MISSISSIPPI SOYBEAN PROMOTION BOARD
PROJECT NO. 58-2015 (YEAR 3)
2015 Annual Report

TITLE: Impact of Planting Date and Maturity Group on Management Strategies for Insect Pest in Soybean, *Glycine Max*

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BACKGROUNG AND OBJECTIVES

Soybean production in Mississippi has risen to the most economically important crop, following forestry and poultry (NASS, 2015). The planting window in Mississippi for soybean is from late March through mid-July, with more than two million acres (65%) of the row-crop land in Mississippi dedicated to soybean. With this large planting window, many acres of soybean are left vulnerable to late-season insect infestations.

In Mississippi, soybean looper (*Chrysodeixis includens*, Walker), corn earworm (*Helicoverpa zea*, Boddie), the stink bug complex, and bean leaf beetle (*Cerotoma trifurcate*, Fabricius) make up approximately 70% of the economic yield loss from insects over the last 10 years (Musser, et al., 2014). This insect complex generally occurs later in the growing year in soybean production systems across the south (Bundy and McPherson, 2000, Carner, et al., 1974, McPherson and Bondari, 1991, Pedigo and Zeiss, 1996).

Bt soybean have the potential to give growers another tool to combat late-season caterpillar pests. The potential option for a Bt soybean trait in the Mid-South is becoming more relevant as the cost of control of these pests is increasing along with the increasing failure of some of the more common insecticide control options for caterpillar pests.

Objective 1: Determine which planting dates of soybean are most vulnerable to insect pressure based on seasonal occurrence of insect pests.

Surveys were conducted in 66 locations throughout Mississippi, with 39 being in the Delta region and 27 being in the Hills region. All locations were separated into planting date categories, with early plantings being soybean planted before 1 May, normal plantings being soybean planted between 1 May and 1 June, and late plantings being soybean planted after 1 June. Of the 66 locations 16, 30, and 20 of the locations were in the early, normal, and late planting window, respectively.

All locations were sampled weekly from the R1 through R7 growth stages by taking 100 sweeps per field using a standard 15-inch-diameter sweepnet. All insect pests and beneficial insects were identified and counted. Weekly sampling locations inside each field were alternated so that samples were representative of the whole field to avoid any edge effects.

Insect pressure was relatively light throughout the 2015 growing season. The most commonly encountered pests were caterpillars, the stink bug complex, bean leaf beetles, and kudzu bugs. A more defined list of the insect pests encountered throughout the growing season is shown in Table 1. All data were analyzed using SAS 9.4 (Proc Means, Cary NC).

Table 1. Major insect pests encountered in the 2015 growing season.

Pest	Scientific Name
Caterpillar Complex	
Corn Earworm	*Heliocoverpa zea* (Boddie)
Soybean Looper	*Chrysodeixis includens* (Walker)
Green Cloverworm	*Hypena scabra* (Fabricius)
Velvetbean Caterpillar	*Anticarsia gemmatalis* (Hubner)
Stinkbug Complex	
Brown Stink bug	*Euschistus servus* (Say)
Green Stink Bug	*Acrosternum hilare* (Say)
Southerngreen Stink Bug	*Nezara viridula* (Linnaeus)
Redbanded Stink Bug	*Piezodorus guildinii* (Westwood)
Other Insects	
Bean Leaf Beetle	*Cerotoma trifurcate* (Forster)
Kudzu Bug	*Megacopta cribraria* (Fabricius)

Objective 2: Determine if Bt soybean will benefit the Mississippi soybean producer.

During the 2015 growing season, large plot studies were conducted on grower fields throughout Mississippi to determine if Bt soybeans will benefit Mississippi soybean producers. There were 11 locations, with four being planted with an indeterminate maturity group (MG) V soybean variety (Asgrow 5335) and seven being planted with an indeterminate MG IV soybean variety (Asgrow 4835) (Table 2).

Plot length and width along with irrigation varied depending on the grower's field and preference. Each location was planted with the grower's equipment. All differing parameters for each location are listed in Table 2. The grower at each location treated the entire field based on threshold numbers for insect pests that were obtained through an independent consultant. This treatment was considered the grower standard.

Each replication had two treatments, with one being the grower standard and the other an automatic Prevathon (Chlorantraniliprole, DuPont™) application that was applied every 2 weeks from R1 through R6.5. This automatic Prevathon application (Simulated Bt) was used to keep plots free of caterpillar pests throughout the growing season to represent any benefit or subthreshold benefit that Bt soybean may provide a grower.

Plots were sampled weekly using a standard 15-inch-diameter sweepnet, and 100 sweeps were taken per plot from R1 through R7. All insect pests and beneficial insects were recorded. Defoliation ratings were taken at R6. Yield was obtained using the grower's harvesting equipment and then measuring the weight of harvested seed for each plot in a weigh wagon. All weights were corrected to 13% moisture. All data was analyzed in SAS 9.4 (Proc Glimmix, Cary NC) with an analysis of variance with alpha level set at 0.05.

Table 2. A description of locations throughout Mississippi for large-plot simulated Bt trials.

County	Region	Irrigated	Planting Date	Maturity Group	Plot Width	Plot Length
Clay	Hills	No	5/5	IV	4 rows	~ 85 ft
Coahoma	Delta	Yes	5/7	IV	12 rows	~ 150 ft
Hinds	Hills	No	5/13	V	8 rows	~ 240 ft
Humphreys	Delta	Yes	5/1	IV	8 rows	~ 380 ft
Leflore	Delta	Yes	5/5	V	6 rows	~ 470 ft
Madison	Hills	No	5/5	IV	4 rows	~ 140 ft
Monroe	Hills	No	5/14	V	4 rows	~ 200 ft
Noxubee	Hills	No	5/8	IV	8 rows	~ 140 ft
Sharkey 1	Delta	Yes	5/5	IV	6 rows	~ 350 ft
Sharkey 2	Delta	Yes	5/5	V	6 rows	~ 350 ft
Sunflower	Delta	Yes	5/4	IV	12 rows	~ 390 ft

RESULTS AND DISCUSSION

Objective 1: Determine which planting dates of soybean are most vulnerable to insect pressure based on seasonal occurrence of insect pests.

All insect pest data were analyzed by planting date to determine which planting dates were most vulnerable. When looking at the caterpillar complex described in Table 1, the normal- and late-planted soybean had significantly more caterpillar pests than soybean in the early plantings (df 2,477; F=3.15; P=0.04) (Fig. 1).

There was no significant difference among planting dates when evaluating the stink bug complex (df 2,477; F=0.765; P=0.47) (Fig. 2). Bean leaf beetle numbers were significantly greater in the late plantings compared to normal and early plantings (df 2,477; F=4.27; P=0.01) (Fig. 3). Planting date had no significant effect on kudzu bug numbers (df 2,477; F=0.29; P=0.75) (Fig. 4).

For the 2015 growing season, insect populations were relatively low. Planting date had a significant impact on the caterpillar complex and bean leaf beetle. For both of these pests, early plantings of soybean had significantly fewer pests than later plantings. The same surveys will be conducted in 2016 to further evaluate how planting date affects insect pest occurrence for soybean grown throughout Mississippi.

Objective 2: Determine what benefit Bt soybean will bring to the Mississippi soybean producer.

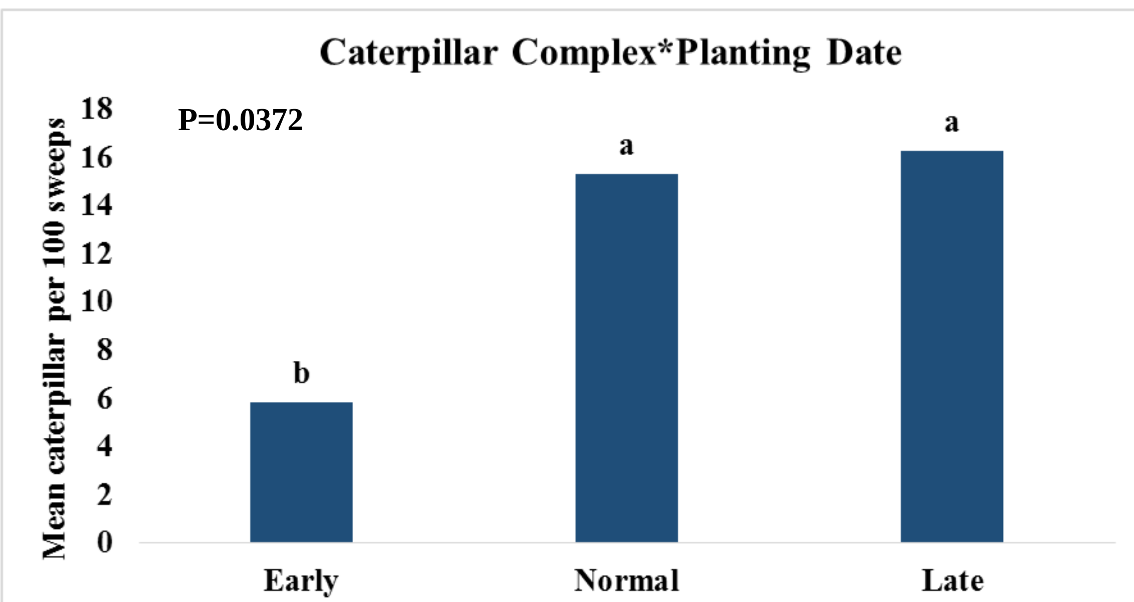
Data for defoliation ratings was analyzed across all locations and maturity groups. The simulated Bt plots had significantly less defoliation at R6 than did the grower standard (df 1,65; F=33.39; P<.01) (Fig. 5).

Defoliation ratings were further analyzed by individual trials, and it was found that 6 of the 11 locations had a significant difference in R6 defoliations between the grower standard and the simulated Bt plots (Table 3). As seen in Fig. 6, the grower standard always had more defoliation at R6 than did the simulated Bt plots. Defoliation during the early reproductive stages of soybean growth can be highly yield-limiting. If Bt soybean perform the same or better than the simulated Bt plots, growers will be protected from season-long defoliation, therefore protecting yield potential.

When yield data were analyzed across all maturity groups and locations, there was no significant difference (df 1,57; F=0.30; P=0.58) (Fig. 7). Therefore, data were then analyzed by each region to see if there was a significant difference by region between the grower standard and the simulated Bt. When data were analyzed by region, neither the Hills region (df 1,26; F=0.02; P=0.89) nor the Delta region (df 1,27; F=1.18; P=0.29) had a significant difference between the grower standard and the simulated Bt treatments (Fig. 8).

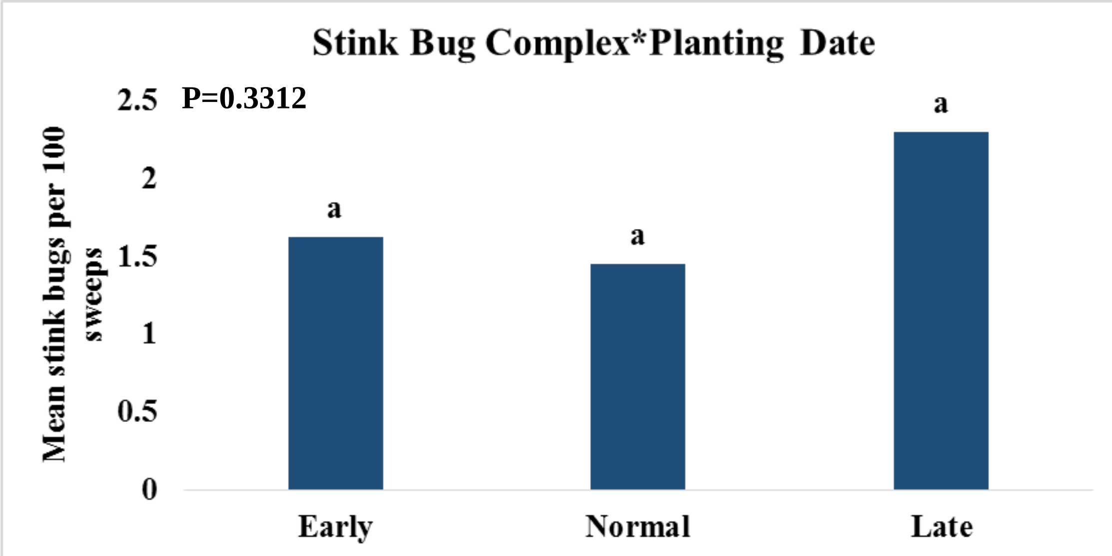
Data were further analyzed by individual trials, and when data were analyzed this way, two locations, Sharkey 1 MG IV (df 1,1; F=1466.02; P=0.02) and Noxubee (df 1,2; F=24.80; P=0.04), had a significant difference between the grower standard and the simulated Bt, with the simulated Bt yielding significantly higher than the grower standard (Fig. 9,10). Although all locations were not significantly different between the two treatments, 64% of the locations had a positive yield increase in the simulated Bt plots compared to the grower standard, with an average of 2.16 bushels per acre positive return (Table 4). These results indicate that even in years with low pest pressure, Bt soybean may bring potential benefit to Mississippi soybean growers with respect to yield.

Fig. 1. Caterpillar occurrence by planting date.



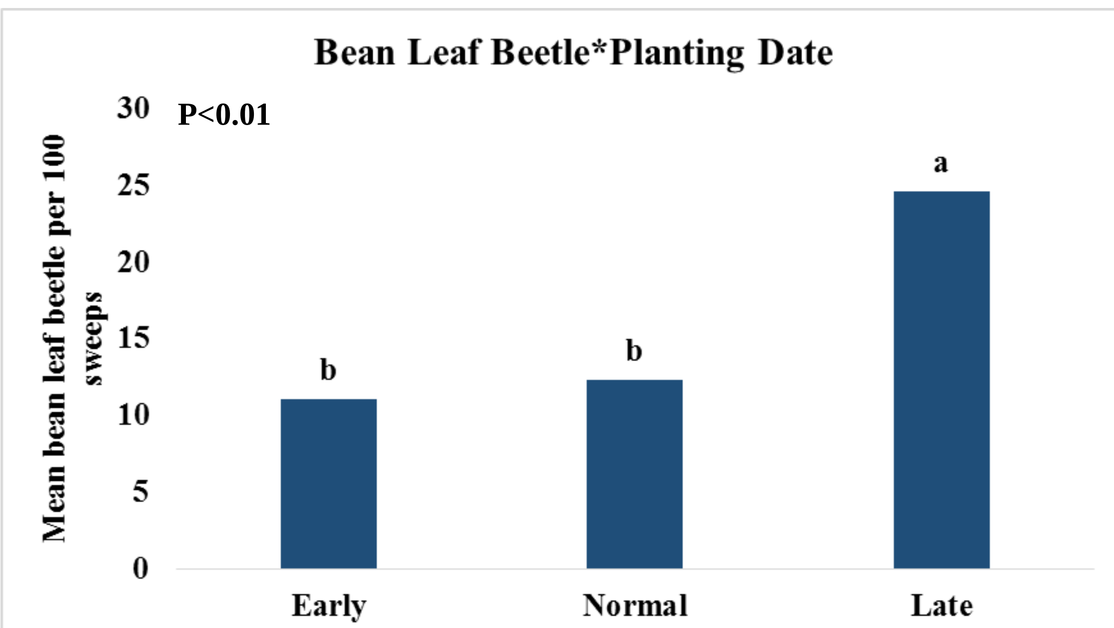
Means across columns followed by the same letter are not significantly different according to Fisher's Protected LSD test (α=0.05).

Fig. 2. Stink bug occurrence by planting date.



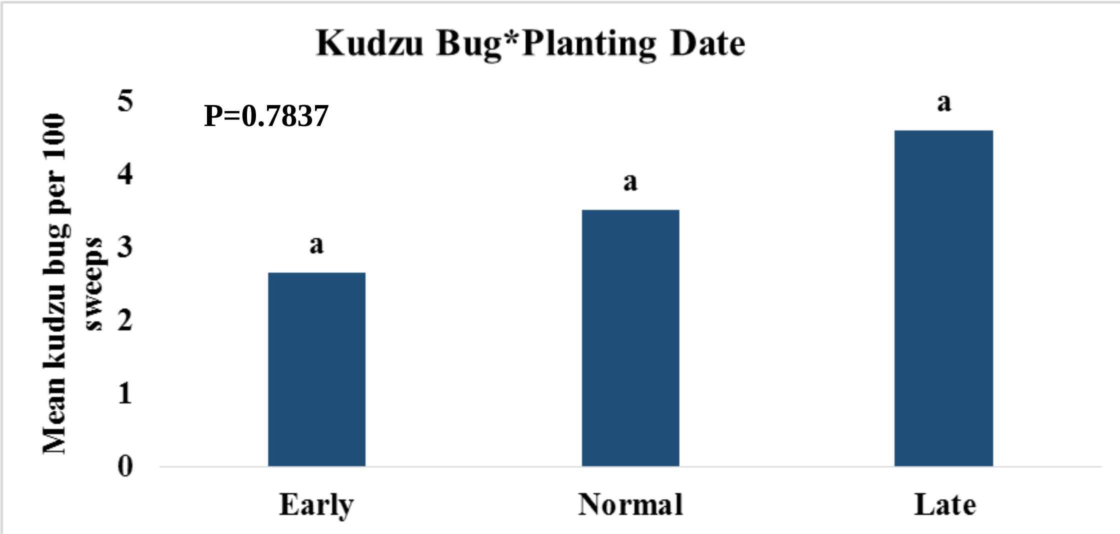
Means across columns followed by the same letter are not significantly different according to Fisher's Protected LSD test (α=0.05).

Fig. 3. Bean leaf beetle occurrence by planting date.



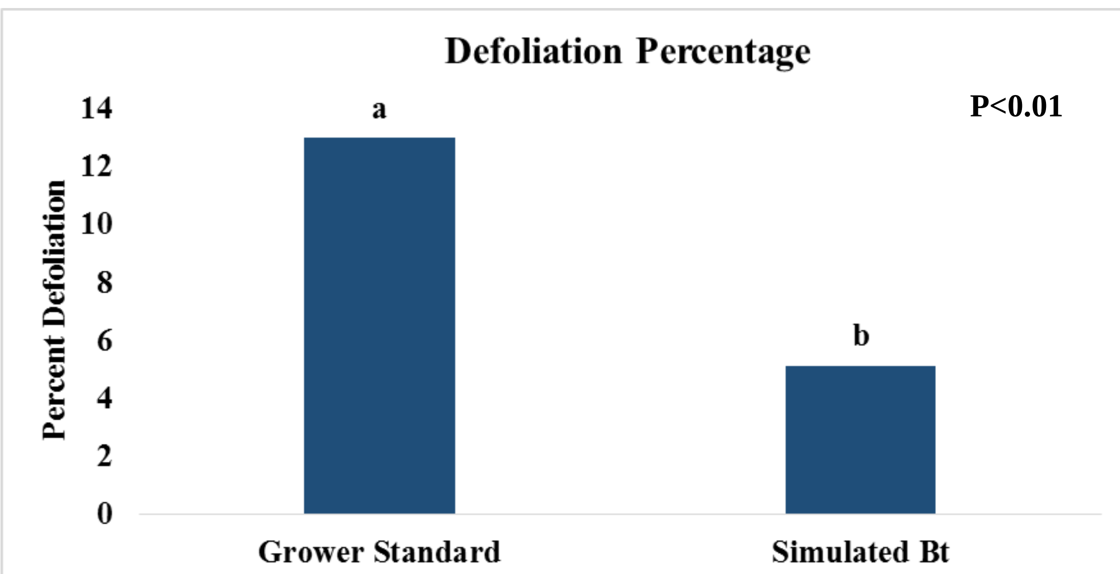
Means across columns followed by the same letter are not significantly different according to Fisher's Protected LSD test (α=0.05).

Fig. 4. Kudzu bug occurrence by planting date.



Means across columns followed by the same letter are not significantly different according to Fisher's Protected LSD test (α=0.05).

Fig. 5. R6 defoliation ratings with data analyzed across all locations and maturity groups.



Means across columns followed by the same letter are not significantly different according to Fisher's Protected LSD test (α=0.05).

Table 3. R6 percentage defoliations for each trial location.

Location	Grower Standard	Simulated Bt
Clay	11.67	6.67
Coahoma	5.00	5.00
*Hinds	35.00	5.00
Humphreys	10.00	6.67
*Leflore	15.00	5.00
*Madison	15.00	5.00
*Monroe	15.00	5.00
Noxubee	5.00	1.67
*Sharkey 1	10.00	5.00
*Sharkey 2	13.33	5.00
Sunflower	10.00	6.67
Average	13.18	5.15

*Represents locations that had a significant difference between the Grower Standard and Simulated Bt.

Fig. 6. R6 percentage defoliation difference between the simulated Bt and the Grower Standard.

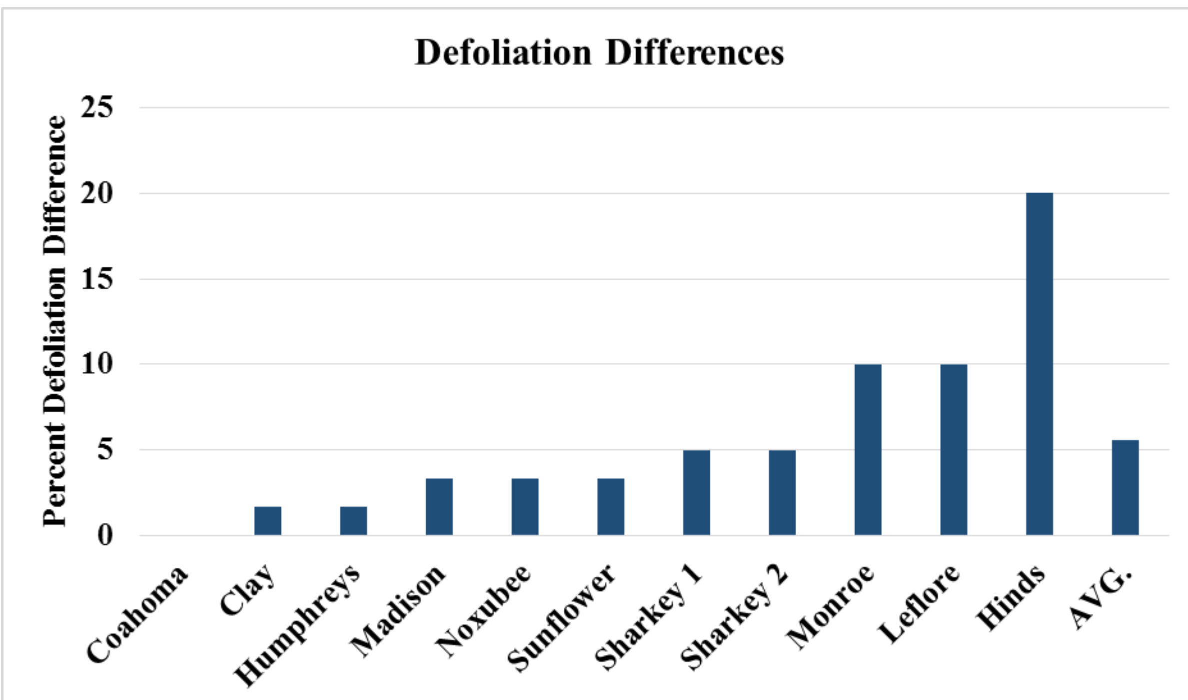


Fig. 7. Yield analyzed across all locations and maturity groups.

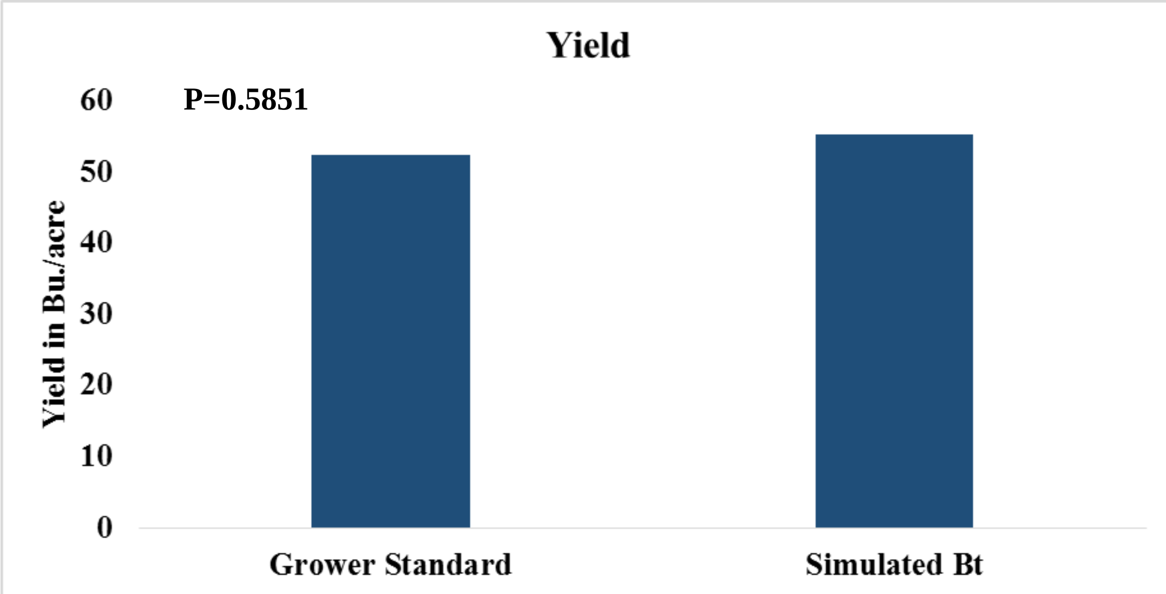
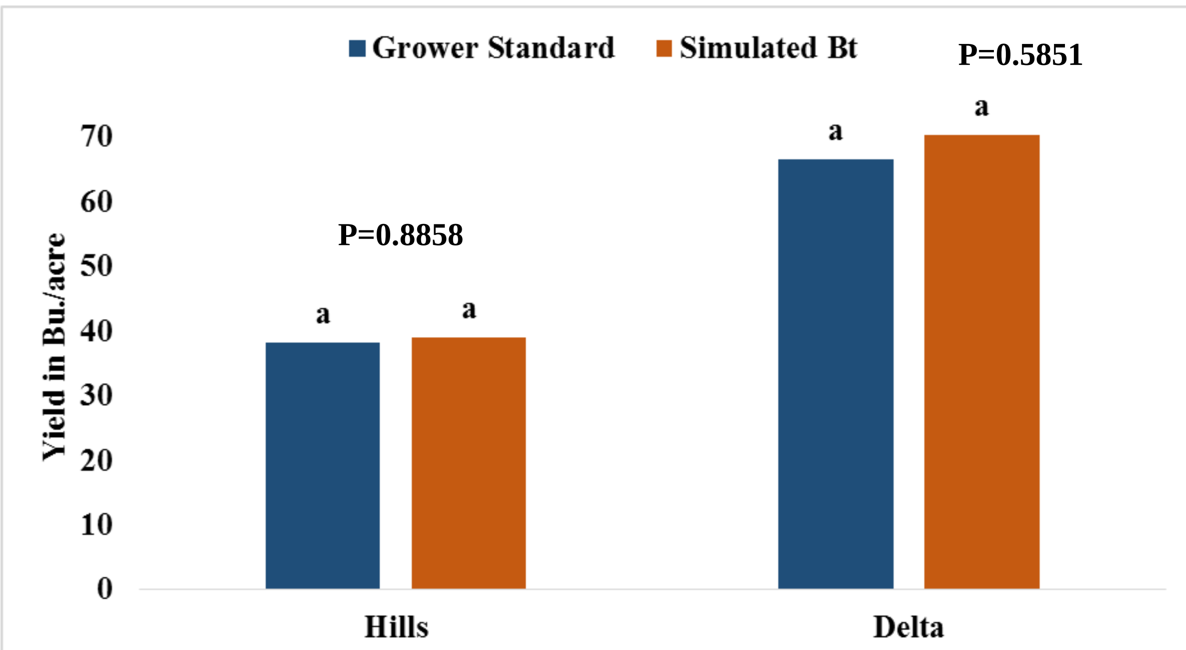
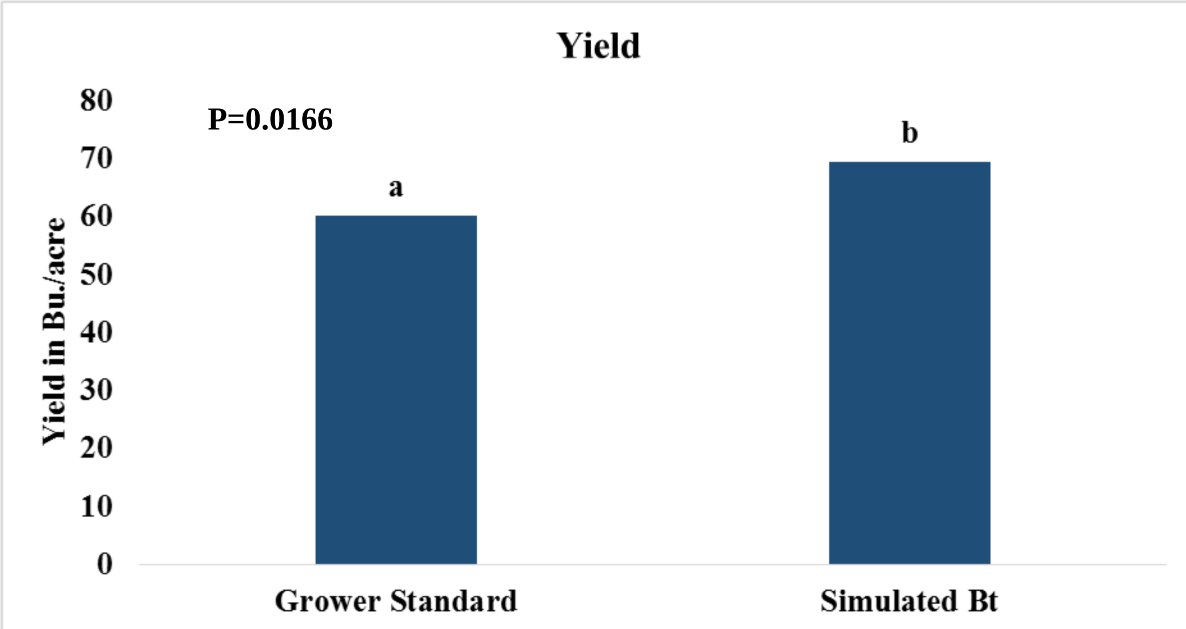


Fig.8. Yield analyzed by region.



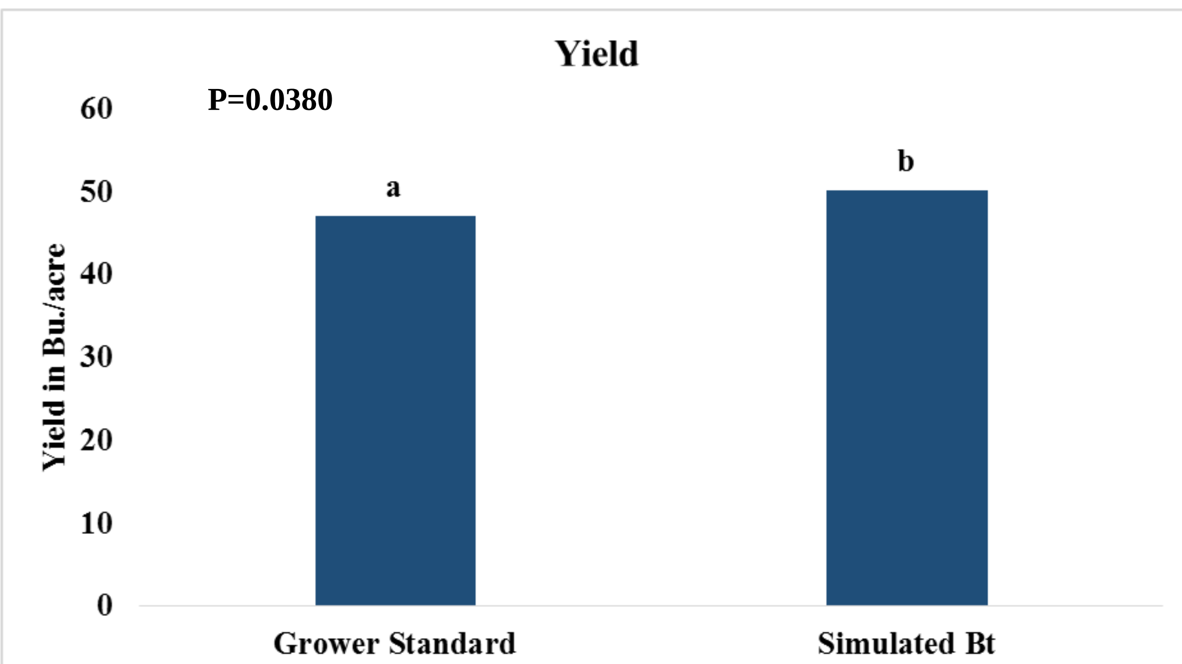
Means across columns followed by the same letter are not significantly different according to Fisher's Protected LSD test (α=0.05).

Fig. 9. Sharkey 1 yield analysis.



Means across columns followed by the same letter are not significantly different according to Fisher's Protected LSD test (α=0.05).

Fig. 10. Noxubee yield analysis.



Means across columns followed by the same letter are not significantly different according to Fisher's Protected LSD test (α=0.05).

Table 4. Yield returns for simulated Bt by location.

Location	Yield Return—bu/acre
Clay	-0.89
Coahoma	-2.01
Hinds	-0.06
Humphreys	4.19
Leflore	3.83
Madison	2.62
Monroe	-.05
Noxubee	3.14
Sharkey 1	9.27
Sharkey 2	2.74
Sunflower	0.99
Average	2.16

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