

# The Handy Bt Trait Table

## for U.S. Corn Production

The latest version of the table is always posted at <https://www.texasinsects.org/bt-corn-trait-table.html>

For questions & corrections: Chris DiFonzo, Michigan State Univ., [difonzo@msu.edu](mailto:difonzo@msu.edu)

Contributor: Pat Porter, Texas A&M University (web site host)

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The Handy Bt Trait Table provides a helpful list of trait names (below) and details of trait packages (over) to make it easier to understand company seed guides, sales materials, and bag tags. This latest version incorporates two new findings of resistance, and categorizes western & northern corn rootworm separately.

**Breaking News #1:** Entomologists at the University of Guelph in Canada confirmed European corn borer (ECB) resistance to Cry1F Bt (the Herculex I trait) in corn. In 2018, ECB populations were collected from multiple locations in the Maritime Provinces of eastern Canada where unexpected damage was reported. Lab bioassays showed a high level of resistance to Cry1F; the registrant of the trait independently confirmed the results. *This is the first case of field-evolved resistance by ECB to Bt corn.*



Use of single-trait hybrids likely contributed to the problem. In eastern Canada, hybrids with only one Bt trait (Cry1F) were still being sold & planted, well after an expected phase out in favor of multi-Bt pyramids to allow for reduced 5% refuge. Although the Maritime provinces are far from the major corn production area in the central U.S., the bioassay results demonstrate that ECB resistance to Bt corn can happen, and that phasing out single-trait hybrids is critical. In short-growing season areas of the U.S. and Canada, seed options tend to be limited, so single-trait hybrids may still be available. Using them risks the development of additional resistant insect populations.

**Breaking News #2:** Entomologists at North Dakota State University confirmed northern corn rootworm resistance to Cry3Bb1 and Cry34Ab1/Cry35Ab1. Although resistance to multiple traits is well-documented in the Midwest for western corn rootworm, this is the *first confirmation of field-evolved resistance by the northern corn rootworm.*

### Field corn 'events' (transformations of one or more genes) and their Trade Names

Trade name for trait	Event	Protein(s) expressed	Primary Insect Targets + <i>Herbicide tolerance</i>
Agrisure CB/LL	Bt11	Cry1Ab + PAT	corn borer + <i>glufosinate</i>
Agrisure Duracade	5307	eCry3.1Ab	rootworm
Agrisure GT	GA21	EPSPS	<i>glyphosate</i>
Agrisure RW	MIR604	mCry3A	rootworm
Agrisure Viptera	MIR162	Vip3Aa20	broad caterpillar control, except for corn borer
Enlist	DAS40278	<i>aad-1</i>	<i>2,4-D herbicide detoxification</i>
Herculex I (HXI) or CB	TC1507	Cry1Fa2 + PAT	corn borer + <i>glufosinate</i>
Herculex CRW	DAS-59122-7	Cry34Ab1/Cry35Ab1 + PAT	rootworm + <i>glufosinate</i>
(None – part of Qrome)	DP-4114	Cry1F + Cry34Ab1/Cry35Ab1 + PAT	corn borer + rootworm + <i>glufosinate</i>
Roundup Ready 2	NK603	EPSPS	<i>glyphosate</i>
Yieldgard Corn Borer	MON810	Cry1Ab	corn borer
Yieldgard Rootworm	MON863	Cry3Bb1	rootworm
Yieldgard VT Pro	MON89034	Cry1A.105 + Cry2Ab2	corn borer & several caterpillar species
Yieldgard VT Rootworm	MON88017	Cry3Bb1 + EPSPS	rootworm + <i>glyphosate</i>

### Abbreviations used in the Trait Table

#### Herbicide traits

GT *glyphosate tolerant*

LL Liberty Link - *glufosinate-tolerant*

RR2 Roundup Ready 2, *glyphosate-tolerant*

#### Insect targets

BCW black cutworm

CEW corn earworm

ECB European corn borer

FAW fall armyworm

CR corn rootworm (NCR = Northern & WCR = Western)

SB stalk borer

SCB sugarcane borer

SWCB southwestern corn borer

TAW true armyworm

WBC western bean cutworm

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Trait packages in alphabetical order (acronym)	Bt protein(s) in the trait package	Marketed for control of:											Resistance confirmed to the combination of Bts in package (check local situation)	Herbicide trait		Non-Bt Refuge % (cornbelt)	
		B C W	C E W	E C B	F A W	S C B	S C B	S C B	T A W	W B C	W B C	R		GT RR2	LL		
AcreMax (AM)	Cry1Ab Cry1F	x		x	x	x	x	x	x					FAW WBC	x	x	5% in bag
AcreMax CRW (AMRW)	Cry34/35Ab1												x	NCR/WCR	x	x	10% in bag
AcreMax1 (AM1)	Cry1F Cry34/35Ab1	x		x	x	x	x	x	x				x	ECB FAW SWCB WBC NCR/WCR	x	x	10% in bag 20% ECB
AcreMax Leptra (AML)	Cry1Ab Cry1F Vip3A	x	x	x	x	x	x	x	x	x	x				x	x	5% in bag
AcreMax TRIssect (AMT)	Cry1Ab Cry1F mCry3A	x		x	x	x	x	x	x				x	FAW WBC WCR	x	x	10% in bag
AcreMax Xtra (AMX)	Cry1Ab Cry1F Cry34/35Ab1	x		x	x	x	x	x	x				x	FAW WBC NCR/WCR	x	x	10% in bag
AcreMax Xtreme (AMXT)	Cry1Ab Cry1F mCry3A Cry34/35Ab1	x		x	x	x	x	x	x				x	FAW WBC WCR	x	x	5% in bag
Agrisure 3010 and 3010A	Cry1Ab			x				x	x						x	x	20%
Agrisure 3000GT and 3011A	Cry1Ab mCry3A			x				x	x				x	WCR	x	x	20%
Agrisure Viptera 3110	Cry1Ab Vip3A	x	x	x	x	x	x	x	x	x	x				x	x	20%
Agrisure Viptera 3111	Cry1Ab Vip3A mCry3A	x	x	x	x	x	x	x	x	x	x			WCR	x	x	20%
Agrisure 3120 E-Z Refuge	Cry1Ab Cry1F	x		x	x	x	x	x	x					FAW WBC	x	See bag tag for code	5% in bag
Agrisure 3122 EZ Refuge	Cry1Ab Cry1F mCry3A Cry34/35Ab1	x		x	x	x	x	x	x				x	FAW WBC WCR	x		5% in bag
Agrisure Viptera 3220 E-Z Refuge	Cry1Ab Cry1F Vip3A	x	x	x	x	x	x	x	x	x	x				x		5% in bag
Agrisure Viptera 3330 E-Z Refuge	Cry1Ab Vip3A Cry1A.105 + Cry2Ab2	x	x	x	x	x	x	x	x	x	x				x		EZ0 NO
Agrisure Duracade 5122 E-Z Refuge	Cry1Ab Cry1F mCry3A eCry3.1Ab	x		x	x	x	x	x	x				x	FAW WBC WCR	x	EZ1 YES	5% in bag
Agrisure Duracade 5222 E-Z Refuge	Cry1Ab Cry1F Vip3A mCry3A eCry3.1Ab	x	x	x	x	x	x	x	x	x	x			WCR	x		5% in bag
Herculex I (HXI)	Cry1F	x		x	x	x	x	x	x					ECB FAW SWCB WBC	x	x	20%
Herculex RW (HXRW)	Cry34/35Ab1												x	NCR/WCR	x	x	20%
Herculex XTRA (HXX)	Cry1F Cry34/35Ab1	x		x	x	x	x	x	x				x	ECB FAW SWCB WBC NCR/WCR	x	x	20%
Intrasect (YHR)	Cry1Ab Cry1F	x		x	x	x	x	x	x					FAW WBC	x	x	5%
Intrasect TRIssect (CYHR)	Cry1Ab Cry1F mCry3A	x		x	x	x	x	x	x				x	FAW WBC WCR	x	x	20%
Intrasect Xtra (YXR)	Cry1Ab Cry1F Cry34/35Ab1	x		x	x	x	x	x	x				x	FAW WBC NCR/WCR	x	x	20%
Intrasect Xtreme (CYXR)	Cry1Ab Cry1F mCry3A Cry34/35Ab1	x		x	x	x	x	x	x				x	FAW WBC WCR	x	x	5%
Leptra (VYHR)	Cry1Ab Cry1F Vip3A	x	x	x	x	x	x	x	x	x	x				x	x	5%
Powercore <sup>a</sup>	Cry1A.105 Cry2Ab2	x	x	x	x	x	x	x	x					CEW WBC	x	x	<sup>a</sup> 5%
Powercore Refuge Advanced <sup>b</sup>	Cry1F																<sup>b</sup> 5% in bag
QROME (Q)	Cry1Ab Cry1F mCry3A Cry34/35Ab1	x		x	x	x	x	x	x				x	FAW WBC WCR	x	x	5% in bag
SmartStax <sup>a</sup>	Cry1A.105 Cry2Ab2	x	x	x	x	x	x	x	x				x	CEW WBC	x	x	<sup>a</sup> 5%
Smartstax Refuge Advanced <sup>b</sup>	Cry1F Cry3Bb1													WCR			<sup>b</sup> 5% in bag
SmartStax RIB Complete <sup>b</sup>	Cry34/35Ab1																
Trecepta <sup>a</sup>	Cry1A.105 Cry2Ab2	x	x	x	x	x	x	x	x	x	x				x		<sup>a</sup> 5%
Trecepta RIB Complete <sup>b</sup>	Vip3A																<sup>b</sup> 5% in bag
TRIssect (CHR)	Cry1F mCry3A	x		x	x	x	x	x	x				x	ECB FAW SWCB WBC WCR	x	x	20%
VT Double PRO <sup>a</sup>	Cry1A.105 Cry2Ab2		x	x	x	x	x	x	x					CEW	x		<sup>a</sup> 5%
VT Double PRO RIB Complete <sup>b</sup>																	<sup>b</sup> 5% in bag
VT Triple PRO <sup>c</sup>	Cry1A.105 Cry2Ab2		x	x	x	x	x	x	x				x	CEW NCR/WCR	x		<sup>c</sup> 20%
VT Triple PRO RIB Complete <sup>d</sup>	Cry3Bb1																<sup>d</sup> 10% in bag
Yieldgard Corn Borer (YGCB)	Cry1Ab			x				x	x						x		20%
Yieldgard Rootworm (YGRW)	Cry3Bb1												x	NCR/WCR	x		20%
Yieldgard VT Triple	Cry1Ab Cry3Bb1			x				x	x				x	NCR/WCR	x		20%