















# CORN

Herbicide	Product/A (ai/A)	Weeds	When to Apply	Remarks and Paragraphs		
<b>Refer to page 6 for Fall or Spring Early Preplant Herbicides.</b>						
<b>Refer to page 28-30 for additional herbicides to use in conventional or herbicide-resistant corn.</b>						
<b>Dual/II/Magnum</b> (S/metolachlor <sup>15</sup> & benoxacor safener)	<b>1 to 2 pt EC</b> (0.95 to 1.9 lb)	Annual grass and some broadleaf weeds.	Shallow PPI or PRE.	PRE requires precipitation for activation. Pyroxasulfone may require multiple rain events for activation. Adjust rate for soil type. Shallow PPI gives more consistent weed control than PRE. 3 to 4 weeks residual weed control after activation. Weed control: pyroxasulfone = acetochlor > dimethenamid = metolachlor. Outlook may be applied as a single application or sequentially. See Outlook label for rates allowed per application. Use the highest rates allowed for greater and more consistent weed control. Refer to label for tank-mix options. A1-2 B1-2 D1 D5 D6		
<b>Harness/Surpass</b> (acetochlor <sup>15</sup> & dichlormid safener) 	<b>1.25 to 2.75 pt 7EC</b> (1.1 to 2.4 lb) <b>1.5 to 3 pt 6.4EC</b> (1.2 to 2.4 lb)					
<b>Outlook</b> (dimethenamid-P <sup>15</sup> )	<b>10 to 24 fl oz EC</b> (0.47 to 1.125 lb)					
<b>Zidua SC</b> (pyroxasulfone <sup>15</sup> )	<b>1.75 to 6.5 fl oz SC</b> (0.9 to 3.4 oz)					
<b>Anthem Maxx</b> (pyroxasulfone <sup>15</sup> & fluthiacet <sup>14</sup> )	<b>2.5 to 6.5 fl oz SC</b> (1.3 to 3.4 oz + 0.04 to 0.1 oz)					
<b>Fierce</b> (pyroxasulfone <sup>15</sup> & flumioxazin <sup>14</sup> )	<b>3 oz WDG</b> (1.28 oz & 1 oz)	Annual grass and broadleaf weeds.	EPP - At least 7 days prior to planting.	Refer to page 6 for crop rotation intervals. Use only on no-till or min-till fields where crop residue hasn't been incorporated into the soil. Requires precipitation for herbicide activation. Refer to label for tank-mix options and crop rotation restrictions. A1-2 B1-2 D1 D6		
<b>Valor SX/EZ</b> (flumioxazin <sup>14</sup> )	<b>2 to 3 oz WDG/SC</b> (1 to 1.5 oz)	Small-seeded broadleaf weeds.				
<b>Sharpen</b> (saflufenacil <sup>14</sup> )	<b>1 to 3 fl oz SC</b> (0.36 to 1.07 oz)	Annual broadleaf weeds.	EPP, shallow PPI, or PRE.	PRE requires precipitation for herbicide activation. Adjust rate for soil type. Sharpen has no grass activity. Provides burndown and rate dependant residual control of emerged broadleaf weeds. Refer to label for tank-mix options. A1-2 B1-2 B12		
<b>Verdict</b> (saflufenacil <sup>14</sup> & dimethenamid <sup>15</sup> )	<b>10 to 18 fl oz EC</b> (0.71 to 1.28 oz + 0.39 to 0.7 lb)	Annual grass and broadleaf weeds.	Shallow PPI, PRE or EPOST up to V2 corn.	PRE requires precipitation for herbicide activation. Adjust rate for soil texture and pH. Provides residual weed control after activation. Do not apply EPOST with oil adjuvant. Balance Flexx and Corvus contains cyprosulfamide to safener corn. Refer to label for crop rotation restrictions. A1-2 D1		
<b>Balance Flexx</b> (isoxaflutole <sup>27</sup> & safener)  <b>RUP</b>	<b>3 to 6 fl oz L</b> (0.75 to 1.5 oz)					
<b>Corvus</b> (isoxaflutole <sup>27</sup> & thiencazone <sup>2</sup> & safener)  <b>RUP</b>	<b>3.33 to 5.6 fl oz SC</b> (0.78 to 1.32 oz & 0.31 to 0.53 oz)					
<b>SureStart/II TripleFlex/II</b> (acetochlor <sup>15</sup> & flumetsulam <sup>2</sup> & clopyralid <sup>4</sup> ) 	<b>1.5 to 3 pt SC</b> (0.7 to 1.4 lb & 0.36 to 0.72 oz & 0.87 to 1.74 oz)					
<b>Resicore</b> (acetochlor <sup>15</sup> & mesotrione <sup>27</sup> & clopyralid <sup>4</sup> ) 	<b>2.25 to 3 qt SC</b> (1.58 to 2.1 lb & 2.7 to 3.6 oz & 1.68 to 2.24 oz)					
<b>Acuron Flexi</b> (S-metolachlor <sup>15</sup> & mesotrione <sup>27</sup> & bicyclopyrone <sup>27</sup> & benoxacor safener) 	<b>1.2 to 2.25 qt SC</b> (0.43 to 0.8 lb & 0.77 to 1.44 oz & 0.19 to 0.37 oz)					
<b>Acuron</b> (S-metolachlor <sup>15</sup> & mesotrione <sup>27</sup> & bicyclopyrone <sup>27</sup> & atrazine <sup>5</sup> & benoxacor safener) 	<b>1.5 to 3 qt SC</b> (0.8 to 1.6 lb & 1.44 to 2.88 oz & 0.36 to 0.72 oz & 0.375 to 0.75 lb)					
					Shallow PPI, PRE or EPOST up to 30 inch tall corn.	PRE requires precipitation for herbicide activation. Adjust rate for organic matter. Provides residual weed control after activation. Bicyclopyrone improves large-seeded broadleaf weed control. Apply Acuron Flexi EPOST with atrazine at 0.38 lb ai/A for greater weed control. Add NIS at 1 qt/100 gal water for POST applications. Do not apply with MSO or nitrogen based adjuvants to emerged corn. Refer to label for tank-mix options and crop rotation restrictions. A1-2 D2 D4
					Shallow PPI, PRE or POST up to 12 inch tall corn.	

Herbicide	Product/A (ai/A)	Weeds	When to Apply	Remarks and Paragraphs
Dicamba <sup>4</sup> 	<b>0.25 to 0.5 pt 4SL</b> <b>3.2 to 6.4 fl oz 5SL</b> (0.125 to 0.25 lb)	Broadleaf weeds.	PRE or EPOST up to 8 inch tall corn.	Seed corn at least 1.5 inches. PRE applications require precipitation for herbicide activation. Residual weed control from soil application is weed and dicamba rate dependent.
<b>DiFlexx</b> (dicamba <sup>4</sup> & cyprosulfamide safener) 	<b>0.5 to 1 pt SL</b> (0.25 to 0.5 lb)		PRE or POST up to V10 or 24 inch tall corn. Weeds: Small.	DiFlexx/Duo contains cyprosulfamide safener and Status contains isoxadifen-ethyl to safen dicamba on corn.
<b>DiFlexx Duo</b> (dicamba <sup>4</sup> & tembotrione <sup>27</sup> & cyprosulfamide safener) 	<b>24 to 40 fl oz SC</b> (0.24 to 0.39 lb + 0.051 to 0.08)	Broadleaf weeds and some annual grass weeds.	PRE or POST prior to V7 or 24 inch tall corn. Weeds: Small.	In one growing season do not apply more than 2 qt/A of dicamba, 24 fl oz/A of DiFlexx, 40 fl oz/A of DiFlexx Duo, or 12.5 oz/A of Status. Apply with PO and MSO adjuvants at 1% v/v to improve weed control. Apply with HSMOC adjuvants when mixed with glyphosate.
<b>Status</b> (dicamba <sup>4</sup> & diflufenzopyr <sup>19</sup> & isoxadifen safener) 	<b>5 to 10 oz WDG</b> (0.125 to 0.25 lb)	Broadleaf weeds.	POST from V2 to V10 or from 4 to 36 inch tall corn. Weeds: Small	Refer to label for adjuvant type and rate recommendations, crop rotation restrictions, and other information. A3 A5-8 B6 D1 D3
<b>Armezon / Impact + Atrazine<sup>5</sup></b> (topramezone <sup>27</sup> )	<b>0.5 to 0.75 fl oz SC + 0.75 pt 4L</b> <b>0.42 lb DF</b> (0.175 to 0.26 oz + 0.375 lb)	Broadleaf weeds and foxtail.	POST to corn. Up to 45 day PHI. Weeds: Small.	Apply early to small weeds to increase residual weed control. Add atrazine at 0.42 lb DF/A or 0.75 pt 4L/A + UAN at 2.5 gal/100 gal or AMS at 8.5 lb/100 gal water.
<b>Armezon Pro + Atrazine<sup>5</sup></b> (topramezone <sup>27</sup> & dimethenamid <sup>15</sup> )	<b>14 to 20 fl oz SC + 0.75 pt 4L</b> <b>0.42 lb DF</b> (0.175 to 0.25 oz & 0.57 to 0.82 lb + 0.375 lb)		Up to 12-inch corn	Apply to corn less than 12 inches when atrazine is applied alone or with other herbicides.
<b>ImpactZ</b> (topramzezone <sup>27</sup> + atrazine <sup>5</sup> )	<b>8 to 10.7 fl oz</b> (0.26 to 0.35 oz + 0.25 to 0.33 lb)			Adjuvant recommendations: Armezon/Impact and Laudis: Add MSO oil adjuvant at 1 to 2 pt pt/A. ImpactZ: Add MSO at 1 to 1.5 gal/100 plus UAN or AMS.
<b>Callisto + Atrazine<sup>5</sup></b> (mesotrione <sup>27</sup> )	<b>3 fl oz SE + 0.75 pt 4L</b> <b>0.42 lb DF</b> (1.5 oz + 0.375 lb)	Broadleaf weeds.	POST up to V8 or 30 inch tall corn. Weeds: Small.	Armezon Pro: Add NIS at 1 to 2 pt/100 gal. Callisto, Capreno, and Revulin Q: Add PO adjuvant at 2 to 4 pt/A or HSOC at 2 qt/A. Resicore: Add NIS at 1 pt/100 gal or PO adjuvant at 2 pt/A.
<b>Resicore</b> (acetochlor <sup>15</sup> & mesotrione <sup>27</sup> & clopyralid <sup>4</sup> ) 	<b>2.25 to 3 qt SC</b> (1.58 to 2.1 lb & 2.7 to 3.6 oz & 1.68 to 2.24 oz)	Broadleaf weeds, annual grasses and quackgrass.	POST up to 11 inch tall corn. Weeds: Small.	Do not apply Armezon Pro, Callisto, Resicore, or Revulin Q with MSO adjuvants.
<b>Revulin Q</b> (mesotrione <sup>27</sup> & nicosulfuron <sup>2</sup> & isoxadifen safener) 	<b>3.4 to 4 oz SG +</b> (1.25 to 1.5 oz + 0.5 to 0.58 oz)	Broadleaf weeds, annual grasses and quackgrass.	POST up to V6 or 20 inch tall corn. Weeds: Small.	Refer to label for tank-mix options and restrictions.  Commercial mixtures with Callisto available: Acuron = mesotrione + bicyclopyrone + S-meto + atra Acuron Flexi = mesotrione + bicyclopyrone + S-meto Callisto Xtra = mesotrione + atrazine Lumax EZ = mesotrione + S-metolachlor + atrazine
<b>Laudis + Atrazine<sup>5</sup></b> (tembotrione <sup>27</sup> & isoxadifen safener)	<b>3 fl oz SC + 0.75 pt 4L</b> <b>0.42 lb DF</b> (1.31 oz + 0.375 lb)	Broadleaf weeds, some grass weeds. Partial green foxtail control.	POST up to V8 stage corn. Weeds: Less than 3 to 4 inches tall.	A3 A5-7 D1 D4
<b>Capreno + Atrazine<sup>5</sup></b> (tembotrione <sup>27</sup> & thiencazone <sup>2</sup> & isoxadifen safener) 	<b>3 fl oz SC + 0.75 pt 4L</b> <b>0.42 lb DF</b> (1.08 oz & 0.21 oz + 0.375 lb)	Broadleaf weeds and most grass weeds including brome and barnyardgrass.	POST up to V5 stage corn. Weeds: Less than 3 to 4 inches tall.	
Atrazine <sup>5</sup> + oil adjuvant <b>RUP</b>	<b>0.75 to 1.5 pt 4L + 0.42 to 0.84 lb DF + 1 qt</b> (0.38 to 0.75 lb)	Annual broadleaf weeds.	EPOST up to 12 inch tall corn. Weeds: Small.	Apply with other POST herbicides to improve weed control. Atrazine may leave a soil residue and injure crops planted the following year. A3 D1-2
Bromoxynil <sup>6</sup>	<b>1 to 1.5 pt EC</b> (0.25 to 0.37 lb)	Small pigweed and lambsquarters, nightshade, kochia and buckwheat.	EPOST up to 12 inch tall corn. Weeds: Less than 2 to 3 inches.	Contact, non-residual herbicides requiring >15 gpa and full sunlight. Apply with other herbicides. May cause speckling on corn leaves. Refer to label for tank-mix options and adjuvant use. A3 B4 D1
<b>Resource</b> (flumiclorac <sup>14</sup> )	<b>2 to 6 fl oz EC</b> (0.215 to 0.65 oz)			

# CORN

Herbicide	Product/A (ai/A)	Weeds	When to Apply	Remarks and Paragraphs
<b>Preharvest Herbicides</b>				
Glyphosate <sup>9</sup>	Up to 3.7 lb ae <b>See Remarks.</b>	Grass and broadleaf weeds.	Preharvest. Apply when grain moisture is <35%	Add AMS fertilizer at 8.5 lb/100 gal. Allow a 7 day PHI. A3 A4-8 B1-2 B8
Paraquat <sup>22</sup>	<b>RUP</b> 1 to 2 pt 2SL 0.8 to 1.3 pt 3SL (0.25 to 0.5 lb)	Annual broadleaf and grass weeds.	and corn seed has formed a black layer.	Add NIS at 0.25% to 0.5% v/v. Allow a 7 day PHI. B11

## HERBICIDE-RESISTANT CORN

Refer to page 128 for control of volunteer glyphosate resistant corn, canola, and soybean.  
Refer to Herbicide Resistant Weeds section (X1) for weed management strategies to delay herbicide resistant weeds.

Rule #1 - Control weeds BEFORE 2 to 4 inches tall to avoid yield loss.  
Remove weeds early especially when grass weed populations are high.

Average ND corn yield loss vs. weed free or herbicide applied at corn planting.			
Weed height when weeds were removed	Average corn yield loss vs. weed-free control		Corn yield loss from weeds may be greater in dry North Dakota environments than other areas of the mid-west that receive greater precipitation.
	ND research*	Mid-west research**	
2-6 inches	0%	6%	
6-8 inches	16%	9%	
8-12 inches	20%	21%	
Untreated	63%	Not harvested	

\*Source: 8 site-years (Carrington and Minot, 2009-2014).

\*\*Source: 2005 Ohio State University summary of 35 university trials in IA, MI, IL, MO, KY, OH TN, and WI.

## LibertyLink Corn

Herbicide	Product/A (ai/A)	Weeds	When to Apply	Remarks and Paragraphs
Liberty 280 + AMS (glufosinate <sup>10</sup> )	32 fl oz SL + 3 lb/A (0.58 lb) <b>Maximum total =</b> 87 fl oz	Annual grass and broadleaf weeds including ALS and glyphosate weeds.	POST. Corn: Up to 7 collars (V7). Weeds: 1 to 3 inches tall.	<b>Apply only to LibertyLink corn varieties.</b> Contact herbicide requiring thorough coverage. Most active in high humidity and temperature. Add AMS - do not use non-AMS adjuvants. A3 A5-6 B9 D1 D7

## Roundup Ready Corn

Herbicide	Product/A (ae/A)	Weeds	When to Apply	Remarks and Paragraphs																																								
Glyphosate <sup>9</sup>	<b>Maximum single application =</b> 0.75 lb ae  <b>Maximum in-crop =</b> 1.5 lb ae <b>See Remarks.</b>	Annual and perennial grass and broadleaf weeds.	POST. Corn: Up to 30 inches tall or 8 collars.	<b>Apply only to Roundup Ready corn varieties.</b>  <table style="margin-left: auto; margin-right: auto;"> <tr> <td></td> <td style="text-align: center;"><u>Maximum single</u></td> <td style="text-align: center;"><u>Maximum in-crop</u></td> <td></td> <td></td> </tr> <tr> <td></td> <td style="text-align: center;"><u>lb ae</u></td> <td style="text-align: center;"><u>lb ae</u></td> <td></td> <td></td> </tr> <tr> <td></td> <td style="text-align: center;"><u>0.75</u></td> <td style="text-align: center;"><u>1.125</u></td> <td style="text-align: center;"><u>1.5</u></td> <td style="text-align: center;"><u>2.25</u></td> </tr> <tr> <td></td> <td style="text-align: center;">-----</td> <td style="text-align: center;">-----</td> <td style="text-align: center;">-----</td> <td style="text-align: center;">-----</td> </tr> <tr> <td></td> <td style="text-align: center;">lb ae/gal</td> <td style="text-align: center;">lb ai/gal</td> <td style="text-align: center;">fl oz</td> <td></td> </tr> <tr> <td></td> <td style="text-align: center;">3 = 4</td> <td style="text-align: center;">= 32</td> <td style="text-align: center;">48</td> <td style="text-align: center;">64 96</td> </tr> <tr> <td></td> <td style="text-align: center;">4/4.17 =</td> <td style="text-align: center;">5.4/5.1 =</td> <td style="text-align: center;">24/23</td> <td style="text-align: center;">36/35 48/46 72/69</td> </tr> <tr> <td></td> <td style="text-align: center;">4.5 =</td> <td style="text-align: center;">5.5 =</td> <td style="text-align: center;">21.3</td> <td style="text-align: center;">32 42.6 64</td> </tr> </table> <p>Apply with AMS fertilizer at 8.5 lbs/100 gal. Refer to label for tank-mix options, application information, and restrictions. A4-7 B8 D1 D8</p>		<u>Maximum single</u>	<u>Maximum in-crop</u>				<u>lb ae</u>	<u>lb ae</u>				<u>0.75</u>	<u>1.125</u>	<u>1.5</u>	<u>2.25</u>		-----	-----	-----	-----		lb ae/gal	lb ai/gal	fl oz			3 = 4	= 32	48	64 96		4/4.17 =	5.4/5.1 =	24/23	36/35 48/46 72/69		4.5 =	5.5 =	21.3	32 42.6 64
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Glyphosate <sup>9</sup>	<b>Maximum single application =</b> 1.125 lb ae  <b>Maximum in-crop =</b> 2.25 lb ae <b>See Remarks.</b>		POST. RR Corn 2: Up to 30 inches tall or 8 collars. Drop nozzles: 30 to 48 inches tall (free standing).	<b>Apply only to Roundup Ready Corn II varieties.</b> Refer to glyphosate above for remarks. Refer to label for registered uses and for additional information and restrictions. A4-7 B8 D1 D8																																								

# GENERAL WEED MANAGEMENT GUIDELINES

- 1. Scout fields** before and soon after herbicide application. Correctly identify weeds. Use effective herbicides, hand-weeding, cultivation/tillage, and other methods of weed control to kill weeds that escape or germinate after chemical application. Scout fields at the end of the season and draw field maps to denote locations of weed species, weed density, and weed escapes. Save maps as a field record.
- 2. Diversified crop sequences** with different life cycles e.g. winter annual crops (winter wheat), perennial crops (alfalfa) and summer annual crops (spring wheat, corn or beans) results in different planting and harvest times, more herbicide options, and decreased risk of herbicide resistant weeds.
- 3. Consider weed biology and ecology.** Use tillage, crop sequence, soil fertility, planting date, emergence timing, crop competition, weed seed longevity, and response to herbicides to increase successful weed management.
- 4. “Don’t forget the PRE”.** Apply effective PRE herbicides at full rates and include multiple mechanisms of action. PRE herbicides will reduce weed emergence and allow flexibility in POST herbicide timing. Residual PRE herbicides applied to soil and early POST (if labeled) will suppress weed emergence through canopy closure, particularly those with a long germination pattern (kochia and waterhemp). Use PRE herbicides that will effectively control problem weeds.
- 5. Apply effective POST herbicides.** Apply herbicides that include multiple mechanisms of action in tank-mix or in sequential applications. Two or more herbicides in mixture must have activity against potentially resistant weeds to be effective. Herbicides in most commercial mixtures do not target the same weed species. Effective tank-mixtures on weeds will reduce selection of herbicide-resistant biotypes more successfully than rotating herbicide modes of action. Antagonism may occur with some mixtures, especially between contact and systemic herbicides.
- 6. Use high herbicide rates and effective adjuvants.** Full rates kill weeds with low-level resistance and dead plants cannot produce resistant progeny. Reduced rates allow plants with low-level resistance to survive, hybridize, and produce progeny with elevated resistance. Hybrid plants (>1 resistance gene) express a higher level of resistance and require even higher herbicide rates to kill the plant. Dead weeds means zero tolerance (no seed production, zero resistant progeny) and is effective resistance weed management.
- 7. Spray small annual weeds.** Generally, small weeds (<3 inches) are more susceptible to herbicides than large weeds. Even weeds with low level herbicide resistance are more susceptible at 1 inch than at larger growth stages.
- 8. Practice Zero Tolerance.** Scout fields after row closure and kill uncontrolled weeds. Seed from escaped weeds will contribute to the weed seedbank and will require diversified weed management strategies of mowing, cultivation/tillage, and hand weeding to achieve near 100% weed control. Timely cultivation can improve weed control and hand-pulling is effective for single plants or small patches.
- 9. Control weeds in field perimeters, drown out, and non-crop areas.** Weeds surviving a partial herbicide dose on field borders can be a repository for the introduction of resistant weeds into a field. Control weeds in all areas of the field where crop is not growing including field edges, fence lines, water-ways, ditch banks, and areas where crop has either not been planted or has been destroyed.
- 10. Rotate herbicides with different mechanisms of action in consecutive years.** Diverse crop rotations can introduce herbicides with different mechanisms of action to delay herbicide resistance. A mix of dead plants, unaffected plants, and plants showing intermediate responses indicate herbicide resistance has occurred.
- 11. Clean tillage and harvest equipment** to ensure weed seed will not be transported between fields. This is particularly important in crops that are harvested with a platform header equipped combine.
- 12. Evaluate weed management** at the end of each season and revise to improve weed control the next year.

Refer to Herbicide Resistant Weeds section (X1) for additional information on resistant weeds.

# Roundup Ready Corn - Herbicides to apply in tank-mix or sequentially with glyphosate for control of weeds not controlled by glyphosate.

Herbicides <sup>Site of action-pg 108-109</sup>	Rate/A	Buckwheat, Wild	Canola, Vol. RR <sup>b</sup>	Horseweed (Marestail)	Kochia	Lambsquarters	Nightshade species	Pigweed, Redroot	Prickly lettuce	Ragweed, Common	Smartweed, Annual	Waterhemp / Palmer
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Preplant-burndown Herbicides <sup>a</sup> - add AMS at 1.5-3 lb/A.		Weed Control Ratings <sup>c,d</sup>											
Glyphosate <sup>9</sup> (4.5 lb ae) + AMS + HSMOC	32 - 105 fl oz	F-E	N	P-E	P-E	E	E	E	E	E	P-E	E	P-E
+ 2,4-D <sup>4</sup>	+ 1 pt + 1-2 pt	F-E	P-G	F-E	P-E	E	P-G	E	E	E	P-E	F-G	F-G
+ 2,4-D <sup>4</sup> + Express <sup>2</sup>	+ 1pt+0.3oz	F-E	G-E	P-E	P-E	E	E	E	E	P-E	E	P-E	P-E
+ Dicamba <sup>4</sup>	+ 8 fl oz 4SL	E	N	F-E	E	G	E	E	G-E	G	E	F	F
	+ 16 fl oz 4SL	E	N	E	E	E	E	E	E	E	E	G	G
+ Dicamba <sup>4</sup> + Sharpen <sup>14</sup>	+8 floz + 2-3 floz	E	G-E	E	E	E	E	E	E	E	E	E	E
Paraquat <sup>22*</sup> + NIS	3 pt 2SL+1-2 qt	F	-	F-G	G-E	P-E	G-E	E	F-G	G-E	E	G-E	G-E
+ Dicamba <sup>4</sup> + MSO	8 fl oz + 1.5 pt	F	-	F-G	G-E	E	G-E	E	F-G	G-E	E	G-E	G-E
+ Sharpen <sup>14</sup> + MSO	2-3 fl oz + 1.5 pt	G-E	F-E	G-E	E	E	G-E	G-E	G-E	G-E	E	G-E	G-E

PRE herbicides <sup>a</sup>		Weed Control Ratings <sup>c,d</sup> - <i>without glyphosate</i>											
Acetochlor <sup>15</sup>	1.25 - 2.25 pt	P	N	N-P	P-F	F-E	F-G	G-E	-	N-P	P	F-E	F-E
+ Balance Flexx No aerial application	+ 1.5 fl oz	P	E	G-E	E	E	E	E	G-E	G-E	F-G	E	E
+ Dicamba	+ 8 fl oz 4SL	G-E	F-E	G-E	G-E	E	E	E	G-E	G-E	E	G-E	G-E
+ SureStart II/Triple Flex II No aerial ap	+ 2 pt	G-E	P-F	F-E	P-F	E	G-E	E	-	F-G	G-E	G-E	G-E
+ Sharpen	+ 3 fl oz	G-E	F-E	G-E	E	E	E	E	G-E	E	E	E	E
Acuron Flexi <sup>15,27,27</sup> No aerial application	1.2 - 2.25 qt	P-F	E	F-G	P-G	E	E	E	-	G-E	G-E	G-E	G-E
Acuron <sup>5,15,27,27</sup> No aerial application	1.5 - 3 qt	G-E	E	E	E	E	E	E	G-E	G-E	G-E	G-E	G-E
Anthem Maxx <sup>14,15</sup>	2.5 - 6.5 fl oz	F-E	P-F	N-P	F-E	F-E	F-E	G-E	-	P-F	F-E	G-E	G-E
Balance Flexx <sup>27</sup> No aerial application	3 - 4.5 fl oz	P	E	G-E	G-E	E	E	E	G-E	G-E	G	E	E
Corvus <sup>2,27</sup> No aerial application	3.33 - 5.6 fl oz	P	E	G-E	G-E	E	E	E	G-E	G-E	G	E	E
+ Verdict <sup>14,15</sup> No aerial application	+ 15 fl oz	G-E	E	G-E	E	E	E	E	G-E	E	E	E	E
Dicamba <sup>4</sup>	0.5 - 1 pt 4SL	E	N-P	G-E	G-E	G-E	G	F-E	G-E	E	E	F-G	F-G
DiFlexx <sup>4</sup>	0.5 - 1 pt	E	N-P	G-E	G-E	G-E	G	F-E	G-E	E	E	F-G	F-G
DiFlexx Duo <sup>4,27</sup>	1.5 - 2.5 pt	E	E	G-E	E	E	E	E	G-E	E	E	G-E	G-E
Fierce <sup>14,15</sup>	3 oz	P-F	G-E	F-G	F-E	F-G	F-E	G-E	F-G	F-G	F-G	G-E	G-E
Harness Max <sup>15,27</sup> No aerial application	55 - 88 fl oz	P-F	E	F-G	P-G	E	E	E	-	G-E	G-E	G-E	G-E
Hornet <sup>2,4</sup>	3 - 4 oz	G-E	P-F	F-E	N	G-E	G-E	G-E	-	F-G	G-E	N	N
Instigate <sup>2,27</sup> No aerial application	5.25 - 7 oz	P-F	G	F-G	P-F	E	E	E	N	P	E	G-E	G-E
Lumax EZ <sup>5,15,27</sup> No aerial application	3* - 4 pt	G-E	E	E	E	E	E	E	G-E	G-E	G-E	G-E	G-E
Prequel <sup>2,27</sup>	1.66 - 2.5 oz	N	E	G-E	G	G-E	G-E	G-E	G-E	G-E	F-G	G	G
Resicore <sup>4,15,27</sup>	2.25 - 3 qt	G-E	G-E	E	G	E	E	E	F-G	E	G-E	G-E	G-E
Sharpen <sup>14</sup>	2 - 3 fl oz	G-E	F-E	G-E	E	E	G-E	G-E	G-E	G-E	E	G-E	G-E
SureStart II <sup>2,4,15</sup> No aerial application	1.5 - 3 pt	G-E	P-F	F-E	P	G-E	G-E	G-E	-	F-G	G-E	P	P
TripleFlex II <sup>2,4,15</sup> No aerial application	1.5 - 3 pt	G-E	P-F	F-E	P	G-E	G-E	G-E	-	F-G	G-E	P	P
Valor <sup>14</sup>	2 - 3 fl oz	P-F	G	F-E	F-G	F-G	G-E	G-E	F-G	P	F	G-E	G-E
Verdict <sup>14,15</sup>	10 - 16 fl oz	G-E	F-E	G-E	E	E	G-E	E	G-E	G-E	E	E	E
+ Prowl <sup>3</sup> + Dicamba <sup>4</sup> (no-till)	+ 3 pt + 8 fl oz	E	G-E	G-E	E	E	E	E	G-E	E	E	G-E	G-E

<sup>a</sup>May carryover more than one cropping season. Follow labeled crop rotation restrictions - see Y15.  
<sup>b</sup>See page 128 for control of volunteer canola and soybean, and herbicide rates.  
<sup>c</sup>E = Excellent (90-99%), G = Good (80-90%), F = Fair (65-80%), P = Poor (40-65%), N = None.  
<sup>d</sup>Includes resistant populations.  
\*Atrazine at 0.38 lb ai/A. Atrazine and paraquat are RUP.

Roundup Ready Corn - cont.

Herbicides <sup>Site of action-pg 108-109</sup>	Rate/A	Buckwheat, Wild	Canola, Vol. RR <sup>b</sup>	Horseweed (Marestail)	Kochia	Lambsquarters	Nightshade species	Pigweed, Redroot	Prickly lettuce	Ragweed, Common	Smartweed, Annual	Waterhemp / Palmer
<b>PRE Herbicides<sup>a</sup> - cont.</b>		<b>Weed Control Ratings<sup>c,d</sup> - <i>without glyphosate</i></b>										
<b>Zidua<sup>15</sup></b>	1.75-6.5 fl oz SC	F-E	P-F	-	F-E	F-E	F-E	G-E	-	P	F-E	G-E
+ <b>Balance Flexx</b> No aerial application	+ 1.5 fl oz	F-E	E	G-E	G-E	E	G-E	E	G-E	G-E	F-E	G-E
+ Dicamba based product	+ 8 fl oz	G-E	F-E	G-E	E	E	G-E	E	G-E	G-E	E	E
+ <b>SureStart II/Triple Flex II</b> No aerial ap	+ 2 pt	E	E	E	E	E	E	E	E	E	E	E
+ <b>Sharpen</b>	+ 3 fl oz	G-E	F-E	G-E	E	E	G-E	E	G-E	G-E	E	G-E
+ Dicamba <sup>4</sup> + <b>Sharpen<sup>14</sup></b> (no-till)	+ 8 fl oz + 3 fl oz	E	G-E	E	E	E	E	E	E	E	E	E
<b>Weed Control Ratings<sup>c,d</sup> - <i>without glyphosate</i></b>												
Acetochlor <sup>15</sup> or	1.25 - 2.25 pt	P	N	N-P	P-F	F-E	F-G	G-E	-	N-P	P	F-E
<b>Acuron Flexi<sup>15,27,27</sup></b> or No aerial application	1.2 - 2.25 qt	G-E	E	E	E	E	E	E	G-E	G-E	G-E	G-E
<b>Acuron<sup>5,15,27,27</sup></b> or No aerial application	1.5 - 3 qt	G-E	E	E	E	E	E	E	G-E	G-E	G-E	G-E
<b>Harness Max<sup>15,27</sup></b> or No aerial application	55 - 88 fl oz	G-E	E	E	E	E	E	E	G-E	G-E	G-E	G-E
<b>Lumax EZ<sup>5,15,27</sup></b> or No aerial application	3* - 4 pt	G-E	E	E	E	E	E	E	G-E	G-E	G-E	G-E
<b>Resicore<sup>4,15,27</sup></b> or	2 - 2.25 qt	G-E	G-E	E	G	E	E	E	F-G	E	G-E	G-E
<b>Verdict<sup>14,15</sup></b> or	10 -16 fl oz	G-E	F-E	G-E	E	E	G-E	E	G-E	G-E	E	E
<b>Zidua<sup>15</sup></b>	1.75-6.5 fl oz SC	F-E	P-F	-	F-E	F-E	F-E	G-E	-	P	F-E	G-E
fb <b>DiFlexx<sup>4</sup></b> or	8 - 16 fl oz	E	N-P	G-E	G-E	G-E	G	F-E	G-E	E	E	F-G
fb <b>Status<sup>4</sup></b> + Atrazine <sup>5*</sup> + oil adjuvant or	fb 5 oz	E	P-G	E	E	E	G	E	E	G-E	E	E
fb <b>SureStart II<sup>2,4,15</sup></b> + oil adj. or No aerial	1.5 - 3 pt	G-E	P-F	F-E	P	G-E	G-E	G-E	-	F-G	G-E	P
fb <b>TripleFlex II<sup>2,4,15</sup></b> + oil adj. or No aerial	1.5 - 3 pt	G-E	P-F	F-E	P	G-E	G-E	G-E	-	F-G	G-E	P
fb <b>WideMatch<sup>4,4</sup></b> + Atrazine <sup>5*</sup> + oil adj. or	fb 1.33 pt	E	P-G	E	G	F-E	G-E	G-E	E	G-E	G	F-E
fb <b>Status<sup>4</sup></b> + <b>WideMatch<sup>4,4</sup></b> + Atrazine <sup>5*</sup> + oil adjuvant	fb 5 oz + 1 pt	E	P-G	E	E	E	G-E	E	E	E	E	E
<sup>a</sup> May carryover more than one cropping season. Follow labeled crop rotation restrictions - see Y15. <sup>b</sup> See page 128 for control of volunteer canola and soybean, and herbicide rates. <sup>c</sup> E = Excellent (90-99%), G = Good (80-90%), F = Fair (65-80%), P = Poor (40-65%), N = None. <sup>d</sup> <b>Includes resistant populations.</b> * Atrazine at 0.38 lb ai/A. Atrazine and paraquat are RUP.												

**Roundup Ready Corn - cont.**

Herbicides <sup>a</sup> Site of action-pg 108-109	Rate/A	Buckwheat, Wild	Canola, Vol. RR <sup>b</sup>	Horseweed (Marestail)	Kochia	Lambsquarters	Nightshade species	Pigweed, Redroot	Prickly lettuce	Ragweed, Common	Smartweed, Annual	Waterhemp / Palmer
<b>POST Herbicides<sup>a</sup> - add MSO or HSMOC adjuvant + AMS at 1.5 lb/A or see label for adjuvant requirements.</b>		<b>Weed Control Ratings<sup>c,d</sup> - <i>without glyphosate</i></b>										
Atrazine <sup>5*</sup> + oil adjuvant	0.75 pt/0.42 lb	G	P-G	F	F	F	F	F	-	P	F	P-F
Dicamba <sup>4</sup> + oil adjuvant	4 - 8 fl oz 4SL	E	N-P	G	F-E	G-E	G	F-G	G-E	E	E	F-G
Armezon <sup>27</sup> + Atrazine <sup>5*</sup> + oil adjuvant	0.5 - 0.75 fl oz	E	G-E	G-E	E	E	E	E	E	E	E	G-E
Armezon Pro <sup>27</sup> + Atrazine <sup>5*</sup> + adjuvant	14 - 20 fl oz	E	E	E	E	E	E	E	E	E	E	E
Callisto GT <sup>9,27</sup> + Atrazine <sup>5*</sup> + NIS + AMS	2 pt	G-E	G-E	G-E	E	E	E	E	E	F	E	E
Callisto Xtra <sup>5,27</sup> + oil adjuvant	15* - 24 fl oz	G-E	G-E	G-E	E	E	E	E	E	F	E	E
Capreno <sup>2,27</sup> + Atra <sup>5*</sup> + adj. No aerial app.	3 fl oz	G-E	G-E	G-E	G-E	E	E	E	G-E	E	G-E	E
DiFlexx <sup>4</sup> + Atrazine + oil adjuvant	0.5 - 1 pt	E	N-P	G-E	G-E	G-E	G	F-G	E	E	E	F-E
DiFlexx Duo <sup>4,27</sup> + Atrazine + oil adjuvant	24 - 40 fl oz	E	E	G-E	E	E	E	E	E	E	E	G-E
Glyphosate <sup>9</sup> (4.5 lb ae) + NIS + AMS	32 fb 32 fl oz	G	N	P-E	P-E	E	E	E	E	P-E	E	P-E
Halex GT <sup>9,15,27</sup> + NIS + AMS	3.6 - 4 pt	P-G	E	G-E	E	E	E	E	F-G	E	E	G-E
Harness Max <sup>15,27</sup> + Atrazine <sup>5*</sup> + NIS+AMS	40 - 75 fl oz	G-E	G-E	G-E	E	E	E	E	E	F	E	E
Impact <sup>27</sup> + Atrazine <sup>5*</sup> + oil adjuvant	0.5 - 0.75 fl oz	E	G-E	G-E	E	E	E	E	E	E	E	G-E
Instigate <sup>2,27</sup> + Atrazine+oil adjuvant+AMS	6 oz	P-F	G	F-G	E	E	E	E	N	P	E	G-E
Laudis <sup>27</sup> + Atrazine <sup>5*</sup> + MSO	3 fl oz	E	G-E	G-E	E	E	E	E	E	E	E	E
Lumax EZ <sup>5,15,27</sup> + oil adjuv. No aerial app.	3* - 4 pt	E	E	G-E	E	E	E	E	E	F	E	E
Realm Q <sup>2,27</sup> + Atra+oil adj. No aerial app.	4 oz	P-F	E	F-G	E	G-E	E	E	N	P	E	G-E
Resicore <sup>4,15,27</sup>	2.25 - 3 qt	G-E	G-E	G-E	G	E	E	E	E	E	E	G-E
Resolve Q <sup>2</sup> + Atra+oil adj. No aerial app.	1 - 1.25 oz	P	G	N	N	F-G	P-G	E	N	F	F-G	N
Revulin Q <sup>2,27</sup> +Atra+oil adj. No aerial app.	3.4 - 4 oz	P-F	E	F-G	E	G-E	E	E	N	P	E	G-E
Status <sup>4,19</sup> + MSO No aerial app.	5 to 10 oz WDG	E	N-P	G-E	G-E	G-E	G	G-E	E	E	E	G-E
SureStart II <sup>2,4,15</sup> + oil adj. No aerial app.	1.5 - 3 pt	G-E	P-F	F-E	P	G-E	G-E	G-E	-	F-G	G-E	P
TripleFlex II <sup>2,4,15</sup> + oil adj. No aerial app.	1.5 - 3 pt	G-E	P-F	F-E	P	G-E	G-E	G-E	-	F-G	G-E	P
WideMatch <sup>4,4</sup> + oil adjuvant	1.33 pt	E	N	G-E	G	N	G-E	N	E	G-E	G	N
<b>Herbicides for Liberty Link corn ONLY - add AMS at 3 lb/A</b>		<b>Weed Control Ratings<sup>c,d</sup> - <i>without glyphosate</i></b>										
Liberty 280 <sup>10</sup> +	32 fl oz	F-G	F-E	G	F-E	F-E	F-E	F-E	P-E	F-E	F-E	F-E
+ Atrazine <sup>5*</sup> + AMS	+ 0.38 lb ai	E	G-E	G-E	G-E	G-E	E	E	G-E	E	E	G-E
+ Dicamba <sup>4</sup> based product + AMS	+ 8 fl oz	F-E	F-E	G-E	E	G-E	E	E	G-E	E	E	F-E
Residual PRE fb Liberty <sup>10</sup> + Atrazine <sup>5*</sup> + AMS	X rate fb 22 fl oz + 0.38 lb ai	E	E	E	E	E	E	E	E	E	E	E

<sup>a</sup>May carryover more than one cropping season. Follow labeled crop rotation restrictions - see Y15.

<sup>b</sup>See page 128 for control of volunteer canola and soybean, and herbicide rates.

<sup>c</sup>E = Excellent (90-99%), G = Good (80-90%), F = Fair (65-80%), P = Poor (40-65%), N = None.

<sup>d</sup>**Includes resistant populations.**

\*Atrazine at 0.38 lb ai/A. Atrazine and paraquat are RUP.

## CORN

**D1.** A combination of cultural, mechanical and chemical methods is necessary for effective weed control in corn. Control early germinating weeds by cultivation or land preparation before planting if conventional tillage is used. A rotary hoe can be used to control emerging weeds when the corn coleoptile is below the working depth of the rotary hoe or when corn is beyond the spike stage. Cultivate between the rows soon after weeds emerge. Corn is very susceptible to early season competition from weeds. Initial postemergence herbicides must be applied before weeds reach 2 to 4 inches in height to avoid yield loss.

**D2.** Atrazine applied PPI or PRE at rates greater than 0.38 lb ai/A is not recommended in ND because soil residue will restrict rotation to most crops. PPI or PRE atrazine require rates greater than 0.75 to 1 lb ai/A for effective weed control but also causes carryover concerns for more than two years. Atrazine is an ingredient in many soil-applied prepackage mixtures and may contain excessive atrazine rates for normal crop rotation in ND. Atrazine is an RUP.

Always add atrazine at 0.38 to 0.5 lb ai/A to POST herbicides (if labeled) and apply to corn less than 12 inches tall and to small weeds. Atrazine enhances control of POST herbicides. Always use oil adjuvant if allowed by label. Atrazine translocation in plants is limited to upward movement through the xylem. Atrazine moves only upward and out to leaf tips requiring thorough spray coverage. Refer to label or Y15 for crop rotation restrictions.

**D3.** Dicamba is safest when applied to corn at the spike stage. Do not apply broadcast to corn greater than 8 inches tall to reduce injury. **Status** (dicamba & diflufenzopyr & isoxadifen safener) applied to corn at least 4 inches tall controls annual and perennial broadleaf weeds and will suppress foxtail. Diflufenzopyr inhibits auxin transport, is synergistic to dicamba and other growth regulator herbicides, and aids translocation to metabolic sinks and areas of high metabolic activity, such as growing points of shoots and roots. Status contains an effective safener (isoxadifen) which allows application to corn greater than 8 inches tall. **DiFlexx** (dicamba & cyprosulfamide safener) and **DiFlexx Duo** (dicamba & tembotrione & cyprosulfamide safener) contains cyprosulfamide to safely apply PRE or POST up to V7 growth stage.

**D4. Callisto** (mesotrione), **Armezon/Pro, Impact** (topramezone), **Laudis** (tembotrione & isoxadifen safener) or **Capreno** (tembotrione & thiencazuron & isoxadifen safener) plus atrazine at 0.38 lb ai/A controls most annual broadleaf weeds and suppresses Canada thistle with excellent corn safety. Always apply with atrazine and with MSO adjuvant at 1.5 pt/A + UAN at 2.5 gal/100 gal water or AMS at 8.5 lb/100 gallons water. Do not apply Callisto with MSO adjuvants for postemergence use unless directed for a specific tank mixture. Apply Capreno only with petroleum oil concentrate adjuvant. Broadleaf weed control from Impact is similar to Callisto but Impact gives nearly complete common ragweed and yellow foxtail control. Laudis will also control yellow foxtail, barnyardgrass, and proso millet. Kochia control is greater from Impact and Laudis than Callisto. All three herbicides will leave a residue in the soil the following year. Refer to label or Y15 for crop rotation restrictions and especially note rotational differences for soybean, dry bean, canola, flax, safflower, and sugarbeet among the three herbicides.

**Lumax** at 3 pt/A contains 3.2 fl oz/A Callisto & 1 pt/A Dual II Magnum\* & 0.38 lb ai/A atrazine and can be applied PRE or POST in corn. Dual\* has no POST activity but emulsifiers in the formulation may function as adjuvants to improve weed control. Refer to label or Y15 for crop rotation restrictions.

**D5. Harness/Surpass\*** (acetochlor & safener) and other acetamide herbicides (acetochlor, dimethenamid, and metolachlor) are adsorbed to OM. ND soils have high OM levels that can inactivate soil-applied herbicides. Acetochlor is least adsorbed by OM but requires higher rates on clay soils with high organic matter. It provides greater and more consistent weed control than other similar soil-applied grass herbicides.

**D6. Zidua** (pyroxasulfone) applied shallow PPI or PRE controls annual grasses and many broadleaf weeds, may provide poor weed control when crop residue is present, may provide 4 weeks residual weed control after activation, and requires multiple rain events for complete activation. Rates used in research prior to registration were above 7 oz/A WDG (6 oz ai/A) but label does not allow use above 3.5 (soybean) to 4 (corn) oz/A WDG (3.4 oz ai/A). Use the highest rates allowed for greater and more consistent weed control. Shallow incorporation will improve weed control under dry conditions and when insufficient rain has failed to activate the herbicide. Corn and soybean has excellent tolerance to registered rates of Zidua.

Weed resistance to pyroxasulfone developed by recurrent low-dose pyroxasulfone selection of multiple herbicide-resistant *Lolium rigidum*. The multiple-resistant population evolved resistance with >30% plant survival at the labeled rate of 4 oz/A after three generations of recurrent pyroxasulfone selection. Evolution to resistance occurred prior to herbicide commercialization. Repeated pyroxasulfone use will rapidly lead to herbicide resistance evolution in some weed populations. Rotate pyroxasulfone with other herbicide with different modes of action to reduce development of resistant weeds.

The approximate ranking of crops from most to least tolerant is corn, sunflower, soybean, potato, pinto dry beans, wheat, field pea, lentil, sorghum, barley, flax, other dry bean types, canola/mustard, alfalfa, oat, and sugarbeet.

### HERBICIDE-RESISTANT CROPS

#### **LibertyLink Canola, Corn, and Soybean**

**D7. Liberty** (glufosinate) applied POST to LibertyLink canola, corn, and soybean varieties controls most annual broadleaf weeds, controls or suppresses grasses, and controls top-growth of perennial weeds. Apply to small weeds because of limited translocation. Liberty does not control large or well-tillered grasses like yellow foxtail, wild oat, or volunteer cereals; is non-residual, which may require multiple applications or apply with a residual herbicide to control multiple weed flushes. Always add AMS fertilizer at 3 lbs/A and do not use AMS replacement or water conditioner adjuvants. Apply Liberty in canola and soybean with registered POST grass herbicides. Refer to B9 for more information or label for weeds controlled, application information and timing, tank-mix options, application information, and other restrictions. Liberty can be used to control weeds resistant to other herbicides.

#### **Roundup Ready Canola, Corn, and Soybean**

**D8.** Glyphosate applied in Roundup Ready (RR) crops controls most annual and perennial weeds. Add NIS at 1 qt/100 gal water unless restricted by the label. Add AMS at 4 to 8.5 lb/100 gal water or at 1 lb/A if applied at more than 12 gpa to all glyphosate formulations. In-crop application timing may not match the most effective application timing for perennial weed control. Glyphosate is a non-selective, non-residual, translocated herbicide. Broadleaf weeds are more difficult to control than grasses. Over use of glyphosate has resulted in several glyphosate resistant weeds. Refer to Weed Resistance Section (X1) for effective weed management strategies.

\*Or generic equivalent.