



Selecting Trait Technology for Corn Insect Management

Corn product selection is a critical component to help achieve yield goals. Planting a range of product relative maturities with different offensive and defensive characteristics and biotech traits can help reduce the impact of poor environmental conditions, disease, and insect pressure. Two primary goals when selecting corn products are to minimize risk and maximize yield potential.

Several *Bacillus thuringiensis* (*B.t.*) trait options are available for insect protection across most corn production areas of the U.S. The first step in selecting a corn product is to identify the insect pest(s) that may be present and select the proper trait(s) for controlling those insects. Using insect trait protection technology can help reduce the risk of damage caused by insect feeding such as stalk and root lodging, dropped ears, and overall loss of yield potential.

VT Double PRO® Corn

VT Double PRO® corn provides above-ground protection from European corn borer, southwestern corn borer, fall armyworm, and corn earworm with two modes of action (MOA).

Trecepta Technology

Built on VT Double PRO® Technology, Trecepta® Technology can be an important management tool to help reduce the damage caused by European corn borer (two MOA), southwestern corn borer (three MOA), fall armyworm (three MOA), corn earworm (three MOA), black cutworm (one MOA), and western bean cutworm (one MOA).

SmartStax® Technology and Corn Rootworm

Production practices that favor the growth of corn rootworm (CRW) populations include long-term corn-on-corn, late-planted fields, and/or planting late-maturing corn products. For example, full-season corn products used by many silage growers are often prime targets for escalating CRW beetle populations because they pollinate later in the season when other desirable adult CRW food sources have deteriorated.

SmartStax® Technology takes advantage of VT Triple PRO® Technology, Herculex® XTRA insect protection, Roundup Ready® 2 Technology, and LibertyLink® Technology. The traits include protection against above-ground insects, below-ground insects, and provide broad herbicide tolerance.

SmartStax® PRO Technology

SmartStax® PRO Technology combines the proven benefits of SmartStax® Technology corn rootworm protection with an additional, novel RNAi-based mode of action, providing improved corn rootworm control over a range of pressures.* Because RNAi technology works differently than a soil-applied insecticide or Bt-traits to control corn rootworm, it can help protect corn against this billion-dollar bug. In addition to corn rootworm, SmartStax® PRO Technology offers growers protection against the above-ground pests European corn borer (three MOA), southwestern corn borer (three MOA), fall armyworm (three MOA), black cutworm (one MOA), and corn earworm (two MOA).

*Based upon 2019 to 2020 Bayer internal trials comparing leading corn rootworm technologies in fields with moderate to heavy corn rootworm pressure.

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VT4PRO™ with RNAi Technology

VT4PRO™ with RNAi Technology is the first product from Bayer that combines the power of the three modes of built-in action in Trecepta® Technology, an elite above-ground pest package for corn that controls insects such as corn earworm and western bean cutworm, along with the RNAi-based mode of action, the latest defense to help manage corn rootworm.

Corn product selection is a critical component to help achieve yield goals. The selection criteria used for historic product selection continues to be important and selecting the proper traits to help manage insect pressure can help maximize yield potential.

Table 1. Corn *Bacillus thuringiensis* (B.t.) trait reference table for above- and below-ground insect control. (Dual-mode activity, * Single-mode activity)**

Technology	Percent Refuge in a Bag	Herbicide Tolerance		Above-Ground <i>B.t.</i> Protection			Below-Ground <i>B.t.</i> Protection		
		^a Glyphosate Tolerant (EPSPS-NK603-Roundup Ready® 2) ^b (mEPSPS-GA21-Agrisure® GT)	Glufosinate Tolerant (PAT- Liberty Link®)	VT Double PRO® (Cry1A.105 + Cry2Ab2) (MON89034)	Herculex® I (Cry1Fa + PAT) (TC 1507)	Agrisure Viptera® (Vip3Aa20) (MIR162)	YieldGard® VT Rootworm/Roundup Ready® 2 (Cry3Bb1 + EPSPS) (MON88017)	Herculex® RW (Cry34Ab1/Cry35Ab1 + PAT) (DAS-59122)	Cry3Bb1 + DvSnf7 dsRNA (MON87411) ²
B.t. Traits with Above-Ground Protection									
VT Double PRO® corn		*a		**					
VT Double PRO® RIB Complete® corn blend	5	*a		**					
Trecepta® corn		*a		**		*			
Trecepta® RIB Complete® corn blend	5	*a		**		*			
B.t. Traits with Above- and Below-Ground Protection									
SmartStax® corn		*a	*	**	*		*	*	
SmartStax® RIB Complete® corn blend	5	*a	*	**	*		*	*	
SmartStax® PRO corn ¹		*a	*	**	*		*	*	**
SmartStax® PRO RIB Complete® corn blend ¹	5	*a	*	**	*		*	*	**
VT4PRO™ Corn ¹		*a		**		*	*		*
VT4PRO™ RIB Complete® Corn Blend ¹	5	*a		**		*	*		*

¹SmartStax® PRO Technology and VT4PRO™ Technology contain event MON 87411 which is a molecular stack of insect protection genes in YieldGard® VT Rootworm/Roundup Ready® 2 and DvSnf7 dsRNA (RNAi Technology).
For cotton production areas there is no refuge-in-bag option for traited corn. The refuge must be structured.



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Table 2. Corn *Bacillus thuringiensis* (B.t.) trait reference table indicating which technology controls which insect pests.

Technology	Above-Ground Insect Pests									Below-Ground Insect Pests		
	European Corn Borer	Southwestern Corn Borer	Stalk Borer	Sugarcane Borer	Fall Armyworm	True Armyworm	Corn Earworm	Western Bean Cutworm	Black Cutworm	Western Corn Rootworm	Northern Corn Rootworm	Mexican Corn Rootworm
B.t. Traits with Above-Ground Protection												
VT Double PRO® corn	✓	✓	✓	✓	✓		✓					
Trecepta® corn	✓	✓	✓	✓	✓	✓	✓	✓	✓			
B.t. Traits with Above- and Below-Ground Protection												
SmartStax® corn	✓	✓	✓	✓	✓		✓		✓	✓	✓	✓
SmartStax® PRO corn ¹	✓	✓	✓	✓	✓		✓		✓	✓	✓	✓
VT4PRO™ corn ¹	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓

Sources:

¹ Schnell, R., Porter, P., Baumann, P., and Fromme, D.D. 2015. Transgenic trait selection in corn. Texas A&M AgriLife Extension. <https://agrilifelearn.tamu.edu/s/product/transgenic-trait-selection-in-corn/01t4x000004OUJZAAW/>

² Licht, M. 2017. A guide to choosing corn hybrids. Iowa State University. ICM News. <https://crops.extension.iastate.edu/cropnews/2017/10/guide-choosing-corn-hybrids>

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ALWAYS READ AND FOLLOW PESTICIDE LABEL DIRECTIONS.


B.t. products may not yet be registered in all states. Check with your seed brand representative for the registration status in your state.

Performance may vary, from location to location and from year to year, as local growing, soil and environmental conditions may vary. Growers should evaluate data from multiple locations and years whenever possible and should consider the impacts of these conditions on their growing environment.

The recommendations in this material are based upon trial observations and feedback received from a limited number of growers and growing environments. These recommendations should be considered as one reference point and should not be substituted for the professional opinion of agronomists, entomologists or other relevant experts evaluating specific conditions.

IMPORTANT IRM INFORMATION: Certain products are sold as RIB Complete® corn blend products, and do not require the planting of a structured refuge except in the Cotton-Growing Area where corn earworm is a significant pest. Products sold without refuge in the bag (non-RIB Complete) require the planting of a structured refuge. **See the IRM/Grower Guide for additional information. Always read and follow IRM requirements.**

Roundup Ready® Technology contains genes that confer tolerance to glyphosate. **Roundup Ready® 2 Technology** contains genes that confer tolerance to glyphosate. Plants that are not tolerant to glyphosate may be damaged or killed if exposed to those herbicides. Insect control technology provided by **Vip3A** is utilized under license from Syngenta Crop Protection AG. Herculex® is a registered trademark of Dow AgroSciences LLC. Agrisure Viptera® is a registered trademark of a Syngenta group company. LibertyLink® is a trademark of BASF Corporation. Respect the Refuge and Corn Design® and Respect the Refuge® are registered trademarks of National Corn Growers Association. Bayer, Bayer Cross, RIB Complete®, Roundup Ready 2 Technology and Design®, Roundup Ready®, SmartStax®, Trecepta®, VT Double PRO®, VT4PRO™, VT4PRO™ and YieldGard Corn Borer and Design® are trademarks of Bayer Group. All other trademarks are the property of their respective owners. ©2024 Bayer Group. All rights reserved. 1215_25854



Before opening a bag of seed, be sure to read, understand and accept the stewardship requirements, **including applicable refuge requirements for insect resistance management**, for the biotechnology traits expressed in the seed as set forth in the Technology/Stewardship Agreement that you sign. By opening and using a bag of seed, you are reaffirming your obligation and agreement to comply with the most recent stewardship requirements.

