2016

Growers' Guide for Producing Quality Sugarbeets

PIONEER • BIG CHIEF
MICHIGAN SUGAR

Michigan Sugar Company Corporate Agricultural Office
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Michigan Sugar Company
Mission Statement

As a grower-owned sugar cooperative, our mission is to maximize shareholder value by efficiently producing quality products, from seed to shelf, while enhancing our employees' future.

INDEX

This booklet is prepared for growers growing sugarbeets for Michigan Sugar Company from information obtained from sources which the Company believes to be reliable; however, the Company cannot guarantee or assume any responsibility for the accuracy of the information, or be responsible for the results obtained. Further, these recommendations and suggestions are only a part of what is necessary to grow a successful crop. Proper equipment in well maintained condition, good farming practices are equally important, along with safety. (March 2016 David Pratt)

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MICHIGAN SUGAR

Approved Varieties for 2016

2014-2015 Data

Variety	Approval Status	$/A	All Values are % of Check															
			RWSA	RWST	Emergence		Cercospora		Rhizoctonia		Root Aphid		Aphanomyces		Fusarium		Rhizomania	
B-149N	Limited Approval	$2,196	106.2	99.5	92	F-	117	P	101	F	58	G+	102	G-	82	G	97	G
B-12RR2N	Full Approval	$2,169	104.8	102.2	100	F	104	F	99	F	128	F-	82	G+	83	G	101	G
SX-RR1243	Limited Approval	$2,156	103.3	100.3	101	G-	95	G-	91	G	133	F-	73	G+	102	G-	99	G
C-RR059	Full Approval	$2,147	103.0	102.0	104	G	96	G-	92	G	60	G+	93	G	72	G	96	G
C-G333NT		$2,136	103.4	98.2	96	F	112	F-	84	G	58	G+	90	G	79	G	92	G+
SX-1228RR	Full Approval	$2,129	102.8	100.2	104	G	108	F	97	G-	140	P	117	F	110	F	96	G
SX-RR1245N	Limited Approval	$2,119	101.8	101.9	101	G-	103	F	101	F	126	F-	90	G	111	F	100	G
B-18RR4N	Special Approval	$2,103	102.1	101.5	102	G-	105	F	105	F-	63	G+	86	G	91	G-	106	G-
SX-1212RR	Full Approval	$2,088	100.8	99.9	104	G	105	F	103	F-	146	P	102	G-	115	F	99	G
C-RR202	Full Approval	$2,087	100.5	101.2	106	G	84	G	100	F	58	G+	139	P	132	F-	100	G
SX-1211N RR	Special Approval	$2,086	100.2	95.8	102	G-	113	F-	102	F	122	F-	68	G+	75	G	91	G+
B-1399	Full Approval	$2,081	100.2	98.8	102	G-	79	G+	85	G	69	G+	93	G	52	G+	102	G
B-133N	Special Approval	$2,068	99.8	96.7	99	F	110	F	72	G+	58	G+	86	G	61	G+	101	G
SX-RR1235N	Full Approval	$2,052	99.1	100.7	103	G-	101	F	104	F-	134	F-	96	G-	118	F	103	G
C-G351NT	Full Approval	$2,030	97.8	104.6	102	G-	98	G-	101	F	58	G+	97	G-	82	G	105	G-
HM-28RR	Full Approval	$2,004	96.5	95.4	107	G+	93	G-	97	G-	142	P	125	F-	135	P	92	G+
HM-NT9617RR	Special Approval	$1,998	96.3	98.0	91	F-	110	F	93	G	92	G	97	G-	84	G	100	G
HM-9616RR	Limited Approval	$1,975	95.2	105.1	86	F-	97	G-	62	G+	95	G	120	F-	121	F-	109	G-
HM-173RR	Full Approval	$1,949	94.1	96.6	91	F-	94	G-	100	F	131	F-	119	F-	122	F-	99	G
HM-NT9607RR	Limited Approval	$1,939	93.3	103.1	102	G-	103	F	98	G-	63	G+	121	F-	111	F	109	G-

A lower value is better for Cercospora, Rhizoctonia, Root Aphid, Aphanomyces, Fusarium and Rhizomania

$/A: Gross dollars per acre assuming $51 Payment

EFFICIENT FARMING

Flourishing farm managers know what's happening in their operation. They have a command of such basic facts as goals and plans (long and short-term), enterprise knowledge, who's who in the industry, the roles and relationships between various supplies and customers, and they define their own job and what's expected of them. If they don't know this information, they know where to get it when they need it.

The job of a producer is very much concerned with making decisions. Sometimes these can be made using logical, optimizing techniques. Other decisions call for the ability to weigh pros and cons in what is basically a very hesitant or vague situation, calling for a high level of judgment or even intuition.

Our agricultural staff can provide valuable information to help each of you in making decisions concerning your farming program, especially those relating to quality sugarbeet production. The internet is also a way for sugarbeet producers to gather information. For more information, contact your agriculturist or visit the Michigan Sugar Company website: www.michigansugar.com for more information.

SOILS AND SEEDBED PREPARATION

Select soils having good tile and surface drainage. It is important to plant into a seed-bed that allows for good seed to soil contact. Sugarbeets should not be planted into actively growing weeds. Weeds are a good source for overwintering pathogens. Weeds should be controlled with herbicides or tillage prior to sugarbeet planting. **Note:** beware to weed resistance. We have glyphosate resistant Horseweed, Palmer Amaranth, and Waterhemp in our sugarbeet area.

WIND EROSION CONTROL

Wind erosion in cropping systems usually results from tillage practices that have buried most or all of the residues from the previous crop. Reducing or eliminating tillage will maintain a residue cover for erosion control with the added benefit of soil moisture conservation.

By following one or more of the following practices will lower problems with wind erosion.

- Reduced or zero tillage systems must include crop residue management; Increasing surface roughness, thereby reducing wind speed at the soil surface so the wind is less able to move soil particles; Plant in fall seeded oats or wheat; Form ridges with appropriate tillage equipment on the soil surface at right angles to the prevailing erosive winds; Use a cultivator tooth between rows at planting; Spread manure on sand knolls; Plant sand knolls to oats or wheat; During or after planning sugarbeets, drill wheat, oats, or rye at intervals across the field.

To control wheat seeded the previous fall, apply a broad-spectrum herbicide at a broadcast rate of 32 fl. oz. (i.e. Roundup WeatherMAX) at sugarbeet planting for excellent control. Always tank mix, this will help slow down resistance. Glyphosate is used to control ground cover vegetation, volunteer grain, and other weeds prior to beet emergence. Apply 3 to 4 days after planting, before sugarbeets emerge, to control wheat cover crops. Microrates with Betamix will control oats also.

CULTIVATION

According to Sugarbeet Advancement research, cultivation should be implemented for various reasons such as weed control, wind erosion protection, pathogen management, and soil crusting. In absence of these types of conditions, any yield enhancement would not be expected.

Do NOT move soil into the sugarbeet crown;
this practice promotes Rhizoctonia crown rot.

FERTILITY

Soil Test: Soil sampling may be the most important part of soil testing. Grid sampling or separating the field by differences in soil texture, organic matter, slope, or past management (i.e., cropping or tillage system) tends to pro-vide the most accurate recommendations. Within each sampling zone, collect about 20 cores to a depth of 8 inches and mix thoroughly.
Soil pH: The pH of soil is very important. It tells if the soil is acid, neutral or alkaline. Soils below pH 6.5 (acid) should have lime applied for optimum sugarbeet production. Soils above pH 7.2 (alkaline) may require manganese in starter fertilizer or sprayed on foliage to correct a deficiency.
Liming: Limestone is a naturally occurring nutrient vital for healthy soil in Michigan. Whether you own a large farm or a small farm, lime can play a big part in higher crop yields, decrease disease pressure and improve soil health and tilth. Liming can:

- Raises pH - reducing acidity; increases efficiency of fertilizers; helps aerate soil by boosting microorganisms and decreasing seedling diseases; stabilizes soil aggregates to slow erosion; encourages activity of soil bacteria; and releasing valuable nutrients.

Nitrogen (N) and Placement: The correct amount of nitrogen to apply to a particular field is not easy to determine. Nitrogen availability to the sugarbeet crop is affected by weather conditions, soil type, crop rotation and producer management practices.

The premium being paid for above average sugar content, because the value of the ton of sugarbeets is higher, makes it even more important to apply the proper amount of nitrogen to provide good yields without decreasing sugar content. Excess nitrogen has an adverse effect on quality, both sugar content and clear juice purity, and does not increase tons per acre. Knowledge of past practices, on a particular farm, help in determining the optimum rate of nitrogen to apply.

All or a portion of the nitrogen can be applied shortly before or at planting time; the remaining nitrogen should be applied early after sugarbeet emergence. Sugarbeets require the most nitrogen during the first 60 days of growth. It is advantageous to get good leaf cover/canopy (to maximize light interception) as early as possible in the growing season. This will enhance maximum sugar production.

Sugarbeets should start to lose their dark green color toward the end of August or early September if the proper amount of nitrogen was applied. Dark green sugarbeets in September indicate excessive available nitrogen and will reduce sugarbeet quality, sugar content and clear juice purity.

Michigan Sugar Company and Michigan State University researchers recommend applying 40 to 50 pounds of N in a 2x2 (2 inches below the seed level and 2 inches away from the row) for 30 inch and 22 inch rows respectively at planting. This is most significant when planting into high residue crops such as corn and wheat stubble.

Sugarbeets require N early to attain canopy closure with smaller amounts of N required later for canopy maintenance. In the autumn canopy color should be declining and leaves yellowing otherwise significant sugar losses may occur if green and vigorous at harvest time.

Excess N late in the season will not increase yield but will reduce quality and sugar per ton. The total amount of N required depends on the amount of residue from the previous crop.

NITROGEN RECOMMENDATIONS

Crop	Early Delivery Nitrogen (total lbs, N/A) 2X2 placement, Only	Campaign Season Nitrogen (total lbs, N/A) 40 lbs. of N in a 2x2, Rest of N is Sidedress
Corn/Wheat	40	140 - 160[1]
Soybeans/Dry Beans	40	100 - 120

[1] Use Higher N Rate Following High Residue Crops

FERTILITY *(Continued)*

Sugarbeet following high residue crops (corn and wheat) typically require 130-160 pounds of N while low residue crops (soybean and dry bean) typically require 90-130 pounds of N. Three factors that may reduce N application rates include: 1) high soil organic matter (> 3%); 2) manure application; and 3) clover or alfalfa plowed down. A plow down of a legume (e.g. clover) after wheat may supply anywhere from 40-80 pounds N per acre depending on the stand density, growth, and timing of the plow-down. Sugarbeet Advancement research indicated that 10,000 gallons of dairy manure applied in the fall may supply most of the sugarbeet N needs in addition to 40 pounds of N applied as a 2x2 at planting.

Starter Fertilizer: Fields with high soil test levels of phosphate and potash generally do not require starter fertilizer. When banding starter fertilizer, place it 2 inches to the side and 2 inches below the seed. Closer placement to the seed may cause seedling injury (especially high rates) and poor seed to soil contact. Under certain environmental conditions, sugarbeet stand has been reduced with in-row starter fertilizer, especially pop-up fertilizers.

Broadcast Fertilizer: This method of fertilizer application speeds up the planting operation, however high rates of fertilizer can cause beet injury. More phosphorus and nitrogen may be needed when applied as a broadcast compared to banded, since broadcast fertilizer is spread over the entire field.

Common 2 X 2 Starter Phosphorus Fertilizer Sources

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

Manure: Manure applications has shown benefits in increase tonnage, along with improving soil health. Make sure it's cost efficient in hauling. The maximum distance to haul manure (to be economical) is 0.25 to 1.5 miles. However, put some considerations in apply manure, especially applying manure on flat and highly erodible lands that could lead to non-point source runoff in surface water.

Phosphorus (P): is generally immobile in the soil and is required for plant growth. Availability is reduced during the cool and moist early spring soil conditions often encountered during sugarbeet planting. Sugarbeets generally do not respond to fertilizer P on high P testing soils (>30 ppm) but growers may still wish to consider a 2x2 starter application of P at planting. Phosphorus application has been documented to increase root yields in soils that are low in P (< 25 ppm) while not affecting sugarbeet quality. Soil testing above 50 ppm soil test P do not require P applications.

Potassium (K): K is essential to sugarbeet production and is more mobile in the soil than P but less mobile than N. Much of Michigan's sugarbeet acres are grown in soils natively high in K. Potassium recommendations depend upon a soil's cation exchange capacity (CEC) so growers need to closely examine changes in soil texture as this may have the greatest impact upon K recommendations.

FERTILITY (*Continued*)

Michigan's P and K recommendations follow the build-up, maintenance, and drawdown philosophy which allow for a build-up of P and K when soil test levels are below critical. Sugarbeets growing on soils that test below critical in P or K have a greater opportunity to respond to applied fertilizer and often result in an economic benefit to the grower. Build-up, maintenance, and drawdown levels for soil P and K (ppm). More information on Sugarbeet Soil Fertility can be found under the REACh Bulletins (https://www.michigansugar.com/).

Phosphate and Potassium Recommendations for Sugarbeets									
	P Soil Test Levels (ppm)					**K Soil Test Levels (ppm)**			
	VH	H	M	L	VL	H	M	L	VL
Bray - 1	70+	69-50	49-35	34-25	0-24	175+	174-130	129-113	0-112
	P2O5 (lbs./Ac)					**K2O (lbs./Ac)**			
	VH	H	M	L	VL	H	M	L	VL
Bray - 1	140+	139-120	119-70	69-50	0-49	350+	349-235	234-225	0-224

PHOSPHATE RECOMMENDATIONS							
Soil Test Available Phosphorous Pounds	**Amount of Phosphate (P_2O_5) to Apply (lbs.) Yield Goal - Tons**						
	18	**20**	**22**	**24**	**26**	**28**	**30**
20	120	130	140	150	160	120	125
40	100	110	120	130	140	70	75
60	70	80	90	100	110	45	50
80	50	60	70	80	90	45	50
100	20	30	40	50	60	30	30
120	0	0	20	30	40	30	30
140+	0	0	0	0	0	0	0

POTASSIUM RECOMMENDATIONS							
Soil Test Available Potassium Pounds	**Amount of Potassium (K_2O) to Apply (lbs.) Yield Goal - Tons**						
	18	**20**	**22**	**24**	**26**	**28**	**30**
50	190	210	230	250	270	230	235
100	150	170	190	210	230	195	205
150	110	130	150	170	190	160	165
200	70	90	110	130	150	125	130
250	30	50	70	90	110	95	95
300	0	0	30	50	70	95	95
350	0	0	0	0	30	95	95
350+	0	0	0	0	0	95	95

MICRO-NUTRIENTS

Of the micronutrients, Boron (B) and Manganese (Mn) are the two that may often be considered for sugarbeets. Typically the most effective application method is in a 2x2 band at planting.

A Mn application of 4 - 18 pounds of Mn would be recommended in actual Mn-deficient situations. If applying as a preventative application, 1-2 pounds of Mn in a starter 2x2 band at planting would be recommend-ed. If you opt not to apply Mn as a starter fertilizer, then a foliar rescue application of 1 to 2.5 pounds Mn per acre in 15 gallons of water is recommended as Mn sulfate or Mn chelate. This application rate may need to be spread over multiple spray intervals. Soil application of foliar chelates is not recommended as other cations (e.g., Ca or Fe) often replace Mn in the chelate and may convert to unavailable forms. Use a spray grade Mn and apply the higher rate on larger plants.

Mn deficiency in sugarbeets often appears as yellowing between leaf veins while veins remain dark green. Since Mn is not a mobile nutrient, chlorosis usually begins on the younger leaves. Do not confuse Mn deficiency with N deficient plants . N deficient plants tend to not have green veins whereas Mn deficient plants have uniform leaf yellowing with green veins.

Research in Michigan has not indicated need for a preventative application of B on sugarbeets grown on finer-textured soils. Sugarbeets growing on sandy or sandy loam soils may benefit from a B application. When applied early in the growing season (typically prior to mid-June) foliar and granular B applications seem to be equally effective. Application of 1 to 3 pounds of granular B in a 2x2 at planting would be recommended (1 pound for heavier soils and 3 pounds for sandier soils). Sodium borate would be the preference to use at this time. Foliar applications may require 1-2 sprays of 0.15 - 0.25 pounds in 15 gallons of water.

Like Mn, B is not mobile and symptoms of B deficiency in sugarbeets start with younger leaves, thus causing cessation of the terminal bud and white, netted chapping of the upper leaves and wilting of tops. Plants later exhibit crosswise cracking of petioles, death of the growing point, and heart rot of the root. NOTE: The sugarbeet plants does not respond to Mn or B above the tenth leaf stage.

SEED TREAMENT

Emergence of sugarbeet seedlings is a major factor limiting satisfactory stand establishment. The variability in emergence is caused in part by differences in germination and seedling vigor among seed cultivar, or between cultivars. Factors affecting sugarbeet seed germination and emergence include underdevelopment and immaturity of seed; cultural practices, soil fertility, climate and maturity at harvest also influence germination and emergence of sugarbeet seeds.

Seed treatments are a convenient, economic, and effective methods (typically giving four weeks of activity, except for CLARIVA™) of reducing seed rot and damping-off diseases and managing early season insect pest. Some seed treatments have activity against one pathogen while others have activity against two or more pathogens. **NOTE:** For some seed treatment they are not meant to replace your normal pesticide applications, for example, Quadris for Rhizoctonia control, but rather add another mode-of-action to your IPM program. Refer to your agriculturalist for more information on seed treatments.

- **Allegiance®** (metalaxyl) is a seed treatment fungicide that provides systemic protection for the seed, roots and emerging plants against diseases such as Pythium, systemic downy mildew and Phytophthora. **Register in USA and Canada.**
- **Apron® XL** (mefenoxam) is a seed treatment fungicide that provides effective protection against Pythium sp and Damping-off. **Register in USA and Canada.**
- **CLARIVA™** (Pasteuria nishizawae) a biological nematode seed treatment product based on natural soil bacteria for protection against nematodes on soybeans and sugarbeets. **Register in USA .**
- **CruiserMaxx® (**thiamethoxam + mefenoxam + fludioxonil) for sugarbeets is a combination of Cruiser, Apron XL, and Maxim that offers protection against both early-season insects and diseases. Insect protection: sugarbeet leaf hopper, sugarbeet root maggot, springtails and wireworms, while fungicide activity protects against seedling diseases such as Pythium and Rhizoctonia. **Register in USA and Canada.**
- **DYNASTY®** (azoxystrobin) is a broad spectrum, preventative seed treatment fungicide with systemic properties recommended for the control of seed rot/pre-emergence damping-off caused by Rhizoctonia solani. **Register in USA and Canada.**
- **Kabina ST™** (penthiopyrad) a seed treatment fungicide with an effective mode of action against Rhizoctonia seedling disease. **Register in USA.**
- **Maxim® 4FS** (fludioxonil) is a seed-delivered fungicide that provides defense against early-season diseases while increasing plant stand, vigor and yield potential. Maxim is effective against Rhizoctonia. **Register in USA and Canada.**
- **Metlock®** Suite (metconazole) provides contact and systemic control, with "inside-out" protection against sugarbeet diseases, including Rhizoctonia and Fusarium. **Register in USA.**
- **NipsIt INSIDE®** (clothianidin) is an insecticide that provides seed and seedling protection against: Black Bean Aphid; Cutworms; Flea Beetle; Springtail; Sugarbeet Leafminer, and Wireworm. **Register in USA.**
- **NipsIt SUITE®** Sugarbeets (Clothianidin + Metconazole, + Metalaxyl) combines three super-systemic active ingredients. Insects: sugarbeet root maggot, springtail and wireworm, and diseases: Rhizoctonia, Fusarium and Pythium. **Register in USA.**
- **Poncho® Beta** (clothianidin + beta-cyfluthrin) a systemic insecticide seed treatment designed to control a range of sugarbeet pests. Provides early season protection against cutworms (black), sugarbeet leaf hopper, sugarbeet root maggot, sugarbeet leafminers, springtails and wireworms. **Register in USA.**
- **Rizolex™** (tolclofos-methyl) is a seed fungicide for long-lasting and unrivaled protection against Rhizoctonia damping-off plus Fusarium and other soil-borne and seed-borne diseases. **Register in USA.**
- **Tachigaren®** (hymexazol) is a fungicide that is active for a few weeks after planting, depending on the rate applied to seed, soil moisture and temperature and microbial activity. It is the only registered fungicide that controls Aphanomyces and Pythium. Available in 20 or 45 grams. **Register in USA .**
- **Thiram** (tetramethylthiuram disulfide) is an industry standard with contact activity against multiple seedborne and soilborne fungi. Key pests that Thiram control are Decay-Seed, Damping off, and Blight-Seedling. **Register in USA and Canada.**

SEED SIZE TERMINOLOGY

Seed Number		Seed Size	Primed	Units per Box
ACH Seeds, Crystal Band (Teal Green)				
Mini Pellets	MP	8.0-10.0/64	Yes - Ulti-Gem	4
Regular Pellets	RM	9.5-11.5/64	Yes - Ulti-Gem	4
ELS/Pro 200		11.5-13.5/64	Yes - Ulti-Gem	4

Source: Andy Bernia, District Market Manager, Crystal Seed

Seed Number		Seed Size	Primed	Units per Box
BetaSeed (Blue)				
Pro50		8.0-10.0/64	Yes	4
Pro100		9.5-11.5/64	Yes	4
Pro200		11.5-13.0/64	Yes	4
Mini Pellets	MP	8.0-10.0/64	Yes	4
Regular Pellets	RM	9.5-11.5/64	Yes	4

Source: Rob Gerstenberger, Sales Manager, BetaSeed

SEED TREATMENT TERMINOLOGY

Seed Number	Seed Size	Primed	Units per Box
Syngenta-Hilleshög (Orange)			
Regular Pellets 4M	10-12/64	Yes	3
S1	8-11/64	Yes	6
S2	11-14/64	Yes	3
2M	8-10/64	Yes	5

Source: Dave Wishowski, Sale Agronomist, Hilleshög

Seed Number		Seed Size	Primed	Units per Box
Holly Seed, LLC - SEEDEX (Pink)				
Agracoat 2M	Mini Pellet	8.0-11.0/64	Yes XBEET	6
Regular Pellets 4M	Regular Pellet	9.5-11.5/64	Yes XBEET	4
Agracoat S 5M	Jumbo Pellet	11.5-13.0/64	Yes XBEET	3

Source: Ron Groskopf, Regional Sales Manager, Holly Seeds, LLC -SEEDEX

SEED AND SEED PLATES

There are multiple sizes of seed available. The amount of seed in each size varies from year to year. Check with your agriculturist each year for the sizes available and be sure you have the proper plates. **Do not plant seed with the wrong plate.**

To determine your seed spacing, refer to the following table and choose the expected emergence on your field. Remember, there are worse problems besides too many sugarbeets!

Determination of Proper Seed Spacing

Expected % Emergence	Sugarbeets/100 Ft. 180 Seed Spacing (Inches) Needed to Achieve	Sugarbeets/100 Ft. 150 Seed Spacing (Inches) Needed to Achieve
40	2.7	3.2
50	3.3	4.0
60	4.0	4.8
70	4.7	5.6
80	5.3	6.4

Note: *Normal emergence is approximately 60-70% in Michigan. Producers should strive for emergence of a minimum final stand of 175-225 beets per 100 feet in both narrow and wide rows. In 30 inch rows, 200 beets would be 35,000 plants per acre. And in 22 inch rows that would equate to 48,000 plants per acre.*

SUGARBEET ADVANCEMENT'S SEED SPACING CHART

Field Emergence Conditions	Poor emerging Variety	Average Emerging Variety	Excellent Emerging Variety
Ideal – Average 70 to 80% Emergence	4.5 Inches	4.75 Inches	5.0 Inches
Fair – Average 40 to 60% Emergence	3.5 Inches	4.0 Inches	4.2 Inches
Poor – Average 20 to 30% Emergence	3.0 Inches	3.0 Inches	3.0 Inches

The financial penalty for thin stands far outweigh any penalty for stands that are too thick.

PLANTER SEED PLATE SPECIFICATION

Planter Type	Medium (8-9 /64)	Large (9-10 /64)	X-Large (10-11 /64)	X-Large+ (11.5-13.5 /64)	GEM 50 (8-10 /64)	GEM 100 (9.5-11.5 /64)	Mini Pellet (8-10 /64)	Regular Pellet (9.5-11.5 /64)	ELS (11.5-13.5 /64)
JD Vacuum	**H 136445***	**H 136445*** A 51713	**A 51713*** H 136445	**A 51713*** A 43066	**H 136445*** A 51713	**A 51713*** H 136445 A 43066	**H 136445*** A 51713	**A 51713*** H 136445 A 43066	**A 43066***
(Vac)	(0.75-1")	(1-2")	(1.5-2")	(1.5-2")	(1.5-2")	(2-3")	(2")	(2-3")	(3-5")
Monose m	**4016***	**4016*** 4020 4025	**4020*** 4016 4025	**4025*** 4020	**4020*** 4016 4025	**4025*** 4020 3622	**4020*** 4016 4025	**4025*** 4020	**4025*** 3622
White	**NR**	**NR**	**NR**	**NR**	**85047**	**N 857155**	**85047**	**N 857155**	**N 856067**
Case IH	**80175*** 8020	**8020*** 8023	**8020*** 8023	**8020*** 8023	**80175*** 8020	**8020*** 8023	**80175*** 8020	**8020*** 8023	**8020*** 8030
(Vac)	--	--	--	--	(20-22")	(23-25")	(20-22")	(23-25")	(20-22")
Milton	**11 X 7 /64**	**12.5 X 7.5 /64**	**NR**	**NR**	**12 X 9 /64**	**14 X 11 /64**	**12 X 9 /64**	**14-11 /64**	**NR**
JD Plate	**Blue Plastic** B13304 (steel)	**Green Plastic** B13931 (steel)	**Brown Plastic**	**NR**	**Orange Plastic**	**Light Green Plastic**	**Orange Plastic**	**Light Green Plastic**	**NR**

***** Preferred Planter Plate For This Seed Size.

Additional Comments: John Deere Central Delivery Systems may require higher vacuum. Fine tune vacuum and/or singulator along with plate/ size combinations to each specific seed lot for maximum performance.

APPROXIMATE UNITS OF SUGARBEET SEED PER ACRE

	Row Width				
Seed Spacing	**20”**	**22”**	**24”**	**28”**	**30”**
3”	1.0	0.95	0.87	0.75	0.70
4”	0.78	0.71	0.65	0.56	0.52
5”	0.63	0.57	0.52	0.45	0.42
6”	0.52	0.48	0.44	0.37	0.35
Linear foot of row/A	**26,131**	**23,764**	**21,780**	**18,669**	**17,424**

PLANTER SPEED

Planter speeds of less than 4 M.P.H. will result in a more uniform depth of seed placement, so seedlings will emerge more evenly. Depth of planting will vary with soil types and moisture conditions. The 1” depth is generally the most satisfactory. When planting begins, seed depth should be checked on each unit. As disks wear, seed depth may be something different than originally desired. One unit is 100,000 seeds.

PLANT POPULATIONS

A poor stand of sugarbeets can reduce sucrose by as much as 2.5 percentage points. Many factors can affect your stand establishment including: variety, crusting, planting depth, seedling disease, insects and a host of other maladies. Research has shown that seedling emergence in Michigan is generally between 60-75%. The Research Education Advisory Council (REACh) recommends a final stand of 175-225 beets per 100 feet in both narrow and wide rows. In 30 inch rows, 200 beets would be 35,000 plants per acre. And in 22 inch rows that would equate to 48,000 plants per acre. Most growers in Michigan are targeting seed spacing at planting between 4 - 4.5 inches to achieve the desired plant population. Not all of the seed planted will make a sugarbeet due to germination problems, soil crusting, seedling disease, insects, herbicides and other factors may reduce the final sugarbeet stand. A producer needs to be realistic when predicting percent emergence expected with management practices on their farm.

SEEDS PLANTED AT VARIOUS ROW WIDTHS AND SEED SPACINGS

Seed per 100 feet of row	**Seed Spacing (inches)**	**Seeds planted per acre** 20” rows	22” rows	28” rows	30” rows
480	2.50	125,203	114,048	89,609	83,635
436	2.75	114,770	103,680	81,463	76,032
400	3.00	104,336	95,040	74,674	69,696
369	3.25	96,511	87,729	68,930	64,335
343	3.50	88,686	81,463	64,007	59,739
320	3.75	83,469	76,032	59,739	55,757
300	4.00	78,252	71,280	56,006	52,272
282	4.25	73,035	67,087	52,711	49,197
267	4.50	70,427	63,360	49,783	46,464
253	4.75	65,210	60,025	47,163	44,019
240	5.00	62,602	57,024	44,805	41,818
229	5.25	59,993	54,309	42,671	39,826
218	5.50	57,385	51,840	40,731	38,016
209	5.75	54,776	49,586	38,960	36,363
200	6.00	52,168	47,520	37,337	34,848
192	6.25	49,560	45,619	35,844	33,454
185	6.50	46,951	43,865	34,465	32,167
178	6.75	46,430	42,240	33,189	30,976
171	7.00	44,343	40,731	32,003	29,870

PLANTERS

Planters should be checked over very carefully for worn disk openers, fertilizer augers, sprockets, chains, etc. Seeding units are one of the most critical parts of the drill to maintain. Visually inspect hopper bottoms for wear, as the relation of plates to the bottoms should be snug and tight fitting; not warped.

Double check seed size to be sure the proper seed is being used with the plates. Plates with cell holes "out of round" should be discarded. Check cell hole size with a gauge or a twist drill of the proper size to determine if the cells are worn. Check brushes and cut offs to make sure they are aligned correctly.

Thickness of the plates is just as important as the cell hole size. Whenever thickness varies, one can expect poor planting results.

The seed knockout (star wheel) should be inspected for wear and replaced if necessary.

Sugarbeet seed is processed and graded to a fine tolerance and hoppers have to be maintained for accurate cell fill.

SPACE PLANTING

Various spacing can be obtained by using different combinations of gears on the drive wheel shaft, hopper bottom shaft or the jackshaft. The jackshaft reduces the turning speed of the plate in the hopper.

SPEED

As planting speeds increase, accuracy of seed spacing and depth are lost, due to bouncing of the seeding unit and seed bouncing in the furrow opening. To attain good spacing and uniform depth, speed of planting should match soil conditions and in no case exceed 4 mph.

DRILL MAINTENANCE CHECKLIST

- Check condition of hoppers, drives, and chains.
- Check seed cutoff points to see pawls or brushes fit seed plates properly to reduce the chance of double cell filling.
- Make sure plates fit properly and filler ring is installed.
- Be sure disc furrow openers are clean and turn freely.
- Be sure depth bands are clean and properly adjusted.
- Check seed drop tubes for restrictions or blockage.
- Be sure row spacing are correct, equal, and row markers adjusted.
- Lubricate the drill properly.
- Clean seed hoppers daily.
- Match seed sizes and planter plates carefully.
- Test the planter on a hard surface to check the seed distribution pattern.
- Check hinge point bushings.
- Seed firmers are generally not recommended.

THE COMPANY HAS A DRILL TEST STAND!
BRING YOUR SEED CANS TO THE
SCHEDULED TESTING

PESTSTICIDE APPLICATION AND SAFETY

Pesticides and fertilizers are used in modern agriculture to maximize efficient food production. When used wisely and safely, pesticides are beneficial; but improper use and misapplication can be hazardous to the applicator, harm our food supply, and adversely impact the environment. A good understanding of how pesticides performed and how to use them properly is mandatory for safe and efficient food production. **Remember**, Pesticide product labels are legal documents. This statement is found on all registered pesticide product labels in the United States: "It is a violation of Federal law to use this product in a manner inconsistent with its labeling." Violation of the pesticide label is subject to state, federal, and Michigan Sugar Company penalties. Therefore, check your pesticide program before planting and after sugarbeets emergence.

SAFETY AND CLEANING

Most sugarbeet pesticides have a low level of toxicity to humans and animals, but they contain solvents which can affect living tissue. Always treat them with respect and follow the label closely. Use and dispose of them wisely, because the user is liable for misuse or improper disposal.

Reduce the possibility of chemical contamination by having application equipment for use solely on the sugarbeet crop. Otherwise follow a thorough cleaning procedure before exchanging equipment.

Chemicals in solution (i.e. 2,4-D) cannot be completely removed from porous tanks, scale, hoses, sumps, pressure regulators, pumps and screens. Suspended chemicals (Accent or Atrazine) may not be as difficult to remove but traces may be present unless all parts (pump included) are washed with commercial tank cleaners. Use two quarts of household ammonia (let stand in sprayer overnight) for growth regulator herbicides such as 2,4-D, or 4 pounds of trisodium phosphate cleaner detergent and rinsed thoroughly with clean water.

EQUIPMENT STORAGE

When preparing to store your sprayer, add one to five gallons of lightweight oil like diesel fuel or kerosene (how much depends on the size of the tank) before the final flushing. As water is pumped from the sprayer, the oil leaves a protective coating on the inside of the tank, pump, and plumbing. To prevent corrosion, remove nozzle tips and screens and store them in a can of light oil. In addition, add a small amount of oil and rotate the sprayer pump four or five revolutions by hand to coat interior surfaces completely. Sprayer engines, whether air- or water-cooled, require additional servicing following a pesticide application. Follow the directions in the engine's owner's manual.

After thoroughly cleaning and draining the application equipment, store it in a dry, clean building, if possible. Replace worn-out, deteriorated, or broken parts.

CHECK-OFF LIST FOR PESTICIDE APPLICATION

1. Read the label–know the toxicity level of chemical in use.
2. Use adequate protective clothing - wash often and do not mix with household laundry.
3. Drain and wash all sections of spray system including pump and filter.
4. Calibrate sprayer.
5. Triple-rinse pesticide cans and put rinsate into tank–dispose of containers in proper fashion (note label instructions).
6. Store pesticides in original containers - never cross labels.
7. Store bulk (mixed herbicides) in proper drums for reuse or disposal.
8. Store sprayer system rinsate in proper disposal containers or apply on vacant land as per label guidelines.
9. Keep adequate field pesticide history records.
10. Enter pesticide applications in crop records.

MIXING INSTRUCTIONS

Herbicides should be added to the spray tank in the proper order to insure they stay in suspension, and spray uniformly.

Herbicides should be added in the following order after filling spray tank 3/4 full.

- AMS (water conditioners)
  - Generally, wettable powder (WP) and dry flowable (DF) or water-dispersible granule (WDG) products should be added first.
  - Followed by flowable (F, FL) and microencapsulated (ME) products.
  - Add emulsifiable concentrates (EC) next
  - Followed by any solution (S) or soluble powder (SP) products.
  - Any crop oils and/or surfactants should be added last.

Dry formulations should be preslurried (mixed with a little water) before adding them to the spray tank; this is also a good idea (even with ECs) if you are using liquid fertilizer as the carrier. Finally, continue adding your carrier to the desired level.

Some spray mixtures are difficult to keep in suspension. A compatibility agent may be used to insure spray uniformity.

Prepare only enough herbicide for the immediate day. Never leave spray in the tanks overnight; it may separate out or have an adverse effect on activity.

APPLICATOR CALIBRATION

Using the correct amount of chemical during pesticide application is crucial to achieving the best results from a pest control product. Most performance complaints involving pesticides, however, are directly related to dosage errors or improper application. Therefore, proper calibration, or adjustment, of the sprayer is essential to ensure it is applying the correct amount of chemical evenly over a given area.

Use the following table to determine gallons per acre applied and add the recommended amount of pesticide to achieve your goals. Most performance complaints involving pesticides, however, are directly related to dosage errors or improper application. Therefore, proper calibration, or adjustment, of the sprayer is essential to ensure it is applying the correct amount of chemical evenly over a given area. NOTE: **85%** of pesticide failure are due to poor calibrations, dirty or contaminated spray systems.

1. Select desired speed of travel (gear + rpm) and row width.
2. Clean all nozzles and screens - fill sprayer with water.
3. Run spray pump at same speed used when spraying.
4. Collect spray for one minute from one nozzle.
5. Determine gallons/ acre from chart at right.
6. If output is too low, raise pressure. If too high, lower pressure.
7. Recalibrate and adjust pressure for desired output.
8. Add chemicals - Fill tank - **SPRAY AT SPEED DECIDED ABOVE**.

Speed in MPH	Time Required in SECONDS to travel a distance of:		
	100 Feet	50 Feet	200 Feet
3.0	23	34	45
3.5	20	29	39
4.0	17	25	34
4.5	15	22	30
5.0	14	20	27

SELECTING NOZZLE - SCREENS

Selection of proper nozzles are very important. When applying pesticides in a band, it is important to use even spray tips which have uniform coverage across the spray pattern. When broadcast applying pesticides, it is important to match spray tips and set nozzle height so that the spray pattern overlaps by 30% on each edge. This ensures uniform coverage. Nozzles should be checked for volume and wear frequently and should be replaced if they vary + /– 10%

Using 50 mesh screens in line strainers and tip strainers will work well in most cases when applying pesticides in sugarbeets. A cleaning kit of water, brush or compressed air and disposable gloves should always be handy.

Formula To Determine Gallons Per Minute (GPM) = (Per Nozzle)

$$\frac{GPA \times MPH \times W}{5{,}940}$$

Formula To Determine Gallons Per Acre (GPA) =

$$\frac{GPM \times 5{,}940}{MPH \times W}$$

Gallons Per Minute = **GPM**; Gallons Per Acre = **GPA**; Miles Per Hour = **MPH**; Nozzle spacing in inches for broadcast spraying) = **W**

SPRAYER CALIBRATION CHART

Calibration of Sprayer: To calibrate your sprayer accurately and be certain you apply the recommended gallons, use a measuring cup marked in ounces and a watch with a second hand. Shown below are the fluid ounces per minute to receive from each nozzle in order to apply gallons of spray solution per acre:

Nozzle Spacing or Row Width	Miles Per Hour	Gallons Per Acre				
		5	7.5	10	12.5	15
		Fluid Ounces Per Minute/Nozzle				
20"	3	6.40	10.62	12.80	16.64	19.20
	4	8.96	12.80	16.64	21.76	25.60
	4.5	10.24	14.08	19.20	24.32	29.44
	5	10.88	16.64	21.76	26.88	32.00
22"	3	7.68	10.24	14.08	17.92	21.76
	4	8.96	14.08	19.20	24.32	28.16
	4.5	10.24	16.64	21.76	26.88	32.00
	5	11.52	17.92	24.32	29.44	35.84
28"	3	8.96	14.08	17.92	23.04	26.88
	4	11.52	17.92	24.32	30.72	35.84
	4.5	14.08	20.48	26.88	34.56	40.96
	5	15.36	23.04	30.72	37.12	44.80
30"	3	10.24	14.08	19.20	24.32	29.44
	4	12.80	19.20	25.60	32.00	38.40
	4.5	14.08	21.76	29.44	35.84	43.52
	5	16.64	24.32	32.00	40.96	48.64

7.5 to 12.5 gallon rates can be obtained from 10-gallon nozzles by adjusting pressure.

PESTICIDE ROTATION RESTRICTIONS

When selecting field locations for sugarbeets, check for potential pesticide carryover for at least four years prior to sugarbeets. This chart list popular pesticides with sugarbeet restrictions.

Trade Name	Months	Trade Name	Months
		Instigate	18
		IntRRo/Micro-Tech	10
Accent Q	10/18[a]	Laudis	18[e]
Afforia >2.5 – 3.75 oz	5/10	Lexar	18
Anthem	15	Lightning	40[b]
Anthem ATZ	18	Lumax	18
Armezon/Impact	18	Marksman	21
Atrazine 1 lb. a.i./A	21	Marvel	18
Atrazine 2 lb. a.i./A	33	Matrix	18
Authority Assist	40[b]	Metribuzin	18
Authority First/Sonic	30[b]	Milestone	12
Authority MTZ	24	Northstar	18
Authority XL	36	Op Till/Op Till Pro	40
Authority MAX	36	Osprey	10
		OutLook	10
AutumnSuper	18	Parallel/Parellel PCS	10
Balance Flexx	10/18	Peak	22
Beacon	18	Permit/Sandea	21
Bicep ll Magnum/Cinch ATZ/Parallel Plus	21	PowerFlex HL	9
		Prefix	18
Bicep Lite ll Magnum/ Cinch ATZ Lite	21	Princep	21
		Priority	21
Boundary		Prowl, Prowl H2O	12
Bullet/Lariat	21	Pursuit, Pursuit Plus	40[b]
Callisto/ Callisto GT/Callisto Extra	18	Python/Accolade	26[b]
Camix	18	Raptor	18
Canopy or Canopy EX	30	Reflex	18
Capreno	18	Realm Q	18
Celebrity Plus	10/18[a]	Require Q	10
Classic	30	Resolve	10/18
Command	9	Resolve Q	10/18
Corvus	17[g]	Scepter	26
Curtail	12	Sencor	18
Degree Xtra/Fultime NXT	15	Sharpen (2.5 oz)	6
Dual Magnum/Dual II	10	Shotgun	10
Envive	30	Sinbar	24
Eptam	10	Solstice	18
Equip	18	Sonalan	8/13
Expert	18	Spartan & Spartan Charge	30
Extreme	40[b]	Starane	10
Field Master	21	Steadfast Q	10/18[a]
Fierce	15	Steadfast ATZ	18
Fierce XLT	30	Stout	10/18[a]
Firstrate	30[b]		

Flexstar or Flexstar GT	18
ForeFront HL	24
Fultime	21
Gangster/Surveil	30[b]
Guardsman Max	21
Harness XTRA/Keystone NXT/ Keystone LA NXT/ Breakfree NXT ATZ/ Breakfree NXT Lite	15
Halex GT	18
Hornet WDG/Stanza	26[b]
Huskie	9
Impact	18
Inspire XT	8[f]
SureStart ll / Tripleflex ll	26[b]
Synchrony XP	30
Trifluralin	12
Trivence	30
Valor (>2-3 oz)	5/10
Valor XLT	30
Velpar	12
Yukon	21
Zemax	18
Zidua	15

a If the pH is less than 7.5 and 25 inches of rain falls between application and planting sugarbeets, 10 months. If pH or greater, 18 months.
b Requires the rotation interval and a successful field bioassay.
c The full rate is not recommended when rotating to sugarbeets. A rotation interval of two growing seasons is recommended for 50% or less of the full rate
d Land should also be plowed prior to planting.
e Rainfall must be 20" & tillage follow the crop. 18 months if things are not met.
f To avoid possible illegal residues, do not plant any other crop (cereals: wheat, barley, triticale, oats, rye) within 30 days; Corn, sweet corn - 60 days; sugarbeets and soybeans - 0 days.
g. When soil pH is 7.5 or above crop plant back should be delayed to the next interval, and to 24 months for crops listed on label in the 17 month interval, and 30" of cumulative precipitation from application to planting of rotational crop.

HERBICIDE CARRYOVER

Herbicides that can be used in crops prior to sugarbeets with low risk of carryover at normal rotation intervals. Since labels change year-to-year, please refer to label for updated information.

Aim	Osprey
Assure II/Targa	Outlook
Axial, Axial XL	Poast/Poast Plus
Banvel	Progress
Basagran	Puma
Basis	Pyramin
Buctril/Moxy	Rage D-Tech
Cadet	Resource
Clarity	Require Q
Cobra/Phoenix	Select/Arrow/Select Max
Command	Sharpen (1 oz./A)**
Distinct	Sharpen (2.5 oz./A)**
Dual Magnum	Stalwart/Stalwart C
Dual Magnum II	Starane
Eptam	Status
Express	Stinger
Fusilade DX	Ultra Blazer
Fusion	Upbeet
Glyphosate	Valor (≤ 2 oz./A)
Gramoxone Inteon	Valor (2-3 oz./A)
Harmony Extra/TNT Broadleaf	Verdict (5 oz./A)
Harmony /Unity	Verdict (≥ 10 oz./A)
Harness//Topnotch/ Degree	Vida
Huskie	Warrant
Liberty/Ignite/Rely	2,4-D Amine
Option	2, 4-D Ester

Weed Source: *2015 Weed Control Guide for Field Crops.* Michigan State University Bulletin E-434.

** Do not count frozen soil months towards rotation restrictions

Pesticides Off-Target/Off Label

If you suspect any pesticides carryover or off-target drift of pesticides, consult your agriculturist immediately. Remember, Pesticide product labels are legal documents. This statement is found on all registered pesticide product labels in the United States: "It is a violation of Federal law to use this product in a manner inconsistent with its labeling". Violation of the pesticide label is subject to state, federal, and Michigan Sugar Company penalties. Therefore, check your pesticide program before planting and after sugarbeets emergence.

WEED CONTROL

To produce a quality crop of sugarbeets, producers must achieve good weed control. The reduction and, in many cases, elimination of hand labor is now possible through timely and effective chemical weed control.

Every producer must correctly identify their weed species and set up a concentrated program to manage those species in all their crops. Therefore, weed control for sugarbeets starts in the crops prior to sugarbeets. Many weed species are difficult to control with sugarbeet herbicides. Sugarbeet herbicides are very effective when used **TIMELY** at the proper rates.

RESISTANCE WEED MANAGEMENT GUIDELINES

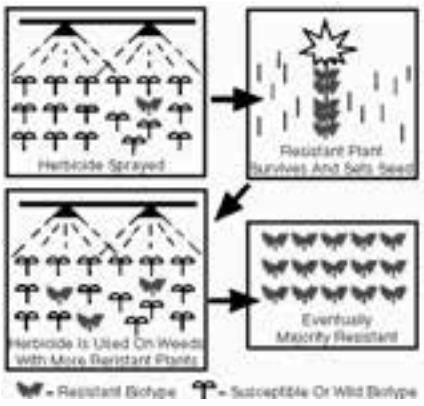
Know the site of action of the potential products to be applied. Note that many products are actually premixes and have multiple sites of action, so **READ** the label.

- Scout your fields before and after herbicide application.
- Start with a clean field, using either a burndown herbicide application or tillage.
- Control weeds early when they are small. **Note:** Follow the label for weed size.
- Rotate crops annually. Weed associations with crops vary because of differences in time of weed emergence relative to crop planting.
- When rotating crops, also **rotate** herbicide sites-of –action, especially with other crops (e.g. corn, wheat, soybeans, dry beans, etc.)
- **Do not** use the same site-of-action multiple times in one cropping season.
- Use **multiple** sites-of-action to target the most problematic weed within a field.
- Use cultural practices such as tillage and narrow row widths to reduce the number of annual herbicide applications.
- Clean equipment before moving from field to field to minimize spread of weed seed.

If a grower has or suspects a herbicide-resistant weed, it is imperative that seed production is prevented. Most weeds are prolific seed producers, with seed remaining viable for many years in the soil; hence, resistant weeds will be a problem in subsequent crops if allowed to produce seed. Weed seed can also be easily spread over an entire farm and onto neighboring farms, exacerbating weed management difficulties. Therefore, if weeds are thought to be resistant to a herbicide, use all means available to prevent seed production and spread of the resistant weed.

HOW DOES SELECTION FOR HERBICIDE RESISTANCE OCCUR

Selection for change in weed populations begins when a small number of plants (a biotype) within a weed species have a genetic makeup that enables them to survive a particular herbicide application. Where this difference in genetic makeup originated is not clear. However, herbicides are not known to directly cause the genetic change (i.e. mutation) that allows resistance. The resistant biotype, therefore, is present in low numbers in natural populations and when a herbicide is applied, most of the susceptible weeds die but the few resistant weeds survive, mature, and produce seed. If the same herbicide continues to be applied and the resistant weeds reproduce, the percentage of the weed population that is resistant will increase.



University of Minnesota Extension

It is difficult to predict exactly which weed species will have biotypes resistant to a given herbicide. However, we have learned from previous pesticide resistance problems that the occurrence of herbicide resistant weeds is linked directly to the herbicide program used, the weed species present, and the crop management practices employed.

HERBICIDE USE

Recommendations placed in this producer guide are suggested from research conducted by Michigan Sugar Company, Michigan State University, other universities and the USDA. These are general recommendations and should not be altered unless discussed with your Michigan Sugar Company agriculturist. Remember, Pesticide product labels are legal documents. This statement is found on all registered pesticide product labels in the United States: "It is a violation of Federal law to use this product in a manner inconsistent with its labeling".

Use only the herbicides recommended in this guide; they are registered and approved by the EPA and MDA. The use of a herbicide not registered for sugarbeets is illegal. Using a herbicide not registered, even if no residue is detected, will cause your crop to be condemned.

Generic herbicides may be available for some pesticides with the same active ingredients as the historical products. Contact your company agriculturist for information on these generic products.

HERBICIDE RAINFASTNESS, PREHARVEST INTERVAL & MAXIMUM USE RATES

Preemergence herbicides require rainfall after application for effective weed control. Herbicides applied to emerged weeds have time limitations before harvest which need to be taken into consideration before application.

Herbicide	Rainfree Period	Preharvest Interval	Maximum Rate Per Season	Storage Temperature
Assure II/ Targa	1 hour	45 days	25 fluid ounce	Store above freezing
Betamix Betanex	6 hours	75 days	12 pints (Betamix) 6 pints (Betanex)	If exposed to subzero temperature, product thickens, will return to original consistency when placed in room (over 50˚F) for several days
Glyphosate (many)	See Label	See Label	See Label	Store above freezing
Gramoxone	30 mins.	-	12 pts.	Store above 34˚F
Norton SC	6 hours	90 days	1 gal (4lbs. ai/A)	Store above freezing
Poast	1 hour	60 days	5 pints	Store above freezing and below 100˚F
Select Max	1 hour	40 days	32 fluid ounce	Store in cool, dry place
Stinger	6 hours	45 days	2/3 pints	Store above 28˚F or warm up to 40˚F and agitate before use
UpBeet	4 hours	60 days	2.5 fluid ounces	Store in cool, dry place

WEED RESPONSE TO HERBICIDES (BROADLEAVES)

CONTROL: **E**= Excellent **G**= Good F= Fair P= Poor N= None	**Redroot Pigweed**	**Com. Lambsquarter**	**Velvetleaf**	**Common Ragweed**	**Black nightshade**	**Common Cocklebur**	**Smartweed**	**Wild Buckweed**	**Wild Mustard**	**Kochia**
Preplant Incorporated										
RO-NEET	**G**	F	**G**	F	F	P	P	F	P	P
Preemergence										
Nortron	**G**	**G**	F	P	**G**	F	**G**	**G**	**G**	F
Postemergence‡										
Nortron	F	F	P	P	**G**	P	**G**	**G**	**G**	F
Betanex	**E**	F	P	F	F	F	F	P	**G**	F
Upbeet	F	P	**G**	F	F	F	F	**E**	F	P
Warrant**	**G**	F	P	**G**	P	P	P	P	P	P
Stinger	P	P	P	**E**	F	**E**	F	F	P	N
Progress*	**G**	**E**	P	**G**	**G**	F	**G**	**G**	**G**	F
Progress+UpBeet	**E**	**E**	**G**	**G**	**G**	F	**G**	**G**	**E**	F
Progress+Stinger	**E**	**E**	P	**E**	**G**	**E**	**G**	**G**	**G**	P
Progress+UpBeet+ Stinger	**E**	**E**	**G**	**E**	**E**	**E**	**G**	**E**	**E**	F
Betanex+UpBeet	**E**	**E**	**G**	**G**	F	F	**G**	**G**	**E**	F
Betanex+Stinger	**G**	**E**	P	**E**	F	**E**	**G**	**G**	**G**	F
Betanex+UpBeet+Stinger	**G**	**E**	**G**	**E**	**E**	**E**	**G**	**G**	**E**	F
Assure II	N	N	N	N	N	N	N	N	N	N
Poast	N	N	N	N	N	N	N	N	N	N
Select/Select Max/Arrow	N	N	N	N	N	N	N	N	N	N
Dual Magnum/Cinch**	**G**	P	N	P	F	N	P	N	P	P
Outlook**	**G**	P	N	P	**G**	N	P	N	P	P
Glyphosate***	**E**	**G**	**G**	**G**	**G**	**E**	**G**	**E**	**G**	**G**
Sequence***	**E**	**G**	**G**	**G**	**G**	**E**	**G**	**E**	**G**	**G**

* Progress is a premix of Progress, Betamix plus Norton. ** Will not control emerged weeds.
*** Use only on Glyphosate-resistant sugarbeet.
E = Excellent (90-99%), **G** = Good (80-90%), F = Fair (65-80%), P = Poor (40-65%), N = None

WEED RESPONSE TO HERBICIDES (GRASSES & PERENNIAL)

CONTROL: **E**= Excellent **G**= Good F= Fair P= Poor N= None	**Volunteer Corn**	**Barnyardgrass**	**Crabgrass**	**Giant Foxtail**	**Green Foxtail**	**Yellow Foxtail**	**Fall Panicum**	**Volunteer Cereal**	**Quackgrass**	**Yellow Nutsedge**	**Canada Thistle**	**P. Sowthistle**
Preplant Incorporated												
RO-NEET	**G**	**G**	**G**	**G**	**G**	**G**	**G**	**G**	F	**G**	N	N
Preemergence												
Nortron	P	P	F	F	F	F	P	P	N	P	N	N
Postemergence‡												
Nortron	P	P	P	F	F	F	P	P	N	N	N	N
Betanex	P	P	P	P	P	P	P	P	N	N	N	N
Upbeet	P	P	P	P	P	P	P	N	N	N	P	N
Warrant**	N	**E**	**E**	**E**	**E**	**E**	**E**	N	N	P	N	N
Stinger	N	N	N	N	N	N	N	N	N	N	**G^**	**G^**
Progress*	P	P	P	F	F	F	P	P	N	N	N	N
Progress+UpBeet	P	P	P	**G**	F	F	P	N	N	P	P	P
Progress+Stinger	P	P	P	F	F	F	P	P	N	N	F	F
Progress+UpBeet+ Stinger	P	P	P	**G**	F	F	P	N	N	P	F	F
Betanex+UpBeet	P	P	P	**G**	F	F	P	N	N	P	P	P
Betanex+Stinger	P	P	P	F	F	F	P	P	N	N	F	F
Betanex+UpBeet+Stinger	P	P	P	**G**	F	F	P	N	N	P	F	F
Assure II	**E**	**G**	**G**	**E**	**E**	**E**	**E**	**E**	E	N	N	N
Poast	**E**	**E**	**G**	**E**	**E**	**E**	**E**	F	F^	N	N	N
Select	**E**	**E**	**G**	**E**	**E**	**E**	**E**	**G**	**G^**	N	N	N
Dual Magnum**	N	**E**	**E**	**E**	**E**	**E**	**E**	-	N	F	N	N
Outlook**	N	**E**	**E**	**E**	**E**	**E**	**E**	-	N	F	N	N
Glyphosate***	**G§**	**E**	**E**	**E**	**E**	**E**	**E**	**E**	**G**	F	**G**	**G**
Sequence***	**G§**	**E**	**E**	**E**	**E**	**E**	**E**	**E**	**G**	F	**G**	**G**

‡ Timely split postemergence herbicide application with reduced rates increase weed control and decrease sugarbeet injury.

^ One season control only

§ Non-Roundup ready corn only

SUGARBEET CONTROL IN CORN AND SOYBEANS

With Roundup Ready sugarbeets being deregulated in mid-2012, growers should continue to control sugarbeets in soybeans and corn fields for good farm management practices and destroy any sugarbeet bolters. Refer to the tables below. For other crops, contact your agriculturist.

Herbicides Used in Soybean to Control Sugarbeets

Herbicide	Rate/A	Rating	REI (hours)	Rainfree (hours)	Comments
Raptor	4 oz.	**G**	4	1	Will not control sugarbeets above the 10-leaf stage
Harmony SG	0.12 oz.	F	4	1	Will not control sugarbeets above the 10-leaf stage

Herbicides Used in Corn to Control Sugarbeets

Herbicide	Rate/A	Rating	REI (hours)	Rainfree (hours)	Comments
2, 4-D Amine	1 pt.	**G**	48	6-8	Will not control sugarbeets above the 10-leaf stage —— Corn: up to 8" tall. 8" to tasseling (use only directed spray)
2,4-D Ester	0.5 pt.	**G**	12	1	Will not control sugarbeets above the 10-leaf stage —— Corn: 4-18" tall. Corn over 8" tall use drop nozzles.
Banvel / Clarity	0.5 pt.	**G**	24	Not Listed on Label	Will not control sugarbeets above the 10-leaf stage —— From spike to 36 inches tall corn or 15 days before tassel emergence

TANK MIXING WITH OTHER PESTICIDES

Research has shown that tank mixing in combinations of two or all three types of pesticides which includes: insecticides, fungicides and herbicides has no antagonism affect with spray performance. However, **read** the label for more details. However, there is an antagonism with mixing Roundup (Glyphosate) with manganese sulfate. To help performance issues with this, add one qt. to the recommended amount of Roundup when using manganese sulfate for manganese deficiencies. For best results, apply glyphosate and the fertilizers separately or use a full-chelated form of the fertilizer, and always include ammonium sulfate (17 lb/100 gal).

COMMON AND SCIENTIFIC NAMES OF WEEDS

Common Name	Computer Code	Weeds Abbrev.	Scientific Name
amaranth, powell	AMAPO	AMAPO	*Amaranthus powelli*
barnyard grass	ECHCG	BYGR	*Echinochloa crus-galli*
Canada thistle	CIRAR	CTHIS	*Cirsium arvense*
common cocklebur	XANST	COBUR	*Xanthium strumarium*
common lambsquarters	CHEAL	CLAMB	*Chenopodium album*
crabgrass, large	DIGSA	CRAB	*Digitaria sanguinalis*
crabgrass, smooth	DIGIS	CRAB	*Digitaria ischaemum*
Eastern black nightshade	SOLPT	EBNSH	*Solanum ptycanthum*
fall panicum	PANDI	FAPA	*Panicum dichotomiflorum*
foxtail, giant	SETFA	GIFOX	*Setaria feberii*
foxtail, green	SETVI	GRFOX	*Setaria viridus*
foxtail, yellow	SETLU	YEFOX	*Setaria glauca*
Jerusalem artichoke		JART	*Helianthus tuberosus*
jimsonweed	DATST	JIMWD	*Datura stramonium*
kochia	KCHSE	KCHSE	*Kochia scoparia*
perennial sowthistle	SONAR	PSOW	*Sonchus arvensis*
pigweed, redroot	AMARE	RRPIG	*Amaranthus retroflexusi*
quackgrass	AGRRE	QUACK	*Elytrigia repens*
ragweed, common	AMBEL	RAGWD	*Ambrosia artemisiifolia*
ragweed, giant	AMBTR	RAGWD	*Ambrosia trifida*
smartweed, ladysthumb	POLPE	SMRT	*Polygonum persicaria*
smartweed, Pennsylvania	POLPY	SMRT	*Polygonum pensylvanicum*
velvetleaf	ABUTH	VELF	*Abutilon theophrasti*
volunteer barley	HORVX	VCERL	*Hordeum vulgare*
volunteer oats	AVESA	VCERL	*Avena sativa*
volunteer rye	SECCE	VCERL	*Secale cereale*
volunteer wheat	TRZAX	VCERL	*Triticum aestivum*
volunteer corn	ZEAMX	VCORN	*Zea mays*
wild buckwheat	POLCO	WIBW	*Polygonum convolvulus*
wild mustard	BRSSU	MUST	*Brassica kaber*
yellow nutsedge	CYPES	YNS	*Cyperus esculentus*

PRE-PLANT HERBICIDE INCORPORATION

Preplant incorporated herbicides are incorporated into the soil prior to planting. Incorporation of some herbicides are necessary to prevent surface-loss from volatility or photodecomposition. Other herbicides are incorporated to reduce the dependence upon rainfall required to more herbicide into the zone of weed seed germination. Incorporation also provides the herbicide placement required for control of some weeds, especially perennials.

Advantages:

- Reduced dependence upon rainfall to position herbicides in the soil.
- Overall more reliable weed control than pre-emergence applications.
- More effective control of some perennial weeds than with pre-emergence applications.
- Herbicide may be applied with or impregnated on dry fertilizer or in liquid fertilizers.

Disadvantages:

- Incorporation represents added cost in herbicide application.
- Incorporation can result in soil compaction and crusting.
- Weed control can be reduced if herbicide is diluted by incorporation that is too deep.
- Streaking of herbicide due to improper incorporation can result in erratic weed control.
- Planting operations can be slowed due to the time required for herbicide application and incorporation.
- Herbicides cannot be incorporated in some reduce tillage situations

It is often difficult to incorporate sugarbeet herbicides in Michigan, due to wet soil conditions early in the spring. Delaying planting of sugarbeets until soil is fit for incorporation, may reduce yield and quality.

Soil-applied herbicides can be applied pre-plant (or early pre-plant), pre-plant incorporated, or pre-emergence to the crop. Activity of these herbicides is affected by soil texture, organic matter content, pH, moisture, and tillage. Most soil-applied herbicides are more available for plant uptake in coarse-textured, low organic matter soils than in fine-textured, high organic matter soils. Many herbicide labels specify application rates based on soil texture and organic matter content. Herbicides are more likely to injure crops in sandy soils low in organic matter, and careful herbicide rate selection is required to avoid injury. Some herbicides are not labeled for use in sandy soils low in organic matter.

Pre-plant herbicides must be properly incorporated, with correct rate, proper depth, no overlap or skips, to achieve satisfactory weed control and no sugarbeet injury. Incorporation should be done “immediately” to prevent loss of the herbicide. Many producers find pulling a tillage tool at 5-6 mph works the best. Norton may be impregnated on dry bulk fertilizer.

BANDING PREEMERGENCE HERBICIDES

The proper herbicide rate must be used to gain effective weed control with minimal sugarbeet injury. Spray calibration, correct band width, proper ground speed, spray pressure and agitation are all necessary for good results. The pump must be large enough for adequate agitation, and develop enough pressure for a good suspension of water and chemical.

A preemergence herbicide treatment will make postemergence herbicide spray applications of herbicides more effective. Always read and follow label directions. Avoid direct contact with any chemicals. Wear protective clothing and launder contaminated clothing separately. Wash hands and face thoroughly before smoking or eating.

POSTEMERGENCE HERBICIDE APPLICATION

Having a timely postemergence herbicide program is a must for labor-free or minimum hand labor sugarbeet production. Consider weed size and sugarbeet stage when determining the time of postemergence herbicide applications. Postemergence herbicides and rates recommended are for small weeds.

When applying standard (traditional) postemergence herbicides to sugarbeets, a few precautions should be considered. First, spray in late afternoon or early evening when temperatures are less than 75˚F. Second, increased crop injury can occur when plants are under stress, such as temperatures above 85˚F or rapid climate changes from cool, overcast days to hot, sunny days. Third, no crop oil concentrate and/or reduced rates of herbicides are suggested under high temperatures and humidity conditions. **SPRAY DRY BEETS.**

SPLIT APPLICATION OF POSTEMERGENCE HERBICIDES

Split application of postemergence herbicides is a common practice with many growers. This practice provides more effective weed control than a single application. Generally, less sugarbeet stunting and injury occurs with the split application. For producer success, timeliness is the key factor; weeds need to be sprayed the first time when they are very small or in the cotyledon growth stage. The second split (spray) should follow approximately seven days later or when new weeds emerge. Research at Michigan State University indicates that split applications can be timed using Growing Degree Days (GDD) contact your agriculturalist for additional information.

Many combinations of herbicides can be split applied for successful weed control. If you have any questions about split applications of postemergence herbicides, contact your agriculturalist. They can assist you in which treatments and rates will give you the most effective and economical weed control.

Poison Control Center

U.S. (anywhere)
1-800-222-1222

Poison centers provide poison expertise and treatment advice by phone. Poison centers are staffed by pharmacists, physicians, nurses and poison information providers who are toxicology specialists. Have pesticide label available when calling.

PREPLANT INCORPORATED HERBICIDES - RATES AND COMMENTS

WEED CONTROLED	TREATMENT	Brdcst/A	REMARKS AND LIMITIATIONS
Annual Grasses	Ro-NEET (*cycloate*)	2 qts	• **DO NOT** apply Nortron preemergence. • Injury can occur when Betamix, Betanex, or Progress is applied at standard rates prior to 6-leaf sugar beets if Ro-Neet was applied. • The risk of injury is reduced if Betamix, Betanex, or Progress is applied at micro- or split-application rates. • Ro-Neet can be applied preplant incorporated prior to postemergence glyphosate applications in glyphosate-resistant sugarbeet. • Ro-Neet provides good velvetleaf suppression. • Refer to label.

PREEMERGENCE HERBICIDES - RATES AND COMMENTS

WEED CONTROLED	TREATMENT	Brdcst/A	REMARKS AND LIMITIATIONS
Annual Broadleaves	Nortron *(ethofumesate*)	3 pt	• Nortron will provide some suppression of annual grasses. • Increase Nortron rate to 4 pt/A on clay soils if weed pressure is heavy. • Nortron can be applied preemergence prior to postemergence glyphosate applications in glyphosate-resistant sugarbeet. • The rotation interval is reduced to 6 months if less than 12 oz/A is applied. • Refer to label.

EARLY POSTEMERGENCE HERBICIDES - RATES AND COMMENTS

WEED CONTROLED	TREATMENT	Brdcst/A	REMARKS AND LIMITIATIONS
Annual Broadleaves	Betanex *(desmedipham phenmedipham)* + UpBeet *(Triflusulfuron methyl)* **FOLLOWED BY** Betamix *(desmedipham phenmedipham)* + UpBeet *(Triflusulfuron methyl)* + Stinger *(clopyralid)*	3 pt + 0.50 oz 3 pt + 0.50 oz + 0.25 pt	• Split low rates of Betamix + UpBeet followed by Betamix + UpBeet + Stinger may be applied to sugar beets at early growth stages (less than the 4- true-leaf stage) to control weed seedlings at the cotyledon stage. Weeds not completely controlled by the first treatment will be checked and controlled by the second application. • The second application MUST BE MADE AT LEAST 7 days but not more than 10 days AFTER the first application. • Growing degree-day recommendations for split low-rate applications: 400 GDD prior to the first application and 350 to 400 GDD prior to the second application. • The rate of Betamix in the second application can be increased to 4.6 pt/A. • Adding Stinger to the second application will control cocklebur and common and giant ragweed and improve lambsquarters control. • Add surfactant at 0.25% v/v to THE SECOND APPLICATION ONLY. • DISPERSE UpBeet thoroughly in the tank before adding other herbicides. • Rainfall within 6 hours of application may reduce control. • If Stinger is added, DO NOT plant dry beans for 18 months if organic matter is less than 2%.

EARLY POSTEMERGENCE HERBICIDES - RATES AND COMMENTS *(CONTINUED)*

WEED CONTROLED	TREATMENT	Brdcst/A	REMARKS AND LIMITIATIONS
Annual Broadleaves	Progress *(desmedipham + phenmedipham + ethofumesate)* + UpBeet *(triflusulfuron methyl)* **FOLLOWED BY** Progress *(desmedipham + phenmedipham + ethofumesate)* + UpBeet *(triflusulfuron methyl)* + Stinger *(clopyralid)*	1.13 pt + 0.50 oz 1.5 pt + 0.50 oz + 0.25 pt	• **DISPERSE** UpBeet thoroughly in the tank before adding other herbicides. • Split (low-rate) applications of Progress plus UpBeet followed by Progress plus UpBeet plus Stinger may be applied to sugar beets at early growth stages (cotyledon to 4-true-leaf stage) to control weed seedlings at the cotyledon stage. • The second application MUST BE MADE AT LEAST 7 days but not more than 10 days AFTER the first application. • Growing degree-day recommendations for split low-rate applications: 400 GDD prior to the first application, and 350 to 400 GDD prior to the second application. • The rate of Progress in the second application can be increased to 2 pt/A if sugar beets are at 2-leaf pairs or larger. • Adding UpBeet to Progress results in velvetleaf control and provides more consistent control of pigweed, mustard, smartweed and wild buckwheat. • Stinger added to the second application controls cocklebur and common and giant ragweed. • **DO NOT** tank mix Progress split-rates with Quadris. • Rainfall within 6 hours of application may reduce control. • If Stinger is added, DO NOT plant dry beans for 18 months if organic matter is less than 2%.

Purchase only those pesticide products labeled for 1) the crop you wish to use it on and 2) the pest you wish to manage on that crop. Remember, the pesticide label is the legal document on pesticide use. The label must be read carefully and all instructions and limitations followed closely. The use of a pesticide in a manner not consistent with the label can lead to the injury of crops, humans, animals and the environment, and also lead to civil fines and/or condemnation of the crop. Pesticides are management tools for the control of pests in crops but only when they are used in an effective, economical and environmentally sound manner.

POSTEMERGENCE HERBICIDES - RATES AND COMMENTS

WEED CONTROLED	TREATMENT	Brdcst/A	REMARKS AND LIMITIATIONS
Annual Grasses	Dual Magnum *(s-metolachlor)* **OR** Dual II Magnum, Cinch *(s-metolachlor)*	1.33 pt **OR** 1.33 pt	• S-metolachlor should be applied to sugarbeets after they have 2 true leaves. • Sugarbeets MUST HAVE 2-fully expanded true leaves before application; applications prior to this stage will result in significant crop injury and possible stand reduction. • Crop safety is greater when s-metolachlor applications are made after beets reach the 4-leaf stage. • S-metolachlor may be tank mixed with micro-rate or standard-split herbicide applications, or with glyphosate for residual weed control in glyphosate-resistant sugarbeets. • S-metolachlor will not control emerged weeds, but will provide residual control of annual grasses and some broadleaf weeds. • MSU does not recommend preplant incorporated or premergence applications of s-metolachlor…..severe stand reductions can occur. • More than one postemergence application can be made, but the total should not exceed 2.6 pt/A.
Annual Grasses	Outlook *(dimethenamid-P)*	16 oz	• Sugarbeets **MUST HAVE** 2-fully expanded true leaves before application; applications prior to this stage will result in significant crop injury and possible stand reduction. • Crop safety is greater when Outlook applications are made after beets reach the 4 -leaf stage. • Apply Outlook before sugarbeets exceed the 8-leaf stage. • Outlook may be tank mixed with micro-rate or standard-split herbicide applications, or with glyphosate for residual weed control in glyphosate-resistant sugarbeets. • Outlook will not control emerged weeds, but will provide residual control of annual grasses and some broadleaf weeds. • More than one application of Outlook can be made; maintain a minimum of 14 days between applications, and the total should not exceed 21 oz/A.

POSTEMERGENCE HERBICIDES - RATES AND COMMENTS *(CONTINED)*

WEED CONTROLED	TREATMENT	Brdcst/A	REMARKS AND LIMITIATIONS
Velvetleaf	Upbeet *(triflusulfuron methyl)* + surfactant	0.50 oz + (0.25%) **AND REPEAT**	• DISPERSE UpBeet thoroughly in the tank before adding AND surfactant. • **A MINIMUM OF TWO APPLICATIONS ARE NEEDED FOR VELVETLEAF CONTROL.** • Apply to velvetleaf at the 1-true-leaf stage. **REPEAT** application 7-10 days later. • Add 2 qt/A 28% liquid nitrogen or 2.5 lb ammonium sulfate in addition to surfactant if velvetleaf plants have 1 to 2 true leaves and beets are at 2-leaf-pair stage. • A third application of 0.5 oz/A of UpBeet + surfactant can be made. • The maximum amount of UpBeet that can be applied in 1 year is 2.5 oz/A. • UpBeet can be tank mixed with Betamix, Progress or glyphosate. • Rainfall within 6 hours of application may reduce control. • Allow at least 60 days between UpBeet application and sugarbeet harvest.
Cocklebur Ragweeds Jimsonweed Volunteer alfalfa Sweet clover Canada thistle Perennial sowthistle	Stinger *(clopyralid)* + COC	0.25-0.50 pt + (1%)	• **DO NOT** use on sands, loamy sands, or permeable soils where water tables are shallow because of potential groundwater contamination. • Apply 0.25 pt/A to control cocklebur, giant ragweed, Canada thistle jimsonweed, volunteer alfalfa and sweet clover up to the Perennial sowthistle 6-leaf stage and common ragweed up to the 5-leaf stage. • Smartweed, wild buckwheat, and nightshade up to the 3-leaf stage will be suppressed at 0.25 pt/A. • Tank mix with other postemergence herbicides to control other annual broadleaf weeds. • After sugarbeets have reached the third leaf pair, apply 0.33 pt/A to Canada thistle (just prior to flowering) for control. Increase the rate to 0.5 pt/A under drought conditions. DO NOT include crop oil concentrate if 0.5 pt/A is tank mixed with Betamix or Progress. • After sugarbeets have reached the third leaf pair, apply 0.5 pt/A for perennial sowthistle control. Increase the rate to 0.67 pt/A under drought conditions. DO NOT tank mix with other herbicides for perennial thistle control. • **DO NOT** apply within 45 days of beet harvest. • **DO NOT** plant dry beans for 18 months if soil organic matter is less than 2%.

POSTEMERGENCE HERBICIDES - RATES AND COMMENTS *(CONTINED)*

WEED CONTROLED	TREATMENT	Brdcst/A	REMARKS AND LIMITIATIONS
Annual Grasses Volunteer Corn Cereals Quackgrass	Assure II/Targa *(quizalofop- P-methyl)* + COC + ammonium sulfate	5-10 oz + 1% + 2.5 lb	• Apply 7 oz/A to actively growing annual grasses up to 4 inches tall; 8 oz/A is required for barnyardgrass and crabgrass control. • Apply 5 oz/A for control of volunteer corn up to 18 inches tall. • Apply 8 oz/A to control spring-seeded cereals up to 4 inches tall. • Apply 10 oz/A to control fall-seeded cereals. • Make an application of 10 oz/A to 6- to 8-inch-tall quackgrass. A second application of 7 oz/A may be required 14-21 days later. • Surfactant may be used instead of crop oil concentrate. • Ammonium sulfate is not required for all Assure II/Targa applications. • Grass control may be reduced if Assure II/Targa is tank mixed with Betamix, Progress, or UpBeet. Apply 5 days later. • **DO NOT** include ammonium sulfate with Betamix, Progress, UpBeet, or Stinger tank mixes. • **DO NOT** apply within 45 days of beet harvest.
Annual Grasses Volunteer Corn Cereals Quackgrass	Fusilade DX *(fluazifop-P-butyl)* + *COC*	12 oz + 1%	• Apply 6 oz/A of Fusilade DX to control volunteer corn. • Apply 8 oz/A to control spring seeded cereals up to 6 inches tall. • Two applications 7-14 days apart are usually needed for control of perennial grasses. • **DO NOT** apply more than 48 oz/A of Fusilade DX per season. • **DO NOT** apply within 90 days of sugarbeet harvest.

POSTEMERGENCE HERBICIDES - RATES AND COMMENTS *(CONTINED)*

WEED CONTROLED	TREATMENT	Brdcst/A	REMARKS AND LIMITIATIONS
Annual Grasses Volunteer Corn Cereals Quackgrass	Poast *(sethoxydim)* + COC + ammonium sulfate	1-1.5 pt + 1% + 2.5 lb	• Poast is not as effective as the other postemergence grass. • For foxtails, barnyardgrass, and fall panicum 8 inches or less and crabgrass 4 inches or less, apply 1 pt/A. The rate can be reduced to 0.75 pt/A if grasses are 1-4 inches tall. • Apply 1 pt/A for control of volunteer corn up to 20 inches tall. • Apply 1.5 pt/A to cereals prior to tillering (less than 4 inches tall). • Make an application of 1.5 pt/A to 6- to 8-inch-tall quackgrass. • A second application of 1 pt/A may be required 14-21 days later. • Grass control may be reduced if Poast is tank mixed with Betamix, Progress or UpBeet. Apply 5 days later. • **DO NOT** include ammonium sulfate with Betamix, Progress, UpBeet or Stinger tank mixes. • **DO NOT** apply within 60 days of beet harvest.
Annual Grasses Volunteer Corn Cereals Quackgrass	Select/Arrow *(clethodim)* + COC + ammonium sulfate	6-16 oz + 1% + 2.5 lb	• For foxtails, barnyardgrass, and fall panicum 8 inches or less and crabgrass 4 inches or less, apply 6 oz/A. The rate can be reduced to 4-5 oz/A if grasses are 1-4 inches tall. • Apply 6 oz/A for control of volunteer corn up to 18 inches tall. The rate can be reduced to 4 oz/A if corn is 4-12 inches tall. • Oats can be controlled with 8 oz/A. • Spring-seeded cereals are labeled for control at 8 oz/A. However, 16 oz/A will provide more consistent control. • Apply 16 oz/A to control fall-seeded cereals. Cereals should not exceed 6 inches tall. • Two applications of 8 oz/A, 14-21 days apart, are generally needed for quackgrass control. • Grass control may be reduced if Select/Arrow is tank mixed with Betamix, Progress or UpBeet. Apply 5 days later. • Select/Arrow at 2 oz/A can be added to each micro-rate application for annual grass control. • **DO NOT** include ammonium sulfate with Betamix, Progress, UpBeet or Stinger tank mixes. • **DO NOT** apply within 40 days of beet harvest.

POSTEMERGENCE HERBICIDES - RATES AND COMMENTS *(CONTINED)*

WEED CONTROLED	TREATMENT	Brdcst/A	REMARKS AND LIMITIATIONS
Annual Grasses Volunteer Corn Cereals Quackgrass	Select Max *(clethodim)* + surfactant + ammonium sulfate	6-16 oz + 0.25% + 2.5 lb	• For foxtails, barnyardgrass, and fall panicum 8 inches or less and crabgrass 4" or less, apply 9 oz/A. The rate can be reduced to 6 oz/A if grasses are 1-4" tall. • Apply 6 oz/A for volunteer corn control and oats can be controlled with 12 oz/A. • Apply 24 oz/A to for control of cereals. Cereals should not exceed 6" tall. • Two applications of 12 oz/A 14-21 days apart are generally needed for quackgrass control. • Grass control may be reduced if Select Max is tank mixed with Betamix, Progress or UpBeet. Apply 5 days later. • **DO NOT** include ammonium sulfate with Betamix, Progress, UpBeet or Stinger tank mixes. • **DO NOT** apply within 40 days of beet harvest.
Annual Grasses Annual Broadleaves Suppression of Perennials	Glyphosate + Sequence *(s-metolachlor)* + Ammonium sulfate	2.5 pt + 17lbs/100 gal	• APPLY TO GLYPHOSATE-RESISTANT SUGAR BEET ONLY. • Apply to sugar beet from the 2-true leaf stage to canopy closure. • **DO NOT** apply within 60 days of beet harvest. • Sequence is designed to control existing weeds and provide residual control of grasses and some small-seeded broadleaf weeds, including pigweeds and nightshade. • On fine and medium textured soils, Sequence can be applied at 3 pt/A prior to 8-true leaf sugar beet. • Sequence at 2.5 pt/A contains 22 fl oz/A of Touchdown Total (0.7 lb a.e./A of glyphosate) and 0.98 pt/A of Dual Magnum. • **DO NOT** exceed total maximum glyphosate use rate restrictions for glyphosate-resistant sugar beet when using Sequence. • **DO NOT** apply more than 7 pt/A of Sequence per season.

POSTEMERGENCE HERBICIDES - RATES AND COMMENTS *(CONTINED)*

WEED CONTROLED	TREATMENT	Brdcst/A	REMARKS AND LIMITIATIONS
Annual Grasses Annual Broadleaves Suppression of Perennials	Glyphosate + Ammonium sulfate	22-32 oz + 17lbs/100 gal	• APPLY TO GLYPHOSATE-RESISTANT SUGAR BEETS • Glyphosate should be applied at a minimum rate of 0.75 lb a.e./A (22 oz of a 4.5 lb a.e./gal glyphosate. • Always add ammonium sulfate (17 lb/100 gal) to maximize glyphosate performance and reduce antagonism from hard water. • The first glyphosate application should be made before annual weeds exceed 2 inches tall. Subsequent applications should be made before additional weed flushes are 4 inches tall to maximize weed control and sugarbeet yield. • Two to four applications of glyphosate will be needed for season-long weed control and to maximize sugar beet yield. • Maximum in crop glyphosate applications include two applications prior to 8-leaf sugar beets totaling 1.9 lb a.e./A (56 oz/A) and two applications after the 8-leaf stage until 30 days prior to harvest totaling 1.5 lb a.e./A (44 oz/A). • Increase the glyphosate rate up to 1.1 lb a.e./A (32 oz/A) to control hard-to-control weeds. This rate can only be used prior to 8-leaf sugarbeets. • Stinger at 2 to 4 oz/A should be tank-mixed with glyphosate to control **VOLUNTEER GLYPHOSATE-RESISTANT SOYBEAN**. • The addition of micronutrient fertilizers (e.g., manganese) to glyphosate can cause a reduction in weed control. For best results, apply glyphosate and the fertilizers separately or use a full-chelated form of the fertilizer, and always include ammonium sulfate (17 lb/100 gal). • Continuous use of the same herbicide can lead to the development of herbicide-resistant weeds. Keep this in mind when planning weed management strategies for the full crop rotation.

Information taken from MSU, 2015 Weed Control Guide to Field Crops.

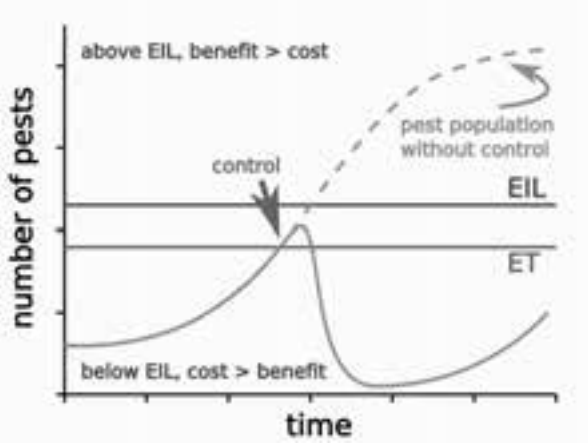
INTEGRATED PEST MANAGEMENT

Integrated Pest Management (IPM) is a multidisciplinary approach to solving pest problems. It involves chemical, cultural, biological, and mechanical methods to manage pests below economic thresholds. A sound understanding of host biology, environmental effects on hosts and pests, and benefits and costs of control alternatives form important components of IPM.

ECONOMIC INJURY LEVELS AND ECONOMIC THRESHOLDS

The general definition of the Economic Injury Levels (EIL) is that point when economic damage that occurs from insect injury equals the cost of managing that insect population. In a word, it is the breakeven point. Damage that occurs below that point is not worth the cost of preventing it; the cost of the insecticide application would be greater than the damage you would be preventing.

The resultant EIL is the point where we do not want insect populations to reach, that is, where economic damage or economic losses will begin. Because we do not want that level of insects or injury to be reached, we use a point that is set well below the EIL where we want to take action, usually meaning where we want to apply an insecticide. This "take action" level is known as the economic threshold (ET), sometimes referred to as the action threshold, AT. The ET is that point where growers should take action to prevent the EIL from being reached; it is NOT the point where economic losses will begin to occur. Although we often talk about the EIL for many pest situations, the levels that we usually present to growers are actually ETs.



FIELD SCOUTING

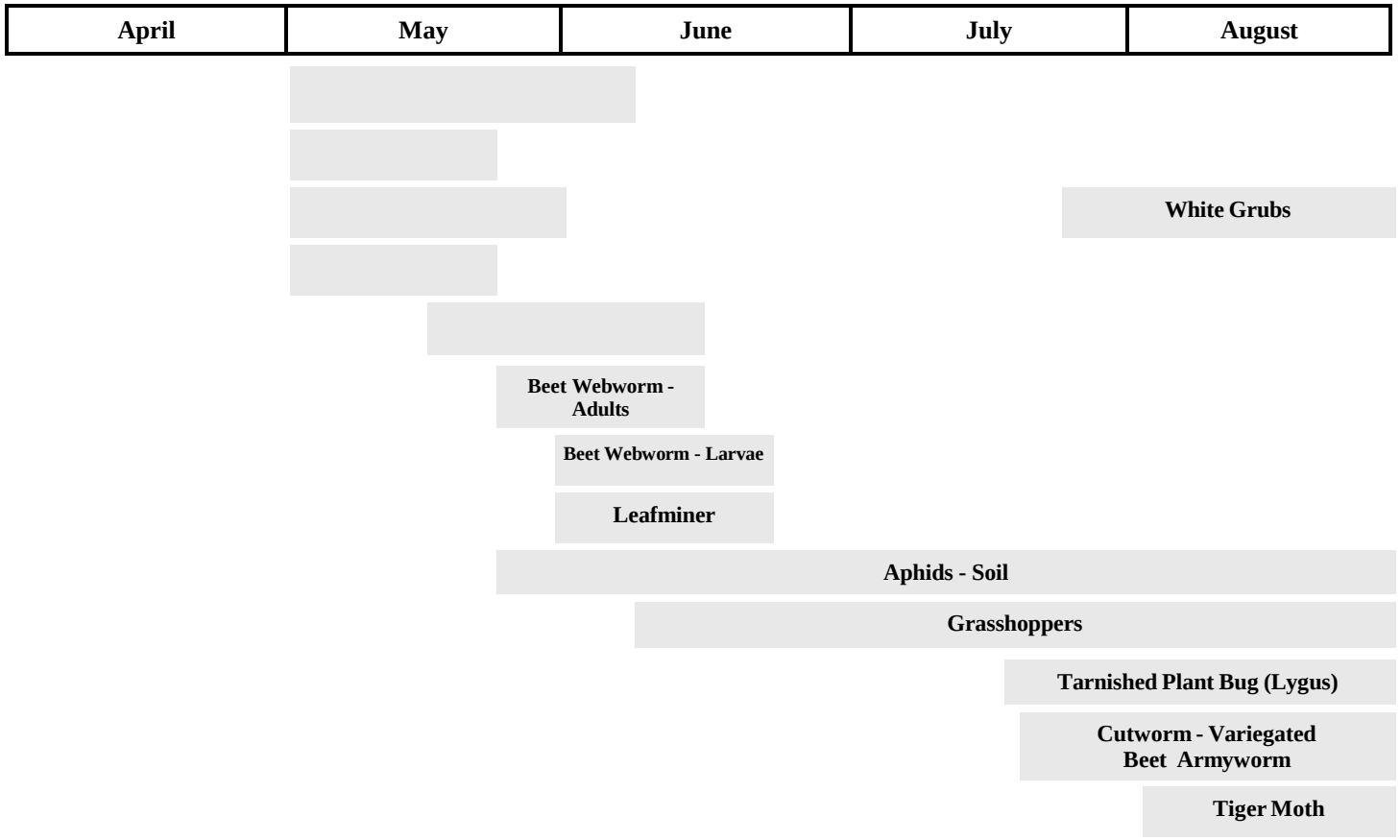
Field scouting-regular examination of fields in a prescribed fashion to measure pest levels.

1. Scout the field regularly and systematically to identify pests.
2. Take actions only when pest population approaches profit threatening levels.
3. If pesticide treatment is required, apply the lowest effective amount using equipment that is properly calibrated.

Why do we need scouting?

- Scouting is important for making crop management decisions
- Not scouting can cause lost due to yield or unnecessary insecticide application
- Many pest problems (e.g., plant diseases) need to be caught early
- Decrease the potential for the development of pesticide resistance
- Scouting is cornerstone of IPM

SUGARBEET INSECT MANAGEMENT CALENDAR



APHIDS - ROOT APHIDS

Sugarbeet root aphids are fairly common and cause localized economic populations in Michigan. The sugarbeet root aphids are small, oval to pear shaped, and pale yellow in color with a soft-body. The females overwinter in soil or on roots of lambsquarter, and move to sugarbeets later in the season. Root aphids reproduction is typically parthenogenesis and viviparous, which during the field season, aphids are all female, and give birth to live offspring without mating. There are several generations per year in Michigan. Aphids are sucking pest; that secretes a distinctive white, waxy substance which inhibits water and nutrient uptake by beets. Their population increase during dry, hot weather conditions.

Scouting:

Scout fields for aphids or wax on roots, particularly in areas with wilted beets. Maximum of **one** application per season. Do not place granules in direct contact with the seed as crop injury may occur.

Aphids Insecticide (*RUP)	Rate/A (Product/A)	REI (Hours)	PHI (Days)
*Counter 20 G *(Terbufos)*...**Suppression Only**	4 - 8 oz. per 1,000 feet of row (banded)	48	110
Variety selection for risk management of this insect	—	—	—

ARMYWORM

Armyworm are occasional economic pests and cause localized economic populations in Michigan. Armyworm defoliation (chewing) the sugarbeet leaves. Armyworm larvae often feed at night. Female moths are attracted to grassy or weedy fields early in the season for egg laying; in midsummer, true armyworms may move from surrounding fields (small grain, pasture, sod) into sugarbeet fields.

Sampling/Scouting/Threshold:

Check several areas of the field for larvae. For true armyworms, check the edges of the fields since these tend to be at a greater risk. Biological Control: predatory insects, rodents, and birds feed on armyworms. Cultural Control: good weed management program can reduce infestation from true armyworm. The threshold for armyworms are **25%** or more of foliage damaged by armyworms. Note: Asana only controls Beet Armyworm.

Armyworm Insecticide (*RUP)	Rate/A (Product/A)	REI (Hours)	PHI (Days)
*Mustang *(Zeta-Cypermethrin)*	3.0 - 4.3 oz.	12	50
*Mustang Max *(Zeta-Cypermethrin)*	2.24 - 4.0 oz.	12	50
*Mustang MAXX *(Zeta-Cypermethrin)*	2.24 - 4.0 oz.	12	50
*Lorsban 4E *(Chlorpyrifos)*	2 pt./A (BC) or 1.33 pt./A (band)	24	28
*Lorsban Advance *(Chlorpyrifos)*	2 pt./A (BC) or 1.33 pt./A (band)	24	28
Sevin 4-F *(Carbaryl)*	1 - 1.5 qts	12	28
*Asana *(Esfenvalerate)*	5.8 - 9.6 oz.	12	21
**Intrepid 2F (Methoxyfenozide)*	8-16 oz.	4	7

BEET WEBWORM

Beet webworms rarely occur in significant numbers in Michigan sugarbeet fields. Larvae are slender caterpillars and are very active when disturbed. Early-stage larvae are dark green. Older larvae are olive green and have a dark band flanked on each side by two light-colored stripes running down the center of their back. Full-grown larvae can be up to 1½ inches long. Adults are mottled tan and brown moths with smoky grayish wing margins. The moths first appear in late May and early June. Larvae usually cause problems during the first 3 weeks of June. A second brood is also possible during late August and September.

Threshold:

Treatment is recommended if **one to two** webworms are present on **50% to 75%** of sampled leaves.

Beet webworm Insecticide (*RUP)	Rate/A (Product/A)	REI (Hours)	PHI (Days)
*Mustang *(Zeta-cypermethrin)*	2.4 - 4.3 oz.	12	50
*Mustang Max *(Zeta-cypermethrin)*	2.24 - 4.0 oz.	12	50
*Mustang MAXX *(Zeta-cypermethrin*)	2.24 - 4.0 oz.	12	50
*Lorsban 4E *(Chlorpyrifos)*	2 pt./A (BC) or 1.33 pt. (band)	24	28
*Lorsban Advance *(Chlorpyrifos)*	2 pt./A (BC) or 1.33 pt. (band)	24	28
*Asana *(Esfenvalerate)*	5.8 - 9.6 oz.	12	21
Sevin (*Carbaryl)*	1 - 1.5 qts.	12	28
*Intrepid 2F (*Methoxyfenozide*)	8-16 oz.	4	7

CUTWORM

Major cutworm pests of sugarbeets in Michigan include the Black, Winter and Variegated.

- Black and Variegated Cutworm: These insects migrate into our region as moths during the spring and are capable of multiple generations within a single growing season. Variegated cutworm larvae 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. Black cutworms can feed more than 2 inches below ground in later growth stages when soils are too warm near the surface. Therefore, late-season control of these cutworms can be difficult to achieve. Insecticides applications may be repeated as necessary during peak cutworm feeding. Liquid formulations generally provide better control of cutworms, especially during very dry periods. If severe crusting is evident in the field, the crust should be broken up prior to or during the insecticide application.
- Winter Cutworm: Were found in large numbers in the fall of 2007 in central and northern Michigan. Sometimes called snow cutworms. In large numbers, caterpillars move across fields and roads, similar to armyworm. However, unlike other caterpillar species winter cutworm is very cold tolerant. The winter cutworm is one of a many insect that lives in a stage of winter dormancy in the soil surface, with the help of an antifreeze like chemical in their body, allowing it to survive subfreezing temperatures. Thus, if a large cutworm-like caterpillar is found late in the fall or during the winter, it is likely Winter Cutworm. The hairless worm-like larvae will emerge in April, begin feeding, and pupate to a moth in May or June and then lay eggs again and start the cycle over.

Early detection of larval feeding activity is essential to a good control program. Fields should be checked for wilting or dead plants at frequent intervals during periods of cutworm activity. Cutworms will generally be found within 1 to 2 inches of the soil surface near the base of wilting plants. Most feeding activity occurs at night. Young sugarbeet plants are often cut off near ground level. During periods of dry weather, larvae prefer feeding just below the soil surface as they move along the row. They will feed above the surface on leaves and petioles during periods of excessive soil moisture.

Threshold:

Cutworm control in young beets is suggested when 4 to 5% cutting of seedlings observed in fields. Control is recommended when a population of **three** to **five** larvae per square foot is observed in late summer when the plant canopy is developed.

Cutworm Insecticide (*RUP)	Rate/A (Product/A)	REI (Hours)	PHI (Days)
*Mustang *(Zeta-cypermethrin)*	2.4 - 4.3 oz.	12	50
*Mustang Max *(Zeta-cypermethrin)*	2.24 - 4.0 oz.	12	50
*Mustang MAXX *(Zeta-cypermethrin)*	2.24 - 4.0 oz.	12	50
*Lorsban 4E *(Chlorpyrifos)*	2 pt./A (BC) or 1.33 pt. (band)	24	28
*Lorsban Advance *(Chlorpyrifos)*	2 pt./A (BC) or 1.33 pt. (band)	24	28
*Asana *(Esfenvalerate)*	5.8 - 9.6 oz.	12	21
*Fastac *(Alpha-cypermethrin)*	2.2 to 3.8 fl ozs	12	50
Sevin *(Carbaryl)*	1 - 1.5 qts.	12	28
*Intrepid 2F (*Methoxyfenozide*)	8-16 oz.	4	7
Poncho Beta Seed Treatment	—	—	—

FLEA BEETLE

The flea beetles most frequently found feeding on beets are shiny black in color and about 1/8 inch in length. All flea beetles are oval-shaped and have enlarged hind legs. When approached or disturbed, they readily jump to escape. Flea beetles overwinter as adults and emerge in late April and May. They feed first on suitable weeds such as winter annuals, and move to field crops as weed hosts are depleted and crop plants begin emerging. Foliar feeding injury from flea beetles consists of small, rounded holes, and gives leaves a shot-hole appearance. Severe shot-holing damage can result in stunting, wilting, and even death of seedling plants. Plant responses will be most dramatic during periods of hot and dry weather.

Threshold:

Treatment is usually justified if flea beetles threaten to reduce sugarbeet plant stands to below 35,000 plants/acre.

Flea Beetle Insecticide (*RUP)	Rate/A (Product/A)	REI (Hours)	PHI (Days)
*Mustang (*Zeta-cypermethrin)*	2.4 - 4.3 oz.	12	50
*Mustang Max *(Zeta-cypermethrin)*	2.24 - 4.0 oz.	12	50
*Mustang MAXX *(Zeta-cypermethrin)*	2.24 - 4.0 oz.	12	50
*Lorsban 4E *(Chlorpyrifos)*	2 pt./A (BC) or 1.33 pt. (band)	24	28
*Lorsban Advance *(Chlorpyrifos)*	2 pt./A (BC) or 1.33 pt. (band)	24	28
*Asana *(Esfenvalerate)*	5.8 - 9.6 oz.	12	21
*Fastac *(Alpha-cypermethrin)*	2.2 to 3.8 fl ozs	12	50
Sevin *(Carbaryl)*	1 - 1.5 qts.	12	28

GRASSHOPPER

Grasshoppers are a common insect and has an occasional outbreaks in Michigan. Grasshoppers overwinter as eggs in the soil, and nymphs hatch in June. Nymphs molt as they grow, and feeding increases with size. Grasshoppers defoliation (chewing) sugarbeets leaves by nymphs and adults. Unplowed or fallow areas next to fields are preferred egg-laying sites, and may contribute to populations in a field. Dry, warm weather often enhances survival of nymphs. Damage to sugarbeets can occur late in season when other crops are scarce.

Sampling/Scouting/Threshold:

Check 5 groups of 20 plants for damage. Cultural control includes plowing and cultivation to destroy eggs. Biological control includes a natural fungal pathogen that will kill several eggs and nymphs under wet spring conditions. Natural enemies include animals (birds, rodents, amphibians), parasitic wasps, and ground beetles. The threshold for grasshopper damage is when **25%** or more of the sugarbeet leaves have been defoliated.

Grasshopper Insecticide (*RUP)	Rate/A (Product/A)	REI (Hours)	PHI (Days)
*Mustang *(Zeta-cypermethrin)*	2.4 - 4.3 oz.	12	50
*Mustang Max *(Zeta-cypermethrin)*	2.24 - 4.0 oz.	12	50
*Mustang MAXX (Zeta-cypermethrin)	2.24 - 4.0 oz.	12	50
*Lorsban 4E *(Chlorpyrifos)*	2 pt./A (BC) or 1.33 pt. (band)	24	28
*Lorsban Advance *(Chlorpyrifos)*	2 pt./A (BC) or 1.33 pt. (band)	24	28
*Asana *(Esfenvalerate)*	5.8 - 9.6 oz.	12	21
*Fastac *(Alpha-cypermethrin)*	2.2 to 3.8 fl ozs	12	50
Sevin *(Carbaryl)*	1 - 1.5 qts.	12	28

LEAFHOPPERS

Leafhoppers are common insects, rarely economic pests in Michigan. Leafhoppers are small, fast moving, torpedo-shaped insects. Nymphs resemble adults but are much smaller and lack wings. There are several species of leafhoppers found in sugarbeets, with all of them having multiple generations per year. Leafhoppers of sucking pest, that remove nutrients from the leaves. Both adults and nymphs remove plant sap as they feed. Symptoms include leaf curling and yellowing of the sugarbeet leaves.

Threshold:

Leafhoppers are not usually a problem in beets. A rough guideline is to treat when large numbers of leafhoppers are seen and leaf curling is present.

Leafhopper Insecticide (*RUP)	Rate/A (Product/A)	REI (Hours)	PHI (Days)
*Mustang *(Zeta-cypermethrin)*	2.4 - 4.3 oz.	12	50
*Mustang Max *(Zeta-cypermethrin)*	2.24 - 4.0 oz.	12	50
*Mustang MAXX *(Zeta-cypermethrin)*	2.24 - 4.0 oz.	12	50
*Asana (*Esfenvalerate)*	5.8 - 9.6 oz.	12	21
Poncho Beta Seed Treatment	—	—	—

TARNISHED PLANT BUG (LYGUS BUG)

Tarnished plant bugs, commonly referred to as "Lygus bugs", have caused late-season injury to Michigan sugarbeets. Most feeding injury appears on new leaves and stems emerging from the sugarbeet plant crown. Feeding symptoms include curling and wilting of leaves, feeding scars on leaf petioles, seepage of a black exudates from petioles of young leaves, and blackening of the new growth near the center of the crown. Multiple generations of Lygus bugs can develop during the growing season, especially if extended periods of unseasonably warm weather prevail during spring and early summer. Populations usually build up in other host plant habitats (e.g., alfalfa and small-seeded broadleaf weeds), then adults migrate to beets in late July through August. Lygus bugs are sporadic pests in this region and their biological profile is not understood well enough to anticipate when or where future problems could arise.

Threshold:

Treatment with an insecticide may be justified if an infestation exceeds **one** Lygus bug per plant (adults and nymphs combined) after checking 30 to 50 plants in a field. Significant economic loss is likely to occur if an infestation reaches **four** Lygus bugs per plant. Lygus bugs usually infested beets during August. Therefore consideration of pre-harvest interval may be a critical factor in choosing an insecticide.

Tarnished Bug Insecticide (*RUP)	Rate/A (Product/A)	REI (Hours)	PHI (Days)
*Mustang *(Zeta-cypermethrin)*	2.4 - 4.3 oz.	12	50
*Mustang Max *(Zeta-cypermethrin)*	2.24 - 4.0 oz.	12	50
*Mustang MAXX *(Zeta-cypermethrin)*	2.24 - 4.0 oz.	12	50
*Lorsban 4E (*Chlorpyrifos)*	2 pt./A (BC) or 1.33 pt. (band)	24	28
*Lorsban Advance *(Chlorpyrifos)*	2 pt./A (BC) or 1.33 pt. (band)	24	28

SPINACH LEAFMINER

Leafminer are occasionally an economic pest in Michigan. Leafminer adults are a slender gray fly with white area between eyes. The larvae feed inside leaf mines of the sugarbeet leaves. Leafminer females lay white, oval eggs in groups of three to eight on undersides of beet leaves. Larvae (maggots) move inside the leaf and feed on tissue between the upper and lower surface. Larvae drop out of the leaf, pupate in the soil. There are multiple generations of leafminers, but only the first attacks beets.

The maggots (larvae) create distinctive, winding mines as they feed internally on the leaf. Seedling beets are more susceptible to damage than older beets.

Sampling/ Scouting/Threshold:

Scouting is crucial, and insecticides are most effective if applied just before or at egg hatch. Check 5 sets of 20 plants for egg masses or small leafminers. Treat if **50% or more** of plants have egg masses and small mines are present.

Leafminer (Adults) Insecticide (*RUP)	Rate/A (Product/A)	REI (Hours)	PHI (Days)
*Mustang (Zeta-cypermethrin)	2.4 - 4.3 oz.	12	50
*Mustang Max *(Zeta-cypermethrin)*	2.24 - 4.0 oz.	12	50
*Mustang MAXX *(Zeta-cypermethrin)*	2.24 - 4.0 oz.	12	50
*Lorsban 4E (*Chlorpyrifos)*	1 pt. (BC) or 0.67 pt. (band)	24	28
*Lorsban Advance (*Chlorpyrifos)*	1 pt. (BC) or 0.67 pt. (band)	24	28
Poncho Beta Seed Treatment	—	—	—

SPRINGTAIL

Springtails that damage sugarbeet fields are tiny (1/32 to 3/32 inch long), wingless, white- to cream-colored insects with fleshy, forward-pointed antennae. They spend their entire life below the soil surface, and are most harmful to seedlings. Plant injury ranges from a few brown feeding punctures to extensive root scarring. Field symptoms include wilted plants and plant stand losses. Fine-textured (i.e., clay or silty clay) soils with high organic matter content are conducive to springtail problems. Early-planted fields, especially 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.

Threshold:

On newly emerging beets, springtail damage is rare unless populations are very high (thousands

per square foot). This happens most often in fields with moist soil and high residue or in early-planted fields under cool, wet conditions.

Springtail Insecticide (*RUP)	Rate/A (Product/A)	REI (Hours)	PHI (Days)
*Mustang *(Zeta-cypermethrin)*	2.4 - 4.3 oz.	12	50
*Mustang Max *(Zeta-cypermethrin)*	2.24 - 4.0 oz.	12	50
*Mustang MAXX *(Zeta-cypermethrin)*	2.24 - 4.0 oz.	12	50
*Asana *(Esfenvalerate)*	5.8 - 9.6 oz.	12	21
Poncho Beta Seed Treatment	—	—	—

WHITE GRUBS

White grubs are common insects, localized problem pests in Michigan. White grubs are white in color, C-shaped larvae of the May and June beetles. White grubs can live for several years in undisturbed grassy areas. White grubs prune small roots, damage larger roots and may sever taproots. Sugarbeets following an established grass sod or fallow are ideal conditions for White grubs. For management, spring and fall plowing of established sod is recommended before crop is planted; Soil insecticide generally not required.

Threshold:
Currently, there is no established threshold for white grubs in sugarbeet. The following insecticides labeled for wireworms and sugarbeet root maggot control will usually provide adequate protection from wireworm injury.

White Grub Insecticide (*RUP) AT PLANTING	Rate/A or 1,000 ft of Row	REI (Hours)	PHI (Days)
*Mustang *(Zeta-cypermethrin)*	4.3 oz./A Apply in-furrow or in a 3 - 4" T-Band (band over the open furrow) at planting in a minimum of 3-5 gallons/A.	12	50
*Mustang Max and Mustang MAXX *(Zeta-cypermethrin)*	4.0 oz./A Apply in-furrow or in a 3 - 4 inch T-Band (band over the open furrow) at planting in a minimum of 3-5 gallons/A.	12	50
*Counter 15G *(Terbufos)*	Banded or Modified In-Furrow: 4.0 - 8.0 oz./1000 ft of row spacing (minimum 20 inches row spacing) or no more than 13.1 lbs./A. For Modified In-Furrow applications, apply in-furrow at 2-3" behind seed drop zone. **DO NOT** incorporate deeper than 2".	48	110
*Counter 20G *(Terbufos)*	Banded or Modified In-Furrow: 3.0 - 6.0 oz./1000 ft of row spacing (minimum 20 inches row spacing) or no more than 9.8 lbs./A. Modified In-Furrow applications, apply in-furrow at 2-3" behind seed drop zone. **DO NOT** incorporate deeper than 2".	48	110

WIREWORMS

Wireworm larvae are smooth, somewhat hard-bodied worms varying in length from 0.50 to 1.5 inches long. Their color can range from yellowish-white to a light copper color. Wireworms feed on a wide variety of crops and weeds, and are generally difficult to detect and control. They tend to be more prevalent in light-textured soils or in soil that has not been in crop production for several years. Fields that had grassy weed escapes during the preceding season are also at risk. Frequent cropping and working the soil helps reduce wireworm problems.

Threshold:

Currently, there is no established threshold for wireworms in sugarbeet. The following insecticides labeled for sugarbeet root maggot control will usually provide adequate protection from wireworm injury.

Wireworms Insecticide (*RUP) AT PLANTING	**Rate/A or 1,000 ft of Row**	**REI (Hours)**	**PHI (Days)**
*Mustang *(Zeta-cypermethrin)*	4.3 oz./A Apply in-furrow or in a 3 - 4" T-Band (band over the open furrow) at planting in a minimum of 3-5 gallons/A.	12	50
*Mustang Max and Mustang MAXX *(Zeta-cypermethrin)*	4.0 oz./A Apply in-furrow or in a 3 - 4 inch T-Band (band over the open furrow) at planting in a minimum of 3-5 gallons/A.	12	50
*Counter 15G *(Terbufos)*	Banded or Modified In-Furrow: 4.0 - 8.0 oz./1000 ft of row spacing (minimum 20 inches row spacing) or no more than 13.1 lbs./A. For Modified In-Furrow applications, apply in-furrow at 2-3" behind seed drop zone. **DO NOT** incorporate deeper than 2".	48	110
*Counter 20G *(Terbufos)*	Banded or Modified In-Furrow: 3.0 - 6.0 oz./1000 ft of row spacing (minimum 20 inches row spacing) or no more than 9.8 lbs./A. Modified In-Furrow applications, apply in-furrow at 2-3" behind seed drop zone. **DO NOT** incorporate deeper than 2".	48	110

***RUP:** Restricted Use Pesticide
REI: Reentry Interval
PHI: Pre-Harvest Interval
BC: Broadcast
Band: Banded Application
Always read and follow the label, since it's a legal document, and wear the proper personal protective equipment (PPE)

SUGARBEET DISEASE CONTROL

Disease management has been a deciding factor for the sugarbeet industry in Michigan as crop production moved to areas where crop diseases could be managed more successfully. Sugarbeet are vulnerable to many pathogens. Some pathogens can live from season to season in the soil and others can be transported to the crop by wind currents, equipment, irrigation water and by man and animals.

The figure illustrates one of the paradigms in plant pathology; that is, the existence of a disease caused by a biotic agent absolutely requires the interaction of a susceptible host, a virulent pathogen, and an environment favorable for disease development . Conversely, plant disease is prevented upon elimination of any one of these three causal components.

What is a Disease?

A disease is any abnormal condition that damages a plant and reduces its productivity or usefulness to man.

Types of Diseases

Non-infectious (Abiotic)

- Nutrition
- Moisture
- Temperature
- Toxic Chemicals

Infectious (Biotic)

- Fungi
- Bacteria
- Viruses
- Phytoplasmas
- Nematodes

SEEDLING DISEASES:

Approved varieties have considerable tolerance to seedling diseases or damping off. In addition, all Michigan Sugar Company seed is treated with Apron/Thiram, which is effective in controlling some of the seedling diseases. Tachigaren is available on pellets to aid in controlling Aphanomyces seedling disease. For more seed treatment options, see page 8.

CERCOSPORA LEAFSPOT:

Cercospora leafspot (*Cercospora beticola*) is the most serious foliar disease of sugarbeets in the Michigan Sugar Company growing region. When the disease is not properly controlled severe yield and sucrose losses can occur. Economic damage occurs when the leaf area has approximately one spot per square inch. Cercospora infestation levels vary considerably across the Michigan Sugar Company growing area. Significant progress has been made in controlling Cercospora in Michigan with the introduction of fungicides and with the adaptation of the BEETcast prediction model.

This fungus feeds on nutrients in the leaf interfering with root growth and sugar storage. Beginning with a few spots, it spreads to the entire leaf and can eventually kill the leaf.

Effective control of Cercospora leafspot in sugarbeets requires an integrated and intensive approach. Since the Cercospora fungus overwinters on infected beet leaves, crop rotation is important. A three-year rotation is minimal for reducing carryover of the fungus. Since plant debris and spores can be blown some distance, Beets grown in field next to fields containing beets the previous year are at high risk, especially if cercospora was present in the field the previous year. Burying beet residue by tillage helps reduce inoculums survival and dispersal. Fall tillage is most effective for reducing Cercospora populations but may increase the severity of soil erosion during open winters.

RESISTANCE MANAGEMENT FOR CERCOSPORA - 2015

Variety selection is an important tool to consider for your cercospora management program.

Varieties with high levels of tolerance can provide considerable assistance in managing the disease.

Fungicide resistance management is critical to maintaining the use of fungicides as an effective tool for managing Cercospora. Please follow cercospora management programs that are endorsed and recommended by Michigan Sugar Company. Please consult with your Agriculturalist for current fungicide application recommendations for your farm.

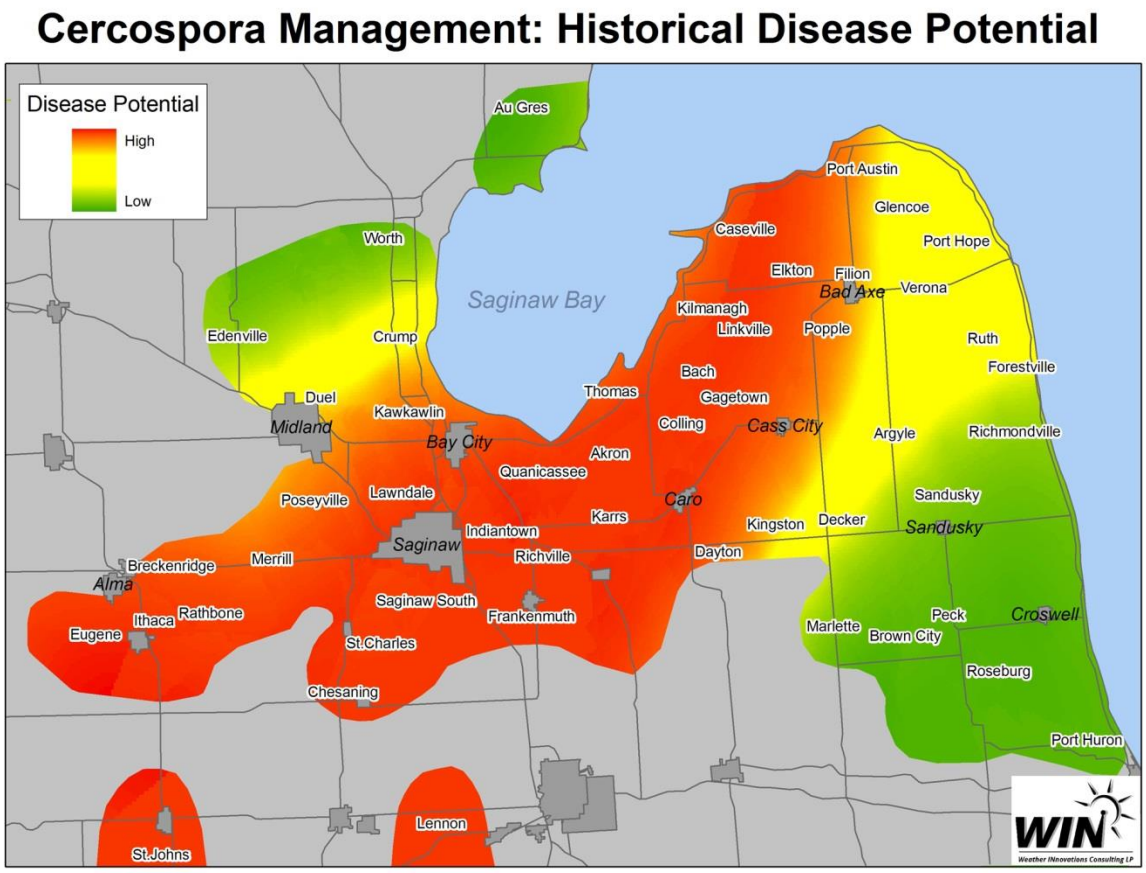
For 2016, it is highly recommended **NOT** to use strobilurins (Headline, Gem or Priaxor) for Cercospora control due to the resistance issues in Michigan that has been confirmed by Michigan State University and observed in Michigan Sugar Company efficacy trials.

It is highly recommended that alternate modes of action (Table 1) with a tank-mix is needed during the growing season. Example 1: Triazole (Inspire, Proline, etc.) with a tank-mix partner like an EBDC or Copper. Example 2: Super Tin with a tank-mix partner like Copper or an EBDC (see the below bullet points).

- Topsin has **99%** isolates resistant in Michigan's sugarbeet area, and didn't perform well in Michigan Sugar Company efficacy trials since 2013. **As a result as a result we are not recommending the use of Topsin fungicide.**
- Apply the suggested rates of all triazoles fungicides, and do not apply triazoles or Super Tin more than twice in a season.
- **Never use reduced rates of any fungicide as it will significantly increase the development of disease resistance**
- **Do not** apply triazoles back-to-back even if you tank mix with another mode of action. Use difference mode-of-action for triazoles.
- **Do not** apply Super Tin back-to-back even if you tank mix with another mode of action.
- **Do not** tank mix triazoles and Super Tin together.
- **Do not** mix Coppers with glyphosate and AMS or crop injury may occur. Beware that applying in a spray solution < 6.5 pH may cause phytotoxicity.
- EBDCs and Coppers can be sprayed multiple times with or without a tank mix partner, and can be applied back-to-back.
- Apply fungicides in an approach to insure maximum coverage, thus improving Cercospora leafspot control.

- Use 20-25 gallons of water with a minimum of 90 PSI, 100 PSI will give better performance. Use surfactants and additives as required by product labels.
- **Do not** wait until the first spot is noticed, by this time, Cercospora has been there for at least 14 days prior to seeing it. Once Cercospora spots are noticed, it's hard to manage the disease.
- Spray all fungicides as preventative programs, there are no curative fungicides for Cercospora leafspot.
- Use BEETcast (http://www.michiganbeets.com) to help you plan on timely applications, especially your first spray. Follow application programs designed for your area, red, yellow or green zone and variety tolerance grown. See recommendation tables
- Crop rotation plays a key component in reducing Cercospora leafspot inoculum from over-wintering in plant debris and soils. A four year rotation is recommended.
- Continue your fungicide spray program through mid-September if beets are going to be harvested for permanent piling.

2016 Cercospora Management Zones



Red Zone (High Cercospora Risk)			
Cercospora Fungicide Application Timings Based on BEETcast DSV's and Fungicide Label (Days)			
Varietal Tolerance to Cercospora	Tolerant Variety	Moderately Susceptible Variety	Susceptible Variety
	< 90% ck	90 - 105% ck	> 105% ck
1st Applic (DSV)	55	50	45
	Reapply (DSV's or Number of Days)		
Triazoles + EBDC or Copper	45 DSV or 21 days	40 DSV or 21 days	35 DSV or 21 days
Tin or Tin + EBDC or Copper	35 DSV or 14 days	30 DSV or 14 days	25 DSV or 14 days
EBDC or Copper + EBDC or Copper	21 DSV or 10 days	18 DSV or 10 days	15 DSV or 10 days
Headline, Priaxor, Gem and Topsin	Not Recommended Due to Resistance		

Yellow Zone (Moderate Cercospora Risk)			
Cercospora Fungicide Application Timings Based on BEETcast DSV's and Fungicide Label (Days)			
Varietal Tolerance to Cercospora	Tolerant Variety	Moderately Susceptible Variety	Susceptible Variety
	< 90% ck	90 - 105% ck	> 105% ck
1st Applic (DSV)	60	55	50
	Reapply (DSV's or Number of Days)		
Triazoles + EBDC or Copper	55 DSV or 21 days	50 DSV or 21 days	45 DSV or 21 days
Tin or Tin + EBDC or Copper	45 DSV or 14 days	40 DSV or 14 days	35 DSV or 14 days
EBDC, Copper	25 DSV or 10 days	21 DSV or 10 days	18 DSV or 10 days
Headline, Priaxor, Gem and Topsin	Not Recommended Due to Resistance		

Green Zone (Low to Moderate Cercospora Risk)			
Cercospora Fungicide Application Timings Based on BEETcast DSV's and Fungicide Label (Days)			
Varietal Tolerance to Cercospora	Tolerant Variety	Moderately Susceptible Variety	Susceptible Variety
	< 90% ck	90 - 105% ck	> 105% ck
1st Applic (DSV)	65	60	55
	Reapply (DSV's or Number of Days)		
Triazoles + EBDC or Copper	60 DSV or 21 days	55 DSV or 21 days	50 DSV or 21 days
Tin	50 DSV or 14 days	45 DSV or 14 days	40 DSV or 14 days
EBDC, Copper	30 DSV or 10 days	25 DSV or 10 days	20 DSV or 10 days
Headline, Priaxor, Gem and Topsin	Not Recommended Due to Resistance		

Table 1. Variety Tolerance to Cercospora Leafspot (% of Checks)		
Variety	Tolerance	% Check
B-1399	Tolerant	78.9
C-RR202	Tolerant	84.0
HM-28RR	Moderately Susceptible	93.0
HM-173RR	Moderately Susceptible	93.9
SX-RR1243	Moderately Susceptible	95.0
C-RR059	Moderately Susceptible	95.4
C-G351NT	Moderately Susceptible	97.5
HM-9616RR	Moderately Susceptible	97.5
SX-RR1235N	Moderately Susceptible	101.2
SX-RR1245N	Moderately Susceptible	102.9
HM-NT9607RR	Moderately Susceptible	103.2
B-12RR2N	Moderately Susceptible	104.0
B-18RR4N	Susceptible	105.2
SX-1212RR	Susceptible	105.4
SX-1228RR	Susceptible	108.2
B-133N	Susceptible	109.6
HM-NT9617RR	Susceptible	110.8
C-G333NT	Susceptible	112.6
SX-1211N RR	Susceptible	113.1
B-149N	Susceptible	117.1

Cercospora Leaf Spot Management for Ontario 2016

Janice LeBoeuf, Ontario Ministry of Agriculture, Food and Rural Affairs
Cheryl Trueman, Ridgetown Campus – Univ. of Guelph

Fungicide resistance is a **major concern** for Cercospora leaf spot (CLS) management because:

- There is widespread resistance to Group 11 (i.e. Headline) and Group 1 (i.e. Senator) fungicides. These products repeatedly provided **no control of CLS** in trials at Ridgetown Campus, University of Guelph.
- There is **only one highly effective group of fungicides remaining** (Group 3). Usually a pathogen with resistance to one fungicide in a group will have resistance to all other fungicides in the same group.
- Overuse of Group 3 fungicides without the use of tank mixes, tolerant varieties, and cultural control methods will speed up evolution of resistance to these fungicides.
    - Tests of Ontario and Michigan CLS samples by Michigan State University show ***C. beticola* is already becoming less sensitive to Group 3 fungicides**. Field rates are still effective, but the pathogen is already adapting to higher selection pressure from these fungicides!
- Cescorpora **spores travel** among fields so it's important that all growers implement resistance management practices; **this is a community problem**!
- Trials completed in Ontario and Michigan identified **no effective fungicides with new modes of action** in the fungicide development pipeline.

Table 1: Cercospora fungicides registered in Ontario

Product (active ingredient)	MOA Group #	Performance in Ontario Field Trials
Inspire (difenoconazole)	3	Excellent
Proline (prothioconazole)	3	Excellent
Mettle (tetraconazole)	3	Excellent, limited data available
Caramba (metconazole)	3	Moderate, limited data available
Headline (pyraclostrobin)	11	No control, resistance widespread
Senator (thiophanate-methyl)	1	No control, resistance widespread
Manzate, Penncozeb, etc. (mancozeb), Polyram (metiram)	M3	Fair-moderate, better at shorter intervals
Parasol, Coppercide, etc. (copper hydroxide)	M1	Fair-moderate, better at shorter intervals

Recommended Ontario Spray Program for CLS Management

Be on time with the first fungicide application of the season and plan ahead for subsequent applications (watch the weather forecasts and BEETcast™ DSV accumulations). Disease will continue to develop into the Fall if condition are warm.

Table 2: Recommended Ontario fungicide schedule for CLS management

Timing	First spray	Second spray	Third spray	Fourth spray	Fifth spray
Product(s)	Group 3 + Group M	Group M (alone)[1]	Group 3 + Group M	Group M (alone)[1]	Group M (alone)[1]

[1] When a group-M fungicide is used alone, a shorter re-spray (DSV) interval should be considered. Ontario field trials (2013-2015) show better performance of this fungicide schedule using a BEETcast™ 50/35 program compared to a BEETcast™ 55/50 program, but economic analysis of the yield and sugar data is still underway.

2016 Michigan Sugar Company Cercospora Management Recommendations for Michigan

Red Zone

- Start using DSV 45, 50 or 55 (determined by variety susceptibility)
- Sequential applications based on DSV or label whichever comes first
- Inspire + EBDC
- Tin + EBDC
- Topguard + EBDC
- Tin + EBDC
- EBDC + Sticker or Copper

Yellow Zone

- Start using DSV 50, 55 or 60 (determined by variety susceptibility)
- Sequential applications based on DSV or label whichever comes first
- Inspire + EBDC
- Tin + EBDC
- Topguard + EBDC
- EBDC + Sticker or Copper

Green Zone

- Start using DSV 55, 60 or 65 (determined by variety susceptibility)
- Sequential applications based on DSV or label whichever comes first
- Inspire + EBDC
- Tin + EBDC
- Topguard + EBDC
- EBDC + Sticker or Copper

Recommendation without the use of Tin

- All Zones
- Start using DSV based on Zone and Variety Susceptibility
- Sequential applications based on DSV or label whichever comes first
- EBDC + Sticker
- Inspire + EBDC
- EBDC + Sticker
- Topguard + EBDC
- EBDC + Sticker
- Copper

RHIZOCTONIA

Rhizoctonia root rot of sugarbeets is one of the most damaging root diseases in Michigan. Yields can be reduced up to 10 tons per acre and sugarbeet quality can be greatly affected. Corn, soybeans and dry edible beans are all hosts for Rhizoctonia, leaving it difficult to lower inoculum levels. Crop rotations with sugarbeets following wheat or wheat and clover may be helpful. Sugarbeet varieties with good resistance to the disease should be considered on fields with a chronic history of the disease.

Research over past several years from Michigan State University Sugarbeet Advancement program and Michigan Sugar Company has shown that Rhizoctonia can be effectively controlled with proper placement and timing of Quadris fungicide. Growers who are planting very susceptible varieties, including the nematode-resistant variety, should consider either one or two fungicide applications depending on the suspected severity of the disease. Applications can be made either as a foliar or a T-band in-furrow application. Many growers are using a combination of the two with very effective results.

In-furrow T-band applications are very effective, economical, and can offer protection from both the seedling and root rot phase of the disease. The standard T-band width of 7 inches has worked well, but research has shown band widths of 3 to 4 inches have had similar effectiveness. This application is very economical because the Quadris rate is reduced proportionately to the band width. Growers that were using 10.5 ounces of Quadris in a 7-inch band are now using 5 to 7 ounces in a 3- to 4-inch band. In-furrow application takes the guess work out of timing a foliar application.

All foliar applications should be applied in a 7-inch band or less. The best timing of applications can vary depending on environmental factors including soil moisture and temperature. Work conducted by MSU Sugarbeet Advancement in the last three years has shown foliar applications at the 6 to 8 leaf stage have been much more effective than earlier timings. When heavy disease pressure is present, the combination of in-furrow and 6 to 8 leaf stage offers longer and improved efficacy.

Timing of application of Quadris can very each year according to the planting date, soil temperature, moisture and variety tolerance. Ideally, applications of fungicide should be applied just before or at disease infection. High infection periods occur as soil temperatures at the 4-inch depth approach 70 degrees and have free moisture.

Fields should be scouted regularly to monitor disease occurrence. If early season die off from Rhizoctonia is seen (approximately 8-16 leaf stage), a rescue treatment may be helpful.

Applications should be banded directly in the crown and additional water may be beneficial. These treatments are never as effective as an in-furrow or well-timed foliar application. Quadris should not be broadcast because of reduced effectiveness. Also, no oil based insecticides should be added, as leaf injury will occur. Micronutrients such as manganese are compatible and safely added to Quadris. Always check compatibility and label precautions when tank-mixing with Quadris.

Summary

Rhizoctonia infects a wide range of plants. The fungus affecting the base of the leaf petioles and crown of the sugarbeet, along with the top of the root system. When this pathogen is active, sugarbeets die down the row and in circular patterns in the field. The ideal temperature for the pathogen is 55-95ºF; optimal= 70 - 85ºF; with adequate soil moisture - ideal would be wet.

POWEDERY MILDEW

Powdery mildew is a fungal disease. It is related to the fungi that cause powdery mildews on grain and other crops. The fungus produces spores called conidia. The conidia blow in the wind, and some will land on sugarbeet foliage. The conidia then germinate and start growing. The fungus grows vegetatively by producing strands called hyphae.

Soon after infection, the fungus will begin to produce conidia. The conidia are formed on other specialized hyphae called conidiophores. When the hyphae and conidia form, the leaf will take on a white, powdery appearance. As the infection progresses, the leaf tissue becomes chlorotic, then brown. These symptoms usually form first on the older leaves. Eventually, all leaves may become infected.

The fungal structures are very sensitive to low temperatures and will not overwinter in the sugarbeet production areas of Michigan. The fungus probably overwinters in California or Oregon. It is thought that wind currents during the summer months move the conidia long distances. These spores infect sugarbeets and produce secondary inoculum, and the disease spreads throughout the crop. Some of these secondary conidia will also be blown long distances, and the cycle repeats. In this way the disease progressively moves from the southwestern part of the country throughout all of the sugarbeet production areas of the United States.

The age of the sugarbeet crop is an important factor in susceptibility to disease. The disease is rarely seen in the field until eight to 12 weeks after emergence. The disease occurs first on the older leaves. If allowed to go unchecked, the disease progresses and within a month will cover all the leaves in a field.

Yield loss due to powdery mildew will occur if the disease is allowed to go unchecked. The earlier the disease occurs during the season, the greater the loss. Loss will occur due to decreased root yield as well as decreased sucrose concentrations. Gross sugar yields may be decreased by as much as 40 percent under severe infection. In addition, powdery mildew will cause a reduction in purity. Infected plants have higher concentrations of sodium and amino-nitrogen in the roots. The decreased purity will reduce the amount of extractable sugar.

To date mildew has not been a serious problem in our sugarbeets. If diseases does become a problem, it can be controlled by applying one of the fungicides, **Eminent, Enable, Headline, Inspire XT, or Gem.** Cultural practices have not played a big part in powdery mildew control, nor has biological Control.

FUSARIUM

Fusarium is a fungal disease with presumed host-specific strains that attack sugarbeet or dry bean. Severely infected plants become yellowed, wilted and die prematurely, which may cause yield reduction or total crop loss. Because sugarbeets and dry edible beans are commonly grown in a short rotation of less than four years in Michigan, incidence and variability of the pathogens may have increased in recent years.

Seedling samples were sent to Michigan State University Diagnostic Center in 2014. Out of the 18 samples submitted, 18 had seedling Fusarium.

Reports from Michigan State University, indicate that the disease has been found in more than 40 percent of sugarbeet fields that could cause significant reduction in yield in various fields. Because yield losses due to this disease vary from year to year and are not easily measured, there has been little effort to develop resistant sugarbeet hybrids.

The pathogen is a soil-borne fungus that survives as microscopic spores (chlamydospores) which germinate and infect the sugarbeet or bean root under favorable conditions. The fungus invades water-conducting tissues of the root and grows upward into leaf petioles and stems of sugarbeet and/or bean plants.

Infected root with grayish-brown to black discoloration of vascular bundles.

Optimum conditions for infection are a temperature of 80ºF degrees or greater, combined with other stress factors such as herbicide, fertilizer, salinity damage to roots, soil compaction, moisture extremes, and poor water drainage.

Symptoms of Fusarium yellows of sugarbeet include wilting of the foliage, yellowing between the veins in the leaves (interveinal chlorosis), and a darkening of the rings in the taproot. Plants can be affected at any stage from seedling until harvest; the majority of plant death appears to occur when plants are in the seedling stage to the four-leaf stage of growth. Dead plants are light brown and many remain visible until harvest. Although diseased plants may be scattered throughout the field, most occur in localized areas. Plants that were infected when young usually are stunted and show severe symptoms of interveinal chlorosis and marginal leaf browning. Plants infected later in the season will be larger in size and usually show mild symptoms, consisting only of minor interveinal chlorosis. When plants are removed and roots sliced in cross section, many show a yellow-brown to gray discoloration of the water-conducting, vascular tissues.

Above ground symptoms on dry bean appear on lower leaves that exhibit yellowing and wilting, which become more pronounced and progress upward into younger leaves. Stunting is evident, especially if plant infection and stress occurred during the seedling and vegetative stages. The margins of infected leaves turn tan to brown, and diseased plants become progressively more yellow. Severely infected plants exhibit permanent wilting and premature defoliation. Vascular discoloration on the main stem is the diagnostic symptom usually evident after the initial appearance of foliar symptoms. The reddish-brown vascular discoloration of root, stem, and petiole tissue of infected plants will vary considerably in intensity, depending on variety reaction, severity of infection, and environmental conditions

Summary

- Plant certified seed of Fusarium wilt-tolerant or resistant varieties, if available.
- Treat seed or furrow with recommended fungicides to delay initial infection of seedlings by Fusarium and other soil-borne pathogens including Pythium and Rhizoctonia.
- Don't follow sugarbeet with dry bean; rotate for three to five years with non-host crops such as corn, wheat, barley or alfalfa.
- Good weed management is important to reduce populations of other potential hosts such as pigweed (susceptible to sugarbeet strains of Fusarium).
- Chiseling (sub-soiling) 10 to 20 inches deep between crop rows reduces soil compaction, and promotes water movement and root penetration.
- Space plants at recommended distances with crop rows to reduce plant competition for water and nutrients, without sacrificing ground cover and yield potential of the crop.
- Be careful during tillage operations to avoid movement of soil (contaminated with other pathogens such as Rhizoctonia) into susceptible crown tissues.

RHIZOMANIA

Rhizomania is caused by beet necrotic yellow vein virus (BNYVV) and transmitted by the soil fungus *Polymyxa betae*. Both the virus and fungal vector are obligate parasites in that they require a living host to reproduce. Both are host specific and the virus is dependent on the vector for infection. The natural host range, therefore, is limited by those species that *P. betae* is capable of infecting, and includes primarily species in the same genus as sugarbeets (*Beta* sp.), a few species in the genus *Chenopodium*.

The vector, *Polymyxa betae*, indefinitely survives in the soil as cysts or groups of cysts called cystosori. With free water and soil temperature above 60ºF, individual cysts germinate in the vicinity of sugarbeet roots and release a single zoospore that infects primary root tissue, carrying the virus into the plant cell. Severity of infection is directly related to the population of

viruliferous *Polymyxa* in the soil. The process continues until the rootlet dies and the plant produces new rootlets. Disease is favored by high soil moisture, optimum temperature of 77ºF, short rotation, and neutral to alkaline soils.

Excessive crown growth and wineglass shape

Roots are stunted and there is a proliferation of lateral rootlets, giving the root a bearded appearance. The taproot may be constricted and there may be excessive crown growth, giving the root a wineglass shape. Vascular tissue is discolored and the taproot may be rotted. With mild infections, there may only be slight lateral rootlet proliferation on the taproot or lateral roots. The vascular discoloration may not be very obvious in mild infections, but in longitudinal section the vascular bundles have a disorganized or "marbling" appearance in the vicinity of rootlet proliferation. This is in contrast to the parallel vascular bundles in normal, healthy tissue.

Leaf symptoms consist of slight yellowing, erect growth habit, and leaf proliferation. Leaves are usually uniformly chlorotic. In mild infections, there may be little or no stunting of the foliage, with a slightly perceptible and uniform lime-green leaf color. This contrasts with nitrogen deficiency where older leaves are often chlorotic while younger leaves are green.

Summary

A resistant variety should be planted if there has been any field history of rhizomania, no matter how small the affected area. If rhizomania has been found on another field on the farm or on a nearby field, the likelihood that most or all fields are infested is very high. Planting resistant varieties will make long-term disease management far more effective. At least two or three sugarbeet crops are necessary after a field is first contaminated with rhizomania before noticeable symptoms develop. With such a long incubation period, once we observe and diagnose the disease, the inoculum has already increased to a high level.

Planting resistant varieties alone will not allow maximum yields to be achieved. A minimum 4-year rotation is essential for good management. For example, research out West has shown that with the best resistant varieties and best management practices except for rotation, measured 16.1 tons with back to back beets, 18.7 tons with a 2-year rotation, 23.8 tons with a 3-year rotation, and 30.7 tons with a 4-year rotation.

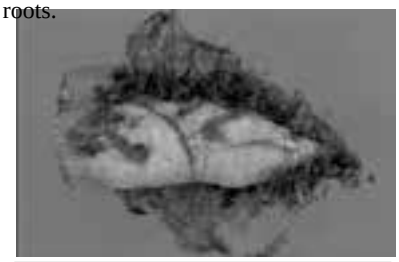
The earlier that plants become infected the more severe the damage from rhizomania will be. The disease is not active below 60ºF, and early planting to establish the crop before infection will reduce losses. Good plant populations can help reduce the severity of rhizomania. Closing the rows early with high plant populations tends to maintain cooler soil temperature which can reduce the rate of disease development.

BCN Female attached to the root

SUGARBEET CYST NEMATODE (BCN)

The major nematode affecting sugarbeet production in Michigan is the sugarbeet cyst nematode (BCN). BCN is distributed world-wide, wherever sugarbeets are grown commercially. This nematode was detected in the United States in 1895. Today, BCN is present in 40 different countries and 17 states in the United States.

BCN is a microscopic plant-parasitic roundworm that feeds on beet roots stealing nutrients from the plants. General nematode injury begins in fields as small patches of poorly growing plants that can exhibit stunted growth, yellowing foliage, and other symptoms of nutrient deficiency. Infected plants may wilt on warm days, and wilting may persist even with adequate soil moisture. Small seedlings are especially susceptible to death in heavy infestations, and surviving beets are typically small with excessively hairy roots. If a plant is carefully removed from the soil, the small, white, lemon-shaped females and brown cysts may be seen on the beet roots. Yield reductions increase as infection severity increases. If the infestation is severe enough, entire seedling stands can be lost.



Severely infested plants are stunted and often have a profusion of lateral roots

No one knows for certain how long the sugarbeet cyst nematode can survive without a host, but a small percentage of eggs within cysts reportedly can survive fallow conditions for over 12 years. Eggs must be inside cysts to survive such long periods without a host. The annual rate of decline of viable eggs and larvae in fields after removal of sugarbeet or another host crop can vary from 40 to 50 percent. The actual rate of decline depends on the type of soil, soil temperature, soil moisture, history of pesticide use (including herbicides), susceptibility and availability of host plants (including weeds), and the presence of predators and parasites.

Summary

- There are several BCN resistant sugarbeet varieties available. Use of a resistant variety in fields heavily infested in BCN has increased yields by 10-15 tons per acre when compared to non-resistant varieties.
- BCN will develop and reproduce on these resistant varieties, but will not get the nutrition as they would on non-resistant varieties, thus decreasing their number, but not eliminating them. Growers should use these varieties cautiously as overuse may lead to a race-shift and breakdown in the resistance to BCN.
- Activities that decrease soil movement will decrease the spread of BCN; this would include equipment movement between fields, soil erosion, and tare soil.
- Oilseed radish has been used successfully as a trap crop for BCN; however, the cultivars of oilseed radish that can be used for this purpose include: Defender, Colonel, and Biofume. Other "tillage" type radishes can increase BCN population 100 fold.
- Growing non-host crops can reduce BCN population density. Grains (grasses), clover, corn, soybeans, dry beans and pickles are good choices as non-host crops. Wheat under seeded with clover can reduce BCN and improve soil health.
- Reduce BCN population density of the pathogen. This can be accomplished utilizing several tactics alone or in combination; these tactics include crop rotation, resistant varieties, trap crops, and nematicides (but is costly).
- BCN Testing Program: Since 2012, **422** samples have been taken and screened for BCN. There will be another BCN testing program for 2015. **Remember:** You must include root hairs (3-4) with the soil sample. This will eliminate the need for a bioassay if cyst are found in the sample.

FUNGICIDE RATING SCALE - MICHIGAN SUGAR COMPANY RESEARCH TRIALS

Product	Class (Chemical)	Action (FRAC Code)	Cercospora Efficacy Rating Scale*	Rhizoctonia *Efficacy Rating Scale
Copper (Kocide)	copper hydroxide	Contact (M1)	F	N/A
Copper (Cuprofix) Copper (AGRI-LIFE)	copper sulfate copper sulfate pentahydrate	Contact (M1) Contact (M1)	F - F(+) F- F(+)	N/A N/A
EBDC (e.g. Dithane, Maneb, Manzate, Penncozeb)	EBDC	Contact (M3)	F(+)	N/A
Eminent / Minerva	triazole	Systemic (3)	**G** [1, 3]	N/A
Enable	triazole	Slightly Systemic (3)	**G** [1, 3]	N/A
Gem	strobilurin	Slightly Systemic (11)	P	N/A
Headline	strobilurin	Slightly Systemic (11)	P	F(-)
Inspire XT	triazole	Slightly Systemic (3)	G(+) [1, 3]	N/A
Priaxor	carboxamide & strobilurin	Slightly Systemic (7&11)	P	F (-)
Proline	triazole	Systemic (3)	**G** [1, 3]	F(+)
Quadris	strobilurin	Systemic (11)	N	**G**
Super Tin/Agri Tin	TPTH	Contact (30)	**G** [1, 2]	N/A
TOPGUARD	triazole	Systemic (3)	**G**(+) [1, 3]	N/A
Topsin	benzimidazole	Systemic (1)	F(+) [1, 2]	N/A
*Efficacy rating scale: E=excellent, G=good, F=fair, P=poor, N=no activity, N/A=Not available				

To reduce further development of disease resistance to fungicides, chemical mode of actions should be rotated! Do not use the same type of chemical class consecutively for any application timing. Strobilurins (Headline/Gem) chemistries have developed resistance in Michigan and Nebraska, thus Michigan Sugar Company is not recommending these products for CLS control. [1.] Tank-mix with EBDCs or Coppers. [2.] Use these fungicide once during a growing season. [3.] Do not tank mix "Tin" with triazoles

RATE CONVERSIONS

Recommended Quadris In-Furrow Rates Based on Band Width and Row Spacing					
Band Width	**30" Rows**	**28" Rows**	**24" Rows**	**22" Rows**	**20" Rows**
7 inch	10.5	11.2	13.1	14.3	15.8
6 inch	9.0	9.6	11.3	12.3	13.5
5 inch	7.5	8.0	9.4	10.2	11.3
4 inch	6.0	6.4	7.5	8.1	9.0
3.5 inch	5.3	5.6	6.6	7.1	7.9
3 inch	5.3	5.6	6.6	7.1	7.9
Quadris Rates in fl.oz./A					
Band widths narrow than 3 inches are not recommended					

If band width is reduced, reduce rate accordingly.
Example: 28 inch row, 4-inch band width: Apply 6.4 fl. Oz/A

FUNGICIDES AVAILABLE FOR CERCOSPORA LEAFSPOT CONTROL

Fungicide	Active Ingredient & (FRAC Code)	Broadcast Rate	REI (hrs.)	Interval of Spray (days)	PHI (days)	Comments
AGRI-LIFE	copper sulfate pentahydrate (M1)	38 fl.oz./A	48	10	0	(1)
Agri Tin	triphenyltin hydroxide (30)	5.0 fl.oz/A	48	14	21	
Champ	copper hydroxide (M1)	2.62 lbs/A	48	10	0	(1)
Cuprofix	copper sulfate (M1)	2 lbs./A	48	10	0	(1)
Dithane F45	mancozeb (M3)	1.6 qts./A	24	10	14	
Eminent / Minerva	tetraconazole (3)	13 fl.oz./A	12	21	14	
Enable	fenbuconazole (3)	8 fl.oz./A	12	14	14	Add COC (1% v/v) or NIS (0.25% v/v) and Dithane
Inspire XT	difenoconzole & propiconazole (3)	7.0 fl.oz./A	12	21	21	
Kocide 3000	copper hydroxide (M1)	2.0 lbs/A	24	10	0	(1)
Maneb 75 DF or 80WP	maneb (M3)	2.0 lbs/A	24	10	14	
Manzate Flowable	mancozeb (M3)	1.6 qts/A	24	10	14	
Penncozeb 4FL	mancozeb (M3)	1.6 qts/A	24	10	14	
Penncozeb 75DF or 80WP	mancozeb (M3)	2.0 lbs/A	24	10	14	
Proline	prothioconazole (3)	5.7 fl.oz./A	12	21	7	Add NIS (0.25% v/v)
Super Tin 4L	triphenyltin hydroxide (30)	8 fl.oz/A	48	14	21	
Super Tin 80WP	triphenyltin hydroxide (30)	5.0 dry oz/A	48	14	21	
TOPGUARD	flutriafol (3)	10 fl.oz./A	12	21	21	
Topsin 4.5FL	thiophanate-Methyl (1)	20 fl.oz/A	24	10	21	Use with non-benzimidazole
Topsin 70 M-WSB	thiophanate-Methyl (1)	1 lb/A	24	10	21	Use with non-benzimidazole

(1) Do not mix with glyphosate and AMS or crop injury may occur. Appling in a spray solution having a pH of < 6.5, phytotoxicity may occur.

BEETCAST™

The improved BEETcast™ model can alert Michigan sugarbeet producers when to apply Cercospora leaf spot and Rhizoctonia root rot fungicides, and glyphosate.

BEETcast™ is sponsored by Michigan Sugar Company and consists of a network of over 50 weather stations that are strategically located in the sugarbeet growing region of Michigan and Ontario. Weather Innovations Inc. originally developed this model to help the Great Lakes sugarbeet industry better predict timely applications of fungicides for Cercospora leaf spot control. Recent modifications to BEETcast™ will now also help improve Rhizoctonia fungicide timing and glyphosate applications. By imputing specific background information and field locations, along with how a producer prefers to be contacted, alerts will be sent to growers indicating when applications should be considered.

BEETcast™ STATION

The website has a new look with additional tools and information that will allow producers to better time pesticide applications. Because specific producer and field information is used, a sugarbeet producer will need to "create an account" that has a username and password for login. There will be no cost for this and its only purpose is maintaining privacy. Producers that create a login account will be able to input specific field information and agronomic details and produce a field map. BEETcast™ will monitor environmental conditions including air and soil temperatures, leaf wetness, rainfall and growing degree days. The model can then provide alerts for timing applications for Cercospora leaf spot, Rhizoctonia and glyphosate applications. Producers will be able to create for each field a custom alarm notification sent to them via email or text message when application timings approach.

This tools will aid in Rhizoctonia and glyphosate applications are average daily soil temperature at the 4" depth and a Growing Degree Day accumulator (GDD). The best fungicide timing for Rhizoctonia control is variable. Research suggests that high levels of control are usually obtained from applying fungicides when the 4" soil temperature reaches and is expected to remain above the mid 60's°F. BEETcast™ will notify growers who input field information when the soil temperature reaches their defined alarm temperature, with the default now set at 63°F. Growers will also be able to get alerts from the GDD accumulator to aid in glyphosate applications.

Other new features include: estimated beet growth stages, site specific weather forecast, 24-hour rainfall and SPRAYcast®. The 24-hour rainfall map now updates frequently and shows real time totals. The SPRAYcast® tool predicts wind speed and spraying conditions hourly for the next three days in advance. This will give producers the best opportunity to safely apply crop protection materials.

In the past, the BEETcast™ model has been a valuable asset to the Great Lakes sugarbeet producers for controlling Cercospora leaf spot. With the recent updates, its value has been further enhanced by providing additional information for control of Rhizoctonia, weeds and other environmental conditions. Sugarbeet producers are highly encouraged to become a registered user of this site. Growers can get additional information and are able to access and input information through the Internet at the Michigan Beets website at **http://www.michiganbeets.com/**

Source: Steven Poindexter, Michigan State University Extension

HARVESTING AND STORAGE

Harvesting has to be a co-operative exercise undertaken in collaboration with the factory if excessive sugar loss is to be avoided. Good harvest planning is essential.

The factory requires the beet to be delivered in good condition and as free as possible from soil and green material. Deliveries may be rejected in extreme circumstances. Harvesting machines must therefore be efficient, minimizing breakages and giving a good separation of the soil and trash. They also have to be compatible with the seed drilling patterns.

Once the beet has been harvested there is a small but steady loss of sugar, exacerbated by poor storage conditions. It is therefore important that sugar losses during on-farm storage are minimized and the agreed delivery schedule to the factory is closely followed.

Sugarbeets should be handled as gently as possible to remove soil and trash to minimize sugarbeet breakage and bruising. The way sugarbeets are handled in harvesting and piling operations has a very significant effect on long-term storage in piles.

Both the quantity and quality of yield are influence by defoliating and scalping operation. Overly aggressive defoliating and scalping will reduce yield for the grower and will increase deterioration during storage, due to the large, expose root surface. If to much of the leaf or petiole is left on the root, root tare will be high and the root will tend to regrow in the storage pile. If the entire crown surface is left intact, impurities detrimental to processing will be high. The best defoliating an scalping compromise, for both grower and processor, is to remove all leaf and petiole material and to scalp only the very top of the root which contains most of the petiole area (sliver dollar size).

Flails should be adjusted to remove all green leaf material from the crowns. Poor flailing operations are generally caused by improper adjustment and too high a rate of ground speed. Flail only the amount of sugarbeets to be harvested each day. Flailed sugarbeets will freeze in the field much quicker compared to sugarbeets with tops.

Harvesters must be properly adjusted and operated at the proper speed and depth to lift and clean sugarbeets. Otherwise, excessive soil, trash, and broken and bruised sugarbeets will be loaded on the trucks. Row finders should be operating properly to prevent slicing and loss of sugarbeet root tips in the field.

Frosted or frozen sugarbeets cannot be piled safely, as they will deteriorate rapidly. When sugarbeet crowns are frozen or frosted in the field, harvest should be delayed until the sugarbeet tissue has a chance to thaw and stabilize.

Proper sugarbeet storage temperature is below 50˚F. Sugarbeets in storage piles are alive and must be maintained in a live condition. When piled hot (above 55˚F), beets lose much more sugar through respiration than when piled cool (below 50˚F).

Typical storage loss in storage piles averages nearly 0.5 pound of sugar per ton of roots per day. Part of that loss is controlled by weather conditions during storage, but some of the loss can be avoided by originally storing roots in good conditions.

Roots are several broken and bruised if the crop row is run over by tractors, trucks, and harvest equipment. To minimize this, use a beet cart when opening up fields to avoid running over the rows when filling trucks.

Field loss is another concern growers need to be aware of. Total field loss can average 0.9 ton/A and range from 0.2 ton/A to 4.0 ton/A. Of this total field loss, roots and root parts that should have been delivered to the processing facilities was the main contributor. The main cause of broken tails are mostly caused by lifter wheels set to shallow into the soil or excessive field speed. Most growers don't know that they have field loss, due to roots and root parts being covered up with soil, or never dug, thus never seen.

TABLE 1 - ONTARIO
Sugarbeet (Processing) Weed Control

Because the Ontario sugarbeet crop is processed entirely in the United states, **all** pesticides used must have both Canadian and United States registrations on sugarbeets. Check with your Michigan Sugar Company agriculturist before spraying.

PREEMERGENCE/POSTEMERGENCE

Active Ingredient TRADE NAME (Formulation)	PRODUCT RATE PER HECTARE (active rate/ha)	PRECAUTIONS
NORTRON SC (480 g/L) *ethofumesate*	**Light Soils:** Sands and Loamy Sands • **Broadcast:** 3.2 - 4.5 L/ha • **18 cm band width 55 cm row:** 1.0 - 1.6 L/ha **Medium Soils:** Silt and Clay Loams which contain < 3% organic matter • **Broadcast:** 4.5 - 6.75 L/ha • **18 cm band width 55 cm row:** 1.6 – 2.25 L/ha **Heavy Soils:** Clay Loam and Clays including those which contain > 3% organic matter • **Broadcast:** 6.75 - 8.25 L/ha • **18 cm band width 55 cm row:** 2.25 – 2.8 L/ha	Apply NORTRON Flowable herbicide before or at planting time and incorporate into the soil to a depth of 2.5 to 5.0 cm. Deeper incorporation may reduce effectiveness. **Do not rotate** with any crops other than sugarbeets for 12 months after application. Thorough tillage, including moldboard plowing, should precede the planting of crops other than sugarbeets. **Do not** use NORTRON Flowable Herbicide on muck or peat soils.
DUAL II MAGNUM (915 g/L) *s-metolachlor/ benoxacor*	1.25-1.75 L/ha 1.14-1.6 kg/ha	Apply to sugarbeets between cotyledon-4 leaf stage before weed emergence. **Do Not** apply more than 1 application/season. **Do Not** feed sugarbeet tops to livestock. Preharvest Interval: 120 days. Apply by ground equipment only.

TABLE 2 - ONTARIO
Sugarbeet (Processing) Weed Control

Because the Ontario sugarbeet crop is processed entirely in the United states, **all** pesticides used must have both Canadian and United States registrations on sugarbeets. Check with your Michigan Sugar Company agriculturist before spraying.

POSTEMERGENCE

Active Ingredient TRADE NAME (Formulation)	**PRODUCT RATE PER HECTARE (active rate/ha)**	**PRECAUTIONS**
ASSURE II (96 g/L) + SURE-MIX *quizalofop p-ethyl* + oil concentrate	0.38 - 0.75 L/ha 5L/1,000 L water 0.036-0.072 kg/ha 0.5% v/v	Apply POST when annual grasses and volunteer cereals are in the 2-leaf to tiller stage and volunteer corn and quackgrass are in the 2 to 6 lead stages. Apply before the crop canopy closes to maximize spray coverage. Use the 0.38 L/ha (0.15 L/ac) rate for annual grasses and volunteer cereals. Use the 0.75 L/ha (0.30 L/ac) rate for quackgrass. Use a second application of 0.38 L/ha (0.15 L/ac) rate for control late emerging weeds. **Do Not** exceed an accumulative seasonal use rate of 0.75 L/ha (0.30 L/ac). **Do Not** use flood jet nozzles. **Do Not** apply if rain is expected within 1 hour after application. Preharvest interval is 80 days.
LONTREL 360 (360 g/L) *clopyralid*	0.28 to 0.83 L/ha Plus any other herbicide approved as a tank-mix at the recommended rate in sufficient water to ensure thorough coverage (100 to 200 L/ha of spray solution) by ground equipment only at pressures of 200 to 275 kPa.	Should be applied when sugarbeets are in the cotyledon to 8 leaf stage. For the most effective control of Canada thistle, apply Lontrel 360 herbicide as a broadcast treatment to the entire infested area. **Do not** apply within 90 days of harvest.

TABLE 3 - ONTARIO
Sugarbeet (Processing) Weed Control

Because the Ontario sugarbeet crop is processed entirely in the United states, **all** pesticides used must have both Canadian and United States registrations on sugarbeets. Check with your Michigan Sugar Company agriculturist before spraying.

POSTEMERGENCE

Active Ingredient **TRADE NAME** **(Formulation)**	**PRODUCT RATE** **PER HECTARE** **(active rate/ha)**	**PRECAUTIONS**
UPBEET (50 DF) + AGRAL 90 **or** AG-SURF **or** CITOWETT PLUS **or** SURE-MIX *triflusulfuron-methyl* + non-ionic surfactant **or** adjuvant	35 - 70 g/ha 2.5 L/1,000 L water 2.5 L/1,000 L water 2.5 L/1,000 L water 2.5 L/1,000 L water 17.5-35 g/ha 0.25% v/v 0.25% v/v	In situations of stress, delay application until both weeds and sugarbeets resume growth. Apply no later than 60 days before harvest. Tankmix partners will vary in their Preharvest intervals. Chlorosis (yellowing) of the crop may be observed following an application of UPBEET but the effect is only temporary. If UPBEET is to be applied alone, an adjuvant **must be** included. The maximum use rate of UPBEET is 100 grams per hectare per growing season. **Do Not** apply while dew is present. **Do Not** spray if rainfall is excepted within 6 hours.
POAST ULTRA (450 g/L) + MERGE *sethoxydim* + surfactant/solvent	0.32-1.1 L/ha 0.25-2.0 L/ha 0.14-0.5 kg/ha 0.25-2.0 L/ha	For annual grasses: use 0.32 L/ha. Apply at the 2-5 leaf stage. For volunteer grains: 0.47 L/ha. Apply at 2-5 leaf stage. For quackgrass: 1.1 L/ha. Apply up to the 3 leaf stage. **Do not** graze treated crops. Spray tips angled forward 45° has better coverage. **Do Not** use flood jet or hollow cone nozzles. **Do Not** apply herbicides other than LONTREL 4 days of application. **Do Not** spray if rainfall is excepted within 1hour after application. Preharvest interval is 85 days.

TABLE 4 - ONTARIO
Sugarbeet (Processing) Weed Control

Because the Ontario sugarbeet crop is processed entirely in the United states, **all** pesticides used must have both Canadian and United States registrations on sugarbeets. Check with your Michigan Sugar Company agriculturist before spraying.

POSTEMERGENCE

Active Ingredient **TRADE NAME** **(Formulation)**	**PRODUCT RATE** **PER HECTARE** **(active rate/ha)**	**PRECAUTIONS**
UPBEET (50DF) BETAMIX ((1:1) 150 g/L) *triflusulfuron methyl* *+ desmedipham/* *phenmedipham*	35 - 70 g/ha 1.75 - 3.5 L/ha	In situations of stress, delay application until both weeds and sugarbeets resume growth. Apply no later than 60 days before harvest. Rainfall within 6 hours may reduce weed control. Make 2 applications 5-10 days apart, or as weeds emerge, to weeds with fewer than 4 true leaves. Best control when weeds have less than 2 leaves. The total grams of product applied must not exceed 100 g/ha per growing season. Yellowing of the crop may occur, but sugarbeets will recover. **Do not** use an adjuvant when tank mixing BETAMIX with UPBEET. If velvetleaf is the predominant weed, use UPBEET alone with adjuvant. Applications made to larger weeds or to weeds under stress may result in unsatisfactory control. **Do Not** apply while dew is present. **Do Not** spray if rainfall is excepted within 6 hours.

TABLE 5 - ONTARIO
Sugarbeet (Processing) Weed Control

Because the Ontario sugarbeet crop is processed entirely in the United states, **all** pesticides used must have both Canadian and United States registrations on sugarbeets. Check with your Michigan Sugar Company agriculturist before spraying.

POSTEMERGENCE

Active Ingredient **TRADE NAME** **(Formulation)**	**PRODUCT RATE** **PER HECTARE** **(active rate/ha)**	**PRECAUTIONS**
BETAMIX β EC ((1:1) 153 g/L) *phenmedipham/desmedipham*	2.75 to 4.75 L in 100 to 200 L/ha of water Repeat Application: For control of later germinating weeds, make a second application of BETAMIX β EC HERBICIDE. Use 2.75 to 3.5 L/ha Refer to the label for the amount to use for band applications.	Apply only to sugarbeets past the 2-true leaf stage. **Do Not** apply under water or heat stress. Allow at least 7 days between first and second applications. **Do not spray** while dew is present. Rainfall within 6 hours of spraying may reduce weed kill. **Do not** spray in excess of a total of 16.5 L/ha of BETAMIX HERBICIDE per season. **Do not** apply BETAMIX to Sugarbeets later than 60 days prior to harvest.
AIM EC (240 g/L) + AGRAL 90 **or** AG-SURF **or** MERGE *carfentrazone-ethyl* + non-ionic surfactant **or** surfactant/solvent	36.5-117 mL/ha 2.5 L/1,000 L 2.5 L/1,000 L 1 L/1,000 L 8.8-28.1 g/ha 0.25% v/v 0.1% v/v	**Broadleaf Herbicide** Apply POST with hooded sprayer between the rows. Apply to actively growing weeds up to 10 cm tall. Apply in a minimum of 100 L/ha water. Do Not apply closer than 1 day to harvest. Apply once/growing season.
ROUNDUP WEATHERMAX (540 g/L) **or** ROUNDUP ULTRA 2 (540 g/L) *glyphosate*	0.83 – 1.67 L/ha 0.45-0.9 kg/ha	**Roundup Ready Sugarbeet Only.** Apply Roundup to emerged weeds up to 15 cm. Up to **4** applications of glyphosate. Allow a minimum of 10 days between applications. **Do not** harvest Roundup Ready® sugarbeets within **30 days** after the final application of glyphosate.

TABLE 6 - ONTARIO
Disease and Insect Control Recommendation for Sugarbeets

Trade Name	Common Name	Group (FRAC Code)	Rate	DHI [1]	Notes
Caramba[2]	Metconazole	triazole (3)	1.0 – 1.25 L/ha	14	**Control** for Cercospora leaf spot. Use the higher rate when disease pressure is high.
Inspire[2]	Difenoconazole	triazole (3)	292 – 512 mL/ha	14	**Control** for Cercospora leaf spot and Powdery mildew. If disease pressure is high, use the highest rate and shortest interval
Mettle 125 ME[2]	Tetraconazole	triazole (3)	950 mL/ha	14	**Control** for Cercospora leaf spot and Powdery mildew. If disease pressure is high, use the highest rate and shortest interval
Proline[2]	Prothioconazole	triazole (3)	315 –415 mL/ha	7	**Control** for Cercospora Leaf Spot Use the higher rate and shorter intervals when conditions are favorable for severe disease pressure .
Headline 250 EC [2, 3]	Pyraclostrobin	strobilurin (11)	670 - 900 mL/ha	7	**Control** for Cercospora Leaf Spot and Powdery Mildew Use the higher rate when disease pressure is high.
Flint[2]	Trifloxystrobin	strobilurin (11)	182-244 g/ha	21	**Control** for Powdery mildew - 12 REI hrs
Quadris	Azoxystrobin	strobilurin (11)	4-6 mL/100 m of row. 0.5-1.1L/ha (over -the-row)	100	**Control** for Rhizoctonia root and crown rot. Apply once in-furrow at seeding or a banded application over the row soon after emergence but before the 6th leaf stage.
Manzate Pro Stick Penncozeb 80WP Polyram DF	Mancozeb	dithiocarbamates (M3)	2.25 kg/ha 2.25 kg/ha 2.25 kg/ha	21 21 21	**Control** for Cercospora leaf spot. Repeat at 7 to 10 day intervals.

[1] DHI=Days to Harvest Interval. [2] Tank mix with another fungicide with a different mode-of-action. [3] Cercospora resistance has been confirmed since 2012.

TABLE 7 - ONTARIO
Disease and Insect Control Recommendation for Sugarbeets

Trade Name	Common Name	Group (FRAC Code)	Rate	DHI [1]	Notes
Parasol WP or Coppercide WP	Copper Hydroxide	inorganic (M1)	2.25-4.25 kg/ha 2.25-4.25 kg/ha	1	**Control** for Cercospora Leaf Spot. Spray every 10 to 14 days depending on weather conditions .Do not mix with glyphosate and AMS or crop injury may occur. Appling in a spray solution having a pH of < 6.5, phytotoxicity may occur
Senator 70WP[2]	Thiophanate-methyl	benzimidazole (1)	420-560 g/ha	21	Systemic Fungicide **Control** for control of Cercospora leaf spot Maximum of one applications per growing season.
Vertisan	Penthiopyrad	pyrazole-4-carboxamides (7)	Soil: 15.5 mL/100m of row	7	**Control** for Rhizoctonia root and crown rot. Apply once in-furrow at seeding or a banded application over the row soon after emergence but before the 6th leaf stage.
Ambush 500 EC - - - - Perm-UP	Permethrin - - - - Permethrin	pyrethroid - - - - pyrethroid	140 - 300 mL/ ha - - - - 180-390 mL/ha	1 - - - - 1	**Control** for Cutworm. Where cutworms are large (near full maturity - 2.5 to 4 cm), use 225 to 300 mL/ ha. **NOTE**: will only control surface feeding or climbing stages of cutworms.
Coragen	Chlorantraniliprole	diamide	250mL/ha	1	**Control** for Cutworm. **NOTE:** will only control surface feeding or climbing stages of cutworms.
DiBrom	Naled	organophosphate	2.1 L/ha	5	**Control** for Red spider mites and leafhoppers.
Lorsban 4E, Pyrinex 480 EC, Warhawk 480EC	Chlorpyrifos	organophosphate	1.2 – 2.4 L/ha	90	**Control** for Cutworm (Pale western and, Redbacked) **Do not** apply more than once per season. **Do not** enter treated fields until 1 day after application.
Malathion 85E	Malathion	organophosphate	535 mL/ha	-	**Control** for flee beetles only.

CONVENIENT CONVERSION FACTORS

Multiply	By	To Get
Temperature (ºC)	1.8 (+32)	Temperature (ºF)
Temperature (ºF)	0.5555 (-17.88)	Temperature (ºC)
Ton (Short)	2,000	Pounds
Yards	3.0	Feet
Yards	36.0	Inches

CAPACITY MEASURE, LIQUID

Fl. ounce - 2 tablespoons
Fl. ounce - 6 teaspoons
Fl. ounce - 29.56 milliliters
Fl. ounce - 1.805 cu. in

Teaspoon - 5 milliliters
Teaspoon - 0.17 fl. ounce
Teaspoon - 60 drops
Pint - 2 cups
Pint - 16 fl. ounces
Pint - 473 milliliters
Pint - 28.87 cu. in.
Pint - 0.125 gallon
Pint - 0.473 liter
Pint - 32 tablespoons
Cu. ft. - 29.92 liq. qt.
Gallon - 128 fl. ounces
Gallon - 231 cu. in.
Gallon - 3,785 milliliters

Cup - 8 fl. ounces
Cup - 0.5 pint
Cup - 236.5 milliliters
Cup - 0.25 quart
Cup - 16 tablespoons
Cup - 48 teaspoons

Tbsp - 3 teaspoon
Tbsp - 15 milliliters
Tbsp - 0.50 fl. ounces
Quart - 32 fl. ounces
Quart - 2 pints
Quart - 57.75 cu. in.
Quart - 946 milliliters
Quart - 0.25 gallon
Quart - 0.94 liter

Liter - 2.1 pints (liquid)
Liter - 1.06 quarts (liquid)
Liter - 1,000 milliliters (liquid)
Liter - 1,000 cc (volume)

STANDARD POUNDS PER BUSHEL

Barley ……..……..48
Beans ……...……..60
Corn …….……...56
Millet……48

Milo …….……..50
Oats ……...…….32
Wheat …….……...60
Sugarbeets (cu. ft.) ……...40

CONVERSION FACTORS

Multiply	By	To Get
Acres	43,560	Square feet
Acres	4,840	Square yards
Acres	0.4047	Hectares
Bushels	2,150.42	Cubic inches
Bushels	1.2445	Cubic feet
Bushels	64	Pints
Bushels	32	Quarts
Cubic feet	1,728	Cubic inches
Cubic feet	0.03704	Cubic yards
Cubic feet	7.4805	Gallons
Cubic feet	59.84	Pint (liquid)
Cubic feet	29.92	Quarts (liquid)
Cubic yards	27	Cubic feet
Cubic yards	46,656	Cubic inches
Cubic yards	0.7646	Cubic meters
Cubic yards	202	Gallon
Cubic yards	1,616	Pints (liquid)
Cubic yards	807.9	Quarts (liquid)
Feet	12	Inches
Feet	0.33333	Yards
Feet per minute	0.01667	Ft. per second
Feet per minute	0.01136	Miles per hour
Gallons	0.1337	Cubic feet
Gallons	231	Cubic inches
Gallons	128	Ounces (liquid)
Gallons	8	Pints (liquid)
Gallons	4	Quarts (liquid)
Gallon of water	8.3453	Lbs. of water
Grams	0.0353	Ounces
Grams per liter	1,000	Parts per million
Hectares	2.471	Acres
Inches	2.54	Centimeters
Inches	0.08333	Feet
Inches	0.02778	Yards
Kilograms	2.205	Pounds
Kilometer	0.6214	Miles
Liters	0.2642	Gallons
Liters	2.113	Pints (liquid)
Liters	1.057	Quarts (liquid)
Meters	100	Centimeters
Meters	3.281	Feet
Meters	39.37	Inches
Square miles	640	Acres
Square miles	28,878,400	Square feet
Square miles	3,097,600	Square yards

CONVERSION FACTORS (CONTINUE)

Multiply	By	To Get
Meters	0.001	Kilometer
Meters	1,000	Millimeter
Meters	1.094	Yards
Miles	5,280	Feet
Miles	320	Rods
Miles	1,760	Yards
Miles per hour	88	Feet per minute
Miles per hour	1.467	Feet per second
Miles per minute	88	Feet per second
Miles per minute	60	Miles per hour
Ounces (dry)	0.0625	Pounds
Ounces (liquid)	1.805	Cubic inches
Ounces (liquid)	0.0078125	Gallons
Ounces (liquid)	29.563	Milliliter (liquid)
Ounces (liquid)	0.0625	Pints (liquid)
Ounces (liquid)	0.03125	Quarts (liquid)
Parts per million	0.0584	Grains per U.S. gallon
Parts per million	0.001	Grams per liter
Parts per million	8.345	Pounds per million gallons
Pints (dry)	0.015625	Bushels
Pints (dry)	33.6003	Cubic inches
Pints (dry)	0.0625	Pecks
Pints (dry)	0.5	Quarts (dry)
Pints (liquid)	28.875	Cubic inches
Pints (liquid)	0.125	Gallons
Pints (liquid)	0.4732	Liters
Pints (liquid)	16	Ounces (liquid)
Pints (liquid)	0.5	Quarts (liquid)
Pounds	16	Ounces
Pounds	0.0005	Short ton
Pounds of water	0.01602	Cubic feet
Pounds of water	27.68	Cubic inches
Pounds of water	0.1198	Gallons
Quarts (dry)	67.20	Cubic inches
Quarts (dry)	0.125	Pecks
Quarts (dry)	2	Pint (dry)
Quarts (liquid)	57.75	Cubic inches
Quarts (liquid)	0.25	Gallons
Quarts (liquid)	0.9463	Liters
Quarts (liquid)	32	Ounces (liquid)
Quarts (liquid)	2	Pints (liquid)
Rods	16.5	Feet
Square feet	144	Square inches
Square feet	0.11111	Square yards
Square inches	0.00694	Square feet

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