WEED CONTROL SECTION

Timing of herbicide applications are extremely important to maximizing weed control and sugarbeet yield. This is true for all herbicides, including Roundup*. To maximize weed control in conventional sugarbeet, apply the first herbicide treatment when weeds are in the cotyledon to first true-leaf stage. Subsequent treatments should be applied every 5 to 7 days, however, scout the field before making the next treatment to determine the effectiveness of the previous treatment. If weeds survived the previous herbicide treatment, apply higher rates of the herbicides than originally planned. Repeat process as needed.

Apply Roundup* to small (1 to 2 inch) weeds in Roundup Ready sugarbeet. Research shows Roundup* will more effectively control common ragweed at 1 inch in height or less compared to plants greater than 1.5 inch in height, including resistant biotypes. Allowing dense weeds to get larger than 2 inches in height usually reduces sugarbeet yield. As weed density decreases, herbicide applications can be delayed with minimal reduction of sugarbeet yield, however as weed size increases, control usually decreases, especially for resistant biotypes.

Wild oat populations resistant to ACCase-inhibiting herbicides, such as Assure II*, continue to increase, especially in the Crookston area. Methods to manage wild oat resistant to ACCase-inhibiting herbicides include the use of Fargo and/or applying Select* alone at high rates to small wild oat and repeat the application as necessary every 10 to 21 days.

Glyphosate-resistant weeds continue to increase throughout MN and eastern ND, especially waterhemp in the lower Red River Valley and southern MN. Glyphosate-resistant waterhemp has been confirmed in Clay, Renville, Swift, Traverse, Wilkin and Yellow Medicine Counties, MN and Cass, Ransom, Richland and Traill Counties, ND. Management of glyphosate-resistant waterhemp is difficult in sugarbeet. Apply Nortron*, Ro-Neet, or Dual Magnum* PPI/PRE as directed followed by glyphosate (1.125lb ae/A) applied to < 1" waterhemp. Five days later scout to determine effectiveness, if waterhemp survived, apply Betamix (highest rate possible) + Norton* (4 fl oz/A) + Dual Magnum or Outlook (highest possible rate) as soon as possible during warm weather. Scout to determine what should be applied in the next application. Glyphosate-resistant giant ragweed has been confirmed in McLoed, Meeker, Renville, Sibley, and Yellow Medicine Counties, Minnesota. Glyphosate-resistant common ragweed has been confirmed in Clay, Norman, Pennington, Red Lake, Stearns and Todd Counties, MN and Cass and Traill Counties, ND. Both ragweed species can be effectively controlled with Stinger at appropriate rates and timings. Controlling glyphosate-resistant weeds in rotational crops, such as corn and wheat, is the most effective strategy.

*Or generic equivalent

Weed Control Recommendations

The weed control suggestions in this production guide are based on the assumption that all herbicides mentioned will have a registered label with the Environmental Protection Agency. Herbicides should **NOT** be used which are **NO** longer registered or have not yet received registration for sugarbeet. Sugarbeet treated with a non-registered herbicide may have an illegal residue which, if detected,could cause condemnation of the crop. Non-registered herbicide is illegal and a user could be subject to a heavy fine even without detectable residue.

Herbicide	**Product/A** (ai/A)	**Weeds**	**When to Apply**	**Remarks**
Roundup* (glyphosate)	(0.75 to 3.0 lb ae) **See Remarks** for product amounts with various formulations.	Emerged grass and broadleaf weeds.	Preplant or anytime prior to crop emergence.	**Product rates** lb ae/gal | lb ai/gal | 0.75 ae | 1.125 ae | 1.5 ae | 2.25 ae ---------- fl oz/A ---------- 3 | 4 = 32 | 48 | 64 | 96 3.75 | 5.0 = 26 | 38 | 51 | 77 4/4.17 | 5.4/5.1 = 24/23 | 36/35 | 48/46 | 72/69 4.5 | 5.5 = 21 | 32 | 43 | 64 4.72 | 6.3 = 20 | 31 | 41 | 61 5 | 6.1 = 19 | 29 | 38 | 58 Non-selective,non-residual, systemic,foliar herbicide. Add AMS fertilizer at 8.5 lb/100 gal. Apply in 5 to 15 GPA spray volume,unless tank-mixed with a contact herbicide,then apply in 15-40 GPA spray volume. Total maximum for preplant or PRE application(s)per season = 3.7 lb ae.

paraquat* (3 SL)	**1.35 to 2.7 pt** (0.5 to 1 lb)	Emerged annual grass and broadleaf weeds.	Preplant or anytime prior to crop emergence	Non-selective, non-residual, contact, foliar herbicide. Apply with NIS. Apply in 15 to 40 GPA spray volume.
Gramoxone Inteon / 2 SL (paraquat)	**2 to 4 pt** (0.5 to 1 lb)			
Liberty 280 (glufosinate)	**29 to 36 fl oz** (0.53 to 0.66 lb)			Non-selective, non residual, contact, foliar herbicide. Apply with AMS fertilizer at 3 lb/A. Apply in 15 to 40 GPA spray volume. Use nozzles and pressures that generate **medium** spray droplets. Seasonal maximum rate = 36 fl oz.
Harmony SG (thifensulfuron)	**0.45 to 0.9 oz** (0.225 to 0.45 oz)	Emerged annual broadleaf weeds.	45 days prior to planting	Selective, non-residual, systemic, foliar herbicide. Apply with MSO plus UAN or AMS fertilizer. Can effectively control Roundup Ready sugarbeet.

*Or generic equivalent

Herbicide	Product/A (lb ai/A)	Weeds	When to Apply	Remarks
Far-Go (triallate) **Far-Go** EC 	**1.5 qt EC** **15 lb 10G** (1.5 lb)	Wild oat.	Spring PPI. Fall incorporated after October 15 until freeze-up or snow cover.	Incorporate immediately after application with a tillage tool set 3 to 4 inches deep. A second incorporation at an angle different from the first will improve wild oat control. One pass in the fall followed by spring seed-bed preparation is sufficient for fall application.
Eptam (EPTC)	**2.3 to 3.4 pt** (2 to 3 lb)	Annual grasses and some broadleaf weeds.	PPI.	Some sugarbeet stand reduction and temporary stunting may occur from Eptam. Weak on wild mustard.
	4 to 5 pt (3.5 to 4.38 lb)		Fall. After October 15 until freeze up.	
Eptam (EPTC) + **Ro-Neet SB** (cycloate)	**1.1 to 2.3 pt** + **2.7 to 3.3 pt** (1 to 2 + 2 to 2.5)	Annual grasses and some broadleaf weeds.	PPI.	Less sugarbeet injury than from Eptam alone and less expensive than Ro-Neet SB alone.
	1.1 to 2.9 pt + **2.7 to 4 pt** (1 to 2.5 + 2 to 3)		Fall. After October 15 until freeze up.	

Ro-Neet SB (cycloate)	**4 to 5.3 pt** (3 to 4 lb)	Annual grasses and some broadleaf weeds	PPI.	Sugarbeet has better tolerance to Ro-Neet SB than to Eptam. Weak on wild mustard. Weed control poorer on fine textured, high organic matter soils.
	5.3 pt (4 lb)		Fall. After October 15 until freeze up.	
Nortron* (ethofumesate)	**6 to 7.5 pt** (3 to 3.75 lb)	Good pigweed and waterhemp and fair to good kochia control.	PPI or PRE.	Incorporation generally improves weed control. Band application reduces cost and risk of carryover into the next year.
	3 to 12 fl oz (0.094 to 0.375 lb)	Improves control of kochia, pigweed waterhemp, and lambquarters.	POST in combination with Betamix or Roundup* up to 90 days PHI.	Apply Norton* POST three times at 4 fl oz/A or four times at 3 fl oz/A, but do not apply POST more than 12 fl oz/A total during the growing season due to crop rotation restrictions. May be mixed with Roundup* + NIS or MSO + AMS to improve control of kochia, lambsquarters, pigweed species, and waterhemp. Allow a 90 day PHI.
Stinger* (clopyralid)	**4 to 10.6 fl oz** (0.09 to 0.25 lb ae)	Cocklebur, sunflower, marshelder, wild buckwheat, ragweed, and Canada thistle.	POST. Sugarbeet: cotyledon up to 8- leaf stage.	Stinger* may be mixed with Betamix and Upbeet. May be mixed with Roundup* + AMS to improve control of volunteer soybean, ragweed, biennial wormwood, and wild buckwheat. Allow a 45 day PHI.

*Or generic equivalent

Herbicide	Product/A (ai/A)	Weeds	When to Apply	Remarks
UpBeet (triflusulfuron)	**0.25 to 1.0 oz** (0.125 to 0.5 oz)	Annual broadleaf weeds.	POST. Weeds: Cotyledon to 2-leaf stage.	Apply two or more times in combination with Betamix. Do not exceed 2.5 oz/A/season. May be mixed with Roundup* + MSO + AMS to improve control of common mallow, redroot pigweed, and velvetleaf. Allow a 60 day PHI.
Betamix (desmedipham & phenmedipham)	**0.75 to 7.5 pt** (0.06 to 0.6 lb + 0.06 to 0.6 lb)	Annual broadleaf weeds.	POST. Sugarbeet: Cotyledon up to 75 days PHI. Broadleaf weeds: Cotyledon up to 4- leaf stage.	Risk of sugarbeet injury is increased by morning or midday application and by certain environments. Split application with reduced rates has reduced sugarbeet injury and increased weed control compared to single full-dose application. Do not add MSO or any adjuvant when applying full rates. Any of these products may be mixed with Roundup* + AMS, however some research shows possibility of antagonism when mixed with glyphosate. Allow a 75 day PHI.
Betamix + Nortron* (desmedipham & phenmedipham + ethofumesate)	**0.52 to 4.6 pt** + 3 to 12 fl oz (0.042 to 0.374 lb + 0.042 to 0.374 lb + 0.094 to 0.375 lb)			

Betamix + **UpBeet** + Stinger* + MSO adjuvant ***or*** **Betamix** + Nortron* + **UpBeet** + Singer* + MSO adjuvant	**MICRO-RATE PROGRAM** **8 to 12 fl oz + 0.125 oz + 1.3 fl oz + 2 pt/A** ***or*** **8 to 12 fl oz + 3 to 4 fl oz + 0.125 oz + 1.3 fl oz + 2 pt/A** **MID-RATE PROGRAM** **12 to 16 fl oz + 0.125 oz + 1.3 fl oz + 2 pt/A** ***or*** **8 to 12 fl oz + 3 to 4 fl oz + 0 .125 oz + 1.3 fl oz + 2 pt/A**	Annual broadleaf weeds and fair to good annual grass control. ***Generally provides poor control of ALS resistant kochia.*** Increasing Stinger* rate from 1.3 to 2.6 fl oz will improve control of lanceleaf sage with some risk of increased sugarbeet injury and carryover risk.	POST. Sugarbeet: Apply a minimum of three times with **subsequent treatments at 5 to 7 day intervals.** Micro-rate can be applied starting at cotyledon sugarbeet stage. Mid-rate can be applied starting at 4-leaf sugarbeet stage.	Use mid-rate program for difficult weed problems or when any application has been delayed! An herbicide for grass control at 1/2 to 1 X normal rate can be added. **Nozzle plugging from herbicide precipitation in the spray tank can be reduced by:** **- Mixing in warm water** **- Raising water pH to 8 or 9** **- Premixing UpBeet** **- Use of a grass herbicide,** **- Frequent sprayer cleaning.** Allow a 75 day PHI unless using Nortron, then 90 day PHI.

*Or generic equivalent

Herbicide	Product/A (ai/A)	Weeds	When to Apply	Remarks
Assure II **Targa** (quizalofop)	**7 to 12 fl oz** (0.77 to 1.32 oz)	Annual grasses, quackgrass, and volunteer grass crops.	POST. Sugarbeet: cotyledon to PHI. Weeds: annual grass weeds and vol. wheat or barley 2 to 6 inches tall.	Apply with oil adjuvant at 1% v/v but not less than 1.25 pt/A. Oil adjuvant at more than 1 qt/A is not needed. See Select Max label for detailed adjuvant recommendations. Apply with AMS or UAN fertilizer for greater control of certain grass species. Only Assure II*, Fusilade DX, Select*, or Select Max* should be used to control volunteer Roundup Ready corn. Include an oil adjuvant with Select* to control volunteer Roundup Ready corn. NDSU research indicates less antagonism of grass control with Select* 2EC tank-mixed with Betamix than Poast or Assure II*. Allow a 40 day PHI for Select*/Select Max*. Allow a 45 day PHI for Assure II*. Allow a 60 day PHI for Poast. Allow a 90 day PHI for Fusilade DX.
Fusilade DX (fluazifop)	**5 to 12 fl oz** (1.25 to 3 oz)			
Select* (2 EC) (clethodim)	**6 to 8 fl oz** (1.5 to 2 oz)			
Select Max* (1 EC) (clethodim)	**9 to 17 fl oz** (1.1 to 2 oz)			
Poast (sethoxydim)	**0.5 to 1.5 pt** (0.1 to 0.3 lb)	Annual grasses.		

Treflan* (trifluralin)	**1.5 pt** (0.75 lb)	Late emerging annual grass and some broadleaf weeds.	POST. Sugarbeet: 2 true leaf to 6 inches tall and well-rooted prior to incorporation.	Must be incorporated. Beet roots must be covered with soil before application. Emerged weeds not controlled. May be applied over the tops of sugarbeet.
Cinch / Dual Magnum* (S-metolachlor)	**1.33 to 1.67 pt** (1.25 to 1.6 lb)		POST. Sugarbeet: 2-leaf stage to canopy closure	Emerged weeds **not** controlled. Precipitation or irrigation required for activation. May be applied more than once but seasonal total applied must not exceed 2.6 pt/A for Dual Magnum* or 24 fl oz/A for Outlook*. Lay-by Dual Magnum* or Outlook* should be cautiously applied where PPI or PRE Norton* was used because sugarbeet injury may be severe. May be mixed with Roundup* +AMS to provide residual weed control. Allow a 60 day PHI, except the PHI is 95 days for Outlook* applied to 9-leaf through 12-leaf sugarbeet.
Outlook* (dimethenamid-P)	18 to 21 fl oz (0.84 to 0.98 lb)		POST. Sugarbeet: 2 to 8-leaf stage.	

Roundup Ready Sugarbeet

Sequence (glyphosate-K & S-metolachlor) **RR sugarbeet only**	**2.5 to 3.0 pt/A** (0.7 to 0.84 lb + 0.94 to 1.125 lb)	Grass and broadleaf weeds.	POST. Sugarbeet: 2-leaf stage to canopy closure.	Maximum rate (2 to 8 lf sgbt) = 2.5 pt/A on coarse soils & 3.0 pt/A on medium to fine soils. Max. rate (8 lf to canopy closure) = 2.5 pt/A. Include additional Roundup* as allowed. Seasonal max. = 7 pt/A. Allow 60 day PHI.

*Or generic equivalent

Roundup Ready Sugarbeet

Herbicide	Product/A (lb ai/A)	Weeds	When to Apply	Remarks
Roundup* (glyphosate) **[Only registered brands may be applied to Roundup Ready sugarbeet]**	**Maximum single application up to 8 leaf stage =** 1.125 lb ae **Maximum single application from 8 leaf sugarbeet to canopy closed** = 0.75 lb ae See remarks.	Emerged annual and perennial grass and broadleaf weeds.	POST. Sugarbeet: emergence to 30 day PHI. Weeds: 1-2 inches in height.	**Apply only to Roundup Ready sugarbeet varieties.** 0.75 lb ae / 0.98 lb ae / 1.125 lb ae lb ae/gal / lb ai/gal = fl oz/A 3 / 4 = 32 / 41 / 48 3.75 / 5.0 = 26 / 33.5 / 38 4/4.17 / 5.4/5.1 = 24 / 31/30 / 36/35 4.5 / 5.5 = 21 / 28 / 32 4.72 / 6.3 = 20 / 27 / 31 5 / 6.1 = 19 / 25 / 29 - Max. single app. from sugarbeet emergence to 8 leaves = **1.125 lb ae** - Total maximum from sugarbeet emergence to 8 leaves **= 1.96 lb ae** - Max. single application from 8 leaves to canopy closure **= 0.75 lb ae** - Total maximum from 8 leaves to canopy closure **= 1.54 lb ae** - Total maximum from sugarbeet emergence through harvest **= 3.38 lb ae** - Maximum for year **= 8.5 lb ae** - Add AMS fertilizer at 8.5 lb/100gal. - Refer to labels for tank-mixing restrictions. Allow a 30 day PHI.

*Or generic equivalent

Research has shown that **conventional** rates of Betamix give greater weed control and sugarbeet injury when applied with 200 PSI and 15 to 20 GPA of water as compared to 40 PSI spray pressure. Also, Betamix is more phytotoxic when applied to areas previously treated with a soil applied herbicide than when applied to untreated areas. Betamix + Nortron* gives increased control and greater risk of sugarbeet injury than Betamix alone. In order to limit the risk of sugarbeet injury to Betamix + Nortron*, the total pounds per acre of active ingredient in Betamix + Nortron* should be equal to the normal total pounds per acre of active ingredient of Betamix that would be applied alone for a given situation. The suggested rates in the following table are adjusted for these factors and sugarbeet growth stage. The rates in the table are conservative rates which assume good growing conditions, afternoon or evening application, and weeds which are the same growth stage or smaller than the sugarbeet. Rates may need to be increased for a dry, cool environment or reduced if the weather has suddenly changed from cloudy, wet and cool to hot and sunny. Micro-rate treatments should not be adjusted for method of application or presence of soil applied herbicide.

Conventional Betamix and Betamix + Nortron* Broadcast Rate

Sugarbeet stage	No soil herbicide						With soil herbicide					
	Low pressure (<100 psi)			High pressure or aerial			Low pressure (<100 psi)			High pressure or aerial		
	(lbai/A)	Bmix (pt/A)	Bmix+Nor (pt/A)	(lbai/A)	Bmix (pt/A)	Bmix+Nor (pt/A)	(lbai/A)	Bmix (pt/A)	Bmix+Nor (pt/A)	(lbai/A)	Bmix (pt/A)	Bmix+Nor (pt/A)
Cotyledon-2 leaf	0.25	1.5	1.02+0.17	0.16	1.0	0.65+0.11	0.16	1.0	0.65+0.11	0.12	0.75	0.46+0.08
2 leaf	0.33	2.0	1.38+0.23	0.25	1.5	1.02+0.17	0.25	1.5	1.02+0.17	0.16	1.0	0.65+0.11
4 leaf	0.5	3.0	2.03+0.33	0.4	2.5	1.67+0.27	0.33	2.0	1.38+0.23	0.25	1.5	1.02+0.17
6-8 leaf	0.75	4.6	3.04+0.5	0.75	4.6	3.04+0.5	0.5	3.0	2.03+0.33	0.5	3.0	2.03+0.33

*Or generic equivalent

CHEMICAL NAMES, CONCENTRATIONS, REI'S, PHI'S AND PRICES

Trade name and (manufacturer)	Common name	Formulation (lb/gal or % ai)	Rentry interval (hours)	Preharvest interval (days)	$/unit
Arrow (MANA)	clethodim	2 EC	24	40	120/gal
Assure II (DuPont)	quizalofop	0.88 EC	12	45	125/gal
Betamix (Bayer)	desmedipham & phenmedipham	0.65 & 0.65 EC	24	75	95/gal
Brawl (Tenkoz)	S-metolachler	7.62 EC	24	60	112/gal
Charger Basic (Winfield)	S-metolachlor	7.62 EC	24	60	120/gal
Cinch (DuPont)	S-metolachlor + safener	7.64 EC	24	60	135 / gal
Clean Slate (Nufarm)	clopyralid	3 SL	12	45	230/gal
Clethodim 2 EC (Albaugh)	clethodim	2 EC	24	40	120/gal
Clopyr Ag (UPI)	clopyralid	3 SL	12	45	410/gal
Commit (Winfield)	dimethenamid-P	6 EC	12	60/95	175/gal
Dual Magnum (Syngenta)	S-metolachlor	7.62 EC	24	60	120/gal

Dual II Magnum (Syngenta)	S-metolachlor + safener	7.64 EC	24	60	135/gal
Eptam (Gowan)	EPTC	7 EC 20 G	12	-	50/gal
Establish (Tenkoz)	dimethenamid-P	6EC	12	60/95	180/gal
Ethofumesate 42 SC (Solera)	ethofumesate	4 SC	12	90 (POST)	85/gal
Ethofumesate SC (Willowood USA)	ethofumesate	4 SC	12	90 (POST)	65/gal
Ethotron SC (UPI)	ethofumesate	4 SC	12	90 (POST)	85/gal
Far-Go (Gowan)	triallate	4 EC	12	-	55/gal
Fusilade DX (Syngenta)	fluazifop-P-butyl	2 EC	12	90	175/gal
Gramoxone Inteon / SL (Syngenta)	paraquat	2 SL	12	-	38/gal
Harmony SG (Dupont)	thifensulfuron	50 SG	4	-	38/oz
Intensity (Loveland)	clethodim	2 EC	24	40	100/gal
Intensity One (Loveland)	clethodim	1 EC	24	40	125/gal

CHEMICAL NAMES, CONCENTRATIONS, REI'S, PHI's, and Prices					
Trade name and (manufacturer)	Common name	Formulation (lb/gal or % ai)	Reentry interval (hours)	Preharvest interval (days)	$/unit
Liberty 280 SL (Bayer)	glufosinate	2.34 SL	12	-	85/gal
Nortron SC (Bayer)	ethofumesate	4 SC	12	90 (POST)	95/gal
Outlook (BASF)	dimethenamid-P	6 EC	12	60/95	185/gal
Poast (BASF)	sethoxydim	1.5 EC	12	60	94/gal
Propel (Rosens)	dimethenamid-P	6 EC	12	60/95	170/gal
Ro-Neet SB (Helm Agro)	cycloate	6 EC	12	-	125/gal
Roundup* and others (many companies)	glyphosate	several	12	30	15-30/gal
Section (Winfield)	clethodim	2 EC	24	40	120/gal
Select Max (Valent)	clethodim	1.0 EC	24	40	120/gal
Sequence (Syngenta)	glyphosate-K & S-metolachlor	2.25 & 3.0 SC	24	60	50/gal

Shadow (Arysta)	clethodim	2 EC	24	40	130/gal
Slider (Loveland)	dimethenamid-P	6 EC	12	60/95	200/gal
Spur (Albaugh)	clopyralid	3 SL	12	45	430/gal
Stinger (Dow)	clopyralid	3 SL	12	45	480/gal
Tapout (Helena)	clethodim	2 EC	24	40	125/gal
Targa (Gowan)	quizalofop	0.88 EC	12	45	125/gal
Treflan* and others (several companies)	trifluralin	EC G	12	-	26-32/gal 1.20/lb
Trigger (Albaugh)	clethodim	2 EC	24	40	120/gal
UpBeet (DuPont)	triflusulfuron	50 DF	4	60	75/oz
Volunteer (Tenkoz)	clethodim	2 EC	24	40	120/gal

*Or generic equivalent

Rainfall shortly after application often reduces weed control from postemergence herbicides because the herbicide is partially washed from the leaves. Herbicides vary in absorption rate and in ease of being washed from leaves. The rainfall effect also can vary depending on rainfall amount and intensity. The approximate time between application and rainfall needed for maximum weed control is given in the following table.

Herbicide	Time Between Application and Rain {**hour(s)**}
Assure II / Targa	**1**
Betamix	**6**
Fusilade DX	**1**
Liberty 280	**4**
Nortron*	**6**
Gramoxone*	**4 to 6**
Poast	**1**
Roundup*	**6 to 12**
Select* / Select Max*	**1**
Stinger*	**6**
UpBeet	**6**

*Or generic equivalent

HERBICIDE COMBINATIONS

Sugarbeet herbicides may be legally tank-mixed if all herbicides in the mixture are registered for use on sugarbeet and if no prohibitions against tank mixes appear on a label. However, ***the user must assume liability*** for any resulting crop injury, inadequate weed control, or illegal

and/or harmful residues. When a non–registered combination is used, none of the manufacturers of the products used in the combination will stand behind their products.

Combinations of Postemergence Herbicides can give more broad spectrum and greater total weed control compared to individual treatments. The risk of sugarbeet injury also increases with combinations so combinations should be used with caution.

A tank-mix of one of the grass control herbicides (Assure II*, Fusilade, Poast, Select*) plus an adjuvant plus one of the broadleaf control herbicides (Betamix, Betamix + Nortron*) will often give less grass control than the grass herbicide plus adjuvant alone. The control of broadleaf weeds is not affected by the tank-mix. Stinger* does not antagonize grass control. Antagonism of grass control by a broadleaf herbicide may not be significant with small grass, optimum soil moisture, grass that is actively growing, and a grass species that is very susceptible to the grass herbicide chosen. For example, antagonism of Poast would be greater on wild oat and volunteer grain than on green and yellow foxtail while antagonism of Assure II* would be greater on yellow foxtail than on wild oat and volunteer grain. Antagonism will be less if an adjuvant is included in the tank-mix but excessive sugarbeet injury may occur from a broadleaf herbicide plus an adjuvant. Antagonism can be nearly eliminated by applying the grass herbicide plus adjuvant 24 hours before the broadleaf herbicide or by applying the broadleaf herbicide 3 to 5 days before the grass herbicide. Also, research results indicated that a full rate of grass herbicide plus a broadleaf herbicide (no adjuvant) applied twice at a 7-day interval gave grass control nearly equal to a single application of the grass herbicide plus adjuvant when the grass was small at treatment. A one-third rate of grass herbicide applied three times at a 7-day interval in combination with the micro-rate generally provides excellent grass control, unless resistant biotypes exsist.

Precipitation and nozzle plugging has been a common problem with ground application of the micro-rate.The following steps will reduce the problem. 1) Start with a clean sprayer, spray out each tank load immediately after mixing, spray until the tank is dry, flush sprayer between loads, clean sprayer frequently and never allow spray solution to set in the tank for an extended time. 2) Fill the spray tank at least half way with water and allow the water to warm before adding the herbicides. 3) Increase the pH of the water in the spray tank to pH 8 to 9 by using ammonia, Quad 7 or other adjuvants that increase pH. 4) Premix the UpBeet in hot water or water with pH 8 to 9. Add the UpBeet to the spray tank first and be sure it is dissolved before adding, in order, Betamix / Betamix + Nortron* and Stinger*. Continue filling the tank and add the methylated seed oil adjuvant when the tank is nearly full. Add a grass herbicide, if desired, after the methylated seed oil adjuvant. 6) Use gentle agitation to keep the mixture uniformly suspended.Vigorous agitation can cause more nozzle plugging than gentle agitation. See the table at the end of the weed control section for the relative response of various weed species to herbicides and herbicide combinations.

*Or generic equivalent

COMBINATIONS OF HERBICIDES AND OTHER PESTICIDES

Betamix or Betamix + Nortron* at conventional rates plus liquid Lorsban 4E has sometimes caused more sugarbeet injury than normal rates of Betamix or Betamix + Nortron* alone. Sugarbeet should have four or more leaves if Lorsban is mixed with conventional rates of Betamix or Betamix + Nortron*. Lorsban 4E can be tank-mixed with the micro-rate without increasing the risk of sugarbeet injury. Poast plus liquid Lorsban plus oil gave grass control similar to Poast plus oil. However, Poast plus Lorsban (no oil) gave less control of volunteer grain than Poast plus Lorsban plus oil so Lorsban will not fully substitute for the oil adjuvant. The use of herbicides plus insecticides has not resulted in reduced control of insects or weeds. Tin fungicides plus postemergence sugarbeet herbicides sometimes has caused more sugarbeet leaf burn than the tin fungicides alone. The injury increased as the temperature and humidity at application increased. Quadris plus oil adjuvant or Quadris plus any herbicide treatment that included an oil adjuvant caused more sugarbeet injury than Quadris alone. The micro-rate plus Quadris was especially injurious. Asana or Mustang plus the micro-rate has not increased sugarbeet injury compared to the micro-rate alone. Roundup* manufacturers currently discourage mixing Roundup* with insecticides and fungicides. There appears to be no problems mixing fungicides and insecticides with Roundup*, however, manufacturers will not support these mixtures.

*Or generic equivalent

HERBICIDE CARRYOVER

Herbicide residue or the persistence of phytotoxic levels of a herbicide for more than one year can be a problem with some of the herbicides used in North Dakota and Minnesota. Herbicide residues are most likely to occur following years with unusually low rainfall because chemical and microbial activity needed to degrade herbicides is limited in dry soil.

Some herbicides, like Pursuit, Python, and Raptor, carry over more in low pH soils while other herbicides, such as the sulfonylureas Accent, Ally, Beacon, Classic and others, carry over more in high pH soils.

Crop damage from herbicide residues can be minimized by application of the lowest herbicide rate that provides effective weed control, by using band rather than broadcast applications, and by moldboard plowing before planting the next crop. Moldboard plowing reduces phytotoxicity of some herbicides by diluting the herbicide residue in a large volume of soil and by providing untreated surface soil in which sugarbeet can germinate and begin growth.

The number of trade names for herbicides and herbicide combinations is increasing each year. The active ingredients of a herbicide should be identified prior to use to avoid unpleasant surprises with unexpected crop injury from carryover. Several herbicides are listed in the following table. These same herbicides could occur in mixtures under different brand names.

Rotation Restrictions for Several Crops

Herbicide	Sugarbeet	Barley	HRS / Drm	Corn	Dry bean	Potato	Soybean
	---------- (months after application) ----------						
DO NOT USE IN ND = Beacon, chlorimuron, Exceed, NorthStar, Scepter, Spirit, and Steel							
Accent* (<0.68 oz DF/A)	**18a**	**8**	**8**	**0**	**10j**	**18j**	**0.5**
Ally Extra* (0.2 oz) (e)	**22b**	**10**	**1/10**	**22**	**22**	**22**	**22**
Anthem	**18**	**18**	**18**	**0**	**18**	**18**	**18**
Armazon	**18**	**3**	**3**	**0**	**18n**	**9**	**9**
Assert	**20**	**NCS**	**NCS**	**NCS**	**NCS**	**15**	**NCS**
atrazine* (0.38 lb ai)	**NCSb**	**NCS**	**NCS**	**0**	**NCS**	**NCS**	**12**
atrazine* (0.38-0.5 lb ai)	**2CSb**	**NCS**	**2CS**	**0**	**2CS**	**NCS**	**12**
atrazine* (0.5-1 lb ai)	**2CSb**	**2CS**	**2CS**	**0**	**2CS**	**2CS**	**12**

Rotation Restrictions for Several Crops

Herbicide	Sugarbeet	Barley	HRS / Drm	Corn	Dry bean	Potato	Soybean
	---------- (months after application) ----------						
Authority Assist	**40b**	**9.5**	**4**	**10**	**4**	**26**	**0**
Authority First / Sonic	**30b**	**12**	**4**	**10**	**12**	**18**	**0**
Authority MTZ	**24b**	**4**	**4**	**10**	**12**	**12**	**0**
Autumn Super (i)	**18**	**9j**	**3**	**1**	**18**	**18**	**2**
Axial TBC	**9**	**0.5**	**0.5**	**4**	**9**	**9**	**9**
Balance Flexx (j)	**18**	**6**	**6**	**0**	**18**	**6**	**6**
Banvel* (<1.5 pt) (h)	**4**	**4h**	**0h**	**0h**	**4**	**4**	**4**
Basis Blend	**18**	**9**	**9**	**0**	**10**	**1**	**10**
Boundary	**18**	**8**	**8**	**8**	**12**	**0**	**0**
BroadAxe	**24b**	**4**	**4**	**10**	**0**	**12**	**0**
Capreno (i)	**18**	**10**	**4**	**0**	**18**	**18**	**10**
Callisto	**18**	**4**	**4**	**0**	**18**	**10**	**10**
Callisto Xtra	**18**	**NCS**	**NCS**	**0**	**18**	**NCS**	**NCS**
Curtail* / Curtail M*	**5**	**1**	**1**	**1**	**10.5m**	**18**	**10.5m**

Everest 2.0 / Sierra	9	9	0/4	NCS	9	9	9
Extreme	40b	9.5	4	8.5	4	26	0
Far-Go	NCS	0	0	NCS	NCS	NCS	NCS
Fierce	18	18	18	0.25	18	18	18
FirstRate	30b	30b	3	9	9	18	0
Flexstar / GT 3.5	18	4	4	10	0	0	0
Gangster	30b	B	3	9	9	18	0
Goldsky	9	0.25	0.25	9	9	9	4
Halex GT	18	4	4	0	18	10	10
Harness / Surpass*	NCS	NCS	4	0	NCS	NCS	NCS
Hornet	26b	4	4	0	10.5m	18	10.5m
Huskie	9	0.25	0.25	9	9	9	4
Huskie Complete	10	9	0.25	9	10	18	10
Impact	18	3	3	0	18n	9	9
Instigate	18	18	9	0	18	10	10
Laudis	18/10g	4	4	0	10g	10	8

*Or generic equivalents

Rotation Restrictions for Several Crops

Herbicide	Sugarbeet	Barley	HRS / Drm	Corn	Dry bean	Potato	Soybean
	(months after application)						
Liberty 280	**0**	**2.33**	**2.33**	**0**	**6**	**2.33**	**0**
Lightning	**40b**	**9.5**	**4**	**8.5**	**9.5**	**26**	**9.5**
Lumax EZ (<3 pt/A)	**18**	**4.5**	**NCS**	**0**	**18**	**18**	**NCS**
Marvel	**18**	**4**	**4**	**10**	**0**	**0**	**0**
Matrix*	**18**	**9/18p**	**9**	**0**	**10**	**0**	**4**
Maverick	**B**	**B**	**0**	**B**	**B**	**B**	**B**
Metribuzin* (u)	**18**	**8u**	**8u**	**4**	**12**	**4**	**4**
Milestone (b)	**B**	**B**	**B**	**12b**	**B**	**B**	**B**
Norton*	**0**	**12**	**12**	**12**	**12**	**12**	**12**
Olympus	**B**	**B**	**0**	**22k**	**B**	**B**	**B**
Osprey	**10**	**1**	**0.25**	**12**	**3**	**10**	**3**
Paramount	**24b**	**10**	**0**	**10**	**24b**	**24b**	**10**
Permit *	**36**	**2**	**2**	**1**	**9**	**9**	**9**
Plateau	**48b**	**24**	**12**	**36**	**36**	**48b**	**18**
PowerFlex	**9**	**9**	**1**	**9**	**9**	**9**	**5**

PrePare	**9**	**9**	**0/4**	**NCS**	**9**	**9**	**9**
Prequel	**18j**	**9**	**9**	**0**	**18j**	**6**	**10**
Prowl EC / H2O	**2CS**	**NCS**	**NCS**	**0s**	**0**	**0**	**0**
Pulsar	**9**	**0.67**	**0.67**	**0**	**9**	**9**	**9**
Pursuit	**40b**	**9.5**	**4**	**8.5**	**4**	**26**	**0**
Python	**26b**	**4**	**4**	**0**	**4**	**12**	**0**
Raptor / Beyond / ClearMax	**18t**	**18t**	**3**	**8.5**	**0**	**18t**	**0**
Raze	**9**	**9**	**0/4**	**NCS**	**9**	**9**	**9**
Realm Q	**18**	**9**	**9**	**0**	**18**	**10**	**10**
Reflex	**18**	**4**	**4**	**10**	**0**	**18**	**0**
Require Q / Resolve Q	**18**	**9**	**9**	**0**	**10**	**0**	**10**
Rimfire Max	**10**	**10**	**0**	**10**	**10**	**12**	**10**
Rimsulfuron* (1 oz DF/A)	**10j**	**9**	**9**	**0**	**10**	**0**	**10**
Sharpen (1.0 fl oz/A) {See label for more info.}(v)	**4**	**0**	**0**	**0**	**4**	**4**	**0-1**
Sharpen (2.0 fl oz/A) {See label for more info.}(v)	**5**	**0**	**0**	**0**	**5**	**5**	**1-2**
Sharpen (3.0 fl oz/A) {See label for more info.}(v)	**6**	**0**	**0**	**0**	**6**	**6**	**2-3**
Sonalan	**2CS**	**NCS**	**NCS**	**NCS**	**0**	**NCS**	**0**

*Or generic equivalents

Rotation Restrictions for Several Crops

Herbicide	Sugarbeet	Barley	HRS / Drm	Corn	Dry bean	Potato	Soybean
	(months after application)						
Spartan	**36**	**4**	**4**	**10**	**0**	**12**	**0**
Spartan Charge	**24b**	**4**	**4**	**10**	**0**	**12/4**	**0**
Starane Flex	**9**	**0**	**0**	**3**	**9**	**9**	**9**
Status (h)	**18a**	**4**	**1**	**0.25**	**4**	**4**	**4**
Steadfast (<0.76 oz/A)	**18a**	**8**	**8**	**0**	**10j**	**18j**	**0.5**
Stinger*	**0**	**0**	**0**	**0**	**10.5m**	**18**	**10.5m**
SureStart / TripleFlex	**26b**	**NCS**	**4**	**0**	**12/18**	**18**	**NCS**
Tordon (1.5 oz)	**2CS**	**NCS**	**NCS**	**2CSx**	**2CS**	**2CS**	**2CS**
Treflan* (y)	**2CS**	**NCS**	**NCS**	**NCS**	**0**	**0**	**0**
Valor / Chateau (2.0 oz/A){See label for more}	**4/8bf**	**3**	**1**	**0.5 / 1**	**3**	**0**	**0**
Valor XLT	**30**	**4**	**4**	**10**	**12**	**30**	**0**
WideMatch*	**0**	**0**	**0**	**0**	**10.5**	**18**	**10.5**
Wolverine	**9**	**0.25**	**0.25**	**9**	**9**	**9**	**4**
Zemax	**18**	**4.5**	**4.5**	**0**	**18**	**NCS**	**NCS**
Zidua	**18**	**18**	**18**	**0**	**18**	**18**	**18**

*Or generic equivalents

NCS = Next cropping season after herbicide application.
2CS = Second cropping season after herbicide application.
MAA = months after application.

Field Bioassay Instructions - Refer to label or paragraph Y6 in the Narrative Section of ND Weed Control Guide

a Soil pH <7.5 = 11 MAA for sunflower. Soil pH >7.5 = 18 MAA for sunflower.
Soil pH <6.5 = 10 MAA for sugarbeet and all crops not listed.
Soil pH >6.5 = 18 MAA for sugarbeet, potato, and all crops not listed and cumulative precipitation in 18 MAA period must exceed 28 inches.

B or b = Bioassay. Do not plant until field bioassay indicates it is safe. Crop rotation after atrazine* is rate and soil pH dependant.
Python, Hornet, SureStart, and TripleFlex require a 26 month rotation **and** a successful field bioassay.
FirstRate requires a 30 month rotation **and** a successful field bioassay.
Lightning and Pursuit requires a 40 month rotation **and** a successful field bioassay.

c Do not use on soil with pH greater than 7.9. Barley and oat can be planted 6 months after application west of highway 83.

d Requires soil pH of 7.9 or less and a 34 month minimum rotation interval and 28 inches of cumulative precipitation.

e Requires soil pH of 7.9 or less, 22 months and 22 inches of precipitation west of Hwy 1 or 34 months and 34 inches of precipitation east of Hwy 1. These restrictions also apply to Ally Extra* at rates greater than 0.2 oz DF/A.

f 4 months if soil is tilled prior to planting of crop **OR** 8 months if no tillage is performed.

g Cumulative precipitation between application and planting of dry beans and sugarbeet is 20 inches. 10 MAA rotation interval applies to all dry bean types
except red kidney and cranberry (18 MAA). Thorough tillage must precede planting of sugarbeet**.**

h Any rotational crop may be planted 120 days following application of Banvel* at 1.5 pt/A or less, excluding days when ground is frozen. For all crops and rates greater than 1.5 pt/A allow 45 days per 1 pt/A of Banvel* used excluding days when ground is frozen.

i Crops with a 10 month rotation restriction require 15 inches of cumulative precipitation after application. Crops with an 18 month rotation restriction require 30 inches of cumulative precipitation after application. Soil at 7.5 pH or above require crop rotation to be extended from 10 months to 18 months and from 18 months to 24 months.

j Requires 15 inches of cumulative precipitation during the growing season following application. An 18 month restriction applies to Accent*, Resolve*, Prequel, and Steadfast applied above rates indicated or if drought follows application. Refer to label if higher rates are used.

k Requires 24 inches of accumulated precipitation.

m Do not plant dry bean,dry pea, soybean or sunflower for 18 months on soil with less than 2% OM **and** rainfall less than 15 inches during the 12 MAA OR may be planted 12 MAA if risk of injury is acceptable. Perform a field bioassay prior to planting for areas that receive less than 15 inches of rainfall and have less than 2% OM. Do not plant lentil, potato or any other broadleaf crop grown for seed for 18 months unless risk of injury is acceptable.

n Dry bean can be planted after 9 months at Impact rates of 0.5 fl oz/A or less.

p Barley can be planted 9 months after application in Cass, Grand Forks, Pembina, Towner, Traill, and Walsh counties of ND. In all other counties of ND allow an 18 month rotation restriction before planting barley.

s Corn can be planted only if Prowl EC / H20 is applied PRE. DO NOT APPLY PPI.

t Rotation to barley is: 9 months if (>18 inches water + >6.2 soil pH) or (moldboard plow with <18 inches water or <6.2 soil pH) **OR** 18 months if (<18 inches water or soil PH <6.2).
Rotation to potato is: 9 months if soil pH is >6.2 **and** rainfall is >18 inches/year **OR**
18 months if soil pH is <6.2 **and** rainfall is <18 inches/year.
Rotation to sugarbeet is: 18 months if the soil pH is >6.2 **OR** 26 months if the soil pH is < 6.2.

u Must add 2 months if soil pH is 7.5 or above. Wheat and barley can be planted 4 MAA following lentils or soybeans.

v Do not include time when soil is frozen. Sunflower and safflower are the most sensitive crops.
For Verdict: Fall seeded cereals can be planted 4 months after application. All crops can be planted the spring following application.

x Do not plant corn or sorghum until soil samples analyzed for Tordon residue indicates no detectable levels present. Restriction is based on non-legal residue that may be found in corn and sorghum and not on crop safety.

y Oats, sorghum, and annual or perennial grass crops may be planted at least 12 MAA in areas that received 20 inches or more of precipitation during the growing season. CRP grasses may be planted 18 MAA if Treflan* is spring applied or 21 MAA if fall applied.

*Or generic equivalent.

Single nozzle band sprayers

Approximate nozzle height, nozzle capacity, and delivery rate per treated acre and per total acre assuming 22 inch rows: 3, 5, and 7 mph and 40 PSI.

					22 inch Row Width					
					3mph		5mph		7mph	
Nozzle	Nozzle Capac. (Gal/hr)	Spray Press (PSI)	Approx. nozzle height (in.)	Band Width (in.)	Gal/ treated acre[a]	Gal/ total acre[b]	Gal/ treated acre[a]	Gal/ total acre[b]	Gal/ treated acre[a]	Gal/ total acre[b]
HC-4	4	40	12	10	13.2	6.0	7.9	3.6	5.7	2.6
45	4	40	8.5	7	18.8	6.0	11.3	3.6	8.0	2.6
40067	4	40	14	10	13.2	6.0	7.9	3.6	5.7	2.6
E	4	40	9.5	7	18.8	6.0	11.3	3.6	8.0	2.6
HC-6	6	40	12	10	19.8	9.0	11.9	5.4	8.5	3.9
45	6	40	8.5	7	28.2	9.0	16.9	5.4	12.1	3.9
4001E	6	40	14	10	19.8	9.0	11.9	5.4	8.5	3.9
	6	40	9.5	7	28.2	9.0	16.9	5.4	12.1	3.9
LE-1 or	6	40	6	10	19.8	9.0	11.9	5.4	8.5	3.9
8001E	6	40	4	7	28.2	9.0	16.9	5.4	12.1	3.9

Single nozzle band sprayers (continued)

Nozzle	Nozzle Capac. (Gal/hr)	Spray Press (PSI)	Approx. nozzle height (in.)	Band Width (in.)	22 inch Row Width					
					3mph		5mph		7mph	
					Gal/ treated acre[a]	Gal/ total acre[b]	Gal/ treated acre[a]	Gal/ total acre[b]	Gal/ treated acre[a]	Gal/ total acre[b]
HC-8	8	40	12	10	26.4	12.0	15.9	7.2	11.3	5.1
	8	40	8.5	7	37.6	12.0	22.6	7.2	16.1	5.1
HC-10	10	40	12	10	33.0	15.0	19.8	9.0	14.2	6.4
	10	40	8.5	7	47.0	15.0	28.2	9.0	20.1	6.4
HC-12	12	40	12	10	39.6	18.0	23.8	10.8	17.0	7.7
	12	40	8.5	7	56.4	18.0	33.5	10.8	24.1	7.7
4002E	12	40	14	10	39.6	18.0	23.8	10.8	17.0	7.7
	12	40	9.5	7	56.4	18.0	33.8	10.8	24.1	7.7
LE-2 or	12	40	6	10	39.6	18.0	23.8	10.8	17.0	7.7
8002E	12	40	4	7	56.4	18.0	33.8	10.8	24.1	7.7
LE-4 or	24	40	6	10	79.2	36.1	47.5	21.6	34.0	15.4
8004E	24	40	4	7	112.8	36.1	67.7	21.6	48.2	15.4

[a] Gallons per treated acre indicates the delivery rate to the treated portion of the field.

[b] Gallons per total acre indicates the delivery rate per total acre in the field. With a 7 inch band and 22 inch rows, only 7/22 of the total acreage would receive the gallonage indicated.

RELATIVE RESPONSE OF WEEDS TO PPI AND PRE HERBICIDES[a]

Herbicide	Barnyardgrass	Buckwheat, wild	Buffalobur	Cocklebur, common	Foxtail (pigeongrass)	Kochia	Ladysthumb (smartweed)	Lambsquarters	Mallow, common	Mustard, wild	Nightshade, E.black	Oat, wild	Pigweed, prostrate	Pigweed, redroot	Ragweed, common	Sunflower, volunteer	Thistle, Canada	Thistle, Russian	Waterhemp (ALS-Res.)
Cinch / Dual Magnum*	G	P	P	N	G	P	P	F	P	P	P	P-F	G-E	G-E	P-F	P	N	P-F	F-G
Eptam	G-E	P-F	G	P	G-E	F	P	F-G	F-G	P	F-G	G	F-G	F-G	F	N	N	P	F-G
Far-Go	N	N	N	N	N	N	N	N	N	N	N	G-E	N	N	N	N	N	N	N
Nortron*	P	F-G	F	P	F-G	F-G	G	P-F	P	P-F	F-G	F-G	F-G	G-E	P	P	N	F-G	F-G
Ro-Neet SB	G	P-F	G	P	G-E	P	P	F-G	F-G	P	F-G	G-E	F-G	F-G	F	N	N	P	F-G

E=Excellent (90-99%), G=Good (80-90%), F=Fair (65-80%), P=Poor (40-65%), N=None

[a] The tables give a general comparative rating of the relative effectiveness of herbicides to weeds. Under vary favorable conditions, control may be better than indicated. Under unfavorable conditions some herbicides rated good to excellent may give erratic or unfavorable results.

*Or generic equivalents.

RELATIVE RESPONSE OF WEEDS TO POSTEMERGENCE HERBICIDES[a]

Weeds	Roundup* (POST only to RR varieties)	Betamix	Betamix + Nortron*	Stinger*	UpBeet + MSO	Betamix + Stinger*	Bmix or Bmix+ Nortron* + Upbeet	Bmix or Bmix+Nortron* + UpBeet + Stinger*	Assure II*, Fusilade DX, Poast, or Select*
Barnyardgrass	E	P	P	P	N	P	P	P	E
Buckwheat, wild	P-G	F	F-G	F-G	F	G-E	F-G	G-E	N
Buffalobur	G-E	G	G	F-G	-	G-E	G	G-E	N
Cocklebur	E	P-F	F	E	N	E	F-G	E	N
Foxtails (pigeongrass)	E	F	F-G	P	F-G	F	F-G	F-G	E
Kochia	F-E[C]	F	F-G	N	P-E[C]	F-G	P-G	P-G	N
Ladysthumb (Smartweed)	P-E	P	F-G	P-F	F	G-E	G	G-E	N
Lambsquarters	P-E	G	G-E	P-F	P	G-E	G-E	G-E	N
Marshelder	G-E	G	G	E	N	E	G	E	N
Mallow, common	P-G	P	P	P	G	P	G-E	G-E	N
Mallow, Venice	G-E	P	P	P	F	P	F-G	G	N
Mustard, wild	G-E	G-E	G	P	G-E	G-E	E	E	N
Nightshade, eastern black	P-G	F-G	G	F-G	F	G-E	G	E	N

Oat, wild	G-E	N	N	N	N	N	P	P	E
Pigweed, redroot	E	G	G	P	F	G	G-E	G-E	N
Ragweed, common	F-E[C]	F	F-G	F-E	F[C]	G-E	F-G	G-E	N
Ragweed, giant	F-E[C]	P	P	F-E	N	G-E	P-F	G-E	N
RR canola	N	N-P	N-P	N	F[d]	P	P-F[d]	P-F[d]	N
RR corn	N	N-P	N-P	N	F[d]	N-P	F[d]	F[d]	E[b]
RR soybean	N	N-P	N-P	G-E	F[d]	G-E	F[d]	G-E	N
Sage, lanceleaf	E	P	P-F	F	P	F-G	P-F	F-G	N
Sunflower, common	G-E	P	P	G-E	F	E	G	E	N
Thistle, Canada	G-E	N	N	G-E	N	G-E	P	G-E	N
Thistle, Russian	G	P	P	P-F	N-P	G	P	G	N
Waterhemp (ALS-Res.)	F-E[C]	F	F	N	N[C]	F	F	F-G	N

E=Excellent (90-99%), G=Good (80-90%), F=Fair (65-80%), P=Poor (40-65%), N=None

[a] This table is a general comparative rating of the relative effectiveness of herbicides to weeds. Under very favorable conditions, control might be better than indicated. Under unfavorable conditions or with herbicide-resistant weeds, some herbicides rated good to excellent might give erratic or unfavorable results.

[b] Only use Assure II*, Fusilade DX, Select Max, or Select* to control volunteer corn.

[C] Resistant biotypes will not be effectively controlled.

[d] Apply first application to small crops (canola - < 2 lf stage; corn - 2 to 3 collar stage; soybean - 1st trifoliate stage). Apply one to two additional applications 7 to 10 days following first application.

*Or generic equivalent

Maximizing Glyphosate (Roundup*) Activity – Best Management Practices

1. Use the correct rate!
   A. Annual grass species: 0.188 to 0.75 lb ae/A
   B. Perennial grass species: 0.75 to 2.25 lb ae/A
   C. Annual broadleaf species: 0.56 to 2.25 lb ae/A
   D. Perennial broadleaf species: 0.75 to 3.0 lb ae/A

2. Apply to small, young annual weeds and the correct stage for perennial weeds. The larger and/or the older a vegetative plant, the more difficult it is to control.
   A. Annual weed species: 1 to 3 inches
   B. Perennial weed species: early bud/boot stage to early flower or in fall to a minimum-sized plant
   C. Biennial species: fall (after a light frost)

3. Always add spray grade AMS fertilizer at least at 8.5 lb/100 gal to increase absorption and translocation and to reduce antagonistic effect from hard water and some herbicide formulations. Use AMS replacements or water conditioning agents at the equivalent rate of 8.5 lb/100 gal.

4. Apply during warm and humid conditions. Do not apply if a temperature change two to three days prior to and/or after the application exceeds 15 to 20° F. For summer annual and perennial weed species in the spring, do not apply if the daytime low temperature is below 38° F and the day time temperature does not exceed 45 to 50° F. These temperature statements have not been confirmed with research. If application is delayed greater than one week, increase the glyphosate rate since plants will be older and/or larger.

5. Apply between 8:00 AM to 8:00 PM, especially if velvetleaf and common and giant ragweed are present.

6. Reduce dust during application by reducing travel speed because it inactivates glyphosate. Placing nozzles before and after wheels, increasing spray volume, and offsetting (perpendicular to first application is ideal) subsequent applications can decrease the inactivation of glyphosate caused by dust.

7. Always allow a rain free period after application of at least 6 to 12 hours, regardless of formulation. This is especially important for lambsquarters.

8. Do not tank-mix antagonistic herbicides with glyphosate, unless necessary. This is especially true for contact herbicides. When tank-mixing with a contact herbicide increase the glyphosate rate to the highest single application rate.

9. Apply the highest single application rate of glyphosate to Roundup Ready crops or an additional 25% for preplant applications if weed size is too large, plants are under stress from temperature or moisture levels, or dust is present during the application.

10. Always add a high quality NIS at 0.25 to 1.0% v/v to all glyphosate formulations, unless the label prohibits the addition of NIS, especially if lambsquarters is present. The rate of NIS to add is dependent upon the amount of NIS in the glyphosate formulation.

11. Apply in 5 to 10 GPA spray volume when applied alone or in combination with another systemic herbicide. Apply in 15 to 40 GPA spray volume when applied in combination with a contact herbicide or when weeds are tall and dense.

12. When tank-mixing with glyphosate, use the most effective rate of the tank-mix partner for the weed species present in the field, use the highest legal rate of glyphosate, and use the most effective adjuvant for the tank-mix partner. Use the least antagonistic adjuvant to glyphosate whenever possible.

13. Apply to actively growing plants.

14. Do not tank-mix foliar fertilizers, unless necessary. When necessary to mix with foliar fertilizers, add spray grade AMS at a minimum of 17 lb/100 gal.

15. Recognize glyphosate-resistant biotypes early (few plants/field) and remove surviving plants from field by hand!

16. The interval between glyphosate applications should be 14 to 24 days.

17. Understand acid equivalent rates of glyphosate and the acid equivalent concentration of the glyphosate formulation being used to be confident of applying the correct product rate.

*Or generic equivalent