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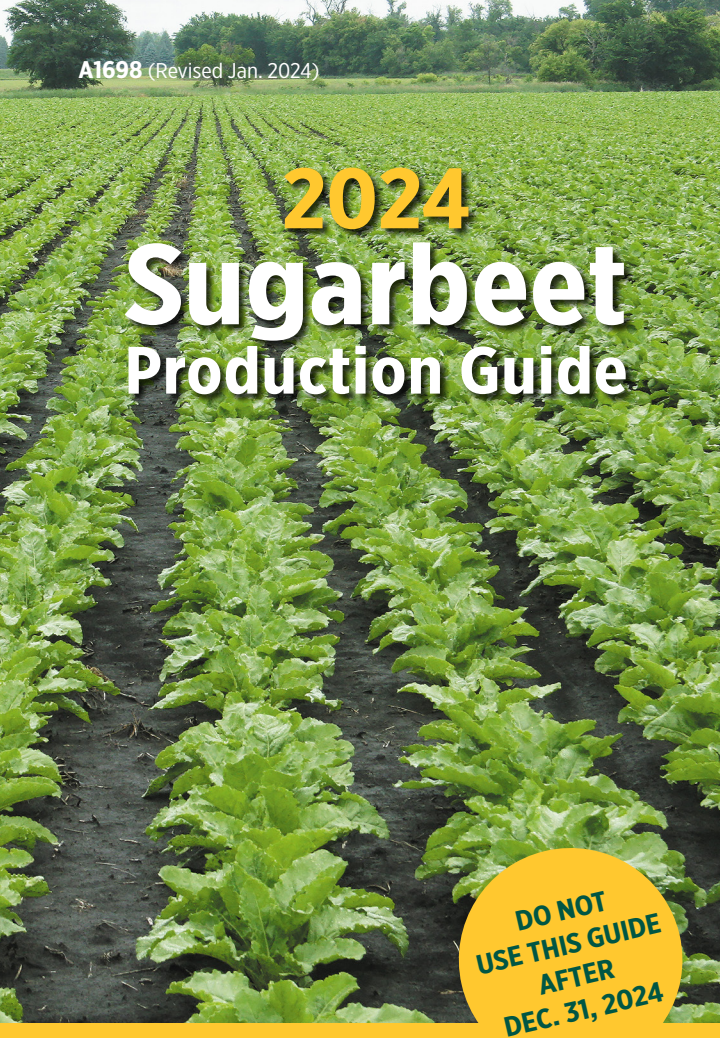
2024 Sugarbeet Production Guide



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INTRODUCTION

Plan for Profitable Sugarbeet Production

This production guide provides useful information to assist you in making timely management decisions. However, it does not give extensive details on any subject discussed. More detailed and complete discussions of weed control, soil fertility, insect and disease control, and most other aspects of sugarbeet production in Minnesota and North Dakota are presented in past issues of the Sugarbeet Research and Extension Reports, which are available at www.sbreb.org.

The pesticide use suggestions in this guide are based on federal label clearances and research information from the North Dakota and Minnesota Agricultural Experiment Stations. All pesticide use suggestions are based on the assumption that all chemicals will continue to have a registered label with the Environmental Protection Agency.

The publishers do not assume any responsibility, make any guarantees or offer any warranties with regard to the results obtained from use of the data in this guide.

FERTILIZING SUGARBEET

Nitrogen and Quality: Sugarbeet quality is dependent on the sucrose content in the roots and the level of impurities that must be removed during sugar refining. Production of high-quality sugar is especially important to growers who are paid based on extractable sugar delivered to the factories. Proper nitrogen fertilizer use increases root and sugar yield. Excessive nitrogen increases impurities and decreases sugar content. More precise nitrogen management within each crop in a sugarbeet rotation will help prevent overapplication and buildup of nitrogen in the subsoil.

Nitrogen Fertilizer Use Guidelines: Recommendation is for soil test available + applied N total:

Minn-Dak and American Crystal northern growing regions
130 lb. N per acre – NO_3-N in a 4-ft. soil sample

For a 2-foot soil sample, target a rate of 100 pounds of total known available N per acre for the Minn-Dak and American Crystal growing regions.

Nitrogen guidelines for Southern Minnesota Beet Sugar Cooperative
110-150 lb. N per acre – NO_3-N in a 4-ft. soil sample

For a 2-foot soil sample, target a rate of 80 to 120 pounds of total known available N per acre for the Southern Minnesota Beet Sugar Cooperative growing region.

Guidelines for Adjusting Nitrogen Recommended for Crops Following Sugarbeets

- Reduce N by 60 to 80 lb/A next season on areas of green sugarbeet tops.
- Reduce N by 20 to 30 lb/A next season on areas of yellow-green sugarbeet tops.
- Do not reduce N in zones within sugarbeet fields with yellow foliage.

Managing N Throughout the Rotation Using Precision Agriculture Techniques

Lower residual N levels can be achieved prior to sugarbeet through a rotation managed with precision ag techniques. Residual nitrate levels can be examined site specifically through grid or zone-based soil sampling. A composite pre-sample can be used to determine the likelihood of significant spatial variability in nitrate levels.

Choose grid soil sampling if field history is unknown, if fertility is high, when the field has a history of manure applications, when two or more fields are merged or if phosphate levels are particularly important.

Choose zone soil sampling if yield monitoring or remote imagery reveals a pattern relationship with the landscape, if no history is available or manure use has occurred, if the field has a history of relatively low phosphorus (P) rates or if mobile nutrient levels, particularly nitrate, are required.

Phosphorus Soil Test, ppm					
Test	VL	L	M	H	VH
Bray 1**	0-5	6-10	11-15	16-20	21+
Olsen	0-3	4-7	8-11	12-15	16+
	------ Broadcast Rate P_20_5 lb/A ------				
	80	55	35	10	0

Use the Olsen P test on soils with pH greater than 7. The Bray test is not recommended in North Dakota.

Potassium Soil Test, ppm					
	VL	L	M	H	VH
	0-40	41-80	81-120	121-150	150+
	------ Broadcast Rate K_20 lb/A ------				
MN ‡	110	80	50	15	0
ND 1	120	90	50	0	0
ND 2	120	120	90	60	0

‡ For potassium in Minnesota, use the MN line. In North Dakota, ND 1 refers to soil with a smectite/illite ratio less than 3.5; ND 2 refers to soil with a smectite/illite ratio greater than 3.5. See NDSU Extension publication SF714 "Fertilizing Sugarbeet in North Dakota at www.ag.ndsu.edu/publications/crops/fertilizing-sugar-beet-in-north-dakota for a map of where these are located.

Fertilizer Application: All P and potassium (K) recommendations in the fertilizer recommendation table are listed as the amount to be broadcast. On low- to medium-testing soils, P fertilizer should be applied before the deepest tillage operation. On soils testing high and very high, shallow incorporation of these rates is adequate. Sugarbeet is especially responsive to banded P placement. It also is a crop that is especially sensitive to fertilizer salts, so any banded starter fertilizer with the seed must be used at low rates. The following table summarizes recent broadcast and banded P research results:

Guidelines for Sugarbeet Fertilization When Including Starter P.

Soil Test Level		
Olsen, ppm	**Bray, ppm**	**Recommendations**
16+	21+	Apply no P fertilizer
8-16	11-20	Use either 3 gpa 10-34-0 seed-placed or recommended broadcast P rate
<8	<11	Use 3 gpa 10-34-0 seed-placed and 40 lb/A P_20_5 broadcast (3 gpa 10-34-0 produces yields equal to recommended broadcast P rates)

Following the above guidelines for the use of fertilizer P should address issues of fertilizer input savings with the use of banded P and maintenance of soil test P important to other rotational crops.

Exercise caution with seed applications. Applying greater than 5 pounds per acre of $N+K_2O$ in contact with the seed can reduce plant stand emergence.

Common starter phosphorus fertilizer sources and maximum amounts suggested for seed application.

Source	Name	Dry or liquid	Maximum amount to apply	Phosphate supplied lb/A
10-34-0	Ammonium Poly Phosphate (APP)	Liquid	4 gal/A	16
18-46-0	Diammonium Phosphate (DAP)	Dry	28 lb/A	13
11-52-0	Monoammonium Phosphate (MAP)	Dry	45 lb/A	24

Secondary and Micronutrients

Sugarbeet rarely respond to the use of secondary macronutrients, such as sulfur, or micronutrients. Before using micronutrients on an entire field, try a test strip to determine a possible need.

ROW WIDTHS AND PLANT POPULATIONS

A row width of 22 inches is recommended in Minnesota and North Dakota. Research in the Red River Valley, Michigan and irrigated beet-growing areas indicates 400 to 600 pounds of sugar per acre are lost as row widths increase to 28 or 30 inches.

Higher, more uniform plant populations are easier to establish on narrow rows. Growers interested in row widths greater than 22 inches must consider the anticipated advantages against lower yields per acre.

A good sugarbeet plant population at harvest should be about 175 to 200 uniformly spaced plants per 100 feet of row. This population should produce very good yields of high-quality sugarbeet.

Planting Rates and Seed Spacing: 22-inch Rows

Inches between seed	6	5.5	5.25	5	4.75	4.5	4	3.5
No. of seeds per/A	47,520	51,840	54,000	57,024	60,000	63,360	71,280	81,463

For 30-inch row, multiply all table values by 0.73.
For 28-inch row, multiply all table values by 0.79.
For 26-inch row, multiply all table values by 0.85.
For 24-inch row, multiply all table values by 0.92.

SEEDS AND SEEDING

Many varieties of seeds are available commercially in Minnesota and North Dakota. The Coded Variety Trial provides a list of approved varieties in this area. Contact your agriculturist or seed company representative for more information on varieties.

Complete Coded Variety Trial results for American Crystal Sugar Co. and Minn-Dak Farmers Cooperative are available in the Sugarbeet Research and Extension Reports (www.sbreb.org).

Sugarbeet should be planted as early as weather, soil moisture and temperature conditions permit. The potential for very high yields from early plantings usually is considered worth the risk of frost damage.

1. Plant seed 1 to 1.25 inches deep for maximum germination and emergence. Use shallow depths for earlier planting.
2. Plant sugarbeet seeds 4.5 to 5 inches apart in 22-inch rows when planting to stand.
3. A planting speed of 4 miles per hour is recommended for conventional planters and 6 to 8 mph for high-speed planters.
4. Perform needed maintenance on the planter prior to planting.
5. Please attend the planter test stand clinic.

Planter Maintenance Checklist

1. Check the condition of hoppers, disks, drives and chains.
2. Be sure disc furrow openers are clean and turn freely.
3. Check seed ejection tubes for restrictions or blockage.
4. Be sure row spacings are correct and equal, and row markers are adjusted.
5. Lubricate the planter properly.
6. Clean seed hoppers daily.
7. Match seed sizes and planter plates carefully.
8. Test the planter on a hard surface to check the seed distribution pattern.
9. Number plates to match planter units.
10. Calibrate starter and/or fungicide application systems.

Planter Off-season Storage

1. Clean the planter with a pressure washer or high-pressure air; washing off all starter fertilizer is especially important to prevent corrosion; flush all liquid-handling systems.
2. Remove plates and store them on a wooden dowel hung horizontally.
3. Remove seed plate doors. Do not stack them on top of each other; use original boxes for storage.
4. Release tension on press wheel springs.
5. Check for missing insecticide spoons or banders.
6. Make a list of needed repairs and parts.
7. Mouse-proof seed tubes by placing fabric softener sheets in seed hoppers.
8. Save all new planter plate boxes for warranty use referral.
9. Keep track of how many acres are seeded on a set of plates. Write the date of purchase in the owner's manual or on the plates.
10. Grease/protect electrical harness.

Sugarbeet Seed Specifications

Size	Company	Diameter	Units/Case	Bulk (Units)
Mini Pellets (Orange Label)	Betaseed	8-10/64	4	Not Available
	Crystal	8-10/64	6	96
	SESVanderHave	8-10/64	6	72
	Maribo	8-10/64	4	
	Hilleshog	8-10/64	4	
	Seedex	8-10/64	6	

Sugarbeet Seed Specifications

Size	Company	Diameter	Units/Case	Bulk (Units)
Regular Pellets (White Label)	Betaseed	9.5-11.5/64	4	96
	Crystal	9.5-11.5/64	4	96
	ACH Seeds	9.5-11.5/64	4	96
	Hilleshog	9.5-11.5/64	4	
	Seedex	9.5-11.5/64	4	48
	SESVanderHave	9.5-11.5/64	4	48
	Maribo	9.5-11.5/64	4	
XTREME (Light Blue)	Crystal	10.5 -13.5/64	3	96
LP Pellets (Yellow Label)	Seedex	10.5 - 13.5/64		24
	SESVanderHave	10.5 - 13.5/64	3	24
Jumbo Pellet (Yellow)	Hilleshog	11 -14/64	4	125-150
	Maribo	11 -14/64	4	
Pro 200	Betaseed	11.5 -13.5/64	4	96
ELS (Gray Label)	ACH Seeds	11.5 -13.5/64	4	

Recommendations for John Deere Maxi II Planter *

Medium Plate — (H 136445)

Mini Pellets..... 2 to 3 inches of vacuum
Regular Pellets ..... Not recommended

Large Plate — (A 51713)

Mini Pellets..... Not recommended
Regular Pellets ..... 2 to 3 inches of vacuum
Large Pellets..... 2 to 4 inches of vacuum
XTREME ..... 3 to 4 inches of vacuum

Sorghum Plate — (A 43066)

Mini Pellets.....Not recommended
Regular Pellets .....3 to 4 inches of vacuum
Pro200 .....5 to 7 inches of vacuum
ELS.....3 to 5 inches of vacuum
XTREME .....3 to 5 inches of vacuum
Large Pellets.....3 to 5 inches of vacuum
Jumbo Pellets .....3 to 4 inches of vacuum

* Central delivery system: Vacuum may need to be higher.
Consult your agriculturist or seed representative prior to updating your planting equipment.

Vacuum Planter Comments

Before purchasing a new planter or different planter plates, contact your agriculturist or seed salesman to discuss advantages or disadvantages.

John Deere

1. These are the best plate combinations. Other combinations will work but may result in more skips or multiples. Adjust the vacuum as necessary.
2. Having plastic residue from the production process partially block the air holes in new plates is common. This causes skips and lower-than-desired population readings on the monitor. Before installing new plates, clean out obstructions by hand with a 1/16-inch drill bit. **Do not enlarge the air hole.**
3. Some new planters have small rough areas on casting from the production process; file them down as necessary.
4. Run units with all seals in place. Without all seals in place, a variation in vacuum levels from unit to unit will be experienced. Replace worn seals.
5. Check the monitor eye in the drop tube to make sure it is positioned properly. Seed may bounce off the monitor eye assembly if it is twisted slightly out of position.
6. In a large-tank central delivery system, remove the fuse that controls agitation in the tank. If not removed, seeds may be damaged.
7. In a large-tank central delivery system, use sorghum inserts.
8. When unfolding, check to see that all tubes have refilled with seed.
9. Replace wipers and knock-out wheels.

Monosem Planter Plates Recommendations

Best to buy with Plate 4025 because it plants seed from all companies

Plate 4016	Plate 4020	Plate 4025	Plate 3622
Mini Pellets	Mini Pellets/Regular Pellets	Mini Pellets/ Regular Pellets Jumbo Pellets ELS Pro 200 Large Pellets XTREME	Regular Pellets Jumbo Pellets Pro200 ELS Large Pellets XTREME

White Planter Plates Recommendation

854047	N 857115	N 856067
Mini Pellets	Regular Pellets	Pro200 ELS Large Pellets Jumbo Pellets XTREME

Vacuum Planter Comments

MONOSEM NG+

1. Using plates smaller than recommended may result in seed falling off the plate when the planter bounces in the field.
2. 36-cell plates with the appropriate hole diameter will work, although increased plate turning speed may require higher vacuum levels to avoid seed falling off the plate.
3. When starting out in the field, monitor seed discs to ensure seed is staying on the plate. Increase vacuum if necessary.

White Seed Boss

1. Use shims to obtain the proper air gap between the plant and meter.
2. Adjustment and/or modification of the tickler brush will improve performance.
3. A sugarbeet cutoff brush with metallic bristles helps remove static electricity.

Case Planter

1. Singulators should be adjusted properly to the percentage of the hole showing and lubricated to work very freely.
2. Running it at a higher vacuum pressure may be better.
3. The planter has no agitation in the large tank; to compensate, use pure graphite or a graphite/talc blend.

Plate Recommendation

Pellet Size	Plate No.	Vacuum [in inches of water]
Mini	8020/6020/6023	[16-20]
Regular	8020/6020/6023	[18-22]
Larger than regular	8023/6020/6023	[20-30]

Plate Planters

Size	Planter	Metal	Plastic	Thickness (Inches)	Cell Dia. (Inches)
Medium	John Deere Milton	B 13304	Blue	0.105	10/64 11 x 7/64
Extra Large	John Deere John Deere	B 29402 B 12733	Brown	0.125 0.125	12/64 11/64 Drill to 12/64
Mini Pellets	John Deere Milton		Orange		12 x 9/64
Regular Pellets	John Deere Milton		Light Green		14 x 11/64

John Deere Plate Planters

1. Plastic plates turn harder than steel, so lubricate the plate, false ring and hopper bottom lightly with talc. The plate should turn easily by hand.
2. Monitor the spring on the drop tube and keep it free of soil. Drop tubes should move freely up and down.

Seeding Rate and Plant Population Establishment (22-inch rows)*

%	Seed Spacing (Inches)							
	3	**4**	**4.75**	**5**	**5.25**	**6****	7**	8**
	---------- (Plants per 100 feet of 22 inch row) ----------							
90	360	270	228	216	206	180	155	135
80	320	240	202	192	183	160	138	120
70	280	210	177	168	160	140	120	105
60	240	180	152	144	137	120	103	90
50	200	150	127	120	115	100	86	75
40	160	120	101	96	92	80	69	60
30	120	90	76	72	69	60	52	45

* Average stand establishment is about 68%.
** Not recommended.

Plant Population

Plants per 100 ft. of row		75	100	125	150	175	200	225
Plants/A	22-inch rows	17,852	23,803	29,754	35,705	41,397	47,607	53,894
Plants/A	30-inch rows	13,068	17,424	21,780	26,136	30,302	34,848	39,450

Tractor Speed Calibration Chart

mph	100 ft.	200 ft.	300 ft.
	--- Time in seconds required to travel a given distance ---		
4	17	34	51
5	14	28	42
6	11	22	33
7	10	20	30

WEED CONTROL

Developing a weed management strategy, not only in sugarbeet but also in the crops in sequence with sugarbeet, is more important than ever in sugarbeet production, especially since surveys at grower seminars indicate glyphosate-resistant (GR) weeds are production challenges in every area of the sugarbeet-growing region. In addition, there are other hard-to-control weeds, such as common lambsquarters, where control seems to be influenced by environmental conditions at application. Map weeds in your fields and develop strategies for control of the one or two most important weeds with two herbicides providing greater than 95% control. Develop a list of herbicides with sites of action that are different from the ones utilized in sugarbeet to control weeds across the crop sequence. And finally, do everything you can to protect new technologies such as Liberty and dicamba so they are viable options once new seed technology is available.

Use maximum Roundup* rates applied to small weeds, even in fields with weeds with low-level resistant biotypes because our fields are a mixed population of resistant and susceptible weeds, and 1- to 2-inch weeds are easier to kill than 3- to 4-inch weeds. Research indicates allowing weeds at high density to get larger than 2 inches in height may reduce sugarbeet root yield. Finally, dead weeds cannot produce resistant progeny.

Apply Roundup* in tank mixtures for waterhemp, kochia and ragweed control in sugarbeet. Layered application of soil residual herbicides is the best program for control of GR waterhemp. Apply Nortron,* Ro-Neet SB, or Eptam PPI, Dual Magnum or Dual Magnum + Nortron* PRE followed by S-metolachlor,*

*Or generic equivalent

Warrant or Outlook*at the 2-lf and 6-lf sugarbeet stage in mixtures with Roundup* at full rates + Nortron* at 4 to 6 fl oz/A. Soil residual herbicides applied POST must be activated by rainfall before waterhemp emerges in fields. Scout fields and spray Betamix (highest rate possible depending on sugarbeet size) + Nortron* + Roundup,* Ultra Blazer or Ultra Blazer + Roundup,* Liberty with the Redball™ 915 hooded sprayer, or inter-row cultivate when waterhemp is up to 2 inches tall to control escapes. Sugarbeet must be greater than 6-lf stage before Ultra Blazer application. Finally, some growers are using The Weed Zapper™ to control waterhemp extending above the sugarbeet canopy to prevent development of viable weed seed.

Control 1- to 2-inch glyphosate-resistant common ragweed with Stinger HL at 2.4 fl oz/A (Stinger* at 4 fl oz/A). Control of common ragweed greater than 2 inches will require a repeat application at 10- to 14-day intervals. Tank mixes providing greater than 95% ragweed control in crops in sequence with sugarbeets, including corn, soybeans and wheat, is the most effective strategy for control including glyphosate-resistant biotypes.

Control of GR kochia is challenging in sugarbeet. Use Nortron* at 6 pt/A followed by repeat applications of Spin-Aid depending on sugarbeet stage mixed with Roundup* + Nortron* on kochia less than 1-inch in diameter. Ultra Blazer is not effective for control on kochia greater than 3 inches. Effective kochia control in the preceding crop is the best kochia control strategy in sugarbeet.

Some producers use fall-seeded cover crops and spring-seeded nurse crops to protect against blowing soils. Our research indicates soil residual herbicides including Nortron* at full rates, Dual Magnum or

*Or generic equivalent

Nortron* + Dual Magnum will not harm fall-seeded cereal rye. However, Nortron* at rates greater than 2 pt/A alone may injure spring-seeded wheat or barley. At this point, cover crops should be implemented as a strategy to reduce blowing soil or sugarbeet damage from wind or blowing soil. NDSU/UMN research does not support fall-seeded cover crops or spring-seeded nurse crops for waterhemp suppression or control..

Some producers are strip tilling sugarbeets. Our research supports sugarbeet production into strip-tillage fields. However, weed management, especially kochia control in the undisturbed areas between the rows, can be challenging because early season kochia is not controlled with preplant tillage to freshen strips. We highly recommend producers spray glyphosate on 1-inch kochia or use paraquat* to control emerged kochia before sugarbeet emergence. Be sure to scout fields as paraquat* will kill emerged sugarbeet.

*Or generic equivalent

Weed Control Recommendations

The weed control suggestions in this production guide assume all herbicides mentioned will have a Section 3 label, 24(c) special local need label or Section 18 emergency exemption with the Environmental Protection Agency. Herbicides no longer registered or herbicides that have not yet received registration for sugarbeets should not be used. Sugarbeets treated with a nonregistered herbicide may have an illegal residue which, if detected, could cause condemnation of the crop. Nonregistered herbicide use is illegal, and a user could be subject to a heavy fine, even without detectable residue.

Herbicide	Product/A (lb ai/A)	Weeds	When to Apply	Remarks
PowerMax3 (glyphosate[9])	**Maximum of 3.1 qt SL** (3.72 lb ae)	Grass and broadleaf weeds, glyphosate sensitive	Preplant, at planting, and/or preemergence	Application before sugarbeet emergence. Addition of ammonium sulfate may improve herbicide performance.
Gramoxone SL 3.0 (paraquat[22])	**1.3 to 2.7 pt SL** (0.49 to 1 lb)	Broadleaf weeds	Preplant, preemergence	Mix with NIS at 1 qt/A. Apply as a ground application in a minimum of 10 gal/A or by air in a minimum of 5 gal/A spray volume. Can be used in fallow bed/stale seedbed for weed control. Gramoxone SL 3.0 can be tank mixed with other herbicides labeled for use on sugarbeets applied by the same methods and at the same timings Sugarbeets emerged at time of application will be killed.

Far-Go (triallate[8]) **Far-Go** EC 	**1.5 qt EC** **15 lb 10 G** (1.5 lb)	Wild oats	Spring PPI. Fall incorporated after Oct. 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 pass will improve wild oat control. One pass in the fall followed by spring seedbed preparation is sufficient for fall application. Will control wild oats that have developed resistance to ACC-ase (SOA1) inhibitor POST herbicides.
Eptam (EPTC[8])	**2.3 to 3.4 pt** (2 to 3 lb) **4 to 5 pt** (3.5 to 4.38 lb)	Annual grasses and certain broadleaf weeds	PPI Fall. After Oct.15 until freeze-up	Eptam may cause reduced sugarbeet stands and temporary early season growth reduction. Injury increases in coarse-textured soils with low OM. Strong on foxtail species. Good control of pigweed species including waterhemp
Ro-Neet SB (cycloate)	**4 to 5.3 pt** (3 to 4 lb) **5.3 pt** (4 lb)	Annual grasses and some broadleaf weeds including waterhemp	PPI Fall. After Oct. 15 until freeze-up	Sugarbeets have better tolerance to Ro-Neet SB than to Eptam or Ro-Neet + Eptam, especially on coarse-textured, low-OM soil. Fair to good on pigweed species. Weed control poorer on fine-textured, high-organic-matter soils.

*Or generic equivalent

Herbicide	Product/A (lb ai/A)	Weeds	When to Apply	Remarks
Eptam (EPTC) + **Ro-Neet SB** (cycloate[8])	**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 potential for sugarbeet injury than from Eptam alone and is less expensive than Ro-Neet SB alone. Adjust rate for soil texture and OM.
	1.1 to 2.9 pt + 2.7 to 4 pt (1 to 2.5 + 2 to 3)		Fall. After Oct. 15 until freeze- up	Improved foxtail, wild oat and pigweed species control than from Ro-Neet SB alone.
Nortron* (ethofumesate[15])	**5 to 7.5 pt** (2.5 to 3.75 lb)	Good pigweed and waterhemp and fair to good kochia control	PPI or PRE	Incorporation may improve weed control, especially control of early germinating weeds such as kochia and waterhemp. Set tillage tool 2 to 4 inches deep (deeper for kochia). Band application reduces cost and risk of carryover into next year, especially on wheat and corn.
	3 to 12 fl oz (0.094 to 0.375 lb)	Improves control of kochia, pigweed, waterhemp and lambsquarters	POST in combination with Spin-Aid, or Roundup* up to 90 days PHI	Apply Nortron* POST two times at 6 fl oz/A or three times at 4 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* + HSMOC + AMS to improve waterhemp control. Check brand label for PHI.
Dual Magnum* (S-metolachlor[15])	**0.5 to 1.0 pt** (0.48 to 0.96 lb)	Waterhemp control	PRE	24(c) local needs label. Dual Magnum rate is dependent on soil texture, % OM and rainfall up to 14 days after PRE application. Rainfall greater than 1.5inch increases sugarbeet injury potential, especially on soils with less than 3.5% OM or coarse-textured soils. Dual Magnum at 0.5 -0.75 pt/A mixed with ethofumesate. Emerged weeds are not controlled.
Dual Magnum* (S-metolachlor[15]) + Nortron* (ethofumesate[8])	**0.5 pt + 0.75pt** (0.48 + 0.72 lb)			

Treflan* (trifluralin[3])	**1.5 pt** (0.75 lb)	Late emerging annual grass and certain broadleaf weeds	POST. Sugarbeets: two true leaf to 6 inches tall and well-rooted prior to incorporation	Must be incorporated. Sugarbeet root must be covered with soil before application. Emerged weeds are not controlled. May be applied over the top of sugarbeets.
Dual Magnum* (S-metolachlor[15])	**1.0 to 1.67 pt** (0.95 to 1.6 lb)	Waterhemp and redroot pigweed control	POST. Sugarbeets: two-leaf stage to canopy closure	Emerged weeds not controlled. Rainfall or irrigation required to incorporate herbicide. Can be applied more than once but seasonal POST total applied must not exceed 2.67 pt/A for Dual Magnum,* 24 fl oz/A for Outlook* or 4 qt/A for Warrant.*
Outlook* (dimethenamid-P[15])	**12 to 21 fl oz** (0.56 to 0.98 lb)		POST. Sugarbeets: two- to eight-leaf stage	Sugarbeet injury may occur when Dual Magnum,* Outlook* or Warrant follows Nortron* PRE. Discuss with your agriculturalist or your Extension sugarbeet agronomist. Can be mixed with Roundup* + Nortron* + adjuvant + AMS for residual control and control of emerged weeds.
Warrant (Acetochlor[15])	**1.25 to 2 qt** (0.94 to 1.5 lb)		POST. Sugarbeets: two- to eight-leaf stage	Allow a 60-day PHI for Dual Magnum.* Allow a 60-day PHI for Outlook,* except the PHI is 95 days for Outlook* applied to nine-leaf through 12-leaf sugarbeets. Allow a 70-day PHI for Warrant.

*Or generic equivalent

Herbicide	Product/A (lb ai/A)	Weeds	When to Apply	Remarks
Stinger* (clopyralid[4])	**4 to 10.6 fl oz** (0.09 to 0.25 lb ae)	Cocklebur, sunflowers, marshelder, wild buckwheat, ragweed and Canada thistle	POST. Sugarbeets: cotyledon up to the eight-leaf stage	Clopyralid may be mixed with Roundup* + chloroacetamide herbicides + Nortron*. Clopyralid may carry over to rotational crops. Consult your sugarbeet agronomist, ag-retailer or agriculturalist. Allow a 45-day PHI.
Stinger HL (clopyralid)	**2.4 to 6.4 fl oz** (0.09 to 0.25 lb ae)	Cocklebur, sunflowers, marshelder, wild buckwheat, ragweed and Canada thistle	POST. Sugarbeets: cotyledon up to the eight-leaf stage	Stinger HL 'High Load' in corn, cereal crops, canola and sugarbeet in North Dakota and Minnesota in 2022. Stinger HL is a 5 lb gallon formulation compared to 3 lb gallon with Stinger. Allow a 45-day PHI.
Spin-Aid phenmedipham[5]	**12 to 48 fl oz** (0.12 to 0.49 lb)	Kochia and lambsquarters	EARLY POST. Sugarbeets: two- to six-leaf stage	Apply to small kochia less than 0.5 inch in diameter. Select Spin-Aid rate dependent on sugarbeet stage and weed size. Maximum of 3 applications allowed and not to exceed 3 qt/A. 75-day PHI. 24(c) local needs label in MN and ND.
Spin-Aid + Nortron* + glyphosate phenmedipham + ethofumesate + glyphosate	**12 to 48 + 4 to 12 fl oz + LR** (0.12 to 0.49 + 0.13 to 0.38 lb + LR)	Kochia and lambsquarters	EARLY POST. Sugarbeets: two to six-leaf stage	Our research demonstrates kochia control is improved when Spin-Aid is mixed with Nortron and glyphosate. Consult with the Spin-Aid 24(c) Special Local Needs label for other tank-mixtures, time interval between applications, additional weeds controlled and further details. 75 day PHI

UpBeet (triflusulfuron[2])	**0.25 to 1.0 oz** (0.125 to 0.5 oz)	Annual broadleaf weeds	POST. Weeds: cotyledon to two-leaf stage	Do not exceed 2.5 oz/A/season. Be aware of ALS-resistant biotypes. Allow a 60-day PHI.
Ultra Blazer (acifluorfen[14])	**16 fl oz/A** (0.25 lb ai)	Waterhemp, redroot pigweed	POST. Sugarbeet greater than six-leaf stage	Section 18 emergency exemption. Apply in 20- to 30- gallon per acre water (GPA) carrier through nozzles delivering a medium- or fine-droplet spectrum using ground equipment only. Aerial application is prohibited. Application before 6-leaf sugarbeet may result in crop injury and potential yield loss. Use Ultra Blazer alone with NIS or Ultra Blazer mixtures with Roundup* and AMS at 2.5% volume per volume (v/v). Allow 45-Day PHI. Application Timing: Application should occur prior to 4-inch weed height for control of weeds. Treating weeds greater than -inches in height or with incomplete coverage will result in reduced weed control.
Liberty 280 SL (glufosinate[10])	**29 fl oz/A** (0.53 lb ai) in a single application or **60 fl oz/A** (1.10 lb ai) per season	Annual broadleaf weeds including waterhemp, redroot pigweed, kochia, common ragweed and biennial wormwood	POST. Sugarbeet between six- and 10-leaf stage	24 (c) local needs label with the Redball™ 915 hooded sprayer, apply to small and actively growing weeds, targeting less than 3-inch weeds in height. Two applications and up to a total of 60 fl oz Liberty 280 SL per acre may be applied per year. Sequential applications must be a minimum of 10 days apart. Spray in a minimum of 15 GPA water carrier. Must use ammonium sulfate (AMS) at 3 lbs/A. Warm temperatures, high humidity and bright sunlight improve the performance of Liberty® 280 SL herbicide. Allow 60-Day PHI.

*Or generic equivalent

Herbicide	Product/A (lb ai/A)	Weeds	When to Apply	Remarks
Betamix (desmediphan[5] and phenmediphan[5])	**0.75 to 7.5 pt** (0.06 to 0.6 lb + 0.06 to 0.6 lb)	Annual broadleaf weeds	POST. Sugarbeets: cotyledon up to 75 days PHI Broadleaf weeds: cotyledon up to four-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 with single full-dose applications. May be mixed with Roundup* + Nortron + HSMOC+ AMS for control of waterhemp. Do not add HSMOC or any adjuvant when applying full rates. Allow a 75-day PHI.
Betamix + Nortron* (desmediphan and phenmediphan + ethofumesate[8])	**0.52 to 4.6 pt + 3 to 12 fl oz** (0.042 to 0.374 and 0.042 to 0.374 lb + 0.094 to 0.375 lb)			

Assure II Targa (quizalofop[1])	**7 to 12 fl oz** (0.77 to 1.32 oz)	Annual grasses, quackgrass and volunteer grass crops	POST. Sugarbeets: cotyledon to PHI. Weeds: annual grass weeds and volunteer 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. Results from 2014 indicated excellent control of V5 corn from Assure II at 2 oz/A, Select Max at 6 oz/A or Assure II + Select Max at 1 + 1 oz/A. Include an oil adjuvant with Select* or Assure II* to control volunteer Roundup Ready corn or HSMOC if combined with Roundup.* NDSU research indicates less antagonism of grass control with Select* 2 EC 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[1])	**5 to 12 fl oz** (1.25 to 3 oz)			
Select* (2 EC) (clethodim[1])	**6 to 8 fl oz** (1.5 to 2 oz)			
Select Max* (1 EC) (clethodim[1])	**9 to 17 fl oz** (1.1 to 2 oz)			
Poast (sethoxydim[1])	**0.5 to 1.5 pt** (0.1 to 0.3 lb)	Annual grasses		

*Or generic equivalent

Roundup Ready Sugarbeet

<table>
<tr><th>Herbicide</th><th>Product/A
(lb ai/A)</th><th>Weeds</th><th>When to Apply</th><th>Remarks</th></tr>
<tr>
<td>Roundup*
(glyphosate[9])

Only registered brands may be applied to RR sugarbeets</td>
<td>Maximum single application up to eight-leaf stage
= 1.125 lb ae

Maximum single application from eight-leaf sugarbeets to canopy closed
= 0.75 lb ae

See Remarks</td>
<td>Emerged annual and perennial grass and broadleaf weeds</td>
<td>POST.
Sugarbeets: emergence to 30-day PHI

Weeds: 1 to 2 inches in height</td>
<td>
Apply only to RR sugarbeet varieties
<table>
<tr><th></th><th></th><th>0.77 lb ae</th><th>0.84 lb ae</th><th>0.98 lb ae</th><th>1.125 lb ae</th></tr>
<tr><th>lb ae/gal</th><th>lb ai/gal</th><th colspan="4">- - - - - - - - - - fl oz/A - - - - - - - - - -</th></tr>
<tr><td>3</td><td>4</td><td>33</td><td>36</td><td>42</td><td>48</td></tr>
<tr><td>3.75</td><td>5</td><td>26</td><td>29</td><td>34</td><td>38</td></tr>
<tr><td>4/4.17</td><td>5.4/5.1</td><td>25/24</td><td>27/26</td><td>31/30</td><td>36/35</td></tr>
<tr><td>4.5</td><td>5.5</td><td>22</td><td>24</td><td>28</td><td>32</td></tr>
<tr><td>4.72</td><td>6.3</td><td>21</td><td>23</td><td>27</td><td>31</td></tr>
<tr><td>4.8</td><td>5.9</td><td>20</td><td>22.4</td><td>25</td><td>30</td></tr>
<tr><td>5</td><td>6.1</td><td>20</td><td>22</td><td>25</td><td>29</td></tr>
</table>
- Max single appl. from sugarbeet emergence to eight leaves = 1.125 lb ae.
- Total maximum from sugarbeet emergence to eight leaves = 1.88 lb ae.
- Max single application from eight leaves to canopy closure = 0.75 lb ae.
- Total max from eight leaves to canopy closure = 1.50 lb ae.
- Total max from sugarbeet emergence through harvest = 3.42 lb ae.
- Maximum for year 6.0 lb ae.
- Add AMS fertilizer at 8.5 lb/100 gal.
- Refer to labels for tank mixing restrictions. Allow a 30-day PHI.
</td>
</tr>
</table>

Sequence (glyphosate-K[9] & S-metolachlor[15]) **RR sugarbeets only**	**2.5 to 3 pt/A** (0.7 to 0.84 lb and 0.94 to 1.125 lb)	Grass and broadleaf weeds	POST. Sugarbeets: two-leaf stage to canopy closure	Maximum rate (two- to eight-leaf sugarbeets) = 2.5 pt/A on coarse soils and 3 pt/A on medium to fine soils. Maximum rate (eight-leaf to canopy closure) = 2.5 pt/A. Include additional Roundup* as allowed. Seasonal maximum = 7 pt/A. Allow 60-day PHI.

*Or generic equivalent

Chemical Names, Concentrations, Re-entry Interval, Preharvest Interval and Cost

Trade Name and (Manufacturer)	Common Name	Formulation (lb/gal or % ai)	Re-entry Interval (hours)	Preharvest Interval (days)	Cost ($/unit)
Arrow (ADAMA)	clethodim	2 EC	24	40	74/gal
Assure II (AMVAC)	quizalofop-ethyl	0.88 EC	12	45	95/gal
Avadex MA (Gowan)	Triallate	10G	12	-	1.40/lb
Betamix (Bayer)	desmedipham and phenmediphan	0.65 and 0.65 EC	24	75	NA
Brawl (Tenkoz)	*S*-metolachlor	7.62 EC	24	60	55/gal
Charger Basic (Winfield)	*S*-metolachlor	7.62 EC	24	60	54/gal
Cinch (Corteva)	*S*-metolachlor + safener	7.64 EC	24	60	108/gal
Clean Slate (Nufarm)	clopyralid	3 SL	12	45	185/gal
Clethodim (several)	clethodim	2 EC	24	40	65/gal
Dual Magnum (Syngenta)	*S*-metolachlor	7.62 EC	24	60	81/gal
Eptam (Gowan)	EPTC	7 EC 20 G	12	_	53/gal
Ethofumesate 4SC (GCS)	ethofumesate	4 SC	12	45 (Post)	70/gal
Ethotron SC (UPL)	ethofumesate	4 SC	12	90 (Post)	78/gal
EverPreX (Corteva)	*S*-metolachlor	7.62 EC	24	60	66/gal
Far-Go (Gowan)	triallate	4 EC	12	_	60/gal
Fusilade DX (Syngenta)	fluazifop-P-butyl	2 EC	12	90	147/gal
Gramoxone SL 3.0 (Syngenta)	paraquat-dichloride	3 SL	12	_	27/gal
Intensity (Loveland)	clethodim	2 EC	24	40	61/gal
Intensity One (Loveland)	clethodim	1 EC	24	40	71/gal
Liberty 280 SL (BASF)	glufosinate	2.34 SL	12	_	58/gal
Maxtron SC Albaugh	ethofumesate	4 SC	12	45	55/gal
Nortron SC (Bayer)	ethofumesate	4 EC	12	_	108/gal

*Or generic equivalent

Trade Name and (Manufacturer)	Common Name	Formulation (lb/gal or % ai)	Re-entry Interval (hours)	Preharvest Interval (days)	Cost ($/unit)
Nektron SC (Atticus)	ethofumesate	4 EC	12	45	NA
Outlook (BASF)	dimethenamid-P	6 EC	12	60/95	148/gal
Poast (BASF)	sethoxydim	1.5 EC	12	60	108/gal
Ro-Neet SB (Helm Agro)	cycloate	6 EC	12	_	173/gal
Roundup*/others (many companies)	glyphosate	several	12	30	27-47/gal
Section (Winfield)	clethodim	2 EC	24	40	120/gal
Section Three (Winfield)	clethodim	3 EC	24	40	77/gal
Select Max (Valent)	clethodim	1.0 EC	24	40	106/gal
Sequence (Syngenta)	glyphosate-K and S- metolachlor	2.25 and 3.0 SC	24	60	56/gal
Shadow (UPL)	clethodim	3 EC	24	40	85/gal
Spin-Aid (Belchim USA)	phenmedipham	1.3 EC	12	60	192/gal

Spur (Albaugh)	clopyralid	3 SL	12	45	185/gal
Stinger (Corteva)	clopyralid	3 SL	12	45	136/gal
Stinger HL (Corteva)	clopyralid	5 SL	12	45	181/gal
Tapout (Helena)	clethodim	1 EC	24	40	100/gal
Targa (Gowan)	quizalofop	0.88 EC	12	45	95/gal
Transline (Corteva)	clopyralid	3SL	12	45	193/gal
Treflan* /others (many companies)	trifluralin	EC G	12	_	24-25/gal 1.00-1.90/lb
UpBeet (FMC)	trifusulfuron	50 DF	4	60	20/oz
Ultra Blazer (UPL)	acifluorfen	2 SL	48	45	61/gal
Vaquero (Wilbur-Ellis)	clethodim	2 EC	24	40	107/gal
Volunteer (Tenkoz)	clethodim	2 EC	24	40	65/gal
Warrant (Bayer)	acetochlor (encapsulated)	3 ME	12	70	35/gal

*Or generic equivalent

Rainfastness Guide

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 the 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 (hours)
Assure II /Targa	1
Betamix	6
Fusilade DX	1
Gramoxone*	4 to 6
Liberty 280	4
Nortron*	6
Poast	1
Roundup*	6 to 12
Select*/Select Max*	1
Spin-Aid	6
Stinger*/Stinger HL	6
Ultra Blazer	4
UpBeet	6

*Or generic equivalent

Herbicide Combinations

Sugarbeet herbicides may be tank mixed legally if all herbicides in the mixture are registered for use on sugarbeets 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 nonregistered combination is used, none of the manufacturers of the product used in the combination will stand behind its products.

Combinations of postemergence herbicides can improve spectrum and provide greater total weed control, compared with individual treatments. The risk of sugarbeet injury also increases with combinations, so combinations should be used with caution.

Roundup* can (and should) be tank mixed with herbicides to improve control of tough-to-control weeds in RR sugarbeets. Roundup* can be applied in combination with Nortron,* Betamix, Stinger* or UpBeet, depending on broadleaf weed species, to improve control in-field. Roundup* also may be tank mixed with Dual-Magnum, Outlook* and Warrant to provide residual grass and small-seeded broadleaf weed control.

In general, annual grass and broadleaf control from Roundup* will not be antagonized by tank-mix partners, provided Roundup* is applied at full rates. Field research in 2014 suggested that Stinger* may antagonize waterhemp control from Roundup,* although no statistical difference was found from Roundup*-alone herbicide treatments.

Adjuvant applied with postemergence herbicides in tank mixes with Roundup* is important. Roundup* is very water- soluble. High water solubility causes slow absorption through waxy plant cuticles. Nonionic surfactant (NIS) increases retention of spray droplets and improves control of hard-to-wet species such as common lambsquarters.

Most herbicides applied with glyphosate are oil soluble. Oil adjuvants, including crop oil concentrate (COC) and methylated seed oil (MSO), greatly enhance oil-soluble herbicides but antagonize glyphosate. NIS is less effective with oil-soluble herbicides. MSO-based high-surfactant oil-concentrate adjuvants (HSMOC) contain a higher concentration

* Or generic equivalent

of surfactant than COC and MSO, and enhance oil-soluble herbicides such as Nortron,* Betamix, Stinger* or UpBeet without decreasing Roundup* activity and, thus, should be used in tank mixes with glyphosate.

Always add ammonium sulfate (AMS) to glyphosate. AMS enhances glyphosate absorption and translocation and deactivates antagonistic hard water salts such as Na, Ca, Mg and Fe.

Glyphosate Combined With Other Pesticides

Liquid foliar insecticide and/or fungicide tank mixes do not antagonize grass or broadleaf weed control from Roundup* and are efficacious against insects and diseases, according to research conducted at NDSU. However, some tank-mix products and combinations have the potential to cause sugarbeet injury under certain environmental conditions at certain growth stages and/or other circumstances.

For example, other herbicides, insecticides and/or fungicides combined with Roundup* are formulated with surfactants that may increase the potential for sugarbeet injury. Consider excluding NIS or HSMOC from insecticide-containing tank mixes with Roundup,* especially when applied to cotyledon to two-leaf sugarbeets.

Tin fungicides plus sugarbeet herbicides, including Roundup,* may cause more sugarbeet leaf burn than the tin fungicides alone. Injury tends to increase as the temperature and humidity at application increases. Quadris plus Roundup* (water- based) is safe for sugarbeets when applied without NIS or other oil adjuvants. However, Quadris plus other herbicides, such as Betamix, Dual Magnum* or Outlook* (oil-based), typically cause more sugarbeet injury than Quadris applied alone.

Roundup* may be applied with clear liquid fertilizers such as 28-0-0 or 10-34-0 but at less than 5% v/v because the salt solution will cause excessive leaf burn, limit translocation of glyphosate, and give erratic control of certain broadleaf and grass weeds. Do not use glyphosate with suspension-type liquid fertilizers.

* Or generic equivalent

Physical incompatibility may occur with herbicide, insecticide and/or fungicide tank mixtures and will result in the formulation of gels, creams, oil scums or other precipitates that may or may not be sprayable. An uneven spray distribution may occur and result in unacceptable performance if the incompatible tank mixture is applied over the crop.

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 in the following years with unusually low rainfall because chemical and microbial activity needed to degrade herbicides is limited in dry soil.

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

Crop damage from herbicide residues can be minimized by the 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 sugarbeets can germinate and begin growing.

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	Sugarbeets	Barley	HRS/Drm	Corn	Dry Beans	Potatoes	Soybeans
	(months after application)						
Acuron/Flexi	18	4	4	0	18	10	10
Acuron GT	18	4.5	4.5	0	18	10	10
Ally Extra (e) (0.3 oz/A)	22b	10	1/10	22	22e	22	22
Anthem/Max	15	11	4	0	11	4	0
Anthem Flex (r)	12-15	11	1-4	0	9	0	0
Armezon/Pro (0.5 fl oz)	18	3/4n	3/4n	0	9n	9	9
atrazine* (0.38 lb ai)	NCSb	NCS	NCS	0	NCS	NCS	10
atrazine* (0.38-0.5 lb ai)	2CSb	NCS	2CS	0	2CS	NCS	10
atrazine* (0.5-1 lb ai)	2CSb	2CS	2CS	0	2CS	2CS	10
Authority Assist	40b	9.5	4	10	4	26	0
Authority Elite	36b	4.5	4.5	10	0	4	0
Authority First/Sonic	30b	12	4	10	12	18	0
Authority MTZ	24b	4	4	10	12	12	0
Authority Supreme (r)	24	11	4	10	9	4	0
Autumn Super (i)	24	9j	3	1	18	18	2
Balance Flexx (j)	18	6	6	0	18	6	6
Banvel[4]* (1 pt)	NCS	3d/oz	3d/oz	NCS	NCS	NCS	45d
Banvel[4]* (1 to 2 pt)	NCS	NCS	3d/oz	NCS	NCS	NCS	90d
Beyond Xtra/Raptor	18t	18t	3t	8.5	0	18t	0
Boundary	18	8	8	4	12	0	0
BroadAxe XC	36b	4.5	4.5	10	12	4	0
Capreno (i)	18	10	4	0	18	18	10
Callisto/GT	18	4	4	0	18	10	10
Callisto Xtra	18	NCS	NCS	0	18	NCS	NCS
Clarity[4]* (8 fl oz)	4	22d	22d	4	4	4	4
Clarity[4]*(16 fl oz)	6	44d	44d	6	6	6	6
Corvus (i)	17	9	4	0	17	17	9
Curtail*/M*	5	1	1	1	10.5m	18	10.5m
DiFlexx Duo	10	4	4	0	10	10	6
Everest 2.0/Sierra	9	9	0	11	9	9	9
Extreme	40b	18	0/4	8.5	4	26	0
Facet L	24b	10	0	10	24b	24b	10
Far-Go	NCS	0	0	NCS	NCS	NCS	NCS
Fierce EZ	12	11	1	7d/1	10.5	4	0
Fierce MTZ/Kyber	18	11	8a	7d/1	12	9	0
FirstRate	30b	12	4	9	9	18	0
Flexstar/GT 3.5	18	4/9a	4/9a	10/18a	0	0	0
Halex GT	18	4.5	4.5	0	18	10	10
Harness*	NCS	NCS	4	0	NCS	NCS	NCS
Huskie	9	0.25	0.25	9	9	9	4
Huskie Complete	9	9	3	9	9	18b	9

* Or generic equivalent

Herbicide	Sugarbeets	Barley	HRS/Drm	Corn	Dry Beans	Potatoes	Soybeans
	(months after application)						
Impact	18	3	3	0	18n	9	9
Instigate	18	18	9	0	18	10	10
Laudis	10g	4	4	0	10g	10	8
Liberty 280	0	2.33	2.33	0	6	2.33	0
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
Metribuzin* (u)	18	8u	8u	4	12	12	4
Milestone (b)	B	B	B	12b	B	B	B
Nortron*	0	12	12	12	12	12	12
Olympus (0.2-0.4 oz)	10	10	0/9	10	10	B	10
Osprey	10	1	0.25	12	3	10	3
PerfectMatch	9	9	1	9	10.5	18	10.5
Permit*	36	2	2	1	0	9	9
Plateau	48b	24	12	36	36	48b	18
PowerFlex HL	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
Pursuit	40b	18	4	8.5	4	26	0
Quelex	15	0	0	3	9	15	3
Realm Q	18	9	9	0	18	10	10

Reflex	18	4	4	10	0	0	0
Require Q/Resolve Q	18	9	9	0	10	0	10
Resicore	18	10.5	4	0	18	18	10.5
Revulin Q	18	10	10	0	18	10	10
Rimsulfuron* (1 oz DF/A)	10j	9	9	0	10	0	10
Sharpen (1 fl oz/A) (v)	4	0	0	0	4	4	0-1
Sharpen (2 fl oz/A) (v)	5	0	0	0	5	5	1-2
Sharpen (3 fl oz/A) (v)	6	0	0	0	6	6	2-3
Shieldex	18	3	3	0	9	9	9
Sinate	18	3	3	0	18	9	9
Solstice	18	4	4	0	18	10	10
Sonalan	2CS	NCS	NCS	NCS	0	NCS	0
Spartan Charge	24b	4	4	4	0	4	0
Spartan Elite	36b	4.5	4.5	10	0	4	0
Starane Flex	9	0	0	3	9	9	9
Status (h)	4	4	1	0.25	4	4	4
Stinger*/ **Stinger HL**	0	0	0	0	10.5m	18	10.5m
SureStart II	26b	NCS	4	0	12/18	18	NCSj
Surpass*	NCS	NCS	4	0	NCS	NCS	NCS
Surveil	30b	B	3	9	9	18	0
Talinor (a)	15	1	1	0	9/15a	9	10
Tordon (1.5 oz)	2CS	NCS	NCS	2CSx	2CS	2CS	2CS
Travallas (e)	B	1day	1day	12	22	B	12

* Or generic equivalent

Herbicide	Sugarbeets	Barley	HRS/Drm	Corn	Dry Beans	Potatoes	Soybeans
	(months after application)						
Treflan* (y)	2CS	NCS	NCS	NCS	0	0	0
TripleFlex II	26b	NCS	4	0	12/18	18	NCS
TriVolt	17	12	4	0	17	17	9
Valor/Chateau (2 oz/A)	4	3	14d-1a	7d-1a	3	4	0
Varisto	18t	18t	3	8.5	0	18t	0
Varro	9	9	3	9	9	18b	3
Widematch*	0	0	0	0	10.5	18	10.5
Wolverine Advanced	9	1	1	9	9	9	4
Zidua (1.75 oz)	12	11	1	0	11	0	0
Zidua (5 oz)	15	11	4	0	11	3	0
Zidua Pro	40b	18	4	8.5	11	26	0

* Or generic equivalent

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

Field Bioassay Instructions – Refer to the label or paragraph Y6 in the Narrative Section of the "North Dakota Weed Control Guide."

a Refer to label - Restrictions may be adjusted based on herbicide rate, rainfall, tillage, soil type, soil pH, bioassay and ND 24(c) labels.

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

c Requires thorough tillage and 12 inches of rain to allow planting at four months after application. If applied in no-till in May-June, can plant alfalfa the following spring

d days

e These rotation intervals apply only to 0.3 lb/A. Dry bean, dry pea, lentil and alfalfa can be planted after 10 months if soil pH is 6.8 or lower, or 22 months if soil pH is 6.9 to 7.9. Canola, corn, flax, soybean and potato require 22 months and 18 inches precipitation. Above soil pH 7.9, soil bioassay must be performed.

g Cumulative precipitation between application and planting of rotational crops is 20 inches. Soil pH >6. No HPPD herbicide applied the previous year. For Laudis only: Cumulative precipitation of 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 sugarbeets.

h Any rotational crop may be planted 120 days following application of dicamba 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 dicamba used excluding days when ground is frozen.

i Crops with a 9- or 10-month rotation restriction require 15 inches of cumulative precipitation after application. Crops with a 17- or 18-month rotation restriction require 30 inches of cumulative precipitation after application. Soil at 7.5 pH or above requires crop rotation to be extended from 9 or 10 months to 17 or 18 months and from 17 or 18 months to 24 months.

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

m Do not plant dry beans, dry peas, soybeans or sunflowers 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 crops grown for seed for 18 months unless the risk of injury is acceptable.

n Alfalfa, canola, dry beans, potato, soybean and sunflower can be planted 9months after applying Armezon Pro at 20 fl oz/A or less or Armezon at 0.74 fl oz or less. Small grains can be planted 3 months after applying Armezon and 4months after Armezon Pro.

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

r Rotation interval is dependent on rate.

s Corn can be planted only if Prowl*/H20 are 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 soil pH <6.2 or or 18 months if (<18 inches water or soil pH<6.2).
Rotation to potatoes is: 9 months: soil pH > 6.2 and rainfall is > 18 inches/year or 18 months: soil pH < 6.2 and rainfall is <18 inches/year.
Rotation to sugarbeets: 18 months: soil pH >6.2 or 26 months if soil pH is <6.2.
Rotation to non-Clearfield wheat west of Highway 83: 3 months if >10 inches water **and** pH >6.2. 15 months if <10 inches water OR pH <6.2. East of Highway 83, wheat injury can occur if <10 inches of water.

u Must add two months if soil pH is 7.5 or above. Wheat and barley can be planted 4 MAA following dry pea, lentil or soybean.

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

w CRP grasses may be planted 13 MAA, but a field bioassay must be performed prior to planting CRP grasses. The manufacturer assumes no liability for injury. Fall is recommended as the best time to plant CRP grasses.

x Do not plant corn or sorghum until soil samples analyzed for Tordon residue indicate no detectable levels present. Restriction is based on nonlegal herbicide 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.

z For rotation to field pea in 10.5 months, precipitation must be greater than 7 inches during the 10.5 months following application and greater than 5.5 inches of precipitation from June 1 to Aug. 31 following application. Otherwise allow 18 months.

*Or generic equivalent.

Relative Response of Weeds to Soil Residual Herbicides Applied PPI, PRE or EPOST[a]

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

Relative Response of Weeds to POST Herbicides[a]

Weeds	Roundup* (POST only to RR varieties)	Spin-Aid	Roundup* + Nortron* at 4-6 fl oz/A	Betamix	Ultra Blazer	Stinger* or Stinger	UpBeet	Assure II,* Fusilade DX, Poast, or Select Max
Barnyardgrass	E	N	E	P	N	N	N	E
Buckwheat, wild	P-G		F-G	F	P	F	F	N
Buffalobur	G-E		G-E	G		F-G	-	N
Cocklebur	E		E	F	F-G	G-E	P	N
Foxtail species	E	N	E	F	N-P	N	N-P	F-E
Kochia	F-E[c]	G	G-E[c]	F-G	P-G	N	F-E[c]	N
Lambsquarters	P-E	G	P-E	P-F	N	N	N	N
Marshelder	G-E		G-E	G	F	G-E	N	N
Mallow, common	P-G		P-G	N	N	F	G	N
Mallow, Venice	G-E		G-E	P		P	F	N
Mustard, wild	G-E	G	G-E	G-E	E	N	G-E	N
Nightshade, eastern black	P-G		F-G	F-G	F-G	G-E	F	N
Oats, wild	G-E	N	G-E	N	N	N	N	G-E[c]
Pigweed, redroot	E	N	E	F-G	P-E	N	F	N
Ragweed, common	F-E[c]	F	F-E[c]	F	N-F	F-E	Fc	N
Ragweed, giant	F-E[c]		F-E[c]	P		F-E	N	N
RR canola	N		N	N	G-E	N	F-G[d]	N
RR corn	N	-	N	N-P	N	N	P-F[d]	E [b]
RR soybeans	N		N	N-P	N	G-E	F[d]	N
Sage, lanceleaf	E		E	P		P	N-P	N
Smartweed species	P-E		F-E	F	G-E	G	F	N
Sunflowers, common	G-E		G-E	P	P-F	G	N	N
Thistle, Canada	G-E		G-E	N	N	F-G	N	N
Thistle, Russian	G		G	P	P-G	P-F	N-P	N
Velvetleaf	G		G	P		P	G-E	N
Waterhemp (ALS-Res)	P-F[c]	N	P-F[c]	F	P-G	N	F[c]	N
Wormwood, biennial	F-E		F-E	P	P	G-E	N	N

E=Excellent (91% to 99%), G=Good (81% to 90%), F=Fair (66% to 80%), P=Poor (40% to 65%), N=No Control

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

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

[c]Resistant biotypes will not be controlled effectively.

[d]Apply first application to small crops (canola, two-leaf stage; corn, two to three collar; soybeans, first trifoliolate stage). Apply one or two additional applications at approximately 10-day intervals following the first application.

*Or generic equivalent

Maximizing Glyphosate (Roundup) Activity – Best Management Practices

1. Use the correct rate
   - Annual grass species: 0.77 to 0.84 lb ae/A
   - Annual broadleaf species: 0.98 to 1.125 lb ae/A
   - Perennial grass and broadleaf species: 1.125 to 3 lb ae/A
2. Apply over small, actively growing annual weeds and at the appropriate stage for perennial weeds. The larger a vegetative plant, the more difficult it is to control.
   - Annual grass and broadleaves: 1 to 2 inches
   - Perennial grass and broadleaf weeds: early bud/boot stage to early flowering or in the fall at a minimum-sized plant
   - Biennial weed species: fall, after a light frost
3. Always add spray-grade AMS fertilizer at 8.5 to 17 lb/100 gallons to increase absorption and translocation and to reduce antagonistic effects from hard water and some herbicide formulations. Use AMS replacements or water-conditioning agents at the equivalent rate of 8.5 lb/100 gal.

   Apply during conditions when plants are growing actively and avoid fluctuation in temperature. Research data show wide temperature changes (greater than 15 degrees) two to three days prior to and/or after the application are more likely to reduce weed control than consistently cool

conditions. For applications to summer annual or spring applications to perennial weed species, do not apply if the daytime low temperature is below 38 F and the daytime temperature does not exceed 45 to 50 F.

4. Apply between 9 a.m. and 5 p.m., especially if velvetleaf and common or giant ragweed are present in the field.
5. Reduce dust during application by reducing travel speed because dust inactivates glyphosate. Increasing spray volume and offsetting (perpendicular to first application is ideal) subsequent applications can decrease the inactivation of glyphosate caused by dust. Always allow a rain-free period after application of at least six to 12 hours, regardless of formulation. This is especially important for common lambsquarters control.
6. Applying contact herbicides in a tank mix with glyphosate may result in antagonism and reduce weed control. Increase the glyphosate rate to the highest single application rate and use a high-surfactant methylated oil concentrate (HSMOC) adjuvant when tank mixing with a contact herbicide.
7. Always add a high-quality nonionic surfactant (NIS) at 0.25% v/v to fully loaded formulations (unless the label prohibits), especially to improve common lambsquarters control, and at 0.25% to 0.50% v/v to partially loaded formulations and at 0.5% to 1% v/v to non-loaded formulations.

8. Apply at a 5- to 10-GPA spray volume when applying alone or in combination with another systemic herbicide. Apply at a 15- to 40-GPA spray volume when applying in combination with a contact herbicide or when weeds are tall and dense.
9. Do not tank mix foliar fertilizers unless necessary. Add spray-grade AMS when necessary to mix with foliar fertilizers.
10. Scout for glyphosate resistance. Identify glyphosate-resistant biotypes early (few plants/field) and remove surviving plants from field by hand-pulling.
11. The interval between glyphosate applications should be approximately 14 days, depending on growing conditions, and weed size and density.
12. Glyphosate products are formulated in many different acid-equivalent concentrations. Use acid-equivalent rates of glyphosate when comparing formulations to be confident of applying the correct product rate.
13. Avoid spraying with heavy dew on plants. Excessive dew on plant foliage at application may reduce weed control by diluting droplet concentration.

INSECT MANAGEMENT

Sugarbeet Root Maggot

2024 Root Maggot Fly Activity Forecast

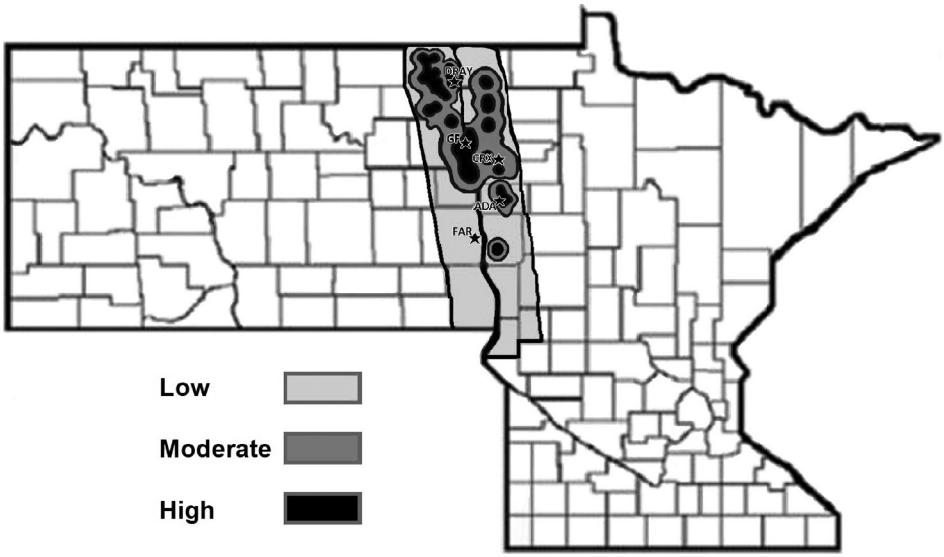
The 2024 risk map for sugarbeet root maggot (SBRM) fly activity in the Red River Valley appears in the figure below. Root maggot fly activity has been on an upward trend for the past several years, and 2023 populations were the fourth highest recorded in the past 17 growing seasons. The high infestations in 2023 suggest that many areas in the valley are at high risk for having economically damaging SBRM infestations in 2024.

Areas at highest risk of SBRM problems in 2024 include rural Auburn, Backoo, Bathgate, Bowesmont, Buxton, Cavalier, Crystal, Drayton, Hensel, Oakwood, Reynolds, St. Thomas, Thompson, Veseleyville, and Voss, ND, as well as Ada, Argyle, Climax, Crookston, Donaldson, East Grand Forks, Oslo, Sabin, Stephen and Warren, MN. Moderate risk is expected in areas bordering high-risk zones, as well as fields near Forest River, Glasston, Grand Forks, Hamilton, Manvel, Merrifield, and Minto, ND, and Angus, Euclid, Kennedy, Borup, Tabor, Eldred, Fisher, and Tabor, MN. The rest of the area is at lower risk.

Proximity to previous-year beet fields where populations were high and/or control was unsatisfactory can increase risk. Areas where high fly activity occurred in 2023 should be monitored closely in 2024. Growers in high-risk areas should use an aggressive form of at-plant insecticide treatment (granular insecticide) and expect the need for a postemergence rescue insecticide application.

Those in moderate-risk areas using insecticidal seed treatments for at-plant protection should monitor fly activity levels closely in their area and be ready to apply additive protection if justified. Pay close attention to fly activity levels in late May through June to determine the need for a postemergence insecticide application.

NDSU Entomology personnel will continue to inform growers regarding SBRM activity levels and hot spots each year through radio reports, the NDSU "Crop and Pest Report" and notification of sugar cooperative agricultural staff when appropriate. Root maggot fly counts for the current growing season and those from previous years can be viewed at https://tinyurl.com/SBRM-FlyCounts.



Anticipated risk of SBRM fly activity and damaging larval infestations in the Red River Valley in 2024.

Root Maggot Management

Please note the following important terminology used in this guide:

- **Fly emergence** pertains to the initial appearance of flies emerging from soil in **previous-year** beet fields where they had overwintered as larvae.
- **Fly activity** refers to fly presence in **current-year** beet fields.

The time period between fly *emergence* from previous-year beet fields and *peak fly activity* in current-year fields is weather dependent and varies between years. Forecasts and updates on these events will be provided to growers, Extension's county personnel, sugar cooperative agricultural staff and other agricultural professionals by using various media outlets. However, there is no substitute for careful activity monitoring on an individual-field basis.

Cultural Control

Early planting allows for larger beet roots during peak SBRM feeding activity (mid-June to mid- July). Larger roots are more able to withstand feeding injury and can avoid potential yield impacts if adequate rainfall is received.

Roots of smaller, late-planted beets are more vulnerable to feeding injury. Severe injury can kill seedlings and cause major stand reductions or result in smaller, sprangled, bulb-shaped roots at harvest.

Using a **rotary hoe or field harrow** across beet rows in June following egg deposition can help reduce maggot numbers. These tillage practices can move eggs away from beet seedlings and onto the soil surface, which exposes them to predators and the elements. As a result of exposure to heat and dry air, the developing maggots sometimes die before hatching. This cultural strategy works best if hot and dry weather coincides with most SBRM progeny in the egg stage.

Sowing oat or rye **cover crops** immediately before beet planting can reduce SBRM injury to sugarbeet roots. Cover crops provide a dense plant canopy, and the shading helps keep soils moist. This condition is believed to keep larvae feeding higher in the soil profile (away from tap roots and nearer to insecticide-treated soil). Also, the dense network of cover-crop roots may impair the ability of larvae to locate and feed on beet roots.

Added benefits of cover crops include soil stabilization, protection of beet seedlings from mechanical injury during windy weather events, and reduced abrasion from wind-blown soil. Cover crops should be killed by applying a grass-killing herbicide during the last week of May or first two weeks of June to avoid sugarbeet yield losses due to competition from cover crops for water, sunlight and soil nutrients.

Chemical Control

Suggestions in this guide assume that insecticides listed will have registration for the recommended use in the current production season. Remember to **always read, understand and follow all label directions and precautions** for the insecticide product you use. Using an insecticide in a manner inconsistent with its label is illegal, and violators may be subject to fines. Nonregistered uses also can result in condemnation of the crop.

Planting-time granular insecticides are important tools for managing sugarbeet root maggots in the Red River Valley.

A few basic steps in preparation for insecticide applications can increase the probability of accuracy, effectiveness, and economical use of these products. Preparation for planting should include serious attention to:

- Accurate calibration
- Unrestricted, consistent flow of granules
- Even distribution of granules over the row
- Adequate incorporation into soil
- Protection from wind

Calibrate **all** of the planter's granular applicators for the insecticide that will be used and for the exact registered rate needed. This is fairly simple because application rates on granular insecticide labels and in Extension materials are listed in ounces of product per 1,000 row feet. Reconfirming calibration settings for the desired output also is advisable at least once after planting about 50% of your anticipated acreage.

Ensure that granules can flow smoothly down drop tubes. Incorporate granules well into the upper ¼-inch of soil.

Wind is a perennial challenge to effective insecticide applications in the Red River Valley. Commonly, as much as 30% of the granules can be blown sufficiently far from the furrow to render them ineffective for protecting roots from insect pest injury. As a result, insecticide concentrations applied directly over the rows are greatly diminished.

If winds are too high (20+ mph), discontinue planting until winds diminish. Calm conditions are more likely during evening and early morning hours, and these times can be more conducive to accurate granule placement when daytime winds are a problem.

The addition of wind shields to planter row units is a practical solution that greatly diminishes the impact of wind on granule placement. **We strongly recommend that wind shields be installed on any sugarbeet planter used to apply planting-time soil insecticides.**

Growers anticipating SBRM problems should consider the following management recommendations:

- Apply a granular insecticide application at planting.
- Place granules in 5-inch bands over the row or deliver via "spoon" placement devices.
- Incorporate insecticide granules into the upper ¼-inch of soil during application.

Recommended Application Rates for Planting-time Soil Insecticides Based on Expected SBRM Population Level

	Rate (lb. product/ac) within population level			
Insecticide	Low	Moderate	High	Timing Options
Counter 20G*	4.5 lb.	7.5 lb.	8.9 lb.	Planting-time or postemergence**

*Restricted use pesticide.

**Counter 20G labeling includes a shortened (90-day) preharvest interval which, in some years, will allow sufficient time to apply it postemergence for sugarbeet root maggot control.

Important: Counter can be applied only once per year per field.

Moderate application rates of labeled soil insecticides are recommended in areas where correspondingly moderate SBRM infestation levels are expected. These treatments should be sufficient if adequate soil moisture prevails after planting. High labeled application rates should be used in areas where SBRM populations are expected to be high (see forecast map), especially in areas where SBRM problems were evident during the preceding year.

Replanting Sugarbeet

NDSU research has shown that major yield losses due to SBRM feeding injury are likely if replanting is done without applying a second insecticide treatment in high-risk fields. Beets in replanted fields usually are smaller and more vulnerable to attack during the root maggot larval feeding period than older, more established plants. Therefore, growers in areas where high maggot populations are anticipated are advised to consider two options:

1) apply another granular material at replanting, or 2) apply a postemergence liquid or granular insecticide.

Treatment with Counter 20G is limited to one application per year. Therefore, if this product was applied at initial planting, another labeled material must be used for replanting or at postemergence. To avoid future development of insecticide-resistant root maggot strains, rotation to a different chemical class is advised.

Postemergence Insecticides

In areas where moderate to high root maggot infestations are common, additive plant protection may be needed for adequate SBRM control, especially if an insecticidal seed treatment, an at-plant liquid insecticide or a low rate of a granular planting-time insecticide was used for at-plant protection. Consideration of a few factors can help decide whether a postemergence insecticide is needed.

Soil moisture – Good soil moisture enhances the effectiveness of planting-time granular insecticides. Postemergence granules work best under moist soil conditions, and liquids work better than granules in dry soils.

Sugarbeet size at peak fly activity – Early planted beets can tolerate some minor larval feeding injury without major yield loss. Sugarbeet fields in 10- to 14-leaf stages of development or those with an established canopy during peak feeding activity are generally large enough to withstand moderate levels of feeding. Tolerance to feeding injury also can be enhanced with rainfall in early June and through July.

SBRM population level – Growers and crop advisers are encouraged to check individual fields for threatening fly activity levels and to monitor radio, the NDSU "Crop and Pest Report," the NDSU Sugarbeet Entomology web page and other media sources for reports on fly activity levels from late May through June.

Postemergence Granular Insecticides

Any of the following conditions can warrant use of a postemergence granular insecticide application:

- Replanted beet field (especially if no insecticide was applied during replanting)
- Heavy rainfall after planting (1 to 3 inches or more within first 24 hours or at least 6 inches if received in one or two rainfall events within a week after planting)
- Proximity of current-year beets to previous-year beet fields where high fly populations occurred during the preceding growing season

When a postemergence granular insecticide application is made, a few important factors should be considered:

- Granules should be applied in late May or early June and, if possible, ahead of a rainfall event. If optimal timing is in question, erring toward applying granules earlier is advisable.
- Granules should be incorporated into the soil. If the soil surface is wet or crusted, drag chains may not sufficiently incorporate the insecticide.
- Moisture is required after application to move the chemical off its granular carrier and into the soil. Without rain to activate the insecticide, control provided by a postemergence granule will be marginal.

Postemergence Liquid Insecticides

Postemergence liquid insecticides are most beneficial and cost-effective under dry conditions, especially when SBRM fly activity is high. Timing of the liquid spray application is critical. Applications made too early or too late may not produce the desired result or be cost-effective.

Liquid insecticides perform best when applied within three days of (preferably before) peak fly activity. Rain following the application can enhance foliar liquid insecticide performance by leaching the active ingredient into the upper ¼-inch of soil for activity against newly hatched larvae.

If rain is likely five to seven days before peak fly activity, the application should be made before the expected rain. These applications will be more effective if applied at least 24 hours before rain occurs.

The decision to apply a sprayable liquid insecticide for SBRM fly control and larval suppression following a planting-time granular insecticide should not be made before the fly infestation level is estimated. Observation of posted sticky stake capture data can aid in this determination; however, it is no substitute for actual monitoring of individual fields.

If conditions warrant applying a postemergence liquid insecticide, the following recommendations are suggested:

- Apply the insecticide in 7- to 11-inch bands or as a broadcast. If broadcasting, avoid using an exceptionally low (less than 50% of labeled maximum) application rate.
- Treat slightly (two to four days) before peak fly activity occurs in the beet field.
- If practical, make only one application per season to minimize the likelihood of developing insecticide-resistant root maggot strains.

Insecticides Labeled for Controlling Insect Pests in Sugarbeet

Sugarbeet Root Maggot

Insecticide and Cost	Rate (lb AI/acre)	Remarks/Restrictions
Seed Treatments		
CruiserMaxx Sugarbeet $ /A = 27.00 to 31.00	60-70 g a.i./ 100,000-seed unit	CruiserMaxx Sugarbeet is a combination of Cruiser 5FS, Apron XL fungicide and Maxim 4FS fungicide. See individual product labels for use directions.
NipsIt Inside $ /A = 20.00 to 22.50	60 g a.i./ 100,000-seed unit	For application to seed only with accurately calibrated mechanical, slurry or misting equipment. Tank mixing or using this product with any other product not expressly authorized by the label shall be the **exclusive risk of user, applicator and/or pest management adviser**.
NipsIt Suite $ /A = 27.00 to 31.00	60 g a.i./ 100,000-seed unit	NipsIt Suite combines NipsIt Inside with Metlock and metalaxyl fungicides. For application to seed only with accurately calibrated mechanical, slurry or misting equipment. Tank mixing or using it with any other product not expressly authorized by the label shall be the **exclusive risk of user, applicator and/or pest management adviser**.
Poncho Beta $ /A = 27.00 to 31.00	68 g a.i./ 100,000-seed unit	For application to seed by commercial treaters only. Not for application to seed via hopper-box, slurry-box or similar on-farm seed treatment applicators. Treated areas may be replanted with any crop listed on clothianidin and beta-cyfluthrin labels. Areas planted with treated seed may be replanted immediately with corn or after 30 days with cereal grains, soybeans, dried beans and dried peas..

Insecticide and Cost	Rate (lb AI/acre)	Product per Acre	Remarks/Restrictions
Granular Insecticides			
Terbufos Counter 20G Lock 'N Load $ /A = 20.00 to 40.00 *RUP* Counter 20G Smartbox $ /A = 20.00 to 40.00 *RUP*	0.9 to 1.8	4.5 to 8.9 lb (3 to 6 oz / 1,000 row ft)	Apply at planting using 5-inch band, modified in-furrow or "spoon" placement. Avoid direct contact with seed. Also may be banded (5- to 7-inch) over rows at postemergence. Product should be incorporated lightly into soil. Do not harvest sugarbeet roots or feed tops to livestock within 90 days after application. **Only one application may be made per year.** Treated areas must be posted with **warning signs**.
Thimet 20G $ /A = 20.00 to 30.00 *RUP*	1.0 to 1.5	4.9 to 7.5 lb (3.2 to 5 oz / 1,000 row ft)	Apply in 5- to 7-inch bands over the row and incorporate lightly into soil. Do not apply more than once per year. Do not apply within 30 days of harvest. Treated areas must be posted with **warning signs**.

***RUP* - restricted use pesticide**

Insecticide and Cost	Rate (lb AI/acre)	Product per Acre	Remarks/Restrictions
Liquid Insecticides Asana XL $ /A = 3.00 to 5.25 *RUP*	0.03 to 0.05	5.8 to 9.6 fl oz	Apply postemergence as a band or broadcast when adults are active. Use ground or air equipment and sufficient water (min. 2 gal/ac finished spray). Do not apply within 21 days of harvest. To avoid possible crop injury, do not tank mix with fungicides containing triphenyltin hydroxide (e.g., Super Tin).
Movento HL $ /A = 25.00 to 50.50	0.07 to 0.14	2.25 to 4.5 fl oz	For root maggot suppression. Apply postemergence as a broadcast with ground or air equipment. Must be tank mixed with a spreading and penetrating adjuvant. Minimum interval between applications is 14 days. Do not apply within 28 days of harvest. Do not apply more than 9 fl oz/ac per crop season.
Mustang Maxx $ /A = 2.75 to 5.50 *RUP*	0.014 to 0.025	2.24 to 4.0 fl oz	Do not apply within 50 days of root or top harvest. Do not apply more than 0.075 lb active ingredient (or 12 fl oz product) per acre per season. Do not make applications less than 7 days apart.

***RUP* - restricted use pesticide**

Wireworms

Wireworms are smooth, somewhat hard-bodied larvae that vary in length from ½ to 1½ inches long; however, they are most damaging when they are ½- to ¾-inch in length. They range from yellowish white to bright or deep copper hues.

Wireworms feed on a wide variety of crops and weeds, and are difficult to detect and control. They tend to be more prevalent in light-textured soils and in fields that had a grassy crop the previous season or had not been in crop production for several years. Fields that had grassy weed escapes during the preceding season also are at risk.

Frequent tillage helps reduce wireworm problems. No economic threshold has been established for wireworms in sugarbeet; however, field history can be a good indicator of risk. The following insecticides should protect the crop from wireworm injury. Refer to product labels for more information.

Insecticide and Cost	Rate (lb AI/acre)	Product per Acre	Remarks/Restrictions
Seed Treatments CruiserMaxx Sugarbeet $ /A = 27.00 to 31.00	60 to 70 g a.i./ 100,000-seed unit		CruiserMaxx Sugarbeet is a combination of Cruiser 5FS, Apron XL fungicide and Maxim 4FS fungicide. See individual product labels for use directions.
NipsIt Inside $ /A = 20.00 to 22.50	60 g a.i./ 100,000-seed unit		For application to seed only with accurately calibrated mechanical, slurry or misting equipment. Tank mixing or using it with any other product not expressly authorized by the label shall be the **exclusive risk of user, applicator and/or pest management adviser**.
NipsIt Suite $ /A = 27.00 to 31.00	60 g a.i./ 100,000-seed unit		NipsIt Suite combines NipsIt Inside with Metlock and metalaxyl fungicides. For application to seed only with accurately calibrated mechanical, slurry or misting equipment. Tank mixing or using it with any other product not expressly authorized by the label shall be the **exclusive risk of user, applicator and/or pest management adviser**.

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Insecticide and Cost	Rate (lb AI/acre)	Product per Acre	Remarks/Restrictions
Poncho Beta $ /A = 27.00 to 31.00	68 g a.i./ 100,000-seed unit		For application to seed by commercial treaters only. Not for application to seed via hopper-box, slurry-box, or similar on-farm seed treatment applicators. Treated areas may be replanted with any crop listed on clothianidin and beta-cyfluthrin labels. Areas planted with treated seed may be replanted immediately with corn or after 30 days with cereal grains, soybeans, dried beans and dried peas.
Mustang Maxx $ /A = 2.75 to 5.50 *RUP*	0.025	4.0 fl oz	Do not apply within 50 days of root or top harvest. Do not apply more than 0.075 lb active ingredient (or 12 fl oz product) per acre per season. Do not make applications less than 7 days apart.
Terbufos Counter 20G Lock 'N Load $ /A = 20.00 to 40.00 *RUP* Counter 20G Smartbox $ /A = 20.00 to 40.00 *RUP*	0.9 to 1.8	4.5 to 8.9 lb (3 to 6 oz / 1,000 row ft)	Controls wireworms best if applied at planting using spoon or modified in-furrow (2 to 3 inches behind seed drop) placement. Banding may not provide acceptable control. Avoid direct contact with seed. Incorporate lightly into soil. Only one application may be made per year. Do not harvest beets or feed tops to livestock within 90 days after application. Treated areas must be posted with **warning signs**.

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Cutworms

Darksided and redbacked cutworms are the most common cutworm pests of sugarbeet in the Red River Valley. Eggs of both species hatch into larvae during late May and early June. Fields should be checked frequently during early spring for cut, wilting or dead plants because early detection of injury is essential to good control.

Cutworms can be found within 2 inches of the soil surface near bases of wilting plants. Most feeding occurs at night. Young plants often are cut off near ground level. During periods of dry weather, larvae feed just below the soil surface as they move along the row. They will feed above the soil surface if soil is excessively moist.

Cutworm larvae are most active after dark, so late-afternoon insecticide applications (that maximize the amount of insecticide active ingredient present after larvae resurface to feed) can be very effective. More than one application may be necessary for adequate control. Liquid insecticides generally provide the best cutworm control, especially in dry soils. If the soil surface is crusted, the crust should be broken up during or before the insecticide application.

Variegated and black cutworms can also cause injury to North Dakota and Minnesota sugarbeet fields, although the injury is rarely economically significant. These cutworm species do not overwinter in our region. They migrate into the area as moths during the spring and are capable of producing multiple generations in a single growing season. Late-season black cutworm infestations often feed more than 2 inches below ground. Therefore, efforts to control them in the latter part of the growing season are rarely effective.

Variegated cutworm larvae can also appear in the Red River Valley. They have a distinctive row of pale yellow spots down the middle of their backs. They are a climbing cutworm species that primarily feeds in the plant canopy during evening hours. Because variegated cutworms feed above ground, they can be effectively managed by using foliar rescue insecticide applications.

Threshold: Application of an insecticide labeled for use in sugarbeet is advisable in young beets when larval cutting of seedling stems reaches between 4% and 5%. Control may be justified for late-season infestations of three to five larvae per square foot if they are feeding near or above the soil surface.

Insecticide and Cost	Rate (lb AI/acre)	Product per Acre	Remarks/Restrictions
Asana XL $ /A = 3.00 to 5.25 *RUP*	0.03 - 0.05	5.8 - 9.6 fl oz	Apply as an at-plant T-band over open seed furrow or conventional band behind planter rear press wheels. Bands should be 4 to 7 inches wide. Also may be applied postemergence as a band or broadcast treatment. Apply with ground or air equipment using sufficient water to provide uniform coverage (minimum of 2 gal of finished spray per acre). Do not apply within 21 days of harvest. To avoid possible crop injury, do not tank mix with fungicides containing triphenyltin hydroxide (e.g., Super Tin).
carbaryl Sevin XLR Plus $ /A = 19.00 to 21.00 several generic products $ /A = variable	1. 5 variable	3 pts variable	This treatment is most effective against cutworms feeding on upper portions of the plant. Apply up to two times per crop season, but not more often than every 14 days. Do not apply within 28 days of harvest. Do not apply more than 3 pounds of active ingredient per acre per crop per year.
Methomyl Lannate LV $ /A = 14.00 to 16.00 *RUP* Lannate SP $ /A = 14.00 to 16.00 *RUP*		1.5 pt 1.5 pt	Apply for *variegated cutworm* control. Do not feed tops to livestock within 30 days of last application. Field re-entry interval is 48 hours. Do not make more than 10 applications per crop. Do not apply within 21 days of root harvest or 30 days of harvest for tops. Do not apply more than 15 pts of Lannate LV per acre per crop. Do not apply more than 5 lb of Lannate SP per acre per crop.
Mustang Maxx $ /A = 2.75 to 5.50 *RUP*	0.014 to 0.025	2.24 to 4.0 fl oz	Do not apply within 50 days of root or top harvest. Do not apply more than 0.075 lb active ingredient (or 12 fl oz product) per acre per season. Do not make applications less than 7 days apart.

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Springtails

Springtails that damage Red River Valley beet fields are tiny (1/32- to 3/32-inch long), wingless, white to cream-colored insects with fleshy, forward-pointed antennae. Species that affect valley beets are subterranean, spending their entire life below the soil surface. They are most harmful to seedlings, and injury ranges from a few brown feeding punctures to extensive root scarring, severed tap roots and seedling death. Symptoms include wilted plants and stand loss, often in patches of 0.3 to 5 acres.

NDSU has confirmed that springtails collected from problem fields in the MonDak growing area are different species than those impacting beets in the Red River Valley. Although they are similar in appearance, they are slightly larger. Problems in the MonDak area also could be resulting from extremely high infestations of those species. Please report any suspected control failures to Mark Boetel at NDSU.

Fine-textured soils with high organic matter content are conducive to springtail problems. Early planted fields, especially in years where soils remain cool and wet during early spring, can be especially vulnerable to attack. Field history is a good indicator of risk because springtails do not migrate from one field to another.

Insecticides registered for use in sugarbeet against other soil-dwelling pests can be used for springtail control; however, manufacturers are not legally bound to guarantee acceptable control if springtail control is not listed on the product label. NDSU research indicates the following:

- Counter 20G should provide good control at rates between 0.9 and 1.5 lb AI (4.5 to 7.5 lb product) per acre.
- Unsatisfactory control from Mustang Maxx has been reported. To maximize performance, apply it:
  - As a 3-inch T-band or directly in-furrow at planting using conventional nozzles (not microtubes)
  - At full rate of 4 oz. of product per acre and
  - Tank mix with clean diluted 10-34-0 starter fertilizer (3:2 parts fertilizer and water)
- CruiserMaxx, NipsIt Inside and Poncho Beta seed treatments also provide good springtail control.

Insecticide and Cost	Rate (lb AI/acre)	Product per Acre	Remarks/Restrictions
Counter 20G Lock 'N Load $ /A = 20.00 to 34.00 *RUP* Counter 20G Smartbox $ /A = 20.00 to 34.00 *RUP*	0.9 to 1.5	4.5 to 7.5 lb (3 to 5 oz / 1,000 row ft)	Apply at planting time using band (5-inch), modified in-furrow or spoon placement. All applications should be incorporated lightly into soil. Avoid direct contact with seed. Only one application may be made per year. Do not harvest beets or feed tops to livestock within 90 days after application. Treated areas must be posted with **warning signs**.
CruiserMaxx Sugarbeets (seed treatment) $ /A = 27.00 to 31.00	60 to 70 g a.i./ 100,000-seed unit		CruiserMaxx Sugarbeets is a combination of Cruiser 5FS, Apron XL fungicide and Maxim 4FS fungicide. See individual product labels for use directions.
NipsIt Inside (seed treatment) $ /A = 20.00 to 22.50	60 g a.i./ 100,000-seed unit		For application to seed only with accurately calibrated mechanical, slurry or misting equipment. Tank mixing or using it with any other product not expressly authorized by the label shall be the **exclusive risk of user, applicator and/or pest management adviser**.
NipsIt Suite (seed treatment) $ /A = 27.00 to 31.00	60 g a.i./ 100,000-seed unit		NipsIt Suite combines NipsIt Inside with Metlock and metalaxyl fungicides. For application to seed only with accurately calibrated mechanical, slurry or misting equipment. Tank mixing or using it with any other product not expressly authorized by the label shall be the **exclusive risk of user, applicator and/or pest management adviser**.
Poncho Beta (seed treatment) $ /A = 27.00 to 31.00	68 g a.i./ 100,000-seed unit		For application to seed by commercial treaters only. Not for application to seed via hopper-box, slurry-box or similar on-farm seed treatment applicators. Treated areas may be replanted with any crop listed on clothianidin and beta-cyfluthrin labels. Areas planted with treated seed may be replanted immediately with corn or after 30 days with cereal grains, soybeans, dried beans and dried peas.

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Lygus Bugs

Tarnished plant bugs, also referred to as Lygus bugs, occasionally have caused late-season injury to North Dakota and Minnesota sugarbeet fields since the late 1990s. Most feeding injury appears on new leaves and stems emerging from the sugarbeet plant crown. Feeding symptoms include leaf curling and wilting, leaf-tip burn, feeding scars on leaf petioles and seepage of a black exudate from petioles of young leaves.

Lygus bugs are sporadic pests in this region. Two to three generations can develop during a single growing season in the Red River Valley. Mild winters or those in which frequent snowfalls provide adequate insulation for overwintering adults, followed by early spring warmups or generally warm growing seasons, increase the likelihood of a third generation occurring. Populations usually build up in other host-plant habitats (for example, alfalfa, canola, small-seeded broadleaf weeds), and then adults migrate to beets in late July through August.

Threshold: Insecticide treatment may be justified if an infestation **exceeds** one Lygus bug per plant (nymphs and adults combined). NDSU research suggests that insecticide treatment is **not** likely to be economically beneficial if the application is made within three weeks of harvest. The insecticide *preharvest interval* is a critical factor in choosing a product for Lygus bug control because these pests usually infest beets late in the growing season.

A number of insecticides approved for use in sugarbeet have activity against Lygus bugs; however, the most common species that attack Red River Valley sugarbeet fields (*Lygus lineolaris*, the tarnished plant bug) is not listed as a target pest in the sugarbeet portion of those labels. Examples include Asana XL, carbaryl (Sevin XLR Plus and several generic products), Lannate LV and Lannate SP.

Applying an insecticide to sugarbeet is legal when it is labeled for use in the crop; however, if the specific target pest is not listed for sugarbeet, effective control is not implied by the manufacturer, and growers who choose to use the product assume all liability for any unsatisfactory performance.

Insecticide and Cost	Rate (lb AI/acre)	Product per Acre	Remarks/Restrictions
Dibrom 8 Emulsive $ /A = 14.00 to 16.00 *RUP*	0.94	1 pt	Apply by air in 1 to 5 gal or by ground in a minimum of 30 gal of finished spray per acre. Do not apply more than 5 pt per acre per season. Do not apply within two days of harvest. Allow a minimum of 7 days between applications. Do not make more than five applications per season.
Mustang Maxx $ /A = 2.75 to 5.50 *RUP*	0.014 to 0.025	2.24 to 4.0 fl oz	Do not apply within 50 days of root or top harvest. Do not apply more than 0.075 lb active ingredient (or 12 fl oz product) per acre per season. Do not make applications less than 7 days apart.
Important: Other insecticides labeled for use in sugarbeet but not specifically labeled for Lygus control in the crop are mentioned in the paragraph preceding this table. Please note the disclaimer stated if considering them for Lygus bug control in sugarbeet.			

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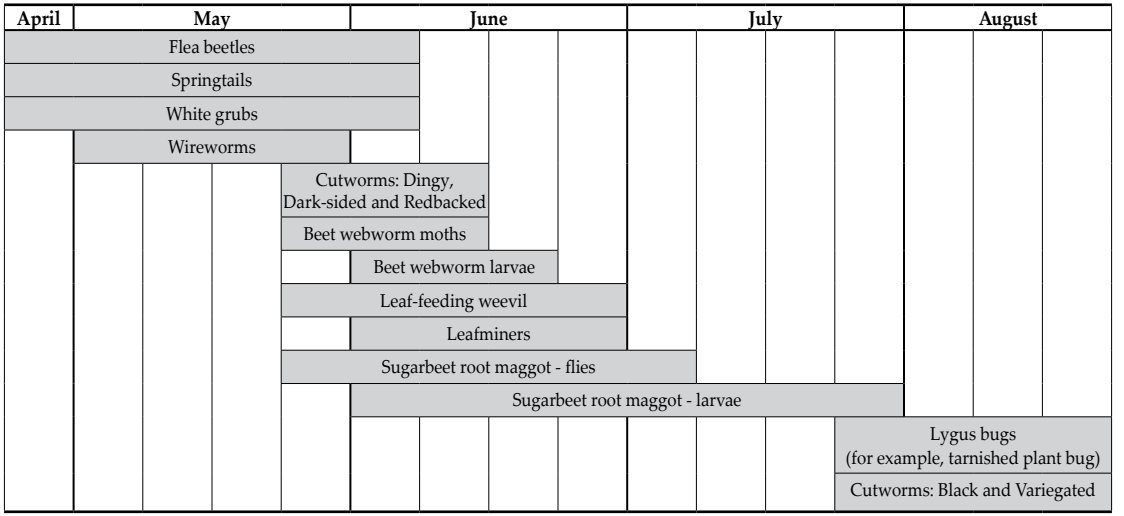
Sugarbeet Insect Pest Activity Calendar for the Red River Valley



SUGARBEET DISEASE MANAGEMENT

Seedling and Root Diseases

Aphanomyces typically causes postemergence damping-off, and seedlings are very susceptible when they are two to three weeks old, especially when soils are wet and warm. Tachigaren (hymexazol) is highly effective against Pythium at lower rates and Aphanomyces at higher rates. Intego Solo (ethaboxam) is also effective against seedling damping-off. These seed treatments persist for only three to four weeks and will provide protection only for the emerging seedlings; they do not provide full-season protection from Aphanomyces.

Commercial seed treaters apply Tachigaren to sugarbeet seeds. Tachigaren can be used at 20 to 30 grams per unit (100,000) of seed on minimum buildup pelleted seed or 45 to 90 grams per unit of seed on standard pelleted seed. Rates greater than 45 grams of Tachigaren per unit of seed may cause phytotoxicity.

The rate of 20 to 30 grams of Tachigaren is recommended on fields with light to medium disease pressure. However, the 20- or 30-gram rate may be inadequate for medium disease pressure when the soil is warm after a heavy rainfall or when these conditions are prolonged within three weeks after planting. The rate of 45 grams of Tachigaren is recommended for fields with heavy disease pressure.

For season-long management of Aphanomyces, the best approach is to use varieties with partial resistance to Aphanomyces treated with Tachigaren or Intego Solo. The sugar factory byproduct "waste lime" at 10 tons/acre is very effective against Aphanomyces for up to 12 years. Early planting and good drainage also may help reduce early season losses from Aphanomyces seedling disease. An Aphanomyces soil test should be done to determine if the soil is infested with Aphanomyces and the level of infection.

Rhizoctonia can cause pre- and postemergence damping-off of seedlings when the soils are warm and moist. In severely infested fields, plant resistant varieties early, avoid "hilling" soil on sugarbeet crowns, increase the length of rotation and rotate with nonhost crops such as small grains.

Seed treatment such as Kabina ST (penthiopyrad), Vibrance (sedaxane), Systiva (fluxapyroxad) or Zeltera (inpyrfluxam) will provide early season protection for about four to five weeks. Products such as Rizolex (Toclofosmethyl) provide some level of protection. Other products may be labeled but do not provide effective control of *R. solani*. Quadris (azoxystrobin), including generics such as Aframe, Satori and AZteroid, and Xanthion (pyraclostrobin+ *Bacillus* spp.) applied in-furrow will provide early to midseason control. In-furrow applied fungicides can affect stands under cold and dry conditions, especially when used with a starter fertilizer such as 10-34-0.

Rhizoctonia also can be managed by applying Quadris and generic azoxystrobin products such as Aframe, Satori and AZteroid, Priaxor (fluxapyroxad + pyraclostrobin), Excalia (inpyrfluxam) or Proline (prothiconazole) in a 7-inch band over the crowns from the four- to eight-leaf stage. Broadcast application is not as effective as band application under moderate to heavy disease pressure. Timing fungicide applications just prior to a ¼- or ½-inch rainfall can be beneficial, but do not wait for rain event to apply fungicides. Fields with a history of severe disease may need a second post-application in warm and wet conditions for extended disease control.

Rhizomania (crazy root) is caused by the *beet necrotic yellow vein virus* (BNYVV), which is transmitted by the soil-borne protozoan vector *Polmyxa betae*. The vector can survive in soil or root debris. High soil moisture and warm temperatures will favor the vector to transmit BNYVV into plants because it infects roots.

Rhizomania is characterized by stunted taproots with masses of hairy lateral roots, giving them a bearded appearance. The root often is constricted, and the vascular tissues become discolored. The leaves, with elongated petioles, become fluorescent yellow, similar to nitrogen deficiency symptoms.

Rhizomania can be managed by early planting of approved resistant varieties in well-drained fields on a three- to four-year rotation. Select varieties with high resistance levels for areas with a known history of severe Rhizomania. Recent research shows that new strains of this virus are developing; these strains may overcome the existing resistance in the current cultivars. Please let your agriculturist know if you suspect Rhizomania in your field(s).

Fusarium yellows and Fusarium yellowing decline typically are caused by the fungus *Fusarium oxysporum* f. sp. *betae* and *F. secorum*, respectively. Fusarium yellows/yellowing decline may cause seedling death or poor growth and even death of older plants.

Symptoms first appear on older leaves as chlorosis (yellowing) between the larger veins. As the disease progresses, younger leaves also become chlorotic, and the older, symptomatic leaves become necrotic. Occasionally, only half of a leaf is chlorotic or necrotic (a symptom more typical of Verticillium wilt, which also was identified on sugarbeet in our region). Entire leaves eventually die but remain attached to the plant and collapse in a heap around the crown.

No external root symptoms are associated with Fusarium yellows/yellowing decline. A transverse section through the root shows a grayish-brown vascular discoloration. Infection of mature plants may not cause death, but the disease causes significant reduction in root yield and recoverable sucrose. In storage, the quality of infected roots deteriorates more rapidly compared with non-infected roots.

The disease is favored by high soil temperatures. Fields that are waterlogged or have poor soil structure provide favorable conditions for infection. In fields with early season abiotic stress, susceptible varieties are more prone to infection and may lead to complete destruction.

Crop rotation may reduce inoculum buildup in the soil, but this practice is unreliable because the pathogens have a wide host range and chlamydospores can survive for many years. Use approved Fusarium-resistant varieties to manage this disease. See NDSU Extension publication PP1247, "Fusarium Yellows of Sugar Beet," for more information on Fusarium yellows of sugarbeet.

Given the long-term nature of the persistence of soil-borne diseases in soil, growers should pay utmost attention to not moving soil between fields, thoroughly cleaning heavy equipment and having a strategy to manage tare piles in individual fields.

Leaf Spots

Various leaf spot diseases can affect sugarbeet. **Cercospora leaf spot (CLS)** caused by *Cercospora beticola*, is the most common and destructive disease in this area. The severity of Cercospora varies from year to year, depending on weather conditions, inoculum potential and varietal resistance. Cercospora can cause losses in susceptible varieties through reduced tonnage, reduced sucrose content, increased impurities and poorer storage after harvest when the roots are in piles.

Bacterial leaf spot generally does not cause economic damage. Bacterial leaf spot may develop in wet weather. No fungicide is registered for its control. See NDSU Extension publication PP1244 for accurate diagnosis.

Alternaria leaf spot is reported in some fields in our growing region that are favored by relatively cool temperatures and high humidity. Stressed sugarbeet plants appear to be more susceptible to Alternaria, and some sugarbeet varieties are more susceptible than others. If you have experienced flare-ups of Alternaria in your fields, talk to your seed company representative for assistance with choosing a suitable variety. Scout fields to determine whether this disease is becoming more prevalent.

Leaf Spot Management

Management of Cercospora requires an integrated approach that includes early incorporation of infected debris, crop rotation, the use of varieties that are less susceptible, disease scouting, timely fungicide, adherence to appropriate application intervals and more frequent applications when environmental conditions are favorable for disease development. Avoid planting next to last year's sugarbeet. This is especially important if last year's fields had high levels of Cercospora. In high-risk situations, select approved varieties that are less susceptible than the average.

Begin checking for Cercospora in late June or early July after row closure, making sure to check near last year's fields or shelter belts. The first fungicide application should occur when conditions first favor disease or at disease onset.

If the first application is late, leaf spot control will be difficult all season, even if shorter-than-normal application intervals are used once applications start. When conditions favor disease or disease already is prevalent, fungicide applications must be more frequent than when disease pressure is low.

Resistance and Tolerance to Fungicides

The terms "resistance" and "tolerance" often are used interchangeably. However, in the following discussion, they are used with specific different meanings. Resistance indicates that the Cercospora fungus is unaffected by a level of fungicide that previously prevented growth in the laboratory. Tolerance indicates that growth of the Cercospora fungus is reduced in the laboratory by a level of fungicide that previously prevented growth in the laboratory.

Resistant isolates of Cercospora are not controlled by field applications of a fungicide. If tolerant strains are present, a reduced level of control will occur.

The systemic fungicide thiophanate methyl (benzimidazole) has federal registration for Cercospora control and is in the benzimidazole class of fungicides. Thiophanate methyl can be used in a tank mix (with triphenyl tin hydroxide [TPTH], triazole or demethylation inhibitor [DMI] fungicides, or multisite fungicides) but only once in a season. The tank mix should be used as the first or second fungicide application.

Benzimidazole-resistant isolates grow normally in the laboratory in the presence of 5 parts per million (ppm) of benzimidazole fungicide. Sensitive isolates do not grow at all in the presence of 5 ppm of benzimidazole fungicide. Some isolates of the Cercospora fungus have been found that were resistant to the benzimidazole class of fungicide and tolerant to TPTH.

Tolerance is best defined as an ability of the fungus to grow in the laboratory in the presence of TPTH at 1 ppm. Sensitive strains do not grow at all when subjected to these levels of TPTH, but tolerant strains grow at a reduced rate compared with growth in the absence of TPTH. Effective fungicides from different classes should be alternated to delay the development of tolerant or resistant strains of the pathogen.

C. beticola was confirmed to be resistant to QoI (Quinone outside inhibitor) fungicides, especially pyraclostrobin, which is found in Priaxor. Populations resistant to QoI fungicides have the G143A mutation and are not controlled when these fungicides are applied, which may lead to field failures. Current populations also are less sensitive to triazole fungicides such as tetraconazole, difenoconazole, propiconazole, fenbuconazole, prothioconazole, mefentrifluconazole and flutriafol.

Managing Cercospora Leaf Spot With Fungicides

In areas where the *C. beticola* population is sensitive to QoI fungicides, the fungicides Priaxor, Gem (QoIs), Proline, Inspire XT, Eminent/Minerva, Topguard, Provysol (triazoles), Lucento, Minerva Duo, Brixen and TPTH, and mixtures of TPTH and Topsin, TPTH or Topsin in mixtures with the triazoles or QoIs used in a rotation program will control Cercospora leaf spot effectively. Because *C. beticola*, under favorable conditions, develops resistance very rapidly to QoI fungicides, we recommend mixing QoI fungicides with a protectant or multisite fungicide for control of CLS. In mixtures, individual fungicides should be used at least at 0.75 to 0.80 times their full labeled rates or preferably at full rates.

In 2016, *C. beticola* populations resistant to QoI fungicides were found throughout the sugarbeet production area. Growers should not use QoI fungicides to manage populations in areas with known QoI resistance. *C. beticola* also has developed reduced sensitivity to triazole (DMI) fungicides. Mixtures of fungicides such as TPTH and triazoles, TPTH + Topsin, TPTH + EBDCs, TPTH + Copper, EBDCs + Copper, Triazoles + Copper and triazoles + EBDCs with different modes of action should be used in a rotation program to manage CLS in areas with known QoI resistance.

Limit the use of triazoles (DMI) and always mix with another mode-of-action fungicide, preferably multisite fungicides. In areas with resistance or reduced fungicide sensitivity, the best option is to use site-specific fungicides (QoIs and DMIs) at full labeled rates in mixtures. Varieties with higher CLS tolerance should be used in combination with timely fungicide applications, incorporation of infected plant debris, crop rotation and planting away from previously infected fields. Growers in areas with a history of high disease severity of CLS should use CR+ varieties that have improved tolerance to *C. beticola*. One option to manage CLS in CR+ varieties is to apply fungicide mixtures as soon as the first symptoms are observed and use subsequent applications of at least 12- to 14 -day intervals based on the presence of symptoms and favorable (>6) daily infection values.

After aerial application, ensure that areas around power lines and trees are side-dressed using ground equipment. Aerial applicators should use a higher water volume to get better coverage. Improperly sprayed areas become focal points for Cercospora spread. Best results with ground equipment are obtained by using high pressure (60 pounds or more per square inch) and a high volume (20 to 25 gal/A) of water.

Preharvest Intervals (PHI): Fungicides may be needed well into September to control Cercospora in some years; stopping the application of fungicides before this time may result in late-season damage that can reduce tonnage, sucrose and quality. Do not allow the preharvest interval (PHI) to be an excuse for missing an application late in the season. Spraying a field but leaving the headland and a strip (or strips) in the middle untreated may be preferable, thereby allowing pre-pile harvest in untreated areas.

Application Intervals: Generally, the application interval for most of the fungicides recommended is 14 days. During periods of regular rainfall, shorten the application interval to 10 to 12 days. EBDCs (ethylene bisdithiocarbamates) may be required at seven- to 10-day intervals for effective control.

Variety Selection and Cercospora Management: Differences occur in Cercospora susceptibility among approved varieties. The current *C. beticola* population is much easier to manage on varieties with higher-than-average tolerance to Cercospora. Conversely, varieties that are more susceptible than the average may need extra fungicide applications in years that are highly favorable for Cercospora. The use of more tolerant varieties is an important part of an integrated disease management plan.

Powdery Mildew Control: Mixtures of triazoles (DMIs) or QoIs and sulfur fungicides will provide effective control. See NDSU publication PP967 "Plant Disease Management: Sugarbeet Powdery Mildew" for more information.

Foliar Sprays – Leaf Spots

Fungicide and Estimated Cost	Label Rate	Harvest Restrictions (PHI)	Remarks/Restrictions
QoIs Priaxor $/A = 22.50 to 30.00	6 to 8 fl oz/A	7-day PHI; Restricted-entry interval (REI) – 12 hours	Best used in mixtures for effective CLS control.
Trifloxystrobin Gem $/A = 26.95	3.5 fl oz/a	21-day PHI REI – 12 hours	Best used in mixtures for effective CLS control.
Triazoles Eminent/Minerva $/A = 15.44	13 fl oz/A	14-day PHI REI – 12 hours	Always alternate with a nontriazole fungicide. Best used in mixtures for effective CLS control.
Inspire XT $/A = 17.94	7 fl oz/A	21-day PHI; REI – 12 hours	Best used in mixtures for effective CLS control.
Proline $/A = 19.53 Propulse	5 fl oz/A 13.6 fl oz/A	7-day PHI REI – 12 hours 7-day PHI	Best used in mixtures for effective CLS control.
Topguard $/A = 11.33 to 15.86	10 to 14 fl oz/A	21-day PHI; REI – 12 hours	Best used in mixtures for effective CLS control.
Provysol $/A = 22.13	5 fl oz/a	7-day PHI; REI – 12 hours	Always alternate with a nontriazole fungicide. Best used in mixtures for effective CLS control.
Minerva Duo $/A = 21.00	16 fl oz/a	14-day PHI; REI – 48 hours	Best used in mixtures for effective CLS control.
Regev	4 to 8.5 fl oz/a	7-day PHI REI – 12 hours	Best used in mixtures for effective CLS control.

Benzimidazole Topsin M WSB Thiophanate Methyl 85 WDG	0.5 lb/A 0.4 lb/A	Do not apply within 21 days pre-harvest interval (PHI).	Resistance to benzimidazole fungicides is common. Use only in a tank mix with other modes of action.
Topsin M4.5F $/A = 3.44	10 fl oz/A	REI - 12 hours	Do not exceed one application/year. See text on page 79.
EBDCs Mancozeb Manzate 75 DF Dithane F-45/M45 Penncozeb DF Koverall $/A = Dry 5.10 to 6.80 $/A = Liquid 8.85 to 14.75	1.5 to 2 lb/A	14-day PHI REI – 24 hours	Effective for about seven to 10 days. Do not enter treated area without protective clothing. Use in a mixture.
Copper ($4.69 to 8.75/A)			
Champ DP	1.33 to 3.33 lb/A	0-day PHI	Do not exceed 21 lb/A per year.
Champ Formula 2 Flowable	1.33 to 3.33 pt/A	0-day PHI	Do not apply more than 21.7 pt/A per year.
ChampION++	0.75 to 2 lb/A	0-day PHI	Max amount per year is 26.2 lb/A.
Cuprofix Ultra 40 Disperss	1.29 to 3.0 lb/A	0-day PHI	Max amount per year is 19.65 lb/A.

Foliar Sprays – Leaf Spots

Fungicide and Estimated Cost	Label Rate	Harvest Restrictions (PHI)	Remarks/Restrictions
Kocide 3000	0.75 to 2 lb/A	0-day PHI	Do not apply more than 26.2 lbs/A per year.
Mastercop	0.5 to 1.5 pt/A	0-day PHI	Do not exceed 7.5 pt/A per year.
ET-F	19 to 38.4 oz/A	0-day PHI	Do not apply more than 7.86 lbs/A. per year.
Badge X2	1 to 4 lb/A	0-day PHI	Do not tank mix with glyphosate.
Badge SC	1 to 4 fl pt/A	0-day PHI	Do not tank mix with glyphosate.
Copper + EBDC Mankocide	2.5 to 4.3 lb/A	14-day PHI	Max amount per year is 26.2 lb/A. Do not feed tops to livestock.
Triphenyl Tin Hydroxide (TPTH) **Super Tin 80WP** $/A = 4.95 to 6.60 Agri Tin Super Tin 4L $/A = 4.92 to 6.56	3.75 to 5 oz/A 6 to 8 fl oz/A	7-day PHI REI - 48 hours	Restricted use pesticide. Use 5 oz/A rate for WP formulation. Do not enter treated fields within 48 hours of treating without protective clothing. Do not exceed 15 oz/A of TPTH 80 WP or 24 fl oz/A of TPTH 4L per season. Ground application must be with enclosed cabin tractors. Do not feed to livestock.

The following are registered fungicides used for controlling Cercospora leaf spot and their class of chemistry:

QoIs (Quinone outside inhibitors)
Gem
Priaxor
Quadris

Benzimidazole
Topsin M

Sterol Inhibitors
Eminent
Enable
Minerva
Proline
Inspire XT
Topguard
Provysol
Regev

Ethylenebisdithiocarbamates (EBDC)
Mancozeb
Penncozeb
Dithane
Manzate
Koverall

Triphenyltin Hydroxide (TPTH)
SuperTin
AgriTin

Multiple modes of action: Lucento, Acropolis, Brixen, Propulse, Dexter Max, Minerva Duo, Priaxor Inspire XT

PS: Products must be labeled before they can be used for controlling disease on sugarbeets.

Rhizoctonia Root Rot Control

Fungicide and Estimated Cost $/A	Label Rate/A	Harvest Restrictions (PHI)	Remarks/Restrictions
Quadris/Satori/Aframe* $10.42 to 16.20 (Quadris) $8.98 to 13.96 (Satori/Aframe)	9.2 to 14.3 fl oz	May be applied up to harvest (0-day PHI) Restricted-entry interval (REI) – 4 hours	In-furrow applications for 22-inch rows; mixing with starter fertilizer not recommended.
Xanthion $18 to 26.50	7.2 to 10.8 fl oz	7-day PHI	In-furrow application
AZteroid FC*	11.9 fl oz	0-day PHI	In-furrow application
AZteroid FC 3.3*	5.7 fl oz (equivalent to 9.2 fl oz Quadris)	0-day PHI	In-furrow application
Quadris/Satori/Aframe $10.42 to 18.88 (Quadris) $8.98 to 16.21 (Satori/Aframe)	9.2 to 16.6 fl oz	0-day PHI	7-inch band application in 22-inch rows between 4- and 8-leaf stage when an effective Rhizoctonia seed treatment is used.
AZteroid $14.88 to 23.63	11.9 fl oz to 18.9 fl oz	0-day PHI	

Fungicide and Estimated Cost $/A	Label Rate/A	Harvest Restrictions (PHI)	Remarks/Restrictions
AZteroid FC 3.3	9.2 fl oz (equivalent to 14.5 fl oz Quadris)	0-day PHI	POST Application 7-inch band application in 22-inch rows between 4- and 8-leaf stage when an effective Rhizoctonia seed treatment is used.
Proline $22.27	5.7 fl oz NIS 0.125% v/v	May be applied to 7-day PHI	
Priaxor $22.50 to 30.00	6 to 8 fl oz	7-day PHI	
Excalia	2 fl oz (broadcast) 0.66 fl oz (7 inch band)	50 days	

*Expect some stand loss under cold and dry conditions when applied in-furrow along with 10-34-0 starter fertilizer.

Sugarbeet Crop Record

Field Number	1	2	3	4	5	6
Acres						
Units/A preplant N						
Date N applied						
Units/A phosphate						
Date P applied						
Other fertilizer						
Date applied						
Seed variety						

Field Number	1	2	3	4	5	6
Sprocket size						
Planting date						
Seed spacing						
Pre-emerge insecticide						
Rate/A						
Emergence date						
PPI herbicide						
Rate/A						

Field Number	1	2	3	4	5	6
Post-herbicide						
Rate/A						
Post-herbicide						
Rate/A						
Post-herbicide						
Rate/A						
Post-herbicide						
Rate/A						
Labor costs/A						

Field Number			1	2	3	4	5	6
Fungicide used: Date	Rate/A	App.						
		1.						
		2.						
		3.						
		4.						
Other insecticides								
Rate/A								
Harvest date								
Yield/A; % S								

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Agvise Laboratories, Northwood, ND	701-587-6010
Agvise Laboratories, Benson, MN	320-843-4109
NDSU Diagnostic Laboratory	701-231-7854
University of Minnesota Disease Diagnostic Laboratory	612-625-1275
NDSU Soil Testing Laboratory	701-231-8942
Agvise Laboratories Website	www.agviselabs.com

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PESTICIDE SAFETY RULES

1. Read the label carefully before using the product.
2. Store chemicals under lock and key.
3. Keep chemicals in original containers.
4. Use chemicals only on crops specified and at the correct rate and schedule.
5. Do not eat or smoke while applying pesticides.
6. Wear protective clothing and masks as directed.
7. Wash clothing and your skin immediately if chemicals come in contact with them
8. Avoid chemical drift from one crop to another.
9. Keep a record of materials, amounts used and the date of application.
10. Dispose of empty containers in a way that they no longer are hazardous.
11. In case of accidental poisoning, call a physician or take the patient to a hospital immediately
12. See the inside back cover of this publication for poison control center telephone numbers.

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Available online at www.sbreb.org

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Do not use this publication after Dec. 31, 2024.

USE OF PESTICIDES

The pesticide recommendations in this "Sugarbeet Production Guide" assume that all pesticides mentioned will have a registered label with the U.S. Environmental Protection Agency. Pesticides should not be used if they no longer are registered or have not yet received registration for sugarbeets. Sugarbeets treated with a pesticide not registered for sugarbeets may have an illegal residue which, if detected, could cause condemnation of the crop. Nonregistered pesticide use is illegal, and a user could be subject to a heavy fine, even without detectable residue.

All pesticide users should read and understand the pesticide label prior to pesticide use. Inclusion of all label details in the "Sugarbeet Production Guide" is not possible, and labels sometimes are modified after the annual guide's printing is completed.

2024

JANUARY 2024

S	M	T	W	T	F	S
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FEBRUARY 2024

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MARCH 2024

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31						

APRIL 2024

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MAY 2024

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JUNE 2024

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JULY 2024

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AUGUST 2024

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SEPTEMBER 2024

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OCTOBER 2024

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NOVEMBER 2024

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DECEMBER 2024

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8	9	10	11	12	13	14
15	16	17	18	19	20	21
22	23	24	25	26	27	28
29	30	31				

Poison Control Centers

North Dakota statewide number:
800-732-2200

Minnesota statewide number:
800-764-7661

Fargo Poison Control number:
701-234-5575

Call the nearest poison control center for recommended treatments for any type of pesticide poisoning.

Have pesticide label information available when calling.

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