SUGARBEET DISEASE CONTROL

I. Seedling Diseases / Root Diseases

When done properly, seed treatment protects seed from pathogenic fungi associated with the seed. Otherwise, spores of pathogenic fungi adhere to the seed. When the seed is planted, these pathogenic fungi begin to grow, invade the seed or seedling, and cause a seedling blight. Other fungi live in the soil and may cause seedling problems. Soil-borne Pythium, Aphanomyces and Rhizoctonia fungi can cause serious stand loss when the soil is moist or wet.

Tachigaren seed pelleting is highly effective against Pythium at lower rates and Aphanomyces at higher rates. Tachigaren persists for only 3-4 weeks and will provide protection only for the emerging seedling; it does not provide protection against mid-season infection. Commercial seed treaters apply tachigaren to sugarbeet seeds. Tachigaren can be used at 20 to 30 grams per unit (100, 000) of seed on minimum buildup pelleted seed, or 45 to 90 grams per unit of seed on standard pelleted seed. Rates greater than 45 gram of tachigaren per unit of seed may cause phytotoxicity. Use rate of 20 to 30 grams of tachigaren is recommended on fields with light to medium disease pressure. Growers with medium disease pressure, however, should be cautioned that use of 20 or 30 gram rate may be inadequate when soil is warm after a heavy rainfall or when these conditions are prolonged within 3 weeks after planting. Use rate of 45 grams of tachigaren is recommended for fields with heavy disease pressure. For season-long management of Aphanomyces, the best approach is to apply Tachigaren

to varieties with partial resistance to Aphanomyces. Early planting and good drainage may also help reduce early season losses from Aphanomyces seedling disease. An Aphanomyces soil test should be done to determine if the soil is infected with Aphanomyces, and the level of infection.

Tachigaren is not effective against Rhizoctonia. To manage Rhizoctonia in severely infected fields, plant resistant varieties early, avoid "hilling" soil on sugarbeet crowns, increase the length of rotation, and rotate with non-host crops. Rhizoctonia may also be controlled by applying Quadris at 9 fl oz per/A in a 7 inch band just before infection occurs.

Rhizomania (Crazy Root) is caused by Beet Necrotic Yellow Vein Virus (BNYVV) that is transmitted by the soilborne protozoan, *Polymyxa betae*. Rhizomania is characterized by stunted taproots with masses of hairy lateral roots giving them a bearded appearance. The root is often constricted and the vascular tissues become discolored. The leaves becomefluoresent-yellow (with elongated petioles) in color, similar to nitrogen deficiency symptoms. Rhizomania may be managed by planting approved resistant varieties early in well drained fields on a 3-4 year rotation.

Fusarium yellows is caused by the fungus, *Fusarium oxysporum* f. sp. *betae*. Fusarium yellows first appears on older leaves as chlorosis (yellowing) between the larger veins. As the disease progresses, younger leaves also become chlorotic, and the older, symptomatic leaves become necrotic. Occasionally, only half a leaf is chlorotic or necrotic (a symptom more typical of Verticillium wilt, which also was recently identified on sugarbeet in this region). Entire leaves eventually die but remain attached to the plant and collapse in a heap around the crown.

There are no external root symptoms. A transverse section through the root shows a grayish brown vascular discoloration. Mature plants rarely die, but the disease causes significant reduction in root yield and recoverable sucrose. In storage, quality of infected roots may deteriorate more rapidly than in non-infected roots. The disease is favored by high soil temperatures. Fields that are waterlogged, or with poor soil structure provide favorable conditions for infection. Crop rotation may reduce inoculum buildup in the soil but this practice is unreliable because *F. oxysporum* f. sp. *betae* has a wide host range and chlamydospores survive for many years. Identification and development of resistant varieties will be an important step in managing this disease in the Red River Valley. See circular PP-1247 for more information on Fusarium yellows of sugarbeet.

II. Leaf Spots

There are various leaf spot diseases of sugarbeets. Cercospora leaf spot is the most common and destructive disease in this area. The severity of Cercospora varies from year to year depending on weather conditions, inoculum potential, and varietal resistance. Cercospora can cause losses in susceptible varieties through reduced tonnage, reduced percent sucrose, increased impurities and poorer storage after harvest when the beets are in piles. Even fairly low levels of leaf spot may cause these effects. Cercospora leafspot disease severity was low in recent years. Bacterial leaf spot generally does not cause economic damage. Bacterial leafspot may develop in wet weather; no fungicide is registered for its control. See Circular PP-1244 for a comparison of Cercospora and Bacterial leaf spots in sugarbeet.

Leafspot Management. **Management of Cercospora requires an integrated approach which includes early incorporation of infected debris, crop rotation, use of varieties that are less susceptible, disease scouting, timely application of fungicide, adherence to appropriate application intervals and more frequent applications when disease conditions are favorable**. Avoid planting next to last year's sugarbeet. This is especially important if last year's fields had high levels of Cercospora. In high risk situations, select approved varieties that are less susceptible than the average. Begin checking for Cercospora in late June or early July, making sure to check near last year's fields or shelter belts. The first fungicide application should occur when conditions first favor disease or at disease onset.

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

Resistance and Tolerance to Fungicides. The terms "resistance" and "tolerance" are often used interchangeably. However, in the following discussion they are used with specific different meanings. Resistance is used to indicate that the Cercospora fungus is unaffected by a level of fungicide that previously prevented growth in the laboratory. Tolerance is used to indicate that growth of the Cercospora fungus is reduced in the laboratory by a level of fungicide that previously prevented growth in the laboratory. Resistant isolates of Cercospora are not controlled by field applications of a fungicide. **If tolerant strains are present, a reduced level of control will occur.**

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

Benzimidazole resistant isolates grow normally in the laboratory in the presence of 5 ppm (part per million) of benzimidazole fungicide. Sensitive isolates do not grow at all in the presence of 5 ppm of benzimidazole fungicide. **Benzimidazole resistant strains and TPTH tolerant strains were common and widespread in Minnesota and North Dakota in 2003. Some isolates of the Cercospora fungus have been found that were resistant to the benzimidazole class of fungicide and tolerant to TPTH.**

Strains of Cercospora with tolerance to TPTH were confirmed for the first time in southern Minnesota and the southern Red River Valley in 1994. Tolerance was detected in fields where control was not as good as expected. Such tolerance is difficult to distinguish from inadequate application technique or a late start in application. Tolerance is best defined as an ability of the fungus to grow in the laboratory in the presence of TPTH at 0.2 ppm or at 1 ppm. Sensitive strains do not grow at all when subjected to these levels of TPTH, but tolerant strains grow at a reduced rate compared to growth in the absence of TPTH. Effective fungicides from different classes should be alternated to delay the development of tolerant or resistant strains of the pathogen.

Managing Cercospora Leaf Spot with Fungicides. In the southern Minnesota, Minn-Dak, and Moorhead factory districts, the fungicides Eminent, Headline or Gem, and TPTH, used in rotation, will effectively control Cercospora leaf spot.

In the Hillsboro, Crookston, East Grand Forks, and Drayton factory districts, the fungicides Eminent, Headline or Gem, TPTH, and a tank-mix of Topsin M and TPTH, used in rotation, will effectively control Cercospora leaf spot. The first fungicide used for Cercospora control in 2008 should not be the same fungicide, or a fungicide from the same class of chemistry as the last fungicide application in 2007.

If aerial application is made, make sure that areas around power lines and trees are side-dressed by the aerial applicator or by use of ground equipment. Aerial applicators should use a minimum of 5 gal water/A; 7-10 gal/A gives better coverage. Improperly sprayed areas become focal points for Cercospora spread. Best results with ground equipment are obtained by using high pressure (100-120 psi) and high volume (20 gal/A) of water.

Pre-harvest Intervals (PHI). Fungicides may be needed well into September to control Cercospora in some years; stopping application of fungicides before this time may result in late-season damage that can reduce tonnage, sucrose and quality. Do not allow the PHI to be an excuse for missing an application late in the season. It may be preferable to spray a field leaving the headlands and a strip in the middle unsprayed, allowing pre-pile harvest in these areas.

Application Intervals. Generally, the application interval for most of the fungicides recommended is 14 days.
Variety Selection and Cercospora Management. There are differences in Cercospora susceptibility among approved varieties. Cercospora may be somewhat easier to manage on varieties with higher than average tolerance to Cercospora. Conversely, varieties that are more susceptible than the average may need an extra spray in years that are highly favorable for Cercospora. Use of more tolerant varieties can be an important part of an integrated disease management plan.

Minn-Dak Approved Varieties for 2008 CLS Rating (2 year mean)					
ACH RR658	3.96	Beta 85RR02	4.64	Beta 86RR44	5.02
Beta 86RR77	4.1	Seedex Alpine	4.81	HM 3028 Rz	5.05
Holly HX631	4.27	Beta 86RR66	4.91	HM 3064 Rz	5.05
Hm 3035 RZ	4.45	HM 4012RR	4.97	Beta 1317R	5.14
Seedex Sonic	4.55	VDH H46531	4.98	VDH H46807	5.15
Holly 448	4.56	ACH R357	5.02	HM 4020RR	5.16
VDH H46519	4.59	ACH R454	5.02	HM 2415Rz	5.34
Holly 567	4.61	ACH RR539	5.02	Beta 1584R	5.35

American Crystal Sugar Co. Approved Varieties CLS Rating (2year mean)

Hilleshög 3031Rz (+ Aph)	4.2	Beta 1301R(+ Aph+ Rhc)	4.8	Hilleshög 3050Rz (7250)	5.1
Hilleshög 3035Rz (+ Aph+ Rhc)	4.4	Seedex Sonic	4.8	Hilleshög 4003RR (9003+ RR)	5.1
Crystal 658RR (+ RR)	4.4	SESVanderhave H46911	4.8	Hilleshög 4010RR (9010+ RR)	5.1
Crystal 727	4.4	Beta 1772R (+ Aph)	4.9	Hilleshög 4012RR (9012+ RR)	5.1
BTS 85RR02 (B5802RR+ Aph+ RR)	4.6	Crystal R308	4.9	SESVanderhave H46531	5.1
SESVanderhave H46519	4.6	SESVanderhave H46532	4.9	SESVanderhave H48607	5.1
Holly 317	4.7	BTS 86RR66 (B6806RR+ RR)	4.9	BTS 86RR44 (B6804RR)	5.1
Holly 556	4.7	Hilleshög 3052Rz (7252)	5.0	Crystal 539RR	5.1
Seedex Alpine (+ Aph)	4.7	Holly 06HX629 (Holly 629)	5.0	Hilleshög 3051Rz (7251)	5.2
Seedex Rezult (+ Aph)	4.7	Seedex Magnum	5.0	SESVanderhave H46807	5,2
Seedex Triton (SX0835)	4.7	Beta 4554R (+ Aph)	5.1	Cryatsl R431	5.3
BTS 86RR88 (B6808RR)	4.7	Crystal 539RR (+ Aph+ RR)	5.1	Crystal R434	5.3
SESVanderhave H66855	4.7	Hilleshög 3028Rz (+ Aph)	5.1	SESVanderhave H46533	5.3
		Hilleshög 3036Rz (+ Aph)	5.1	Beta 1305R (+ Aph)	5.4

Varieties with lower CLS ratings are more tolerant than varieties with higher ratings. Varieties with higher ratings may need more fungicide applications to control CLS.

III. Powdery Mildew

Powdery mildew may occur on sugarbeet. The spread may be spotty, depending on the time of infection and weather conditions. When mildew occurs in late July or early August, we might expect some crop loss. Late occurring mildew (September) would not be expected to cause a measurable crop loss. Headline and Eminent, used for Cercospora leaf spot control, also provide good powdery mildew control. In areas where fungicides are not used for Cercospora leaf spot, apply sulfur at 8-10 lb a.i/A, Headline, Eminent, or Enable to control mildew if it appears prior to mid-September.

IV. Note

Other fungicides may be registered or currently recommended products may be dropped from registration, *therefore, be sure to check the product label for registered use on sugarbeets.* For rates and intervals of application, follow the directions on the label.

FOLIAR SPRAYS - LEAFSPOTS

Fungicide and Estimated Cost	Label Rate	Harvest Restrictions (PHI)	Application Interval
Strobilurins			
Azoxystrobin			
Quadris $/A= 21.24 - 35.54	9.2-15.4 fl oz/A	May be applied up to harvest (0 d PHI). Re-entry interval (REI) - 4 hr	Always alternate with a non-strobilurin fungicide. Effective for 14 days.
Pyraclostrobin			
Headline $/A= 15.00	9 fl oz/A	Do not apply within 7 days of harvest (7 d PHI). REI - 4 hr	Always alternate with a non-strobilurin fungicide. Effective for 14 days.
Trifloxystrobin			
Gem $/A= 22.75	3.5 fl oz/A	Do not apply within 21 days of harvest (21 d PHI). REI - 12 hr	Always alternate with a non-strobilurin fungicide. Effective for 14 days.
Triazole			
Eminent $/A = 17.00	13 fl oz/A	Do not apply within 14 days of harvest (14 d PHI) REI - 12 hr	Always alternate with a non-triazole fungicide.
Enable 2F $/A=13.50-14.00	8 fl oz/A	14 days PHI	Alternate with a non-triazole fungicide

FOLIAR SPRAYS - LEAFSPOTS

Fungicide and Estimated Cost	Label Rate	Harvest Restrictions (PHI)	Application Interval
Benzimidazole			
Topsin M WSB	0.5 lb/A	Do not apply within	**Resistance to benzimidazole**
Thiophanate		21 days of harvest	**fungicides is common**. Use
Methyl 85 WDG	0.4 lb/A	(21 d PHI).	*only* in a tank mix with a
			protectant
Topsin M4.5F	10 oz/A		
$/A =8.84		REI - 12 hr	Do no exceed 1 application/year.
			See text.
EBDC			
Mancozeb			
Manzate 75 DF	1.5-2 lb/A	Do not apply	Effective for about 7-10 days.
		within 14 days	Do not enter treated
Penncozeb DF	1.5-2 lb/A	of harvest	areas within 24 hours
		(14 d PHI).	without protective clothing
$/A =4.05-5.50		REI - 24 hr	
			Do not exceed 11.2 lb
Maneb			ai/A per season of total
Maneb 80	1.5-2 lb/A		EBDC (mancozeb and/or
			maneb) *i.e.* do not exceed
Maneb 75DF	1.5-2 lb/A		14 lb/A of formulated WP
			or DF or 11.2 qt/A of
Manex	1.2-1.6 qt/A		formulated flowable
$/A =4.50 - 6.00**;**			
4.73 - 6.30; 4.25 - 5.66			

FOLIAR SPRAYS LEAFSPOTS

Fungicide and Estimated Cost	Label Rate	Harvest Restrictions (PHI)	Application Interval
Maneb 75DF	1.5-2 lb/A		14 lb/A of formulated WP or DF or 11.2 qt/A of formulated flowable
Manex $/A =4.50 - 6.00**;** 4.73 - 6.30; 4.25 - 5.66	1.2-1.6 qt/A		
Triphenyl Tin Hydroxide (TPTH)			
Super Tin 80WP Super Tin 4L, Agri Tin $/A = 4.71- 9.42	2.5-5 oz/A	Do not apply Super Tin 4L within 21 days of harvest in MN & ND. Do not apply Agri Tin or Super Tin 80WP within 7 days of harvest in ND & MN. Do not graze or feed beet tops to livestock. REI - 48 hr.	**Restricted use pesticide.** Use 5 oz/A rate. Do not enter treated fields within 48 hours of treating without protective clothing. Do not exceed 15 oz/A of TPTH 80 WP per season. Ground application must be with closed cabs.

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

Strobilurins	**Sterol Inhibitors**	**Ethylenebisdithiocarbamates (EBDC)**
Gem	Eminent	Maneb
Headline	Enable	Mancozeb
Quadris	Tilt	Manzate
		Penncozeb
Benzimidazole		**Triphenyltin Hydroxide (TPTH)**
Topsin M		SuperTin
		Agri Tin

PS: Products must be labeled before they can be used for controlling Cercospora leaf spot on sugarbeet.

Rhizoctonia crown rot control

Fungicide and Extimated Cost	Label Rate	Harvest Restrictions (PHI)	Application Interval
Quadris $/A= 21.24 - 35.54	9.2-15.4 fl oz/A in a 7" band	May be applied up to harvest (0 d PHI). Re-entry interval (REI) - 4 hr	Always alternate with a non-strobilurin fungicide.

POWDERY MILDEW

Fungicide and Estimated Cost	Label Rate	Harvest Restrictions (PHI)	Remarks
Sulfur			
Micro Sulf 80%	5-10 lb/A (4-8 lb ai)	Can be used up to harvest	One application gives protection for 4 weeks.
Microthiol Disperss 80%	5-10 lb/A (4-8 lb ai)	(0 d PHI) REI - 24 hr	
Thiolux (DF)	10-20 lb/A (8-16 lb ai)		
$/A= 10.00-11.00 (8-10 lb ai)			