

**PERFORMANCE SUMMARY OF BOLLGARD™
COTTON VARIETIES ACROSS THE SOUTH
DELTA OF ARKANSAS, LOUISIANA
AND MISSISSIPPI**

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Abstract

Cotton varieties containing the Bollgard™ technology have been increasing since introduction in 1996. With a growing need to combat resistant *Heliothis virescens* and maintain quality cotton varieties across the Mid-South, Deltapine Seed has initiated extensive grower trials to investigate and expand the number of varieties currently containing this technology. The objective was to obtain data pertinent to the growth and development of Bollgard™ cotton varieties that extended beyond sole insect control. Results from 14 on-farm trials in the South Delta of Arkansas, Louisiana and Mississippi showed that DP 20B, DP 428B, DP 32B and DPX 8C49B possessed the greatest consistency in yield, return-on-investment, earliness, fruit retention and fiber qualities. Further data also indicated that DP 20B, DP 428B and DPX 8C49B produced the greatest amount of fruit between nodes 6-10 and 11-15 indicating a tendency toward earliness and a need for adequate early season management.

Introduction

Background

Protection of pre-squaring and early squaring cotton has been shown to be an important link to earliness (Parvin et al., 1987). Rusco et al. (1997) noted a delay in cotton maturity due to early-season insects while evaluating foliar insecticides on pre-squaring cotton. This was further verified by Andrews et al. (1997), while evaluating the impacts of insect complexes on early fruiting sites. From mechanical square removal studies, these delays have been further qualified. Turnipseed et al. (1995) showed a week delay in maturity from mechanical fruit removal. A detailed study performed by Phelps et al. (1997) showed harvest delays of 2-14 days in maturity when square removal occurred at 2, 3 and 4 weeks following square initiation. In the extreme North Delta where the growing season is shorter than many regions, Stevens et al. (1995) noted the importance of early-season inputs in securing early maturity. The importance of protecting early fruiting-sites and alleviating early stresses to pre-squaring cotton has been further related to varietal differences. Jenkins and McCarty (1995) showed that early maturing cotton varieties like DES 119 produced 41 percent of its crop on the first five main-stem fruiting nodes while DP 5415 only produced 27% of its crop on the same main-stem nodes. Rusco et al. (1997)

alluded that by removing *H. virescens* from the pre-squaring and pre-bloom growth phase of NuCOTN 33B and combined with foliar applications for *Lygus spp.* yield and earliness of NuCOTN 33B were improved. The economic benefits of Bollgard™ technology has been shown by researchers to range from \$51.00 to \$79.00/Ac (Carlson et al., 1998, & Bryant et al., 1996). Layton et al. (1998), from surveys across Mississippi indicated that Deltapine Bollgard™ cotton varieties out-performed competitive Bollgard™ products in *H. virescens* control. He further stated that NuCOTN 33B was the most frequently planted Bollgard™ variety in Mississippi. Leonard et al. (1998) further reported excellent *H. virescens* control resulting from NuCOTN 33B, DP 50B, DP 20B, DP 32B and NuCOTN 35B in Louisiana. They also showed higher yields occurring in non-sprayed trials of DP 32B over STV 474.

Materials and Methods

Fourteen on-farm grower trials were established and monitored through the 1998 growing season in Arkansas, Louisiana, and Mississippi. Evaluation time frames included; 15 days after emergence (DAE), pre-bloom, 30% open boll, pre-harvest and harvest. Plant sample size included 15-16 plants per variety. All MS trials were randomized and replicated three to four times. The eleven varieties were as follows:

| | <u>VARIETY</u> | <u>LOCATION NUMBER</u> |
|-----|----------------|------------------------|
| 1. | DP 20B | 14 |
| 2. | DP 32B | 13 |
| 3. | NuCOTN 33B | 13 |
| 4. | DP 428B | 14 |
| 5. | DP 50B | 7 |
| 6. | DPX 8C49B | 14 |
| 7. | DP 90B | 3 |
| 8. | NuCOTN 35B | 4 |
| 9. | PM 1215B | 11 |
| 10. | PM 1560B | 8 |
| 11. | BG 4740 | 14 |

Company's involved in the testing program were Deltapine Seed, Paymaster Seed and Stoneville Seed.

15 DAE & Pre-Bloom

Six Mississippi locations were evaluated during these time frames for plant population, vigor, node of first fruiting branch, total fruiting branches and first and second position squares retained. All information was assessed from previously established monitoring sites. Plant populations were derived from 10 feet of row. Vigor was visually assessed on a scale of one to five (1=greatest and 5=lowest). To reduce subjectivity, vigor was also based on height from the ground to the cotyledons. All pre-bloom plant evaluations were based on consecutive plants to avoid bias selections. Varieties evaluated included; DP 20B, DP 32B, NuCOTN 33B, DP 428B, DPX 8C49B, PM 1215B, PM 1560B and BG 4740.

30% Open Boll

Four Arkansas, Louisiana and Mississippi trials were evaluated during this final plant map time frame for node of first boll, average bolls per plant and boll retention within plant zones. Plant zones were categorized from nodes 6 to 10, nodes 11 to 15 and nodes 16 to 20. Varieties evaluated included; DP 20B, DP 32B, NuCOTN 33B, DP 428B, DPX 8C49B, PM 1215B, PM 1560B and BG 4740.

Pre-Harvest

Two trials in Mississippi were evaluated for plant criteria that could influence the efficacy of harvest-aids and timely harvest. These criteria included nodes above cracked boll, % open boll, and % natural defoliation at day of application. Varieties evaluated included; DP 20B, DP 32B, NuCOTN 33B, DP 428B, DPX 8C49B, PM 1215B, PM 1560B and BG 4740. One location was visually monitored for the effects of harvest-aids following application for % boll opening, defoliation, basal regrowth, first harvest and days to harvest ready.

Harvest

Fourteen trials across Arkansas, Louisiana and Mississippi were assessed for yield, return-on-investment, gin-turnout and fiber qualities. To acquire fiber qualities, each plot received a random hand sample that was ginned separately. Varieties included; DP 20B, DP 32B, NuCOTN 33B, DP 428B, DPX 8C49B, DP 50B, NuCOTN 35B, DP 90B, PM 1215B, PM 1560B and BG 4740. In addition to standard harvest data, two non-replicated trial locations were established in Mississippi to evaluate the impacts of harvest aids on harvest-ease of NuCOTN 33B. Evaluations included a first harvest by machine and a second harvest from 30 feet by hand. To quantify boll opening, hand-held calipers were used to measure the outer diameter of 30 top bolls per harvest-aid treatment. Harvest aid treatments included: Finish® (1.5 Lb. Ai/Ac) + Dropp® (.04 Lb. Ai/Ac), Cotton Quick® (1.75 Qt./Ac) + Dropp® (.04 Lb. Ai/Ac) and Prep™ (1.0 Lb. Ai/Ac) + Dropp® (.04 Lb. Ai/Ac). Harvest aids were applied in 20-acre blocks by ground equipment at a rate of 20 gallons of water per acre.

Discussion

15 DAE

Plant population at 15 days following emergence indicated that NuCOTN 33B, DP 20B, PM 1560B, DP 32B and DP 428B occurred at populations above 40,000 plants per acre. DPX 8C49B held a population of 38,698 (Table 1). Vigor at 15 days following emergence showed DP 50B, DP 20B and DPX 8C49B possessed vigor ratings below two. DP 32B, DP 428B and NuCOTN 33B were in the two range. However, PM 1215B, PM 1560B and BG 4740 occurred in the three range (Table 1).

Pre-Bloom

Node of first branch occurred at node 5.5 in DP 20B. DP 50B, DPX 8C49B, PM 1560B, DP 428B, DP 32B,

NuCOTN 33B and PM 1215B began fruiting at nodes 6.1, 6.2, 6.2, 6.3, 6.7 and 6.8, respectively. PM 1215B and BG 4740 initiated fruit on node 7.0 and 8.0 (Figure 1). Node of first boll differed very little from node of first fruiting branch. This indicated that improved *H. virescens* control through the Bollgard™ technology maintained a higher level of early fruit which related to improved plant earliness (Figures 1 & 4). Total fruiting branches during this period was greatest in PM 1215B, DP 20B, DP 428B and DPX 8C49B at levels of 6.4, 6.2, 5.1 and 5.1, respectively. DP 50B, PM 1560B, NuCOTN 33B and DP 32B showed slightly fewer fruiting branches (4.8, 4.8, 4.6 and 4.6) respectively. BG 4740 only possessed three fruiting branches (Figure 2). First and second position square numbers retained per plant indicated higher levels in DP 20B, PM 1560B, PM 1215B and DPX 8C49B at 10.2, 9.1, 8.9 and 8.8, respectively. These varieties were followed closely by DP 428B, DP 32B and NuCOTN 33B. BG 4740 only produced 3.9 squares per plant in the same time (Figure 3).

30% Open Boll

Percent boll retention by zone indicated that DP 20B, DPX 8C49B and DP 428B produced the highest boll levels in plant zone 1 (nodes 6-10) and plant zone 2 (nodes 11-15) indicating their trend toward earliness. The remaining varieties produced larger quantities in plant zone 2 (nodes 11-15). This indicated a need for sound, early-season management with DP 20B, DPX 8C49B and DP 428B (Figure 4). Total bolls per plant indicated DP 32B, DP 428B, DP 20B, PM 1215B and BG 4740 occurred at levels of 17, 15.6, 15.4, 15.3 and 15, respectively. The fewest bolls per plant were produced on PM 1560B and DPX 8C49B (13.1 and 13.5). Observations indicate that the high boll numbers in BG 4740 is misleading because of the high level of juvenile bolls (Figure 5).

Pre-Harvest

Nodes above cracked boll were lower in PM 1215B and DP 20B (2.7 and 3.7) indicating their earliness across locations. The remaining varieties were in the 4 nodes above cracked boll range with DPX 8C49B approaching 5 at 4.8 nodes above cracked boll (Table 2). On day of harvest aid application, all varieties were above 50% open boll with PM 1215B, PM 1560B and DP 20B being 70, 60, and 63% open respectively. Percent natural defoliation occurring in the plant was greatest in PM 1215B, PM 1560B and DP 428B (78, 68, and 55%). The remaining varieties showed lower levels of natural defoliation occurring in the 30 to 40% range (Table 2). Following the application of the harvest-aid, all varieties showed % open boll and defoliation levels above 90% except BG 4740 (Table 3). Days to harvest ready evaluations showed DP 428B, PM 1215B, PM 1560B, DP 20B and DPX 8C49B being at 0, 0, 0, 1 and 1.6 days to harvest ready respectively while DP 32 B, NuCOTN 33B and BG 4740 were at 3, 3 and 6 days, respectively (Table 3). Percent first harvest at this location indicated that all varieties were above 80% harvested with

exception of DP 32B and NuCOTN 33B which were at 75% (Table 3). Percent basal regrowth at day of application indicated that DP 32B and NuCOTN 33B held the highest level of basal regrowth. However, following application, these levels increased slightly while all other varieties showed strong increases (Table 3).

Harvest

Yields of the top six varieties across all locations were DP 32B, DP 428B, DPX 8C49B, DP 20B, DP 50B and NuCOTN 33B at 926, 903, 899, 879, 870 and 869 lb. lint per acre respectively (Table 4). The greatest gross dollar values also occurred within this group but changed in relative to order. DP 32B, DP 20B, DP 428B, DPX 8C49B, DP 50B and NuCOTN 33B showed the highest gross value at 678, 669, 629, 612, 590 and 598 dollars per acre (Table 4). Percent gin turn-out was as follows; DP 20B (35.1), DP 32B (34.7), BG 4740 (35.2), NuCOTN 35B and PM 1215B (33.9), DP 428B (33.5), NuCOTN 33B and PM 1560 (33.5), DPX 8C49B (32.4), DP 90B (31.8) and DP 50B (31.6) (Table 4).

Fiber Qualities

Staple length of all varieties was a 35 with exception of DP 90B and PM 1215B which were 34 and 36 respectively (Table 5). Strength was 27 or greater for all varieties except DP 428B and DPX 8C49B had strength of 26. DP 90B, PM 1215B and PM 1560B had strength of 28 (Table 5). Micronaire was relative high in all varieties due to the high temperature and drought. However, DP 20B was the lowest at 4.5. Micronaire of 4.7 was found in DP 428B and PM 1215B while 4.8 and 4.9 readings were found in DP 50B, DPX 8C49B NuCOTN 33B, PM 1560B, DP 32B and BG 4740. Micronaire of 5 was found in DP 90B and NuCOTN 35B (Table 5). Leaf content increased to two or above in DPX 8C49B, NuCOTN 33B, DP 32B and PM 1215B. BG 4740 showed leaf levels of 3 (Table 5). Grade levels were above 40 in all varieties except NuCOTN 33B, DP 32B and PM 1215B which were 39 (Table 5).

Harvest Aid Effects on Harvest of NuCOTN 33B

Finish® + Dropp® and Cotton Quick® + Dropp® treatments increased yields of first harvest by 138 and 91 Lb. lint cotton per acre respectively over the Prep™ + Dropp® treatment. This relates to 81 % first harvest with Finish® + Dropp®, 78 % with Cotton Quick® + Dropp® and 73 % with Prep™ + Dropp®. This improvement was further observed in carpel wall opening of top bolls. Finish® + Dropp® increased carpel opening to 5.1 cm, Cotton Quick® + Dropp® to 5 cm and Prep™ + Dropp® 4.6 cm (Figure 6, 7, 8).

Summary

DP 428B, DP 20B, DP 32B, NuCOTN 33B and DPX 8C49B showed greatly improved yields and return on investment over PM 1560B, PM 1215B and BG 4740. Plant earliness and improved early fruit retention was

observed in DP 428B, DP 20B and DPX 8C49B when compared to NuCOTN 33B and DP 32B. Application of Finish® + Dropp® and Cotton Quick® + Dropp® initially seem to improve the first harvest of NuCOTN 33B over the commonly used Prep™ + Dropp®.

Acknowledgments

Bollgard™ is a trademark of Monsanto.
Cotton Quick® is a registered product of Griffin.
Dropp® is a registered product of AgrEvo.
Finish® is a registered product of Rhone-Poulenc Ag Company.
Prep™ is a trademark of Rhone-Poulenc Ag Company.

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Table 1. Plants per acre and vigor*.

| 15 DAE | DPX 8C49B | DP 428B | DP 20B | NC 33B | DP 32B | PM 1215B | PM 1560B | BG 4740 |
|-----------------|-----------|---------|--------|--------|--------|----------|----------|---------|
| Plnts. Per Acre | 39,698 | 40,013 | 42,889 | 44,579 | 41,283 | 33,872 | 41,645 | 38,547 |
| Vigor | 1.8 | 2.2 | 1.6 | 2.4 | 2.0 | 3.0 | 3.0 | 3.2 |

*Plants per acre assessed in 10 feet of row

*Vigor of 1=greatest & vigor of 5=poorest

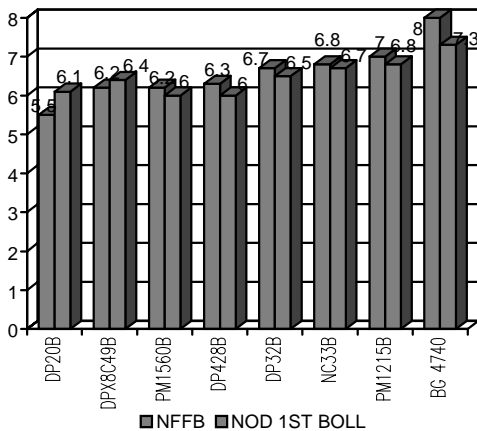


Figure 1. Node of first fruiting branch and node of first boll. Measurements made on per plant basis.

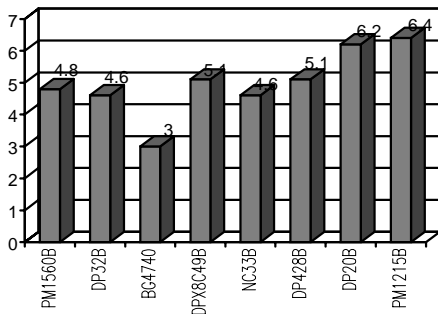


Figure 2. Total fruiting branches (pre-bloom). Measurements on number of fruiting branches per plant.

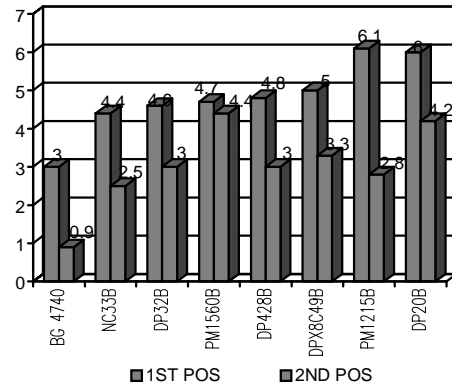


Figure 3. First and second position squares retained. Measurements made on square numbers per plant.

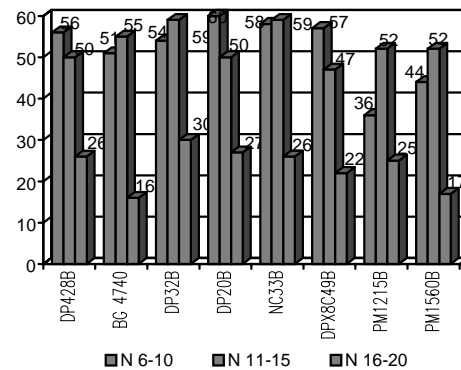


Figure 4. Boll retention by zone (30% open). Measurements made on % boll retention per plant.

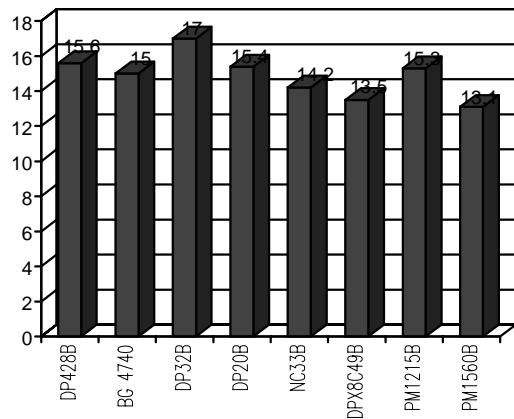


Figure 5. Bolls per plant (30% open). Measurements made on bolls per plant.

Table 2. Characteristics at application of harvest aid (pre-harvest).

| | DP 32B | NC 33B | DP 20B | DPX 8C49B | DP 428B | PM 1215B | PM 1560B | BG 4740 |
|-----------|--------|--------|--------|-----------|---------|----------|----------|---------|
| NACB | 4.5 | 4.4 | 3.7 | 4.8 | 4.3 | 2.7 | 4.3 | 4.4 |
| % OPEN | 53 | 54 | 63 | 56 | 55 | 70 | 60 | 53 |
| % DEFO | 44 | 38 | 48 | 35 | 55 | 78 | 68 | 30 |
| % BAS REG | 18.3 | 18.3 | 5 | 10 | 4.3 | 5 | 10 | 1 |

Table 3. Performance following harvest aid application (pre-harvest).

| | DP 32B | NC 33B | DP 20B | DPX 8C49 | DP 428B | PM 1215B | PM 1560B | BG 4740 |
|---------------------------|--------|--------|--------|----------|---------|----------|----------|---------|
| % DEFO | 97 | 97 | 96 | 95 | 99 | 99 | 98 | 88 |
| % OPEN | 93 | 96 | 97 | 98 | 99 | 99 | 99 | 96 |
| DIHR | 3 | 3 | 1 | 1.6 | 0 | 0 | 0 | 6 |
| % 1 ST Harvest | 75 | 75 | 83 | 85 | 83 | 86 | 87 | 88 |
| % BAS REG | 22 | 18.3 | 21.7 | 28.3 | 20 | 16 | 22 | 25 |

Table 4. Pounds lint per acre, dollars per acre*, and % gin turnout (harvest)

| | DP 32B | DP 428B | DPX 8C49 | DP 20B | DP 50B | NC 33B | PM 1560B | PM 1215B | BG 4740 | DP 90B | NC 35B |
|-------------|--------|---------|----------|--------|--------|--------|----------|----------|---------|--------|--------|
| Lbs. lint/a | 926 | 903 | 899 | 879 | 870 | 864 | 808 | 789 | 760 | 611 | 696 |
| \$/ac | 678 | 629 | 612 | 668 | 590 | 589 | 547 | 594 | 520 | 413 | 466 |
| % Lint | 34.7 | 33.7 | 32.4 | 35.1 | 31.6 | 36.2 | 33.5 | 33.9 | 35.2 | 31.8 | 33.9 |

*Dollars per acre calculated 0.70/Lb.

Table 5. Fiber quality (harvest).

| | DP 428B | DP 20B | DP 50B | DPX 8C49 | NC 33B | DP 32B | DP 90B | NC 35B | PM 1215B | PM1 650B | BG 4740 |
|---------|---------|--------|--------|----------|--------|--------|--------|--------|----------|----------|---------|
| Staple | 35 | 35 | 35 | 35 | 35 | 34 | 35 | 36 | 35 | 35 | 35 |
| Strngth | 26 | 27 | 26 | 26 | 27 | 27 | 28 | 27 | 28.3 | 28 | 27 |
| Mic | 4.7 | 4.5 | 4.8 | 4.8 | 4.8 | 4.9 | 5 | 5 | 4.7 | 4.8 | 4.9 |
| Leaf | 1.8 | 1.5 | 1.6 | 2.2 | 2 | 2.1 | 1 | 1.5 | 2 | 1.6 | 3 |
| Unif | 82 | 82 | 82 | 82 | 82 | 81 | 81 | 81 | 83.1 | 83 | 82.1 |
| Grade | 40 | 41 | 41 | 40 | 39 | 39 | 46 | 46 | 39 | 42 | 42 |

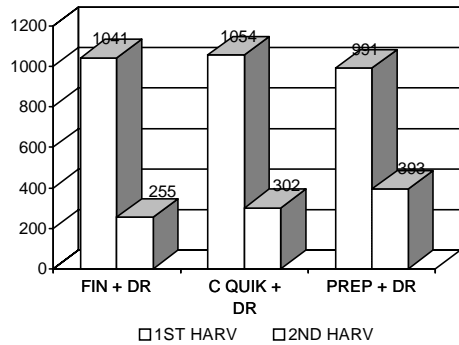


Figure 6. Harvest efficacy of NuCOTN 33B (pounds per acre).

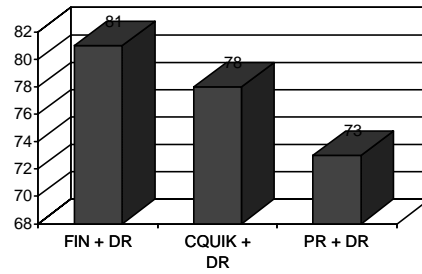


Figure 7. Percent first harvest of NuCOTN 33B (harvest).

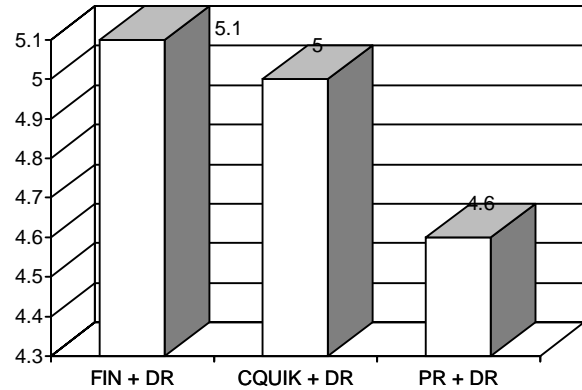


Figure 8. Harvest aids on carpel opening of NuCOTN 33B. Measurements made on 30 bolls per treatment.