area of Texas, the Mid-South, and the Southeast, respectively. Yield improvement from both NuCOTN varieties was approximately equal in the picker area of Texas and the Southeast. In the Mid-South, yield of NuCOTN 33^B was 20 percent greater than DP 5415 while NuCOTN 35^B was only 4 percent greater than DP 5690.

Nine tests did not show a yield response from NuCOTN varieties. At these locations, non-transgenic cotton (no Bollgard) that was sprayed according to scouting guidelines had an average yield increase that was 36 percent greater than the same varieties without worm sprays. We believe the worm sprays provided some control of plant bugs and weevils that the NuCOTN plots did not get.

In 26 tests, the yield increase from NuCOTN with Bollgard was greater than 20 percent (averaging 56 percent). In 12 of these 26 locations, normal varieties (no Bollgard gene) that were not sprayed for worms yielded more than sprayed plots. In these tests, worm sprays were either not frequent enough or they were ineffective. The high yield increase from NuCOTN varieties verifies the presence of damaging levels of worms. This result could be a combination of resistance to the applied pesticide and/or disruption of beneficial insects. NuCOTN 33^B and NuCOTN 35^B have demonstrated yield performance and provide a new opportunity for a more effective and environmentally friendly pest management system.

Table 1. Growth and fiber quality comparisons for NuCOTN varieties with the Bollgard gene.

Trait	NuCOTN 33^B	DP 5415	NuCOTN 35^B	DP 5690	LSD 0.05
Seed Size (seed/lb)	5418	5948	4773	4748	--
Seed Vigor (1=G)	2.76	3.10	2.10	2.26	0.35
Plant Height (in.)	38.1	36.5	41.5	40.2	2.0
No. Nodes	22.5	22.0	23.0	22.9	0.7
HNR	1.78	1.74	1.88	1.83	0.07
Node 1st FB	6.6	6.4	6.8	6.7	0.2
% Ret Bot 5 FP1	60.3	53.4	57.3	53.1	5.7
% Ret - 95% Zone	59.4	51.8	53.6	49.2	4.3
Cutout Node	17.4	17.2	18.0	18.0	0.7
Nodes on July 15	17.5	17.4	18.8	18.6	0.5
Fiber Length (in.)	1.12	1.12	1.13	1.12	N.S.
Fiber Strength	28.8	29.2	30.4	30.6	0.5
Micronaire	4.26	4.42	4.23	4.33	0.09
Loan Value (¢/lb)	54.7	54.3	55.1	54.2	0.8

Table 2. Yield performance of NuCOTN varieties by Regions for 1994 and 1995.

Region	Year	No. Locations	NuCOTN 33^B	DP 5415	NuCOTN 35^B	DP 5690	LSD 0.05
				lbs/acre			
Texas Picker	1994	2	947	741	799	650	NS
	1995	7	931	698	865	684	113
	Avg.	9	935	708	850	675	101
Mid-South	1994	12	931	817	808	795	106
	1995	5	1001	715	895	816	NS
	Avg.	17	952	789	834	802	100
Southeast	1994	11	1447	1345	1401	1226	140
	1995	15	999	751	923	708	106
	Avg.	26	1189	998	1124	925	86
Beltwide	1994	25	1188	1068	1094	1021	59
	1995	27	982	732	902	719	76
	Avg.	52	1085	900	998	870	--