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

VOID

Updated March 2021

An up-to-date version of the table is posted at https://www.texasinsects.org/bt-corn-trait-table.html
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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.*

A new mode of action in 2021 - RNA interference (RNAi). SmartStax-Pro is the first trait package to include RNAi technology for pest control, with one species (corn) interfering with protein production in another species (corn rootworm).
• Imagine a recipe book, and a chef who turns the written directions into a cake. In an organism, the DNA (the recipe book) in each cell contains the genes (the recipes) to make the proteins (cakes) needed for survival and growth. RNA molecules are a bit like 'chefs' directing this process. Interfering with a chef results in no 'cake' from a gene recipe. This interference is called *gene silencing*. It happens naturally, but it also is the mode of action for new non-browning GMO apple and potato lines.
• SmartStax-Pro hybrids are modified to produce RNA fragments which silence the *Dvsnf7* gene, the 'recipe' for a key protein in the rootworm gut. Larvae ingest dsRNA as they feed on the roots. The RNA molecules interfere with production of the protein in the midgut and the larvae eventually die. The mode of action is specific to rootworm and it doesn't involve making a Bt toxin.
• The RNAi trait in SmartStax-Pro will be pyramided with Cry3Bb1 and Cry34/35Ab1, giving plants three modes of action against rootworm; this will be helpful in areas with Bt-resistant rootworm populations. However, there is no guarantee that rootworms won't develop resistance to RNAi! Demonstration sites will be planted in 2021 and seed will be commercially available in 2022.

Happy Birthday, Bt corn. 2021 marks the 25th year of commercialization of Bt corn in the U.S. The first Bt hybrids produced only one toxin, Cry1Ab, for European corn borer control. Bt has come a long way since then, given the laundry list of trade names in the current table. Bt hybrids are now planted on >80% of U.S. corn acres. The benefits of widespread use of Bt hybrids include a reduction in corn borer in the landscape (benefitting conventional corn & vegetables too), and an overall reduction in insecticide use. Costs include increasing problems of insect resistance, overuse of neonicotinoid seed treatments, and the literal high price of seed. 25 more years? We'll see…..

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

Trade name for trait	Event	Bt toxin or other trait expressed	Primary Insect Targets + *Herbicide tolerance*
Agrisure CB/LL	Bt11	Cry1Ab + *PAT*	corn borer + *glufosinate tolerance*
Agrisure Duracade	5307	eCry3.1Ab	rootworm
Agrisure GT	GA21	*EPSPS*	*glyphosate tolerance*
Agrisure RW	MIR604	mCry3A	rootworm
Agrisure Viptera	MIR162	Vip3Aa20	broad caterpillar control, except for corn borer
Enlist	DAS40278	*aad-1*	*2,4-D & 'FOPs'*
Herculex I (HXI) or CB	TC1507	Cry1Fa2 + *PAT*	corn borer + *glufosinate tolerance*
Herculex RW	DAS-59122-7	Cry34Ab1/Cry35Ab1 + *PAT*	rootworm + *glufosinate tolerance*
Roundup Ready 2	NK603	*EPSPS*	*glyphosate tolerance*
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 + *glyphosate tolerance*
(None – in Qrome)	DP-4114	Cry1F + Cry34Ab1/Cry35Ab1 + *PAT*	corn borer + rootworm + *glufosinate tolerance*
(None – in SmartStax Pro)	MON87411	Cry3Bb1 + DvSnf7 dsRNA + *EPSPS*	rootworm + *glyphosate tolerance*

Abbreviations used in the Trait Table

Herbicide tolerance
E Enlist - *2,4-D and 'FOPs'*
G *glyphosate*
R Roundup Ready 2 - *glyphosate*
LL Liberty Link - *glufosinate*

Insect targets
BCW black cutworm
CEW corn earworm
CR corn rootworm
 (N- Northern, W- Western)
ECB   European corn borer

FAW fall armyworm
SB   stalk borer
SCB   sugarcane borer
SWCB southwestern corn borer
TAW   true armyworm
WBC   western bean cutworm

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Abbreviations for "Marketed for control of" columns: BCW, CEW, ECB, FAW, SB, SCB, SWCB, TAW, WBC, CR. Herbicide trait columns: GR, LL, E.

Trait name / acronym (alphabetical order) (acronym that may be used)	Bt protein(s) (or other trait) in package	BCW	CEW	ECB	FAW	SB	SCB	SWCB	TAW	WBC	CR	Resistance confirmed to the combination of Bts in package (check local situation)	GR	LL	E	Non-Bt Refuge % (cornbelt)
AcreMax (AM)	Cry1Ab Cry1F	x	x	x	x	x	x	x				CEW 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	ECB FAW SWB 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		5% in bag
AcreMax TRIsect (AMT)	Cry1Ab Cry1F mCry3A	x	x	x	x	x	x	x			x	CEW FAW WBC WCR	x	x		10% in bag
AcreMax Xtra (AMX)	Cry1Ab Cry1F Cry34/35Ab1	x	x	x	x	x	x	x			x	CEW 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	CEW FAW WBC WCR	x	x		5% in bag
Agrisure 3010 (BR)	Cry1Ab		x	x			x	x				CEW	x	x		20%
Agrisure 3000GT & 3011A	Cry1Ab mCry3A		x	x			x	x			x	CEW WCR	x	x		20%
Agrisure Viptera 3110 (VR)	Cry1Ab Vip3A	x	x	x	x	x	x	x	x	x			x	x		20%
Agrisure Viptera 3111 (A4)	Cry1Ab Vip3A mCry3A	x	x	x	x	x	x	x	x	x		WCR	x	x		20%
Agrisure 3120 E-Z Refuge (BZ)	Cry1Ab Cry1F	x	x	x	x	x	x	x				CEW FAW WBC	x	See bag tag. EZ0=no EZ1=yes		5% in bag
Agrisure 3122 E-Z Refuge	Cry1Ab Cry1F mCry3A Cry34/35Ab1	x	x	x	x	x	x	x			x	CEW FAW WBC WCR	x			5% in bag
Agrisure Viptera 3220 E-Z (VZ)	Cry1Ab Cry1F Vip3A	x	x	x	x	x	x	x	x	x			x			5% in bag
Agrisure Viptera 3330 E-Z	Cry1Ab Vip3A Cry1A.105/Cry2Ab2	x	x	x	x	x	x	x	x	x			x			5% in bag
Agrisure Duracade 5122 E-Z (D1)	Cry1Ab Cry1F mCry3A eCry3.1Ab	x	x	x	x	x	x	x			x	CEW FAW WBC WCR	x			5% in bag
Agrisure Duracade 5222 E-Z (D2)	Cry1Ab Cry1F Vip3A mCry3A eCry3.1Ab	x	x	x	x	x	x	x	x	x	x	WCR	x			5% in bag
Agrisure Duracade 5332-E-Z	Cry1A.105/Cry2Ab2 Cry1Ab Vip3A mCry3A eCry3.1Ab	x	x	x	x	x	x	x	x	x	x	WCR	x	x		5% in bag
Herculex I (HXI)	Cry1F	x		x	x	x	x	x				ECB FAW SWB 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	ECB FAW SWB WBC NCR WCR	x	x		20%
Intrasect (YHR)	Cry1Ab Cry1F	x	x	x	x	x	x	x				CEW FAW WBC	x	x		5%
Intrasect TRIsect (CYHR)	Cry1Ab Cry1F mCry3A	x	x	x	x	x	x	x			x	CEW FAW WBC WCR	x	x		20%
Intrasect Xtra (YXR)	Cry1Ab Cry1F Cry34/35Ab1	x	x	x	x	x	x	x			x	CEW FAW WBC NCR WCR	x	x		20%
Intrasect Xtreme (CYXR)	Cry1Ab Cry1F mCry3A Cry34/35Ab1	x	x	x	x	x	x	x			x	CEW FAW WBC WCR	x	x		5%
Leptra (VYHR)	Cry1Ab Cry1F Vip3A	x	x	x	x	x	x	x	x	x			x	x		5%
Powercore [a] (PW) / PW Refuge Advanced [b] (PWRA)	Cry1A.105/Cry2Ab2 Cry1F	x	x	x	x	x	x	x				CEW WBC	x	x		[a] 5% / [b] 5% in bag
Powercore Enlist (PWE)	Same as Powercore	x	x	x	x	x	x	x				CEW WBC	x	x	x	5% in bag
QROME (Q)	Cry1Ab Cry1F mCry3A Cry34/35Ab1	x	x	x	x	x	x	x			x	CEW FAW WBC WCR	x	x		5% in bag
SmartStax [a] (SX, STX or SS) / STX Refuge Advanced [b] (SXRA) / STX RIB Complete [b] (STXRIB)	Cry1A.105/Cry2Ab2 Cry1F Cry3Bb1 Cry34/35Ab1	x	x	x	x	x	x	x			x	CEW WBC NCR WCR	x	x		[a] 5% / [b] 5% in bag
SmartStax Enlist (SXE)	Same as SmartStax	x	x	x	x	x	x	x			x	Same as SmartStax	x	x	x	5% in bag
SmartStax Pro *2022 commercialization date	Same as SmartStax + DvSnf7 dsRNA	x	x	x	x	x	x	x			x	CEW WBC	x	x		5% in bag
Trecepta [a] (TRE) / Trecepta RIB Complete [b] (TRERIB)	Cry1A.105/Cry2Ab2 Vip3A	x	x	x	x	x	x	x	x	x			x			[a] 5% / [b] 5% in bag
TRIsect (CHR)	Cry1F mCry3A	x		x	x	x	x	x			x	ECB FAW SWB WBC WCR	x	x		20%
VT DoublePRO [a] (VT2P) / VT2P RIB Complete [b] (VT2PRIB)	Cry1A.105/Cry2Ab2		x	x	x	x	x	x				CEW	x			[a] 5% / [b] 5% in bag
VT TriplePRO [c] (VT3P) / VT3P RIB Complete [d] (VT3PRIB)	Cry1A.105/Cry2Ab2 Cry3Bb1		x	x	x	x	x	x			x	CEW NCR WCR	x			[c] 20% / [D] 10% in bag
Yieldgard Corn Borer (YGCB)	Cry1Ab		x	x			x	x				CEW	x			20%
Yieldgard Rootworm (YGRW)	Cry3Bb1										x	NCR WCR	x			20%
Yieldgard VT Triple (VT3)	Cry1Ab Cry3Bb1		x	x			x	x			x	CEW NCR WCR	x			20%

Herbicide trait note (Agrisure E-Z Refuge rows, LL column): See bag tag. EZ0=no EZ1=yes