6 April 2015
Updates to this bulletin posted at www.msuent.com

Handy Bt Trait Table

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VOID

Most corn hybrids planted in the U.S. now contain one or more transgenic traits for weed or insect management. These traits are meant to increase flexibility and profitability for producers, but sometimes also lead to questions or cause confusion about their spectrum of control or refuge requirements to delay resistance. This bulletin provides a handy one-stop-guide to understand sales materials, bag tags, and the hybrids you purchase.

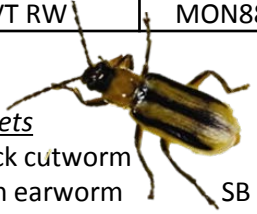
Table 1 lists the names of the important 'events' (transformations of one or more genes) in corn, their more familiar Trade Names, the protein(s) expressed, and their pest targets. Table 2 lists specific trait packages (combinations of events) sold by various seed companies, with their spectrum of control plus refuge % and location. In recent years, the pyramiding of Bt traits allowed for the reduction of some refuges from 20% to 10% or 5%, depending on the trait package. Some hybrids still require a structured refuge planted as a block or series of rows (within, adjacent to, or ~½ mile from the Bt field) , but many hybrids are now sold as a convenient refuge-in-the-bag (RIB). But it is still important to take the following steps:

*Understand the ***biology*** of each trait, the expected level of control, and refuge requirements;
*****Confirm that the seed you ordered the previous year*** is the seed delivered in the spring;
*Keep good ***planting records*** and save a representative sample of ***bags or bag tags;***
*For herbicide applications, ***Ask Twice-Spray Once***, especially if you hire a custom applicator;
*Most important, if you see **unexpected damage or poor performance** of a trait (especially damage from corn rootworm), contact your seed dealer and extension educator immediately so that the field can be visited while the problem is still fresh and samples can be taken. This is critical to **identify and manage cases of rootworm Bt resistance**.

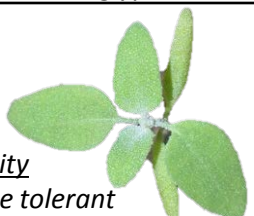
This bulletin strives for completeness, but keeping track of Bt traits isn't easy. For a searchable, easy-to-use database of GM crop approvals, see the ISAAA web site at http://www.isaaa.org/gmapprovaldatabase

Table 1. Event names for proteins expressed in Bt corn plants

Trade name	Event name	Protein(s) expressed	Insect Target or *Herbicide Activity*
Agrisure CB/LL	Bt11	Cry1Ab+PAT	corn borer + *glufosinate tolerance*
Agrisure Duracade	5307	eCry3.1Ab	rootworm
Agrisure RW	MIR604	mCry3A	rootworm
Agrisure Viptera	MIR162	Vip3Aa	broad lep control
Herculex 1 or CB	TC1507	Cry1F + PAT	corn borer + *glufosinate tolerance*
Herculex RW	DAS-59122-7	Cry34Ab1/Cry35Ab1+PAT	rootworm + *glufosinate tolerance*
Roundup Ready 2	NK603	CP4 EPSPS	*glyphosate tolerance*
YieldGard CB	MON810	Cry1Ab	corn borer
YieldGard VT Pro	MON89034	Cry1A.105+Cry2Ab2	broad lep control
YieldGard VT RW	MON88017	Cry3Bb1+CP4 EPSPS	rootworm + *glyphosate tolerance*



Abbreviations used in Table 2 on page 2



Insect targets

BCW black cutworm
CEW corn earworm
ECB European corn borer
FAW fall armyworm
RW corn rootworm
SB stalk borer
SWCB southern corn borer
TAW true armyworm
WBC western bean cutworm

Herbicide activity

GT *glyphosate tolerant*
LL Liberty Link, *glufosinate-tolerant*
RR2 Roundup Ready 2, *glyphosate-tolerant*

Table 2. Bt corn trait packages, with spectrum of control and refuge requirements.

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(Updated 6 April 2015)

Trait Family Product	Bt protein(s)	Insects controlled or *suppressed* Above-ground	In soil	Herbicide tolerant?	Refuge %, placement (for the MIDWEST)
AGRISURE					
Agrisure GT/CB/LL, 3010A	Cry1Ab	ECB SWCB *CEW FAW SB*	---	GT LL	20% structured-½ mile
Agrisure 3000GT, 3011A	Cry1Ab mCry3A	ECB SWCB *CEW FAW SB*	RW	GT LL	20% structured-w/in, adj
Agrisure Viptera 3110	Cry1Ab Vip3A	BCW CEW ECB FAW SB SWCB TAW WBC	---	GT LL	20% structured-½ mile
Agrisure Viptera 3111	Cry1Ab mCry3A Vip3A	BCW CEW ECB FAW SB SWCB TAW WBC	RW	GT LL	20% structured-w/in, adj
Agrisure 3122 E-Z Refuge	Cry1Ab Cry1F mCry3A Cry34/35Ab1	BCW ECB FAW SB SWCB WBC *CEW*	RW	GT	5% in the bag (RIB)
Agrisure Viptera 3220 E-Z Refuge	Cry1Ab Cry1F Vip3A	BCW CEW ECB FAW SB SWCB TAW WBC	---	GT	5% in the bag (RIB)
Agrisure Duracade 5122 E-Z Refuge	Cry1Ab Cry1F mCry3A eCry3.1Ab	BCW ECB FAW SB SWCB WBC *CEW*	RW	GT	5% in the bag (RIB)
Agrisure Duracade 5222 E-Z Refuge	Cry1Ab Cry1F Vip3A mCry3A eCry3.1Ab	BCW CEW ECB FAW SB SWCB TAW WBC	RW	GT	5% in the bag (RIB)
HERCULEX					
Herculex 1 (HX1)	Cry1F	BCW ECB FAW SB SWCB WBC *CEW*	---	LL	20% structured-½ mile
Herculex RW (HXRW)	Cry34/35Ab1	---	RW	RR2 (most)	20% structured-w/in, adj
Herculex XTRA (HXX)	Cry1F Cry34/35Ab1	BCW ECB FAW SB SWCB WBC *CEW*	RW		20% structured-w/in, adj
OPTIMUM					
TRIsect	Cry1F mCry3A	BCW ECB FAW SB SWCB WBC *CEW*	RW	LL RR2	20% structured-w/in, adj
Intrasect	Cry1F Cry1Ab	BCW ECB FAW SB SWCB WBC *CEW*	---	LL RR2	5% structured-½ mile
Intrasect Leptra	Cry1F Cry1Ab Vip3A	BCW CEW ECB FAW SB SWCB TAW WBC	---	LL RR2	5% structured-w/in, adj
Intrasect XTra	Cry1F Cry1Ab Cry34/35Ab1	BCW ECB FAW SB SWCB WBC *CEW*	RW	LL RR2	20% structured-w/in, adj
Intrasect XTreme	Cry1F Cry1Ab mCry3A Cry34/35Ab1	BCW ECB FAW SB SWCB WBC *CEW*	RW	LL RR2	5% structured-w/in, adj
AcreMax (AM)	Cry1F Cry1Ab	BCW ECB FAW SB SWCB WBC *CEW*	---	LL RR2	5% in the bag (RIB)
AcreMax RW (AMRW)	Cry34/35Ab1	---	RW	LL RR2	10% in the bag (RIB)
AcreMax1 (AM1)	Cry1F Cry34/35Ab1	BCW ECB FAW SB SWCB WBC *CEW*	RW	LL RR2	10% in the bag *(RW)* & 20% structured-½ mile *(CB)*
AcreMax TRIsect (AMT)	Cry1F Cry1Ab mCry3A	BCW ECB FAW SB SWCB WBC *CEW*	RW	LL RR2	10% in the bag (RIB)
AcreMax Xtra (AMX)	Cry1F Cry1Ab Cry34/35Ab1	BCW ECB FAW SB SWCB WBC *CEW*	RW	LL RR2	10% in the bag (RIB)
AcreMax XTrem (AMXT)	Cry1F Cry1Ab mCry3A Cry34/35Ab1	BCW ECB FAW SB SWCB WBC *CEW*	RW	LL RR2	5% in the bag (RIB)
YIELDGARD / GENUITY					
YieldGard CB (YGCB)	Cry1Ab	ECB SWCB *CEW FAW SB*	---	RR2	20% structured-½ mile
YieldGard VT Rootworm	Cry3Bb1	---	RW	RR2	20% structured-w/in, adj
YieldGard VT Triple	Cry1Ab Cry3Bb1	ECB SWCB *CEW FAW SB*	RW	RR2	20% structured-w/in, adj
Genuity VT Double PRO (or as RIB complete)	Cry1A.105 Cry2Ab2	CEW ECB FAW SB SWCB	---	RR2	5% structured-½ mile (or 5% in the bag (RIB))
Genuity VT Triple PRO (or as RIB complete)	Cry1A.105 Cry2Ab2 Cry3Bb1	CEW ECB FAW SB SWCB	RW	RR2	20% structured-w/in, adj (or 10% in the bag (RIB))
Genuity SmartStax RIB Complete	Cry1A.105 Cry2Ab2 Cry1F Cry3Bb1 Cry34/35Ab1	BCW CEW ECB FAW SB SWCB WBC	RW	LL RR2	5% in the bag (RIB)
OTHERS					
Smartstax (or as Refuge Advanced)	Cry1A.105 Cry2Ab2 Cry1F Cry3Bb1 Cry34/35Ab1	BCW CEW ECB FAW SB SWCB WBC	RW	LL RR2	5% structured-w/in, adj (or 5% in the bag (RIB))