

# TIMELY INFORMATION

## Agriculture & Natural Resources

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### 2010 Buyer's Guide for Bt Corn in Alabama

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Bt corn\* is really a form of crop insurance that comes in the seed bag. The presence of one or more Bt genes in a corn hybrid will not increase yield potential. Instead, the gene(s) prevent yield losses from certain insects. Therefore, the most important thing to remember is that if the insect population in your field is high enough, the Bt corn will pay off. If the "insect pressure" is not there, then you won't get your money back. So it is a matter of deciding if the risk is high enough to warrant the "insurance." This information sheets discusses situations in which Bt corn can pay off.

There are different kinds of Bt corn. Some of the Bt genes protect against stalk borers. Some protect the roots from western corn rootworm. Still others help prevent leaf and ear damage from various caterpillars including corn earworm and fall armyworm. These genes are bundled together in various combinations, with or without herbicide tolerance genes. See Tables 1-2 below for details regarding transgenic products that include Bt insect resistance. Make sure that the seed dealer explains exactly what kind of Bt corn hybrids he is selling.

How much does Bt technology cost? It is important to work with your seed dealer to understand how much you are paying for the Bt technology, then weigh that against the expected benefits. The price of corn seed has risen dramatically in the past decade. This is because the price includes insecticide and fungicide seed treatments, as well as herbicide tolerance and Bt traits. The cost of Bt technology that protects against corn borers and other caterpillars is about \$3.70 for older products such as YieldGard Corn Borer, Agrisure CB/LL, and Herculex I. The cost of the Bt technology for western corn rootworms is also about \$3.70 per acre. This year many corn hybrids include a suite of transgenes marketed under the product name Genuity VT Triple Pro (GENVT3P). This product contains genes for Roundup tolerance, as well as for caterpillar and western corn rootworm control. The insect protection part of GENVT3P costs about \$10.50 per acre.\*\*

Always pick hybrids with good a good agronomic fit for your farm, and make sure the hybrid has good disease resistance. Always consider the yield potential of the hybrid family involved, and make sure the hybrid is adapted for planting in the Southeast. Then think about what other value-added traits are available, such as herbicide resistance or Bt corn technology.

\*Corn that contains insect resistance genes from the bacterium *Bacillus thuringiensis*

\*\* based on comparing the cost of a hybrid with GENVT3P with the same hybrid sold with Roundup resistance alone.

To help preserve the usefulness of Bt corn, the Environmental Protection Agency requires that non-Bt corn be planted on part of the corn acres on each farm as a refuge. See Tables 1-2 below for details about the amount of refuge corn needed for each type of Bt corn. Most Bt corn for aboveground caterpillars has a 50% refuge requirement. However, hybrids containing Genuity VT Triple Pro have just a 20% refuge requirement. This difference in the refuge requirement will affect the economic returns realized from a particular Bt technology.

There are four situations where it is easy to recommend planting Bt corn hybrids (see Table 1 for a listing of Bt corn products recommended for each of these situations). The reasoning for these recommendations is described below for each of these situations.

- Situation 1. Northwest Alabama, with consistently high Southwestern corn borer populations
- Situation 2. Corn that will be planted after the recommended planting date
- Situation 3. Corn planted in the southern tier of counties where pressure from fall armyworm is the highest
- Situation 4. Non-rotated (corn after corn) in north Alabama, where western corn rootworm can be a problem

The fifth situation in the table is corn planted at the recommended planting date, in which the corn earworm is the primary insect contributing to yield loss, year in and year out. Genuity VT Triple Pro (GENVT3P) may pay off in this situation. See below for the reasoning involved.

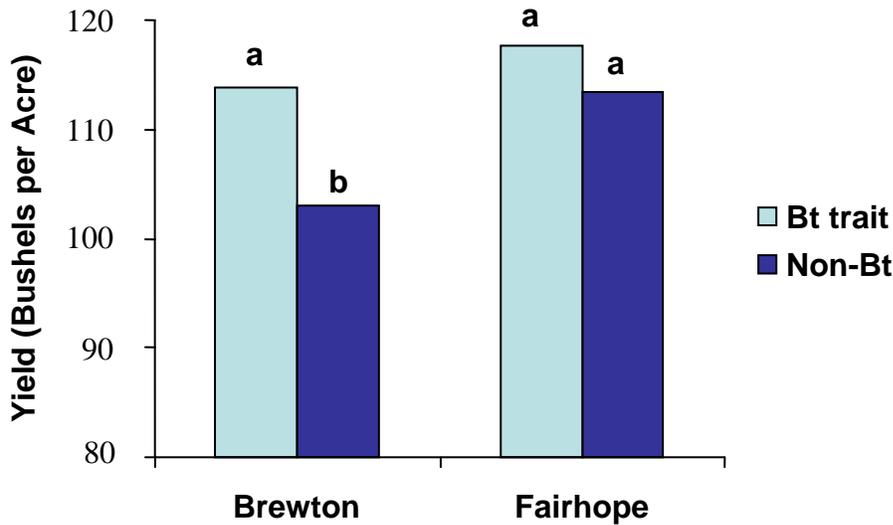
Table 1. Bt corn technology worksheet showing which Bt corn products are appropriate for different situations.

Product Trade Name (Abbreviation)**	Situation*					For every acre with this tech- nology plant this many non-Bt acres as a refuge
	1 stalk borers	2 late planting	3 South AL	4 root- worm	5 ear- worm	
Genuity VT Triple PRO (GENVT3P)	yes	yes	yes	yes	yes	0.25 acre
YieldGard Corn Borer (YGCB) or Agrisure CB/LL	yes	yes	maybe	no	no	1 acre
Herculex I (BT (HX I))	yes	yes	yes	no	no	1 acre
Herculex XTRA (CRW (HXRW) + BT (HX 1))	yes	yes	yes	yes	no	1 acre
YieldGard VT Triple (VT3) or YieldGard Plus (YGPL)	yes	yes	maybe	yes	no	1 acre
Agrisure CB/LL/RW or Agrisure 3000 GT	yes	yes	maybe	yes	no	1 acre
Herculex RW (CRW (HXRW)), Agrisure RW, or YieldGard Rootworm (YGRW)	no	no	no	yes	no	.25 acre

\*See below for a detailed discussion of each of these situations

\*\*The most commonly available commercial products are listed. Others are available, see Table 2 below for a complete listing including products that may be available for Southern adapted hybrids in 2011).

**Remember**, Bt corn is **insurance**, there are no guarantees that insect pressure will be high enough in every field every year. A good example of this is data from Austin Hagan's 2009 trials in Brewton and Fairhope, using hybrids containing Herculex I, YieldGard Corn Borer, or YieldGard VT Triple. A significant difference in yield was observed in Brewton, but not in Fairhope (LSD  $P \leq 0.05$ ):



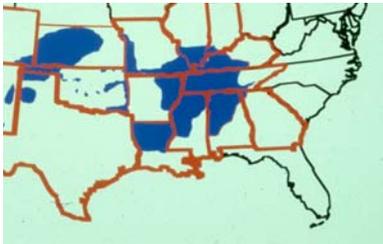
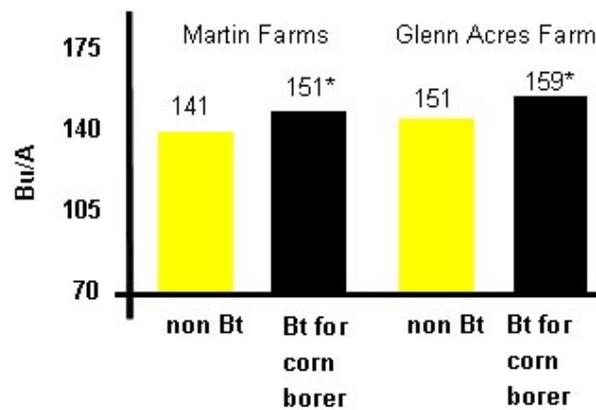
### Situations where Bt Technology is Most Likely to Pay Off

**Situation 1.** Do you have grow corn in an area known to have **consistent stalk borer problems**? If so, pick a hybrid that works for **Situation 1** in Table 1.



Advantage for Bt corn for SW corn borer:

9 bushels per acre in 2004



Southwestern corn borer distribution

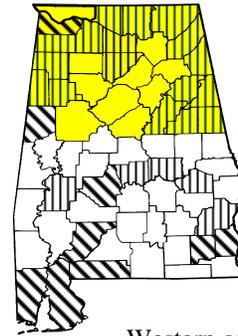
R. Duffield, AL Wheat & Feed Grain Study



**Situation 4.** Do you grow **corn after corn** in an area known to have problems with western corn rootworm? If so, pick a hybrid that works for **Situation 4** in Table 1.



western corn rootworm adult, about 1/4" long.



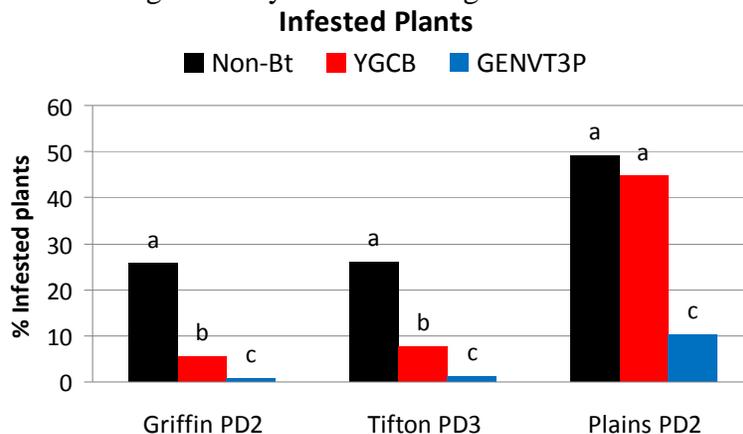
Western corn rootworm as of 2009

- found in traps
- area at greatest risk
- not found in traps

### A Situation Where Bt Corn May Pay Off

**Situation 5.** which is perhaps the most common situation in Alabama, is corn planted at the recommended planting date, in which the primary insect contributing to yield loss, year in and year out, is the corn earworm. Fall armyworm damage varies from year to year in this situation but can be significant. One transgenic product, Genuity VT Triple Pro (GENVT3P), is highly effective against these two pests. In 2011, two more products will be available for this situation (Genuity SmartStax and Agrisure Viptera). The yield return from this technology will depend primarily on how high the pressure is from corn earworm and fall armyworm. Field trials in the Southeast, from industry and university researchers, have shown an **average 3 bushel per acre** yield difference between a hybrid with GENVT3P and its corresponding isolate (in areas where corn earworm and fall armyworm were the primary pests).

The following 2009 data, courtesy Dr. David Buntin, University of Georgia, shows how the GENVT3P product has significantly less ear damage than YGCB or a non-Bt corn.



Studies are ongoing to determine if this greater ear protection will result in consistently lower aflatoxin levels. To date, results regarding aflatoxin have been mixed. This may be due to the fact that other insects, including stink bugs, and maize weevils, have also been associated with higher aflatoxin contamination.

**Table 2. Relative Efficacy of Various Bt Corn Products<sup>1</sup>**

version 2010.2

Product Trade Name (Abbreviation)	Corn Earworm (ear)	Fall Armyworm (whorl)	Corn Borers <sup>2</sup> (stalk)	Western Corn Rootworm <sup>3</sup> (roots)	Black Cutworm (seedling)	Lesser Cornstalk Borer <sup>4</sup>	Refuge Requirement <sup>5</sup>	Original Target Pests (Bt Protein)	Event(s)
<b>Bt Corn for Controlling Above-Ground Caterpillars (Moths, Lepidoptera)</b>									
Herculex I (BT (HX 1))	Poor-Fair <sup>6</sup>	Excellent	Excellent	None	Good	Good-Excellent	50%	Corn borer, western bean cutworm, black cutworm and fall armyworm resistance (Cry1F) Liberty (glufosinate) herbicide tolerance	TC1507
Agrisure CB/LL	Fair-Good	Good	Excellent	None	Poor	Poor-Fair	50%	Corn borer protection (Cry1Ab) Liberty (glufosinate) herbicide tolerance	Bt11
YieldGard Corn Borer (YGCB)	Fair-Good	Good	Excellent	None	Poor	Poor-Fair	50%	Corn borer protection (Cry1Ab)	MON810
YieldGard VT Pro (VTP)	Very Good	Excellent	Excellent	None	Poor	Poor-Fair	20%	Corn borer, fall armyworm, corn earworm protection (Cry1A.105 and Cry2Ab)	MON89034
<b>Bt Corn for Controlling Below-Ground Rootworms (Beetles, Coleoptera)</b>									
Agrisure RW	None	None	None	Fair-Good	None	None	20%	Corn rootworm protection (modified Cry3A)	MIR604
Herculex RW CRW (HXRW)	None	None	None	Excellent	None	None	20%	Corn rootworm resistance (Cry34/35Ab1) Liberty (glufosinate herbicide tolerance)	DAS-59122-7
YieldGard Rootworm (YGRW)	None	None	None	Good	None	None	20%	Corn rootworm protection (Cry 3Bb)	MON863
YieldGard VT Rootworm/RR2 (VTRR2)	None	None	None	Excellent	None	None	20%	Corn rootworm protection (Cry3Bb) Roundup (glyphosate) herbicide tolerance	MON 88017
<b>Bt Corn for Controlling Above-Ground Caterpillars (Lepidoptera) and Below-Ground Rootworms (Coleoptera)</b>									
YieldGard Plus (YGPL)	Fair-Good	Good	Excellent	Good	Poor	Poor-Fair	50%	Corn borer protection (Cry1Ab) Corn rootworm protection (Cry3Bb)	MON810 MON863
YieldGard VT Triple (VT3)	Fair-Good	Good	Excellent	Excellent	Poor	Poor-Fair	50%	Corn borer protection (Cry1Ab) Corn rootworm protection (Cry3Bb) Roundup (glyphosate) herbicide tolerance	MON 810 MON 88017
Agrisure CB/LL/RW	Fair-Good	Good	Excellent	Fair-Good	Poor	Poor-Fair	50%	Corn borer protection (Cry1Ab) Corn rootworm protection (modified Cry3A) Liberty (glufosinate) herbicide tolerance	Bt11 MIR604

continued

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<b>Bt Corn for Controlling Above-Ground Caterpillars (Lepidoptera) and Below-Ground Rootworms (Coleoptera)</b>									
Agrisure 3000 GT	Fair-Good <sup>6</sup>	Good	Excellent	Fair-Good	Poor	Poor-Fair	50%	Corn borer protection (Cry1Ab) Corn rootworm protection (modified Cry3A) Roundup (glyphosate) herbicide tolerance Liberty (glufosinate) herbicide tolerance	Bt11 MIR604 SYTGA21
Herculex XTRA (CRW (HXRW) + BT (HX 1))	Poor-Fair	Excellent	Excellent	Excellent	Good	Good-Excellent	50%	Corn borer, fall armyworm, western bean cutworm, black cutworm and resistance (Cry1F) Corn rootworm resistance (Cry34/35Ab1) Liberty (glufosinate) herbicide tolerance	TC1507 DAS 59122-7
Genuity VT Triple PRO (GENVT3P)	Very Good	Excellent	Excellent	Excellent	Poor	Poor-Fair	20%	Corn borer, fall armyworm, corn earworm protection (Cry1A.105 and Cry2Ab) Corn rootworm protection (Cry3Bb) Roundup (glyphosate) herbicide tolerance	MON 89034 MON 88017
Genuity SmartStax (VT3P/HXX)	Very Good	Excellent	Excellent	Excellent	Good	Good-Excellent	20%	Corn borer, fall armyworm, corn earworm, western bean cutworm, black cutworm protection (Cry1A.105, Cry2Ab, Cry1F) Corn rootworm protection (Cry3Bb, Cry34/35Ab1) Roundup (glyphosate) herbicide tolerance Liberty (glufosinate) herbicide tolerance	MON 89034 MON 88017 TC1507 DAS 59122-7
Agrisure Viptera <sup>7</sup> stacked with Agrisure 3000 GT or Agrisure CB/LL/RW or Agrisure CB/LL	Excellent	Excellent	Excellent	Fair- Good if stacked with the RW trait (MIR 604)	Very Good	?	20%	Corn earworm, western bean cutworm, black cutworm, and fall armyworm control (Vip3A) Corn borer protection (Cry1Ab) Liberty (glufosinate) herbicide tolerance depending on stack: Roundup (glyphosate) herbicide tolerance and corn rootworm protection (modified Cry3A)	MIR162 Bt11 depending on stack: SYTGA21 MIR604

<sup>1</sup> Most of these insect resistant products are marketed as stacks with herbicide resistant products.

<sup>2</sup> Southwestern corn borer, European corn borer, and sugarcane borer.

<sup>3</sup> There are several species of corn rootworm in the Southeast. Southern corn rootworm is the most prevalent species. These “rootworm” products are not effective against southern corn rootworm. They are effective against western corn rootworm larvae, which occur in areas such as north Alabama and north Georgia.

<sup>4</sup> Lepidopteran Bt traits do not specifically list lesser cornstalk borer as a target pest.

<sup>5</sup> See product Insect Resistance Management (IRM) documentation from the seed companies for more details.

<sup>6</sup> The exact meaning of these terms is somewhat arbitrary. *Excellent* means better than 95 percent control. *Poor* means about 30 to 50 percent control. Rankings are meant to be relative, not absolute.

<sup>7</sup> When this document was printed, Viptera was not for sale in the U.S. This product will not be available until all necessary regulatory approvals and authorizations have been granted.