

# How to use the Handy Bt Trait Table

Chris DiFonzo, Michigan State University

*Disclaimer: examples in this slide set are given to demonstrate use of the Bt table, not to endorse any specific company, trait, or hybrid*

# The Handy Bt Trait Table

- Developed as a reference for US Bt corn trait packages
- *Why is it 'handy'? Because few sources compare all Bt trait packages in a single document*

## The Handy Bt Trait Table

Updated March 2023

for U.S. Corn Production

Compiled by  
Chris DiFonzo  
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Web site hosting by  
Pat Porter  
Texas A&M University

The most up-to-date version of this table plus related extension materials are free online at:  
<https://www.texasinsects.org/bt-corn-trait-table.html>  
Questions? Comments? Complaints? difonzo@msu.edu

The Handy Bt Trait Table provides a helpful list of trait packages to make it easier to understand seed guides, sales materials, and bag tags.

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For those who need it, the table of 'transformation events' (on page 1 of previous versions) has moved online. Also new online: a checklist of events x stacks, plus a list of EPA registration numbers for the trait packages on the Handy Bt Trait Table. Visit the web link in the header.

I am often asked why older trait packages with limited or no commercial availability remain on the table. This is for historical reference, to interpret previous year's planting records, seed guides, and research results. Also, companies often refer to older trait stack names in current seed guides (e.g. 'AwesomeSeed's new XYZ-Pro is a combination of trait packages A, B, and C'). Thus, the Handy Bt Trait Table is a one-stop shop for both past and present Bt hybrid information.

### ABBREVIATIONS in the TRAIT TABLE

#### Insect Pest Targets

BCW black cutworm  
CEW corn earworm  
CRW corn rootworm  
ECS European corn borer  
FAW fall armyworm  
NCR northern corn rootworm  
SB stalk borer  
SCB sugarcane borer  
SWCB southwestern corn borer  
TAW true armyworm  
WBC western bean cutworm  
WCR western corn rootworm

#### Herbicide Tolerance

GLY glyphosate / Roundup-Ready  
LL glufosinate / Liberty Link  
LL? check the bag tag for LL status  
2,4D 2,4-D  
fops group 1 'fops'

#### Refuge

Unless specified as RIB (Refuge In Bag), all other percentages assume separate, structured refuge areas planted in strips, blocks, borders, or whole fields

Version: March 2023	Bag tag code	Toxins in package ***** Font type denotes target: caterpillar or rootworm	Marketed to control: B C E F S T W W C E J A S C W A B H W W B W B B S W C W	Resistance cases for all Bts in package	Refuge, northern states (higher in south)	Herbicide tolerance ( ? = check the bag tag)
Duracade D Refuge Renew	D	Cry1Ab - Cry1F - eCry3.1Ab - mCry3A	x x x x x x x x	CEW FAW WBC WCR	EZ: 5% RIB Renew: 5%	GLY LL?
Duracade Viptera DV Refuge Renew	DV	Cry1Ab - Cry1F - Vip3A - eCry3.1Ab - mCry3A	x x x x x x x x	CEW FAW WBC WCR	EZ: 5% RIB Renew: 5%	GLY LL?
Duracade Viptera Z3 DVZ Refuge Renew	DVZ	Cry1Ab - Cry1A.105 - Cry2Ab2 - Vip3A - eCry3.1Ab - mCry3A	x x x x x x x x	CEW FAW WBC WCR	EZ: 5% RIB Renew: 5%	GLY LL?
Herculex I	HXI	Cry1F	x x x x x x	CEW FAW WBC WCR	20%	GLY LL
Herculex RW	HXRW	Cry34Ab1 - Cry35Ab1	x x x x x x	NCR WCR	20%	GLY LL
Herculex XTRA	HXX	Cry1F - Cry34Ab1 - Cry35Ab1	x x x x x x	CEW FAW NCR SWCB WBC WCR	20%	GLY LL
Intrasect	YHR	Cry1Ab - Cry1F	x x x x x x	CEW FAW WBC WCR	5%	GLY LL
Intrasect TRIssect	CYHR	Cry1Ab - Cry1F - mCry3A	x x x x x x	CEW FAW WBC WCR	20%	GLY LL
Intrasect Xtra	YXR	Cry1Ab - Cry1F - Cry34Ab1 - Cry35Ab1	x x x x x x	CEW FAW NCR WBC WCR	20%	GLY LL
Intrasect Xtreme	CYXR	Cry1Ab - Cry1F - Cry34Ab1 - Cry35Ab1 - mCry3A	x x x x x x	CEW FAW WBC WCR	5%	GLY LL
Lepra	VYHR	Cry1Ab - Cry1F - Vip3A	x x x x x x	CEW FAW WBC WCR	5%	GLY LL
Powercore	PW	Cry1A.105 - Cry2Ab2 - Cry1F	x x x x x x	CEW WBC	5%	GLY LL
Powercore Refuge Adv.	PWRA	Cry1A.105 - Cry2Ab2 - Cry1F	x x x x x x	CEW WBC	5% RIB	GLY LL
Powercore Enlist Refuge Adv.	PWE	Cry1A.105 - Cry2Ab2 - Cry1F	x x x x x x	CEW WBC	5% RIB	GLY LL 2,4-D fops
QROME	Q	Cry1Ab - Cry1F - Cry34Ab1 - Cry35Ab1 - mCry3A	x x x x x x	CEW FAW WBC WCR	5% RIB	GLY LL
SmartStax & Genuity SmartStax	SS SX	Cry1A.105 - Cry2Ab2 - Cry1F - Cry3Bb1 - Cry34Ab1 - Cry35Ab1	x x x x x x	CEW NCR WBC WCR	5%	GLY LL
SmartStax Enlist	SSE	Same as SmartStax	x x x x x x	CEW NCR WBC WCR	5%	GLY LL 2,4-D fops
SmartStax Enlist Refuge Adv.	Same as SmartStax	Same as SmartStax	x x x x x x	CEW NCR WBC WCR	5% RIB	GLY LL 2,4-D fops
SmartStax Refuge Adv. or SmartStax RIB Complete	SXRA	Same as SmartStax	x x x x x x	CEW NCR WBC WCR	5% RIB	GLY LL
SmartStax PRO		Cry1A.105 - Cry2Ab2 - Cry1F - Cry3Bb1 - Cry34Ab1 - Cry35Ab1 - dvSn7	x x x x x x	CEW WBC	5%	GLY LL
SmartStax PRO Enlist		Same as SmartStax Pro	x x x x x x	CEW WBC	5%	GLY LL 2,4-D fops
SmartStax PRO Enlist Refuge Advanced		Same as SmartStax Pro	x x x x x x	CEW WBC	5% RIB	GLY LL 2,4-D fops
SmartStax PRO Refuge Adv. RIB Complete, or w/RNAi Tech	SSPro	Same as SmartStax Pro	x x x x x x	CEW WBC	5% RIB	GLY LL
Tricepta RIB Complete	TRERIB	Cry1A.105 - Cry2Ab2 - Vip3A	x x x x x x	CEW WBC	5% RIB	GLY LL
TRIssect	CHR	Cry1F - mCry3A	x x x x x x	CEW FAW SWCB WBC WCR	20%	GLY LL
Viptera Vip Refuge Renew	V	Cry1Ab - Cry1F - Vip3A	x x x x x x	CEW FAW WBC WCR	EZ: 5% RIB Renew: 5%	GLY LL?
Viptera Z3 VZ Refuge Renew	VZ	Cry1Ab - Cry1A.105 - Cry2Ab2 - Vip3A	x x x x x x	CEW FAW WBC WCR	EZ: 5% RIB Renew: 5%	GLY LL?
Vorced Enlist	V	Cry1A.105 - Cry2Ab2 - Cry1F - Cry3Bb1 - Cry34Ab1 - Cry35Ab1 - dvSn7	x x x x x x	CEW NCR WBC WCR	5% RIB	GLY LL 2,4-D fops
VT Double PRO	VT2P	Cry1A.105 - Cry2Ab2	x x x x x x	CEW	5%	GLY LL
VT2 PRO RIB Complete	VT2PRIB	Cry1A.105 - Cry2Ab2	x x x x x x	CEW	5% RIB	GLY LL
VT Triple PRO	VT3P	Cry1A.105 - Cry2Ab2 - Cry3Bb1	x x x x x x	CEW NCR WBC	20%	GLY LL
VT3 PRO RIB Complete	VT3PRIB	Cry1A.105 - Cry2Ab2 - Cry3Bb1	x x x x x x	CEW NCR WBC	10% RIB	GLY LL
VT4 PRO w/RNAi Tech. Expected 2024	VT4PRO	Cry1A.105 - Cry2Ab2 - Vip3A - Cry3Bb1 - dvSn7	x x x x x x	CEW NCR WBC	5% RIB	GLY LL
YieldGard Corn Borer	YGCBC	Cry1Ab	x x x x x	CEW	20%	GLY LL
YieldGard Rootworm	YGRW	Cry3Bb1	x x x x x	NCR WCR	20%	GLY LL
YieldGard VT Triple	VT3	Cry1Ab - Cry3Bb1	x x x x x	CEW NCR WCR	20%	GLY LL

The table in this slide set is the March 2023 version

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AcreMax	AM	Cry1Ab - Cry1F	x x x x x x	CEW FAW WBC	5% RIB	GLY LL
AcreMax1	AM1	Cry1F - Cry34Ab1 - Cry35Ab1	x x x x x x	CEW FAW WBC NCR SWCB WBC WCR	10% RIB 20% ECS	GLY LL
AcreMax Legtra	AML	Cry1Ab - Cry1F - Vip3A	x x x x x x	CEW FAW WBC WCR	5% RIB	GLY LL
AcreMax R1W	AMRW	Cry34Ab1 - Cry35Ab1	x x x x x x	NCR WCR	10% RIB	GLY LL
AcreMax TRIssect	AMT	Cry1Ab - Cry1F - mCry3A	x x x x x x	CEW FAW WBC WCR	10% RIB	GLY LL
AcreMax Xtra	AMX	Cry1Ab - Cry1F - Cry34Ab1 - Cry35Ab1	x x x x x x	CEW FAW NCR WBC WCR	10% RIB	GLY LL
AcreMax Xtreme	AMXT	Cry1Ab - Cry1F - Cry34Ab1 - Cry35Ab1 - mCry3A	x x x x x x	CEW FAW WBC WCR	5% RIB	GLY LL
Agrisure 3000GT	3000GT	Cry1Ab - mCry3A	x x x x x	CEW WCR	20%	GLY LL
Agrisure 3010	3010	Cry1Ab	x x x x x	CEW	20%	GLY LL
Agrisure Above AA Refuge Renew	AA	Cry1Ab - Cry1F	x x x x x x	CEW FAW WBC	EZ: 5% RIB Renew: 5%	GLY LL?
Agrisure Total AT Refuge Renew	AT	Cry1Ab - Cry1F - Cry34Ab1 - Cry35Ab1 - mCry3A	x x x x x x	CEW FAW WBC WCR	EZ: 5% RIB Renew: 5%	GLY LL?
Agrisure Viptera 3110	3110	Cry1Ab - Vip3A	x x x x x x	CEW	20%	GLY LL
Agrisure Viptera 3111	3111	Cry1Ab - Vip3A - mCry3A	x x x x x x	CEW WCR	20%	GLY LL

Header

version

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#### Herbicide Tolerance

GLY glyphosate / Roundup-Ready  
LL glufosinate / Liberty Link  
LL? check the bag tag for LL status  
2,4D 2,4-D  
fops group 1 'fops'

#### Refuge

Unless specified as RIB (Refuge In Bag), all other percentages assume separate, structured refuge areas planted in strips, blocks, borders, or whole fields

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# Intro

- \*new traits
- \*resistance
- \*regulations

# actual table

Version: March 2023		Bag tag code	Toxins in package ***** Font type denotes target: caterpillar or rootworm	Marketed to control:											Resistance cases for all Bts in package	Refuge, northern states (% RIB) (higher in south)	Herbicide tolerance (? = check the bag tag)
Trait packages A-Z = former name	B			C	E	F	S	T	W	C	R	W	C	R			
AcreMax	AM	Cry1Ab - Cry1F	x	x	x	x	x	x	x	x					CEW FAW WBC	10% RIB	GLY LL
AcreMax1	AM1	Cry1F - Cry34Ab1 - Cry35Ab1	x	x	x	x	x	x	x						ECB FAW NCR SWCB WBC WCR	10% RIB 20% ECB	GLY LL
AcreMax Leptra	AML	Cry1Ab - Cry1F - Vip3A	x	x	x	x	x	x	x						NCR WCR	5% RIB	GLY LL
AcreMax RW	AMRW	Cry34Ab1 - Cry35Ab1													NCR WCR	10% RIB	GLY LL
AcreMax TRIssect	AMT	Cry1Ab - Cry1F - mCry3A	x	x	x	x	x	x	x						CEW FAW WBC WCR	10% RIB	GLY LL
AcreMax Xtra	AMX	Cry1Ab - Cry1F - Cry34Ab1 - Cry35Ab1	x	x	x	x	x	x	x						CEW FAW NCR WBC WCR	10% RIB	GLY LL
AcreMax Xtreme	AMXT	Cry1Ab - Cry1F - Cry34Ab1 - Cry35Ab1 - mCry3A	x	x	x	x	x	x	x						CEW FAW WBC WCR	5% RIB	GLY LL
Agrisure 3000GT	3000GT	Cry1Ab - mCry3A	x	x											CEW WCR	20%	GLY LL
Agrisure 3010 =Agrisure GT/CB/LL	3010	Cry1Ab	x	x											CEW	20%	GLY LL
Agrisure Above =Agrisure 3120EZ AA Refuge Renew =Agrisure 3120	AA	Cry1Ab - Cry1F	x	x	x	x	x	x							CEW FAW WBC	EZ: 5% RIB Renew: 5%	GLY LL?
Agrisure Total =Agrisure 3122EZ AT Refuge Renew =Agrisure 3122	AT	Cry1Ab - Cry1F - Cry34Ab1 - Cry35Ab1 - mCry3A	x	x	x	x	x	x	x						CEW FAW WBC WCR	EZ: 5% RIB Renew: 5%	GLY LL?
Agrisure Viptera 3110	3110	Cry1Ab - Vip3A	x	x	x	x	x	x	x							20%	GLY LL
Agrisure Viptera 3111	3111	Cry1Ab - Vip3A - mCry3A	x	x	x	x	x	x	x						WCR	20%	GLY LL

# List of trait packages = commercial names for combos of Bts x herbicide tolerance

- listed alphabetically
- remaining columns give details about each package

Version: March 2023 Trait packages A-Z = former name	Bag tag code	Toxins in package ***** Font type denotes target: caterpillar or <i>rootworm</i>	Marketed to control:											Resistance cases for all Bts in package	Refuge, northern states (higher in south)	Herbicide tolerance (? = check the bag tag)	
			B C W	C E W	E C B	F A W	S B	S C B	S W C B	T A W	W B C	W C W	C R W				
Duracade =Agrisure 5122EZ D Refuge Renew =Agrisure 5122	D	Cry1Ab - Cry1F - <i>eCry3.1Ab</i> - <i>mCry3A</i>	x	x	x	x	x	x	x						CEW FAW WBC WCR	EZ: 5% RIB Renew: 5%	GLY LL?
Duracade Viptera =Agrisure 5222EZ DV Refuge Renew =Agrisure 5222	DV	Cry1Ab - Cry1F - Vip3A - <i>eCry3.1Ab</i> - <i>mCry3A</i>	x	x	x	x	x	x	x	x	x	x	x	x	WCR	EZ: 5% RIB Renew: 5%	GLY LL?
Duracade Viptera Z3 =Agrsr 5332EZ DVZ Refuge Renew =Agrisure 5332	DVZ	Cry1Ab - Cry1A.105 - Cry2Ab2 - Vip3A - <i>eCry3.1Ab</i> - <i>mCry3A</i>	x	x	x	x	x	x	x	x	x	x	x	x	WCR	EZ: 5% RIB Renew: 5%	GLY LL?
Herculex I	HXI	Cry1F	x		x	x	x	x	x					ECB FAW SWCB WBC	20%	GLY LL	
Herculex RW	HXRW	<i>Cry34Ab1</i> - <i>Cry35Ab1</i>												NCR WCR	20%	GLY LL	

- All trait packages are included (older single traits + newer stacks) for historical reference



- Qrome® (Q) provides the same control and traits as AMXT, but through a unique molecular stack of the Herculex® I and Herculex® RW traits which makeup Herculex Xtra. This insertion technique allows trait compatibility with a wider range of germplasm, leading to more high yielding and agronomically sound hybrids in the future. It is also resistant to glufosinate and glufosinate herbicides.

Version: March 2023	Bag tag code
<b>Trait packages A-Z</b> = former name	
AcreMax	AM
AcreMax1	AM1
AcreMax Leptra	AML
AcreMax RW	AMRW
AcreMax TRIsect	AMT
AcreMax Xtra	AMX
AcreMax Xtreme	AMXT
Agrisure 3000GT	3000GT
Agrisure 3010 =Agrisure GT/CB/LL	3010
Agrisure Above =Agrisure 3120EZ AA Refuge Renew =Agrisure 3120	AA
Agrisure Total =Agrisure 3122EZ AT Refuge Renew =Agrisure 3122	AT
Agrisure Viptera 3110	3110
Agrisure Viptera 3111	3111

## Columns 1 and 2:

Trait package **trade names & codes**

\*used in seed guides, bag tags, field signs

\*if practical, include former and new names

## Column 3 : Bt proteins expressed in each trait package

- compare among hybrids, determine which are the same
- important for **resistance management**

Version: March 2023	Bag tag code	Toxins in package ***** Font type denotes target: caterpillar or <i>rootworm</i>
Trait packages A-Z = former name		
AcreMax	AM	Cry1Ab - Cry1F
AcreMax1	AM1	Cry1F - <i>Cry34Ab1</i> - <i>Cry35Ab1</i>
AcreMax Leptra	AML	Cry1Ab - Cry1F - Vip3A
AcreMax RW	AMRW	<i>Cry34Ab1</i> - <i>Cry35Ab1</i>
AcreMax TRIsect	AMT	Cry1Ab - Cry1F - <i>mCry3A</i>
AcreMax Xtra	AMX	Cry1Ab - Cry1F - <i>Cry34Ab1</i> - <i>Cry35Ab1</i>
AcreMax Xtreme	AMXT	Cry1Ab - Cry1F - <i>Cry34Ab1</i> - <i>Cry35Ab1</i> - <i>mCry3A</i>
SmartStax PRO		Cry1A.105 - Cry2Ab2 - Cry1F- <i>Cry3Bb1</i> - <i>Cry34Ab1</i> - <i>Cry35Ab1</i> - <i>dvSnf7</i>



Cry1Ab  
Cry1A.105  
Cry2Ab2  
Cry1F  
Vip3A

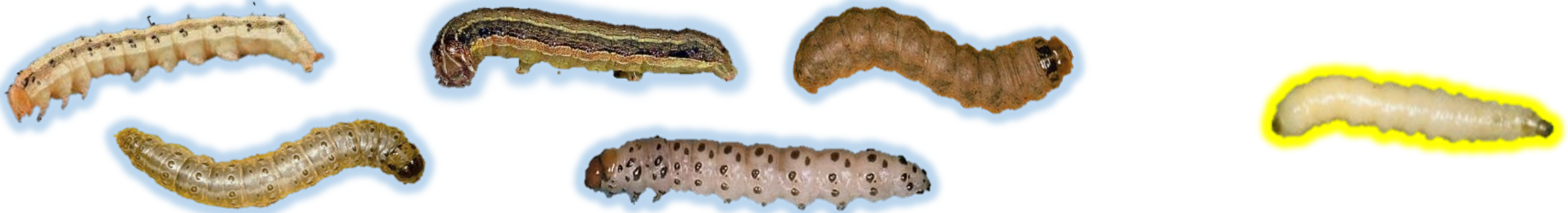


*Cry3Bb1*  
*mCry3A*  
*eCry3.1Ab*  
*Cry34/35Ab1*  
*dvSnf7*

Column 4: Insects controlled by the Bts in the package (as claimed)

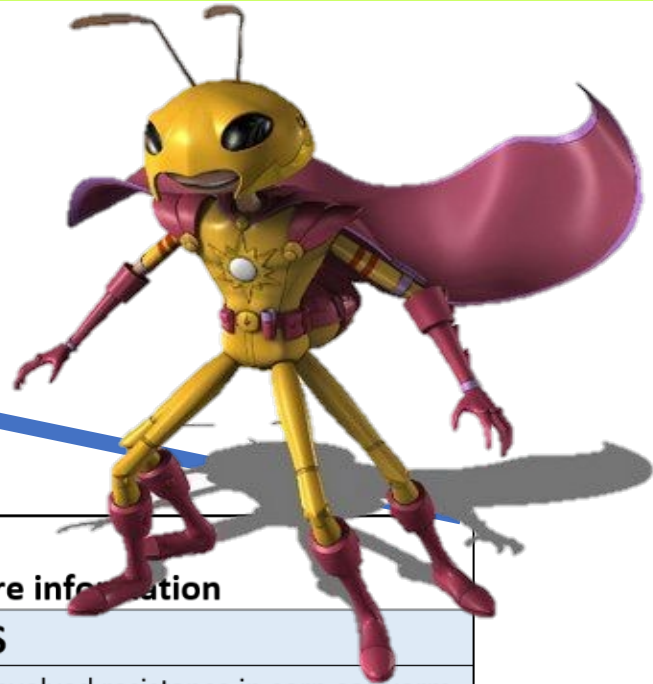
Column 5: Insects which are resistant to all Bts in the package

<p><b>Toxins in package</b>                      *****  <b>Font type denotes target:</b>                      caterpillar or <i>rootworm</i></p>	<b>Marketed to control:</b>										<p><b><u>Insect Pest Targets</u></b>                      BCW black cutworm                      CEW corn earworm                      CRW corn rootworm                      ECB European corn borer                      FAW fall armyworm                      NCR northern corn rootworm                      SB stalk borer                      SCB sugarcane borer                      SWCB southwestern corn borer                      TAW true armyworm                      WBC western bean cutworm                      WCR western corn rootworm</p>
	B	C	E	F	S	S	S	T	W	C	
	C	E	C	A	S	C	W	A	B	R	
	W	W	B	W	B	B	C	W	C	W	
Cry1Ab - Cry1F	X	X	X	X	X	X	X				
Cry1F - Cry34Ab1 - Cry35Ab1	X		X	X	X	X	X			X	
Cry1Ab - Cry1F - Vip3A	X	X	X	X	X	X	X	X	X		





# resistance citations posted online with the Bt trait table



Selected citations for field-evolved Bt resistance in U.S. corn pests  
 These publications are the basis for the resistance ratings in the Handy Bt Trait Table. Lepidoptera species are listed first, followed by corn rootworm species.

Updated March 2023

Insect	Bt protein	Crop Location	Source/Citation for more information
<b>LEPIDOPTERAN (CATERPILLAR) SPECIES</b>			
<b>corn earworm (CEW)</b>	Cry1Ab	Sweet corn Maryland	Dively et al. 2016. Field-evolved resistance in corn earworm to Cry proteins expressed by transgenic sweet corn. <u>PLoS ONE 11(12)</u>
<b>Helicoverpa zea</b>	Cry1A.105 x Cry2Ab2	Sweet corn Maryland	Dively et al. 2016. Field-evolved resistance in corn earworm to Cry proteins expressed by transgenic sweet corn. <u>PLoS ONE 11(12)</u>
	Cry1A.105	Field corn the Carolinas Louisiana Texas	Bilbo et al. 2019. Susceptibility of Corn Earworm to Cry1A.105 and Cry2Ab2 in North & South Carolina. <u>J. Econ. Entomol.</u> 1-13
	Cry1A.105 x Cry2Ab2 pyramids	southeastern states	Kaur et al. 2019. Field-evolved resistance of <i>Helicoverpa zea</i> (Boddie) to transgenic maize expressing pyramided Cry1A.105/Cry2Ab2 proteins in northeast Louisiana. <u>J. Invertebr. Pathol.</u> 163: 11-20
<b>European corn borer (ECB)</b>	Cry1F	Field corn Nova Scotia	Smith et al. 2019. Practical resistance of <i>Ostrinia nubilalis</i> to Cry1F <i>Bacillus thuringiensis</i> maize discovered in Nova Scotia. <u>Nature Sci Rep 9</u> , article #18247
<b>Ostrinia nubilalis fall armyworm (FAW)</b>	Cry1F	Field corn Florida N. Carolina Puerto Rico	Storer et al. 2010. Discovery and characterization of field resistance to Bt maize: <i>Spodoptera frugiperda</i> in Puerto Rico. <u>J. Econ. Entomol.</u> 103: 1031-1038
<b>Spodoptera frugiperda</b>	Cry1F	Field corn	Huang et al. 2014. Cry1F Resistance in fall armyworm <i>Spodoptera frugiperda</i> : single gene versus pyramided Bt maize. <u>PLoS ONE 9(11)</u>
			Li et al. 2016. Frequency of Cry1F non-recessive resistance alleles in North Carolina field populations of <i>Spodoptera frugiperda</i> . <u>PLoS ONE 11(4)</u>
<b>Southwestern corn borer (SWCB)</b>	Cry1F	Field corn Arizona New Mexico	Arizona Pest Management Center. Posted 1 Feb 2017. Chlorpyrifos use in Arizona and New Mexico. Public comment submitted to EPA. ID Docket EPA-HQ-OPP-2015-0853-0654.
<b>Diatraea grandiosella western bean cutworm (WBC)</b>	Cry1F	Field corn Western corn belt	Numerous field failures in Great Lakes region in 2016 Gottwald et al 2016. Monitoring susceptibility of western bean cutworm field populations to <i>Bacillus thuringiensis</i> Cry1F protein. <u>J. Econ. Entomol.</u> 109(2) 847-853.
<b>Striacosta albicosta</b>	Cry1F	Field corn Great Lakes region Ontario	Smith et al. 2017. Evidence for field-evolved resistance of <i>Striacosta albicosta</i> to Cry1F <i>Bacillus thuringiensis</i> protein and transgenic corn hybrids in Ontario, Canada. <u>J. Econ. Entomol.</u> 110: 2217-2228.

Insect	Bt protein	Crop Location	Source/Citation for more information
<b>CORN ROOTWORM SPECIES</b>			
<b>Northern corn rootworm (NCR)</b>	Cry3Bt1	Field corn North Dakota	Callos-Torres et al. 2019. Field-evolved resistance of northern and western corn rootworm populations to corn hybrids expressing single and pyramided Cry3Bt1 & Cry3A/35Ab1 Bt proteins in North Dakota. <u>J. Econ Entomol.</u> 112(4): 1875-1886
<b>Diatraea barberi</b>	Cry3A/35Ab1	Field corn North Dakota	Callos-Torres et al. 2019. Field-evolved resistance of northern and western corn rootworm populations to corn hybrids expressing single and pyramided Cry3Bt1 & Cry3A/35Ab1 Bt proteins in North Dakota. <u>J. Econ Entomol.</u> 112(4): 1875-1886
<b>Western corn rootworm (WCR)</b>	Cry3Bt1	Field corn Illinois Iowa Minnesota Nebraska North Dakota	Gasman et al. 2021. Field-evolved resistance to Bt maize by western corn rootworms. <u>PLoS ONE 16(7)</u> Gasman et al. 2021. Western corn rootworm and Bt maize: Challenges of pest resistance management and Bt & food: Biotech in Ag and the food chain 5(1) 1-10 Gasman et al. 2022. Field-evolved resistance to Bt maize by western corn rootworms: predictions from the laboratory and effects in the field. <u>J. Invert Pathology</u> 110:287-295. Wang et al. 2015. Susceptibility of Nebraska western corn rootworm populations to Bt corn events. <u>J. Econ. Entomol.</u> 108: 742-752. Zukoff et al. 2016. Multiple assays indicate varying levels of cross resistance in Cry3Bt1-selected field populations of the western corn rootworm to mCry3A, vCry3A, Cry3A/35Ab1. <u>J. Econ. Entomol.</u> 109(3): 1587-1598. Schradler et al. 2017. Evaluation of adult emergence and larval root injury for Cry3Bt1-resistant populations of the western corn rootworm. <u>J. Appl. Entomol.</u> 141: 41-52. Ludwick et al. 2017. Minnesota field population of western corn rootworm shows incomplete resistance to Cry3A/35Ab1 and Cry3Bt1. <u>J. Appl. Entomol.</u> 141: 41-52. Callos-Torres et al. 2019. Field-evolved resistance of northern and western corn rootworm populations to corn hybrids expressing single and pyramided Cry3Bt1 &

Insect	Bt protein	Crop Location	Source/Citation for more information
<b>LEPIDOPTERAN (CATERPILLAR) SPECIES</b>			
<b>corn earworm (CEW)</b>	Cry1Ab	Sweet corn Maryland	Dively et al. 2016. Field-evolved resistance in corn earworm to Cry proteins expressed by transgenic sweet corn. <u>PLoS ONE 11(12)</u>
	Cry1A.105 x Cry2Ab2	Sweet corn Maryland	Dively et al. 2016. Field-evolved resistance in corn earworm to Cry proteins expressed by transgenic sweet corn. <u>PLoS ONE 11(12)</u>
	Cry1A.105 Cry2Ab2 Cry1A.105 x Cry2Ab2 pyramids	Field corn the Carolinas Louisiana Texas southeastern states	Bilbo et al. 2019. Susceptibility of Corn Earworm to Cry1A.105 and Cry2Ab2 in North & South Carolina. <u>J. Econ.Ent.</u> , 1-13 Kaur et al. 2019. Field-evolved resistance of <i>Helicoverpa zea</i> (Boddie) to transgenic maize expressing pyramided Cry1A.105/Cry2Ab2 proteins in northeast Louisiana. <u>J. Invertebr. Pathol.</u> 163: 11-20. Yang et al. 2019. Occurrence and ear damage of <i>Helicoverpa zea</i> on transgenic <i>Bacillus thuringiensis</i> maize in the field in Texas, U.S., and its susceptibility to <i>Vip3A</i> protein. <u>Toxins</u>

# Resistance may be local, regional, or widespread



*check w/  
your local  
extension or  
seed dealer*



western corn rootworm

Resistant to: Cry3Bb1, mCry3A, Cry34/35Ab1

- common in the central Plains
- isolated fields elsewhere

western bean cutworm

Resistant to: Cry1F

- everywhere

# Column 6 Refuge requirement

- most but not all hybrids are sold as RIB, Refuge In the Bag
- note the refuge is for the northern states / corn belt  
(% refuge is higher in southern cotton-growing areas)

Version: March 2023	
Trait packages A-Z = former name	<b>Refuge, northern states</b> (higher in south)
AcreMax	5% RIB
AcreMax1	10% RIB 20% ECB
AcreMax Leptra	5% RIB
AcreMax RW	10% RIB
AcreMax TRIsect	10% RIB
AcreMax Xtra	10% RIB
AcreMax Xtreme	5% RIB
Agrisure 3000GT	20%
Agrisure 3010 =Agrisure GT/CB/LL	20%
Agrisure Above =Agrisure 3120EZ	EZ: 5% RIB
AA Refuge Renew =Agrisure 3120	Renew: 5%
Agrisure Total =Agrisure 3122EZ	EZ: 5% RIB
AT Refuge Renew =Agrisure 3122	Renew: 5%



# Column 7 Herbicide tolerance

Trait packages A-Z = former name
AcreMax
AcreMax1
AcreMax Leptra
AcreMax RW
AcreMax TRIsect
AcreMax Xtra
AcreMax Xtreme
Agrisure 3000GT
Agrisure 3010 =Agrisure GT/CB/LL
Agrisure Above =Agrisure 3120EZ
AA Refuge Renew =Agrisure 3120
Agrisure Total =Agrisure 3122EZ
AT Refuge Renew =Agrisure 3122
SmartStax Enlist

Herbicide tolerance (? = check the bag tag)
GLY LL
GLY LL
GLY LL
GLY LL
GLY LL
GLY LL
GLY LL
GLY LL
GLY LL
GLY LL
GLY LL?
GLY LL?
GLY LL
2,4-D fops

GLY glyphosate / Roundup-Ready  
LL glufosinate / Liberty Link

LL? check the bag tag


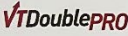





















Enlist trait = 2,4-D & group 1 'fops'



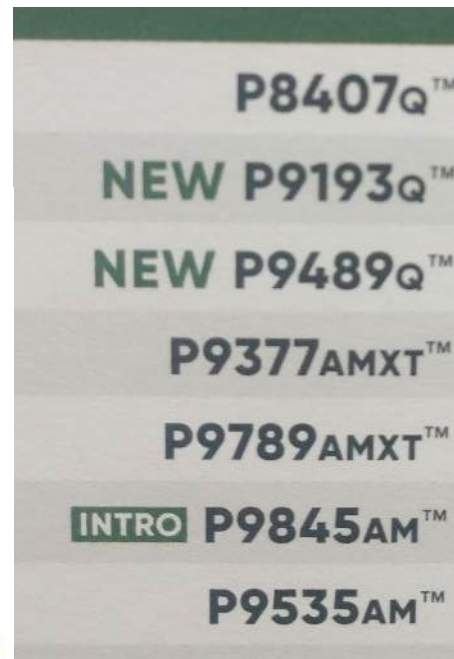
# Practical uses of the Trait Table

# Reading print & web-based seed guides

	BRAND / HYBRID	RM
AcreMax	DAIRYLAND SEED DS-4878AM	108
	DAIRYLAND SEED DS-4917AM	109
	DAIRYLAND SEED DS-5018AM	110
QRome	DAIRYLAND SEED DS-5144Q	111
	DAIRYLAND SEED DS-5250AM	112
Viptera	DAIRYLAND SEED DS-5279Q	112
	DYNAGRO D48VC84	108
	DYNAGRO D50VC09	110
	GOLDEN HARVEST G08R52-3220	108
Duracade Vip	GOLDEN HARVEST G09Y24-3220A	109
	GOLDEN HARVEST G10L16-5222A	110
Vip Z3	KEY 908BLG	108
	LEGACY SEEDS LC592-21 3330	109
	M&W SEEDS 44V83	108
Viptera	M&W SEEDS 43V69	111
	NK Brand NK0877-3220	108
Duracade Vip	NK Brand NK1082-5222A	110
Duracade Vip Z3	NK Brand NK1026-5332	110
	RENK RK700SSTX	107
	RENK RK765VT2P	109

TRAIT VERSIONS			
This table outlines the abbreviation method LG Seeds uses to designate value-added trait versions currently offered for			
<b>CONVENTIONAL</b>	<b>CONV</b> Indicates a conventional (non-traited) product		<b>RR</b> Roundup Ready® Corn 2
	<b>VT2PRO</b> VT Double PRO®		<b>VT2RIB</b> VT Double PRO® RIB Complete®
	<b>DGVT2PRO</b> DroughtGard® Hybrids with VT Double PRO® Corn Blend		<b>DGVT2RIB</b> DroughtGard® Hybrids with Complete® Corn Blend
	<b>TRC</b> Trecepta®		<b>STX</b> SmartStax®
	<b>TRCRIB</b> Trecepta® RIB Complete® Corn Blend		<b>STXRIB</b> SmartStax® RIB Complete®
	<b>GT</b> Agrisure® GT		<b>SSPRIB</b> SmartStax® PRO RIB Complete®
	<b>5222</b> Agrisure Duracade® 5222 Refuge Renew™		<b>5222A</b> Agrisure Duracade® 5222
	<b>5222EZ</b> Agrisure Duracade® 5222 E-Z Refuge®		<b>5222AEZ</b> Agrisure Duracade® 5222
	<b>5122EZ</b> Agrisure Duracade® 5122 E-Z Refuge®		<b>3330AEZ</b> Agrisure Viptera® 3330
	<b>3220</b> Agrisure Viptera® 3220 Refuge Renew™		<b>3220AEZ</b> Agrisure Viptera® 3220
	<b>3220EZ</b> Agrisure Viptera® 3220 E-Z Refuge®		<b>3111</b> Agrisure Viptera® 3111
	<b>3120EZ</b> Agrisure® 3120 E-Z Refuge®		<b>3110</b> Agrisure Viptera® 3110

# Comparing hybrids



**Q = Qrome**

- pyramids for caterpillars & CRW

**AMXT = AcreMax Xtreme**

- Essentially the same as QRome

**AM = AcreMax**

- Same pyramid for Leps, but no CRW

<u>LG49C28</u>	99	<ul style="list-style-type: none"> <li>• Top performance in high yield environments.</li> </ul> <p><b>Read More...</b></p>	<ul style="list-style-type: none"> <li>• VT Double Pro<sup>®</sup> RIB Complete<sup>®</sup> Corn Blend</li> <li>• Conventional</li> </ul>	<b>Two Bts to control many Leps</b>
<u>LG49C62</u>	99	<ul style="list-style-type: none"> <li>• Top-end yields in ideal yield environments from medium height, very attractive plants.</li> </ul> <p><b>Read More...</b></p>	<ul style="list-style-type: none"> <li>• Trecepta<sup>®</sup> RIB Complete<sup>®</sup> Corn Blend</li> </ul>	<b>SAME as VT2Pro but adds VIP for broadest control</b>
<u>LG50C93</u>	100	<ul style="list-style-type: none"> <li>• A tall plant with exceptional plant health and intactness that can stand late into the season.</li> </ul>	<ul style="list-style-type: none"> <li>• Agrisure Duracade<sup>®</sup> 5222 E-Z Refuge<sup>®</sup></li> </ul>	<b>Different Lep Bts. Adds CRW Bts.</b>

# Reading bag tags



**Channel**  
Seedsmanship At Work®  
Hybrid Corn Seed Blend

**209-15VT2PRIB**  
BRAND

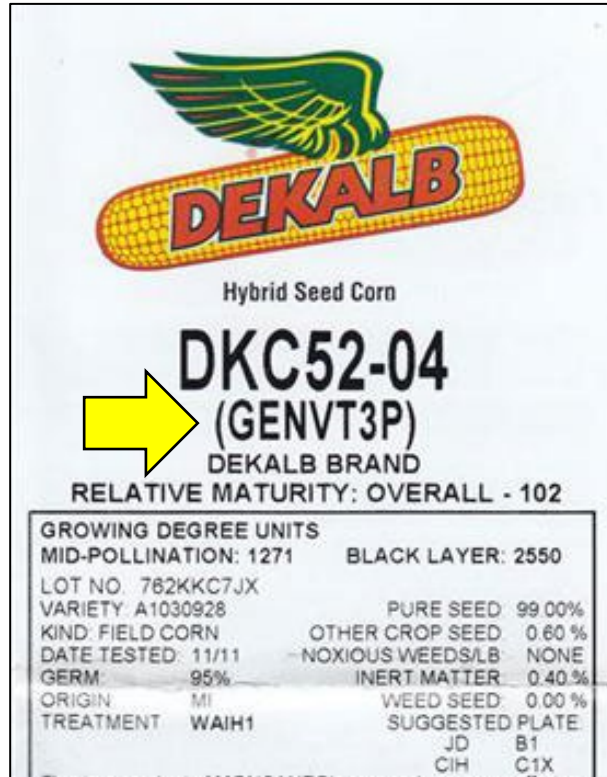
RELATIVE MATURITY 109 Day

VARIETY	TRT/UNT	ORIGIN	GERM	DATE TESTED
1070314	FALH1B	94.00%	IN	95% 11/18
1064083	FALH1B	5.00%	IN	95% 11/18

LOT **E95G3BGBT**

NOXIOUS WEEDS/LB: NONE  
KIND: FIELD CORN

Acceleration B-300 SAT Batch #: 1815J82-48 Not Claimed  
Effective After: 08/01/2020 For storage Requirements see Product-Specific Additional Information on this label.

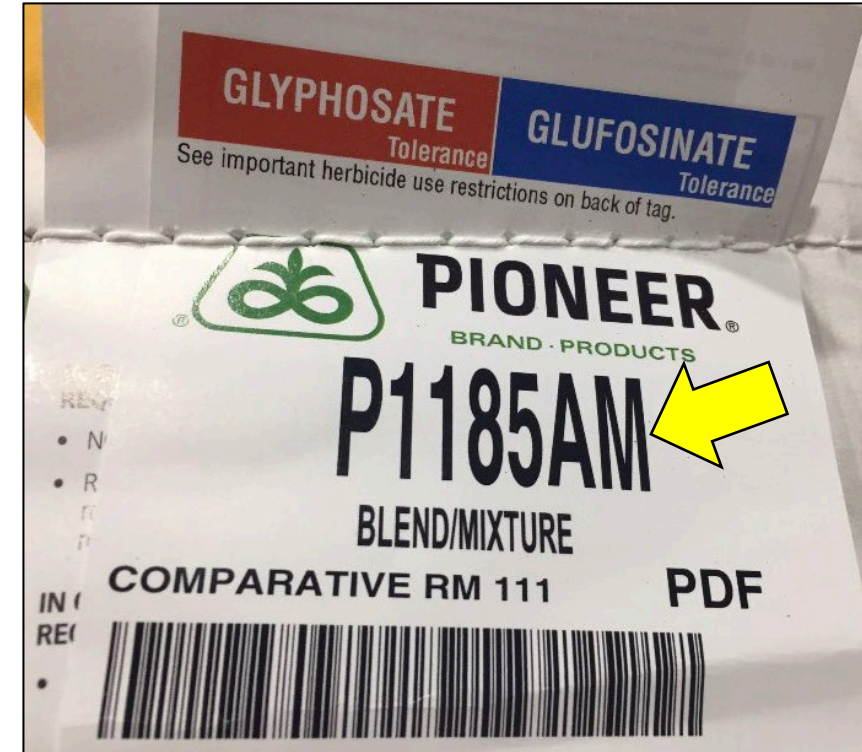


**DEKALB**  
Hybrid Seed Corn

**DKC52-04**  
(GENVT3P)  
DEKALB BRAND

RELATIVE MATURITY: OVERALL - 102

GROWING DEGREE UNITS	
MID-POLLINATION: 1271	BLACK LAYER: 2550
LOT NO. 762KKC7JX	
VARIETY: A1030928	PURE SEED: 99.00%
KIND: FIELD CORN	OTHER CROP SEED: 0.60%
DATE TESTED: 11/11	NOXIOUS WEEDS/LB: NONE
GERM: 95%	INERT MATTER: 0.40%
ORIGIN: MI	WEED SEED: 0.00%
TREATMENT: WAIH1	SUGGESTED PLATE:
	JD B1
	CIH C1X



**GLYPHOSATE Tolerance** **GLUFOSINATE Tolerance**  
See important herbicide use restrictions on back of tag.

**PIONEER**  
BRAND PRODUCTS

**P1185AM**  
BLEND/MIXTURE

COMPARATIVE RM 111 PDF

IN REI

VT2 PRO RIB Complete	VT2PRIB	Cry1A.105 - Cry2Ab2	x	x	x	x	x	x	CEW	5% RIB	GLY
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# Understanding field signs



Version: March 2023	Bag tag code	Toxins in package ***** Font type denotes target: caterpillar or <i>rootworm</i>
Trait packages A-Z = former name		
AcreMax	AM	Cry1Ab - Cry1F

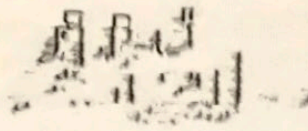
- Multiple (3) Bts for Lep's including WBC
- EZ refuge: 5% refuge in bag in the northern state



# Understanding old invoices, planting records, trials

**PIONEER.**  
Pioneer Hi-Bred International, Inc.

2017 CORN



Product	Segment	Sub-Product Description	In
P1311AMXT	AMXT/LL/RR2	NW84 MR 40 H IST V RA	Re
P1311AMXT	AMXT/LL/RR2	NW61 PDR 50 H IST V R	R
P1311AMXT	AMXT/LL/RR2	NW01 PDR 80 H IST V R	R
P1602R	RR2	NW01 PDR 80 H IST V R	V
P1690CHR	RW/HX1/LL/RR2	NW62 PDF 50 H IST V R	
P1690CHR	RW/HX1/LL/RR2	NW01 PDR 80 H IST V R	
P1751AMT	AMT/LL/RR2	NW81 PDR 40 H IST V R	
P1751AMT	AMT/LL/RR2	NW61 PDR 50 H IST V R	
P1751AMT	AMT/LL/RR2	NW01 PDR 80 H IST V R	
<b>Corn Total</b>			

**Gross Invoice Value**

2013				Huron - Late										
BRAND / HYBRID	RM	TRT	TRAIT	YIELD				% QUALITY						
				%DM	GT/A	DT/A	%STD	IVD	ADF	NDF	NDFD	CP	STR	
AGRIGOLD A6358VT3Pro	105	P500	1,2,3	40.2	24.0	9.3	100	82.4	20.8	37.7	53.3	6.7	40.9	
AGRIGOLD A6408VT3PRIB	107	P500	1,2,3	36.3	25.7	9.3	100	81.1	20.6	38.9	51.5	6.8	38.1	
CHANNEL 207-13VT3PRIB	107	PV500	1,2,3	38.6	26.1	10.1 *	99	82.5	18.8	36.8	52.4	7.2	39.4	
CROPLAN 5887VT3P	107	C250	1,2,3	37.7	25.2	9.5	100	82.2	18.8	37.1	52.0	7.1	39.4	
DAIRYLAND SEED DS-9311SSX	110	C250	1,2,3,4,6	36.0	24.1	8.7	100	81.5	20.7	39.6	53.4	7.3	36.6	
DAIRYLAND SEED Hi DF-3108RA	108	C250	1,2,3,4,6	32.7	28.3	9.3	100	80.2	22.2	41.3	52.2	6.8	32.9	
DAIRYLAND SEED Hi DF-3510SSX	110	C250	1,2,3,4,6	31.0	29.7	9.2	98	80.4	23.3	41.2	52.6	6.7	31.4	
DYNAGRO D50SS43	110	P500	1,2,3	34.8	25.4	8.6	99	80.4	20.2	40.5	51.6	7.0	35.8	
DYNAGRO D45Q50	105	P500	1,2,3,4	35.1	27.5	9.6 *	99	82.8	19.9	37.9	54.6	7.2	37.3	
GOLDEN HARVEST G05T82-3122	105	C250	1,2,3,4,6	38.4	24.4	9.4	99	83.2	17.9	35.0	52.0	7.4	41.2	
GOLDEN HARVEST G08X83-3110	108	C250	1,2,4,6	34.3	28.4	9.8 *	100	81.3	20.2	38.9	51.9	8.0	35.3	
GOLDEN HARVEST G09E98-3000G	109	C250	1,2,3,4	36.6	26.7	9.8 *	97	82.8	19.3	36.8	53.2	7.0	37.8	
GREAT LAKES 5785VT3PRIB	107	P500	1,2,3	36.5	24.3	9.1	100	81.4	20.3	38.4	51.7	6.7	39.1	
HYLAND SEEDS 4687	110	P250	1,2,3,4	35.1	27.0	9.5	99	82.3	21.1	39.4	55.0	6.7	38.7	
HYLAND SEEDS 8695RA	110	P250	1,2,3,4,6	37.5	24.9	9.3	100	82.2	19.6	37.6	52.6	7.0	40.3	
LEGACY SEEDS L-5810 3000GT	106	C250	1,2,3,4	36.6	26.5	9.7 *	99	83.0	19.8	36.5	53.4	7.0	39.9	
LEGACY SEEDS L-7253 3000GT	112	C250	1,2,3,4	36.1	25.8	9.3	100	81.6	20.6	39.1	52.8	7.1	39.3	
MASTERS CHOICE MCT-5663	106	C250	1,2,3,4	33.8	26.9	9.1	100	82.8	19.6	37.0	53.5	7.0	39.3	
NK Brand N53W-3122	105	C250	1,2,3,4,6	38.2	24.7	9.4	99	83.1	18.1	35.0	51.6	7.2	41.5	
NK Brand N61X-3110	108	C250	1,2,4,6	34.6	27.7	9.6 *	100	81.6	20.2	39.5	53.2	7.6	35.7	
NK Brand N63R-3000GT	109	C250	1,2,3,4	35.2	27.6	9.7 *	100	82.5	18.4	35.8	50.9	7.0	34.4	
NuTech 3A-306™	106	C250	1	34.1	26.4	9.0	100	81.6	21.2	40.6	54.5	7.1	36.1	
NuTech 5N-406™	106	C250	1,2,3,4	35.7	26.5	9.4	99	82.3	19.2	37.8	53.2	6.9	38.5	
NuTech/G2 GENETICS 3D-909™	109	C250	1,2,3,4	39.0	24.7	9.6 *	100	81.6	18.8	36.9	50.0	7.3	38.9	
NuTech/G2 GENETICS 5H-806™	106	C250	1,2,4	38.7	23.6	9.1	99	83.1	18.3	36.6	53.8	7.0	40.9	

To view/ download the trait table:  
[www.texasinsects.org/bt-corn-trait-table.html](http://www.texasinsects.org/bt-corn-trait-table.html)



home  
[bt corn trait table](#)  
about us  
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extension entomology home  
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legacy extension entomology homepage  
texas a&m agrilife extension homepage

### Handy Bt Trait Table for U.S. Corn Production

This 2-page document list the types of Bt present in all commercialized corn in the U.S.A. in a concise format. It presents the trade names for traits, Bt event, protein(s) expressed, targeted insects and herbicide traits.

Now in its 21st year, the Trait Table for field corn has become the standard as an authoritative reference to Bt toxins in corn. Dr. Chris DiFonzo at Michigan State University is the author, and questions or comments should be directed to her. If you would like to reprint the table in a local publication or extension bulletin, contact Chris DiFonzo ([difonzo@msu.edu](mailto:difonzo@msu.edu) or 517-353-5328) for a version modifiable for your state.

[Handy Bt Trait Table For FIELD CORN \(New version posted 3/7/2023\)](#)

**Supplements for more information:**

- [Checklist of Bt Events by Stack \(3/2023\)](#)
- [Table of Bt Events \(3/2023\)](#)
- [Table of EPA Registration Numbers \(3/2023\)](#)
- [Citations for resistance statements in the Trait Table \(4 Feb. 2020\)](#)
- [How to use the Trait Table \(and what it tells you about your corn hybrid\)](#)

[Handy Bt Trait Table for SWEET CORN \(Updated March 17, 2023\)](#). The Trait Table for sweet corn was first published in 2020, and questions should be directed to Ben Phillips, Michigan State University ([phill406@msu.edu](mailto:phill406@msu.edu))

## *Supplementary materials:*

- \* sweet corn Bt table
- \* resistance citations
- \* list of Bt events
- \* EPA registration #s

The version on the site  
is always the latest....