

2018 SOYBEAN WEED MANAGEMENT



COMPARISON OF SOYBEAN WEED MANAGEMENT SYSTEMS						
Soybean Trait	Genuity® Roundup Ready 2 Yield® Soybeans	Roundup Ready® Xtend Crop System		LibertyLink® Soybeans	LibertyLink® GT27™ Soybeans	Enlist E3™ Soybeans ¹
		Roundup Ready 2 Xtend® Soybeans	XtendFlex® Soybeans ¹			
Availability¹	Currently available	Currently available	Not yet commercially available	Currently available	Currently available	Pending export approvals
Company	Bayer	Bayer	Bayer	BASF	MS Technologies, BASF, and Mertec LLC	Corteva (Dow AgroSciences)
Seed features including herbicide tolerance	Tolerant to glyphosate Contains the high-yielding Genuity® Roundup Ready 2 Yield® trait	Stacked with tolerance to glyphosate and dicamba Built on the high-yielding Genuity Roundup Ready 2 Yield technology Enables farmers to use dicamba as a burndown, PRE, and POST herbicide on Roundup Ready 2 Xtend® soybeans	Stacked with tolerance to glyphosate, dicamba, and glufosinate	Tolerant to glufosinate	Stacked with tolerance to isoxaflutole, glyphosate, and glufosinate Anticipated that once labeled, isoxaflutole can be used PRE on LibertyLink GT27 soybeans	Stacked with tolerance to glyphosate, 2,4-D, and glufosinate
Mode of Action	Amino acid synthesis inhibitor	Synthetic auxin (growth regulator) + amino acid synthesis inhibitor	Synthetic auxin (growth regulator) + amino acid synthesis inhibitor + nitrogen metabolism (glutamine synthesis inhibitor)	Glutamine synthesis inhibitor (nitrogen metabolism)	HPPD inhibitors + amino acid synthesis inhibitor + glutamine synthesis inhibitor (nitrogen metabolism)	Amino acid synthesis inhibitor + synthetic auxin (growth regulator) + glutamine synthesis inhibitor (nitrogen metabolism)
Herbicide Class	Glycines	Glycines + benzoic acids	Glycines + benzoic acids + phosphinic acids	Phosphinic acids	Isoxazoles + glycines + phosphinic acids	Glycines + phenoxyalkanoic acids + phosphinic acids
HRAC Group	Group G	Group G; Group O	Group G; Group O; Group H	Group H	Group F2; Group G; Group H	Group G; Group O; Group H
WSSA Group	9	9, 4	9, 4, 10	10	27, 9, 10	9, 4, 10
Weed Species Labeled²	~ 175	~ 350	~ 375	~ 130	~ 230	~ 260

COMPARISON OF HERBICIDES FOR USE IN SOYBEAN						
Herbicides	Roundup® Brand Glyphosate-only Agricultural herbicides	XtendiMax® herbicide with VaporGrip® Technology	Roundup Xtend™ herbicide with VaporGrip® Technology ¹ <small>pending regulatory approvals</small>	Liberty® 280 SL herbicide	Balance® Bean ¹ herbicide <small>pending regulatory approvals</small>	Enlist Duo® herbicide
Chemistry Features	Broad-spectrum herbicides for grass and broadleaf weed control	A low-volatility dicamba formulation for tank mixing with other herbicides	Designed as an enhanced, low-volatility formulation delivering both dicamba and glyphosate in a pre-mix formulation	Offers nonselective control of many broadleaf and grass weeds Labeled for in-season use on all LibertyLink® crops		Optimized with Colex-D® technology: - Ultra low volatility - Minimizes potential for physical drift
Active Ingredient(s)	Glyphosate	Dicamba	Anticipated to contain dicamba + glyphosate	Glufosinate	Anticipated to contain isoxaflutole	2,4-D choline (quaternary ammonium salt) + glyphosate
Amount of Translocation	Translocated through xylem or phloem	Translocated through xylem or phloem	Anticipated to translocate through xylem or phloem	Limited	Anticipated to translocate through xylem	Translocated through xylem or phloem
Soil Activity	Little to none	Up to 14 days on certain small-seeded broadleaf weeds	Pending label up to 14 days on certain small-seeded broadleaf weeds	Little to none	May be high (depends on weather, soil pH, and organic matter content)	Little to none
Ground Application Carrier Volume (GPA)	10 to 20	Minimum of 15	Pending label for a minimum of 15	Minimum of 15	Currently not specified	10 to 15
Aerial Application Carrier Volume (GPA)	3 to 15	Do not use aerial applications of Roundup Xtend herbicide with VaporGrip Technology	Aerial applications of Roundup Xtend herbicide with VaporGrip technology will be restricted	Minimum of 10	Currently not specified	Aerial applications are restricted
In-Crop Application Window	Burndown through R2	Burndown/pre-plant/preemergence to R1 (labeled) Burndown/pre-plant/preemergence to V4 (recommended)	Pending label for burndown/pre-plant/preemergence to R1 Recommended application timing will be burndown/pre-plant/preemergence to V4	Emergence up to (not through) bloom stage (R1)	Anticipated for preemergence application only	Up to R2



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Maximum Rate/Year	5.3 qts/A	2 lb ae/A dicamba	Pending label for 2 lb ae/A dicamba 4 lb ae/A glyphosate	87 oz/A (burndown to bloom)	Currently not specified	14.25 pts/A
Pre-harvest Interval	7 to 14 days (see label for details)	7 to 14 days (see label for details)	Pending label for 7 to 14 days	70 days	Pending label for POST application	50 days
Rainfastness	Roundup WeatherMAX® herbicide: 30 minutes	4 hours	Pending label for 4 hours	4 hours	Anticipated to be soil applied	4 to 6 hours
Rotation Restrictions	None	15-22 days per 11 fl oz/acre between application and barley, oat, wheat, and other grass seedlings Check restrictions on rotation to sensitive soybean	Pending label for 15-22 days/ 32 fl oz/A between application and barley, oat, wheat, and other grass seeding No restrictions at 120 DAT or more	None for canola, corn, cotton, rice, soybeans, and sugarbeets 70 days for small grains, root, tuber, and brassica leafy vegetables 180 days for all other crops	Currently not specified	Do not replant treated fields with crops other than those labeled for 2,4-D and glyphosate
FABs (Pros/Cons)	PRO: No plant-back restrictions (crops can be planted or seeded directly following application) PRO: Wide spectrum of control PRO: Part of the Roundup Ready PLUS® Crop Management Solutions CON: Glyphosate-resistant weeds	PRO: Can provide some residual soil activity, which can be beneficial in dry conditions PRO: Very effective on a wide variety of weeds including glyphosate-resistant marestail, Palmer amaranth, and waterhemp PRO: Enhanced efficacy on difficult-to-control broadleaf weeds PRO: Superior efficacy on winter annuals and perennial weeds compared to other auxins like 2,4-D PRO: Part of the Roundup Ready PLUS Crop Management Solutions CON: Limited efficacy when weeds are larger than recommended	PRO: May provide some residual soil activity from dicamba in the pre-mix, which can be beneficial in dry conditions PRO: Anticipated to be effective on a wide variety of weeds including glyphosate-resistant marestail, Palmer amaranth, and waterhemp PRO: Anticipated enhanced efficacy on difficult-to-control broadleaf weeds PRO: Anticipated superior efficacy on winter annuals and perennial weeds compared to other auxins like 2,4-D PRO: Anticipated to be in Roundup Ready PLUS Crop Management Solutions CON: One effective MOA of dicamba on glyphosate-resistant weeds	PRO: Serves as an alternative weed control tool for glyphosate-resistant weeds CON: Grass activity limited CON: Weed size must be very small in general to obtain effective control; not a wide window of application time CON: No soil activity CON: Reduced herbicide efficacy under low light (dawn/dusk/at night)	PRO: May provide an option to control glyphosate-resistant weeds including Palmer amaranth PRO: May provide some "reach back" control CON: Pending label for use on coarse soils less than 1.5% OM or 7.5 pH or greater may result in adverse crop response CON: Restricted-use pesticide. May be restricted by geography due to water table issues CON: Is not anticipated to be labeled POST	PRO: effective on a wide variety of broadleaf weeds including glyphosate-resistant Palmer amaranth and waterhemp CON: Limited residual activity
Recommended Droplet Size for Application	Medium to very coarse	Very coarse to ultra coarse	Very coarse to ultra coarse	Medium to coarse	Currently not specified	Very coarse to ultra coarse

¹ Pending regulatory approvals.

² Based on approved EPA herbicide labels as of Aug. 2018 for listed herbicide tolerances above.

XtendiMax® herbicide with VaporGrip® Technology is part of the Roundup Ready® Xtend Crop System and is a restricted use pesticide for retail sale to and use only by Certified Applicators or persons under their direct supervision and only for those uses covered by the Certified Applicator's certification. ALWAYS READ AND FOLLOW DIRECTIONS FOR USE ON PESTICIDE LABELING. It is a violation of federal and state law to use any pesticide product other than in accordance with its labeling. XtendiMax® herbicide with VaporGrip® Technology and cotton with XtendFlex® Technology may not be approved in all states and may be subject to use restrictions in some states. Check with your local product dealer or representative or U.S. EPA and your state pesticide regulatory agency for the product registration status and additional restrictions in your state. For approved tank-mix products and nozzles visit XtendiMaxApplicationRequirements.com

This information is for educational purposes only and is not an offer to sell Roundup Xtend™ with VaporGrip™ Technology. These products are not yet registered or approved for sale or use anywhere in the United States.

Commercialization is dependent on multiple factors, including successful conclusion of the regulatory process. The information presented herein is provided for educational purposes only, and is not and shall not be construed as an offer to sell, or a recommendation to use, any unregistered pesticide for any purpose whatsoever. It is a violation of federal law to promote or offer to sell an unregistered pesticide.

ALWAYS READ AND FOLLOW DIRECTIONS FOR USE ON PESTICIDE LABELING. IT IS A VIOLATION OF FEDERAL AND STATE LAW to use any pesticide product other than in accordance with its labeling. NOT ALL formulations of dicamba or glyphosate are approved for in-crop use with Roundup Ready 2 Xtend® soybeans. ONLY USE FORMULATIONS THAT ARE SPECIFICALLY LABELED FOR SUCH USES AND APPROVED FOR SUCH USE IN THE STATE OF APPLICATION. Contact the U.S. EPA and your state pesticide regulatory agency with any questions about the approval status of dicamba herbicide products for in-crop use with Roundup Ready 2 Xtend® soybeans.

Roundup Ready 2 Xtend® soybeans contains genes that confer tolerance to glyphosate and dicamba. Glyphosate will kill crops that are not tolerant to glyphosate. Dicamba will kill crops that are not tolerant to dicamba. Glufosinate will kill crops that are not tolerant to glufosinate. Contact your seed brand dealer or refer to Monsanto's Technology Use Guide for recommended weed control programs.

Always read and follow grain marketing and all other stewardship practices and pesticide label directions. Roundup Ready technology contains genes that confer tolerance to glyphosate, an active ingredient in Roundup® brand agricultural herbicides. Agricultural herbicides containing glyphosate will kill crops that are not tolerant to glyphosate. Tank mixtures: The applicable labeling for each product must be in the possession of the user at the time of application. Follow applicable use instructions, including application rates, precautions and restrictions of each product used in the tank mixture. Not all tank mix product formulations have been tested for compatibility or performance other than specifically listed by brand name. Always predetermine the compatibility of tank mixtures by mixing small proportional quantities in advance. Genuity®, Roundup Ready 2 Xtend®, Roundup Ready PLUS®, Roundup Ready 2 Yield®, Roundup Xtend™ Roundup Ready®, Roundup®, VaporGrip®, XtendFlex® and XtendiMax® are registered trademarks of Bayer Group. Liberty® and LibertyLink® and the Water Droplet Design® are trademarks of BASF Corporation. All other trademarks are the property of their respective owners. ©2018 Monsanto Company. 180925161435 09252018CRB.