Department of Plant Sciences

TENNESSEE ROW CROP TRAIT CHEAT SHEET

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The majority of corn, soybean and cotton grown in Tennessee are genetically modified. These traits provide important tools for controlling weed and insect issues faced by producers. As single traits make way to multi-trait stacks, keeping track of what is contained in various packages can be challenging. To address this challenge, this publication provides an overview of currently available herbicide and insect tolerance packages being marketed in Tennessee corn, soybean and cotton.

Soybean

Soybean genetic modification has focused primarily on herbicide tolerance. Several platforms are currently available. Table 1 provides a general overview of herbicide tolerance by trait. This overview is followed by a more detailed overview for each trait.

Table 1. Summary of available soybean herbicide tolerance traits. Herbicides are abbreviated as follows: Sulfonylurea (Sulf.); Glufosinate (Gluf.); Glyphosate (Glyp.); Dicamba (Dica.); 2,4-dicholorophenoxyacetic acid (2,4-D); Isoxaflutole (Isox.).

Trait Name	Abbr.	Company	Sulf.	Gluf.	Glyp.	Dica.	2,4-D	Isox.
Sulfonylurea Tolerant[z]	STS, SR	Off patent	x					
Roundup Ready	RR, RR1	Off patent			x			
Roundup Ready 2 Yield	RR2, RR2Y	Bayer			x			
Roundup Ready 2 Xtend	RR2X	Bayer			x	x		
XtendFlex	XF	Bayer		x	x	x		
LibertyLink	LL	BASF		x				
GT27[y]	GT27	BASF			x			x
Enlist E3	E3	Corteva		x	x		x	

[z] Available stand-alone or as a stack with other traits

[y] Available stand-alone or as a stack with the LL trait

Sulfonylurea tolerant (STS)

Sulfonylurea tolerance is a native (non-GM) trait. Two versions are available. The first contains a single gene, Als1, and is off-patent while the second contains two genes, Als1 and Als2, and is owned by Corteva. Both confer tolerance to sulfonylurea, which is in the ALS inhibitor class of herbicides. STS is available as a standalone trait or in combination with a number of other traits.

Roundup Ready (RR) and Roundup Ready 2 Yield (RR2Y)

The original Roundup Ready trait, which confers tolerance to glyphosate, is off-patent but can still be found in offerings out of university breeding programs and from some smaller seed companies. Roundup Ready 2 Yield, while not differing in herbicide tolerance from the original Roundup Ready, was marketed as having less yield drag. Roundup Ready 2 Yield is still available in a number of commercial lines, though Bayer has shifted most of its material development into the Roundup Ready 2 Xtend platform.

Roundup Ready 2 Xtend (RR2X) and XtendFlex (XF)

Roundup Ready 2 Xtend soybeans, which combine glyphosate and dicamba tolerance, have steadily increased in number over the past few years and currently dominate the soybean market in Tennessee. This increase has been driven largely by a need to control glyphosate resistant weeds which began to occur in the Western part of the state and have become increasingly problematic statewide. Current offerings are expected to shift to the newly launched XtendFlex platform, which combines glyphosate, glufosinate and dicamba tolerance. Herbicides labeled for use in the Xtend platform include XtendiMax, Enginia and Tavium. Because of potential issues with off-target injury, these herbicides have a number of restrictions and require additional applicator training.

LibertyLink (LL) and LL/GT27

Tolerance to glufosinate has been important to Tennessee producers in addressing issues with glyphosate and dicamba tolerant weeds. Standalone LibertyLink soybeans are still available, but will likely make way to the newer stacks of LL and GT27 which combine glufosinate tolerance with glyphosate and isoxaflutole tolerance. Isoxaflutole is the first member of a new structural class of herbicides and is the active ingredient in the herbicide Alite27. Growers should be aware that Alite 27 is currently restricted to use in a select number of counties.

Enlist E3

Enlist E3 soybeans combine tolerance to glyphosate, glufosinate and 2,4-D. While offerings in this platform have been limited in Tennessee, increases are expected over the coming years. Growers should be aware that the glyphosate tolerance trait contained in Enlist E3 and LLGT27 is not the same as that contained in the Roundup Ready platform. Because of this, not all glyphosate products are labeled for use on Enlist E3 soybeans. Enlist One (2,4-D choline) and Enlist Duo (glyphosate + 2,4-D choline) are two herbicides registered for use on Enlist E3 soybeans.

Corn

Unlike soybean, herbicide tolerance in corn has mainly been restricted to hybrids with tolerance to glyphosate, glufosinate or a combination of both. Enlist hybrids, containing quizalofop, glyphosate, glufosinate and 2,4-D tolerance, are limited but expected to expand along with

acreage of Enlist E3 soybeans. Insect tolerance, on the other hand, has rapidly expanded, stacking multiple Bt proteins to encompass a broad range of insect pests. A complete list of Bt corn traits and abbreviations is included in "The Handy Bt Trait Table for U.S. Corn Production" (texasinsects.org/bt-corn-trait-table.html). A summary of trait efficacy in the Southeast is available in "2019 Bt Corn Products for the Southeastern United States" (grains.caes.uga.edu/content/dam/caes-subsite/grains/docs/corn/2019-Bt-corn-SE-Bt-corn-traits.pdf).

Cotton

Similar to corn, herbicide tolerance in cotton cultivars has recently boiled down to three major traits. The XtendFlex trait, abbreviated XF in cultivar names, provides tolerance to glyphosate, glufosinate and dicamba. The Enlist trait, abbreviated FE in cultivar names, provides tolerance to glyphosate, glufosinate and 2,4-D. The Glytol/LibertyLink trait, abbreviated GL in cultivar names, provides tolerance to glyphosate and glufosinate. Almost all of Tennessee's cotton acres are currently planted to cultivars containing either the XF or FE traits, with greater than 99 percent of the acreage containing either the XF, FE or GL trait; conventional cultivars containing no herbicide trait currently comprise less than 1 percent of Tennessee's planted cotton acres. Available Bt traits for cotton and their relative efficacy are given in Table 2.

Table 2. Relative efficacy of commercially available Bt cotton traits on common caterpillar pests.

Target Pest	Bollgard 2 or TwinLink Cry1A, Cry2A	WideStrike 3 Cry1F, Cry1A, Vip3A	Bollgard 3 or TwinLink Plus Cry1A, Cry2A, Vip3A
Tobacco Budworm	Excellent	Excellent	Excellent
Bollworm	Good*	Very Good*	Very Good*
Fall Armyworm	Good*	Excellent	Excellent
Beet Armyworm	Very Good	Excellent	Excellent

* Supplemental insecticide applications may still be necessary in some cases.

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