

# Crop Profile for Sugar Beets in Michigan

Prepared: October, 1999

## General Production Information

Sugarbeet is the only field crop grown in Michigan where the grower contracts the entire acreage. The sugar companies each have agricultural staff which include farm advisors (fieldmen), agronomic research staff and laboratory facilities to analyze beets for quality. There is a close working relationship between the sugarbeet industry and Michigan State University.

A sugarbeet farm is often larger than other farms in Michigan which produce field crops. This may be because of the amount of input needed to farm sugarbeets due to the specialized equipment. For example, the average sugarbeet farm is approximately 800 acres compared to 290 for the cash crop type of farm which does not include sugarbeets or potatoes (Chase et al., 1990).

About 5% of the sugarbeet growers are under 25 years of age, 18% are 25-34, 22% are 34 to 44, 23% are 45 to 54, 25% are 55 to 64 and 7% are over 65 (Ferris, 1990). The median age of the primary operator is 48, while the second operator is 39. The second operator is most often a relative, usually a spouse or a son. Yield of all crops for the sugarbeet type of farm is considerably above the state average. Sugarbeets are grown on some of the better soils in the state. The sugarbeet enterprise requires a larger investment than other cash crop enterprises and the crop is generally more difficult to manage than other field crops.

In processing of sugarbeets, several advancements have decreased labor and increased efficiency in the refining plants. Automated centrifugals, which remove liquid from the sugar, allow a continuous flow rather than a batch method of operation. This is more efficient and requires less labor. Continuous flow diffusers have increased the rate of sugarbeet processing. It has also decreased the amount of labor required compared to the batch diffuser. Continuous flow operating pans (boiling off excess liquid from the sugar) make this phase of the operation more efficient. This industry is in the early stages of development of computer-controlled factory operations which will likely change processing from an art to a science. The driving force behind these changes has been the need to be more efficient. There has been a need to increase efficiency of processing operations in order to remain competitive. (15)

- The top state in sugar beet production is Minnesota.
- Michigan ranks 5th in sugar beet production.

	<b>Sugarbeets</b>
Michigan Ranking	4

Percent U.S. Production	10.3
Area Planted (5 year Average in acres)	181,000
Area Harvested (5 year average in acres)	173,000
Value of Production (5 year average)	\$110,213
Production (tons/acre) (5 year average)	2,847,800

(7)

(7)

	District	Counties	Acres Planted	Acres Harvested
Sugarbeets (from 1996-97 MASS)(7)	Central	Gladwin 1995	1350	1300
		1996	1100	1000
		Gratiot 1995	22500	22100
		1996	17500	13000
		Isabella 1995	1750	1700
		1996	1600	1200
		Midland 1995	5700	5600
		1996	4000	3400
		Montcalm 1996	500	400
	East Central	Arenac 1995	4900	4800
		1996	4400	4000
		Bay 1995	23100	23000
		1996	17600	14000
		Huron 1995	46000	45800
		1996	45000	43000
		Saginaw 1995	22000	21400
		1996	16500	12500
		Sanilac 1995	19000	19000
		1996	13500	11500
	Tuscola 1995	37000	37000	
	1996	27000	22000	
	Southeast	Lenawee 1995	2600	2500
		1996	1600	1500
St. Clair 1995		2000	1900	
1996		1750	1700	
Other counties 1995		500	500	
1996		650	600	

## Cultural Practices

There has been a steady increase in the number of acres of sugarbeets harvested in Michigan expanding from an average of 74,000 in the period 1960-1965 to 152,000 for the 1987-1991 period (Table 1). Yields increased from 15.6 to 18.1 tons/acre over this same period. Michigan's share of the U. S. production has increased from 5.9% to 10.3% during this 27-year period. However, Michigan's national ranking did not change, which reflects increased acreage in other areas such as Minnesota, North Dakota and Idaho.

In 1990 there were 157,000 acres of sugarbeets harvested in Michigan. It ranks sixth behind corn, hay, soybeans, wheat and dry beans in Michigan with respect to the number of acres grown. Michigan ranks fourth in the U.S. in total tons of sugarbeet produced. Broad-spectrum herbicides and post-emergence herbicide programs, coupled with band spraying, has led to cost-effective weed control programs requiring less hand labor. It should be noted that labor is not as available as it was previously for both blocking and thinning and weed control. The development of machinery which defoliates rather than scalping (slicing off the crown) the sugarbeet has increased storage quality. Scalping leaves a portion of the beet root in the field and increases spoilage in the pile during storage because of the wound to the root. Development of 4- and 6-row harvesters, which can efficiently harvest sugarbeets in a wide range of conditions, has made it possible to increase both the acreage produced and the size of sugarbeet farms. Mono-germ seed, fungicide treatment of seed, better seed quality and new herbicides reduce labor requirements and have made production more efficient. (15)

## Insect Pests

### Tarnished plant bugs (*Lygus lineolaris*)

#### *Biology*

The tarnished plant bug is found throughout North America. It has two to five generations per year, depending on location. It is a true bug with piercing-sucking mouthparts.

Adults are 6-6.5 mm long, oval and somewhat flattened. They are greenish-brown in color with reddish brown markings on the wings. A distinguishing characteristic is a small but distinct yellow-tipped

triangle in the center of the back. They overwinter as adults under leaf litter, stones, and tree bark and in other protected places. They become active at the end of April and begin laying eggs in crop and weed hosts. The eggs are about 1 mm (0.04 in.) long, cream colored and flask shaped. They are laid in plant tissues so only the small anterior end is visible. Eggs can be laid on fruit crops but are generally deposited on weeds and grasses. The eggs hatch into nymphs about 7 days after being laid. Young nymphs are pale green and resemble aphids, except their legs are more robust, their movements are more rapid and they have no abdominal cornicles. The nymphs resemble the adults without wings. The damage is caused by the toxin excreted from feeding on the plants, causing yellowing symptoms.(23)

#### *Cultural Controls*

The plants are frequently monitored for plant bugs visually or by sweep net sampling, especially during flowering and pod formation.

#### *Chemical Controls*

carbaryl  
esfenvalerate

Treatment is rarely justified and the thresholds are not well defined, however, spraying has occurred in the last few years.

#### *Alternative Controls*

No information available

## Cutworms

#### *Biology*

Cutworms may overwinter as 1/2- to 1-inch long larvae or as eggs in the soil. They may cut plants off at the soil surface. Cutworms are most abundant in weedy areas of a field or adjacent to cover crop strips after the cover crops are killed or tilled.. They pupate in the soil, and adult moths emerge in June or July. They may have from 1 - 3 generations per year, but typical cutworm injury occurs only early in the season when plants are small.

#### *Cultural Controls*

Good weed control (23)

#### *Chemical Controls*

chlorpyrifos  
carbaryl

#### *Alternative Controls*

No information available

## **Spinach leafminer**

### *Biology*

The spinach leafminer adult is a medium-sized fly. Female flies lay white, oblong eggs on the undersides of beet cotyledons and leaves. Females prefer more fully expanded leaves versus the newly emerging ones. Eggs are typically laid side by side in groups of three to seven. Eggs hatch in three to ten days, depending on temperatures, and the young larvae (maggots) begin to mine in the leaf tissue. At first, a thin winding tunnel appears and gradually expands into a progressively larger mine. The larvae eat all of the leaf tissue between the upper and lower leaf surfaces leaving only the epidermis. The mined out area appears translucent and can be up to two inches in diameter. After feeding for one to three weeks (again depending on temperature), the mature larvae drop out of the leaf and pupate in the soil. New adults will emerge from these pupae. The spinach leafminer has three generations in Michigan. Typically, only the first generation feeds in beets. However, in some years, all three generations attack the crop. (20)

### *Cultural Controls*

Older beets will generally be more tolerant of feeding than newly emerged ones. (20)

### *Chemical Controls*

chlorpyrifos

Insecticide treatments are only considered if one-half or more of the small plants have egg masses and applied when the first small mines appear. Many fields establish larvae in mines before treatments can be applied. The only product labeled for foliar control of spinach leafminer in beets is Diazinon. While Diazinon does not have systemic activity, tests in 1993 showed that small-to medium-sized larvae could be controlled in the mines in most cases. While not specifically labeled for leafminer, Lannate is labeled for flea beetle control on beets and would be legal to use on spinach leafminer. Lannate was effective on spinach leafminer in 1993 tests, but no more than Diazinon. (20)

### *Alternative Controls*

No information available

## **Flea beetle**

### *Biology*

Adults overwinter in leaf litter, generally around field edges. Flea beetles lay their eggs at the base of the plant, and larvae feed on roots. Adults feed on foliage, chewing small, round "shotholes" in leaves. Damage from adult feeding is most severe when plants are young. Damage may also be localized in the

field, being more severe near the field edges where beetles overwinter.

*Cultural Controls*

No information available

*Chemical Controls*

No information available

*Alternative Controls*

No information available

## **Sugarbeet Root Aphid**

*Biology*

Sugarbeet root aphids (SRA) are active, feeding on roots of common lambsquarter in fields in the Thumb. Female SRA overwinter in the soil. When lambsquarter emerges, the aphids colonize the roots, begin to feed, and have live babies. The most noticeable sign of early SRA infestation is a bright white coating on the roots or in the soil around the root. This is a waxy protective substance secreted by the aphid. As SRA populations build, the aphids will move to roots of developing sugarbeets. (15)

*Cultural Controls*

Good weed control

Tolerant varieties available (23)

*Chemical Controls*

terbufos (23)

triazimate (23)

*Alternative Controls*

No information available

## **Insecticide Profiles**

### **Insecticides Reported Used by Michigan Growers**

**diazinon** (organophosphate) (2)

- Formulations: Diazinon

- Pests Controlled: Foliar Aphids, leafhoppers, spinach leafminer and wireworms.(2)
- Percent of Crop Treated:
- Types of Applications: banded(5)
- Application Rates: On aphids, leafhoppers and leafminers- 4EC=0.75 to 1 pint/acre; 50W=0.75 to 1 lb/acre; AG 500=0.75 to 1 pint/acre. formulated ingredient=0.38-0.5lb/acre. On wireworms-14 G=21-28 lb/acre; 4 EC=3-4 qt/acre;50 WP=6-8 lb/acre; AG500=3-4 qt/acre. formulated ingredient=3-4 lb/acre. (2)
- Number of Applications: 1 (23)
- Timing: aphids-when there is one colony or more per plant; leafhoppers-when leafhoppers are easily seen in the field or there is noticeable leaf curling; leafminers-when eggs appear on half of small plants or more.
- Pre-Harvest
- Interval: 14 days (2)
- REI: 12-24 hours.(2)
- Use in IPM Programs: No information available.
- Use in Resistance Management Programs: No information available.
- Efficacy Issues: No information available.
- Advantages: No information available.
- Disadvantages: No information available.
- Critical Use Issue: Highly toxic to bees.(2)

### **chlorpyrifos** (organophosphate)

- Formulations: Lorsban 4E, Lorsban 2EE (23)
- Pests Controlled: Spinach Leafminer
- Percent of Crop Treated:
- Types of Applications: Broadcast-1 pt/acre; Banded-2/3 pt/acre. Aerial application-use 2-5 gallons of water per acre. Ground application-10-30 gallons of water per acre.(15)
- Number of Applications:
- Timing: when one egg is seen on at least 50% of plants.(15)
- Pre-HarvestInterval:
- REI:
- Use in IPM Programs:
- Use in Resistance Management Programs:
- Efficacy Issues:
- Advantages:
- Disadvantages:
- Critical Use Issue:

### **carbaryl** (carbamate) (2)

- Formulations:Sevin, Sevin XLR (2)

- Pests Controlled: armyworms, cutworms, flea beetles, leafhoppers and plant bugs. (2)
- Percent of Crop Treated:
- Types of Applications:
- Application Rates: : 4 F or XLR Plus-1-1.5 qt/acre, 1-1.5 lb/acre active ingredient; 50 W-2-3 lb/acre; 80 S or 80 SWP-1.25-1.875 lb/acre.(2)
- Number of Applications: Maximum 4 lb active ingredient per season. (2)
- Timing: no information available
- Pre-Harvest Interval: 28 days (2)
- REI: 12 hours (2)
- Use in IPM Programs: no information available
- Use in Resistance Management Programs: no information available
- Efficacy Issues: no information available
- Advantages: no information available
- Disadvantages: no information available
- Critical Use Issue: High toxic to bees (2)

### **terbufos** (organophosphate) (2)

- Formulations: Counter 20 CR (2)
- Pests Controlled: white grubs and wireworms (2)
- Percent of Crop Treated:
- Types of Applications: In-furrow or banded. (2)
- Application Rates: 3-6 oz/1000 row ft, 0.65-1.3 lb/acre active ingredient (2)
- Number of Applications: 1 per season (2)
- Timing: no information available
- Pre-Harvest Interval: information not available (2)
- REI: 48 hours (2)
- Use in IPM Programs: no information available
- Use in Resistance Management Programs: no information available
- Efficacy Issues: no information available
- Advantages: no information available
- Disadvantages: no information available
- Critical Use Issue: moderately toxic to bees. Do not place granules in direct contact with seed as crop injury may occur. Restricted Use Pesticide- A pesticide applicator certificate is required from the MDA for the purchase and use of these pesticides. (2)

### **esfenvalerate** (pyrethroid) (10)

- Formulations: Asana XL 0.66 EC (10)
- Pests Controlled: no information available
- Percent of Crop Treated: no information available
- Application Rates: no information available
- Types of Applications: banded and broadcast. (12)

- Number of Applications: no information available
- Timing: no information available
- Pre-Harvest Interval: 21 days(10)
- REI:12 hours (10)
- Use in IPM Programs: no information available
- Use in Resistance Management Programs: no information available
- Efficacy Issues: no information available
- Advantages: no information available
- Disadvantages: no information available.
- Critical Use Issue: High toxicity to bees.Max 2lbs active ingredient per acre per season. Do not graze or feed forage to livestock. (10) Restricted Use Pesticide- A pesticide applicator certificate is required from the MDA for the purchase and use of these pesticides. (10)

### Section 18 Insecticide granted in 1999 on Sugarbeets

#### **triazimate** (related to carbamate insecticides) (24)

- Formulation: Aphistar 50WSP
- Pests Controlled: sugarbeet root aphid (24)
- Percent Crop Treated:
- Types of Applications:
- Application Rates: 4.0 - 8.0 ozs (0.12-0.25 lb active ingredient, or 1/2 -1 packet)per acre. It is packaged in water soluble pouches, 8 oz each. One pouch will treat one to two acres depending on rate used. (24)
- Number of Applications: Maximum use is 8 ozs of product per acre per season and 2 applications per year. One 8 oz application or 2 4 oz applications per acre per season. (24)
- Timing:
- Pre-Harvest Interval: 28 days (24)
- REI: 12 hours (24)
- Advantages: Little impact on honey bees, predatory mites and other beneficial insects.(24)
- Disadvantages:
- Critical Use Issue: Environmental concerns include toxicity to fish and aquatic invertebrates. Occupational exposure is another concern, addressed in the additional restrictions listed below. (24)
- **Additional Restrictions placed on the use of Aphistar in Michigan:**
  - Acreage restriction: A maximum of 65,000 acres of beets in Mchigan may be treated.
  - Application work-day restriction: No applicator, mixer, or loader may apply, mix or load Aphistar for more than 7 days during this season.
  - Daily acreage restriction: A person cannot mix or load more than 300-acres worth of product per day, assuming the maximum (8oz) rate. If the mixer/lader is also the person applying the pesticide, then he is restricted to no more than 150 acres per day.
  - PPE requirement: EPA requested that use of goggles and an apron be added to the PPE requirements on the label.

- Equipment restriction: Applicators must use an enclosed cab. (24)

### **Other registered insecticides reported in E-1582 for use on sugarbeets:**

**demeton-S-methyl** (organophosphate) (2)

**malathion** (organophosphate) (2)

**methomyl** (carbamate) (2)

**Thimet** (organophosphate) (2)

**endosulfan** (chlorinated cyclic diol) (2)

**naled** (organophosphate) (2)

**fonofos** (organophosphate) (2)

## **Diseases**

### **Seedling Black Rot**

#### *Biology*

Seedlings and young plants have dark colored hypocotyls that reduce to a black thread. Pre- and post-emergence damping-off is characteristic of black rot in seedlings. This disease favors warm, wet soils. The method of transmission is a soil-borne fungus. (21)

#### *Cultural Controls*

Rotating crops and planting on well drained soils are practiced to reduce the occurrence of seedling black rot. (21)

#### *Chemical Controls*

Treating seed with appropriate fungicide and using a *Aphanomyces* tolerant variety helps to control seedling black rot. (21)

#### *Alternative Controls*

No information available.

### **Rhizoctonia (late season crown rot) (*Rhizoctonia solani*)**

### *Biology*

Leaf stems blacken and outer leaves yellow; extensive rotting of crown and root tissue follows. Infected leaves collapse. This disease favors high temperatures throughout the growing season. The fungus survives in the soil and root of many weeds and is thus transmitted to crops. (21)

### *Cultural Controls*

Rotating crops, controlling weeds, and not throwing cultivated soil in the crowns of the beets are all practiced to reduce the occurrence of late season crown rot. Planting tolerant varieties when available is also a common practice. (21)

### *Chemical Controls*

None recommended.

### *Alternative Controls*

No information available.

## **Pythium (Damping Off)**

### *Biology*

Damping off can be a problem. It is a seed disease caused by several fungi, most commonly Pythium, a key cause of pre-emergence and post-emergence damping off. Infection rates can be high, particularly during the periods of cool, wet weather, and can lead to germination failure. Infected seedlings wilt, turn brown, and die, resulting in poor stands. Seedlings that are attacked at the ground level develop a water-soaked, discolored stem and topple over. Infected plants seldom recover. Yield loss due to pythium damping off can be as severe as 100%. (12)

Pythium develops as white mycelium, branching off and forming reproductive structures. The spores move through water to the host, surviving best on dead plant and animal matter, but able to survive on living plants in particularly wet soils. The fungus enters plant cells, consumes cellular material, and kills the cells. If the initial infection of a plant occurs at a more mature stage of the plant's development, the host is able to resist the fungal growth. However, at more immature stages -- such as seeds and young seedlings -- the fungus is able to grow readily into the plant tissues and kill the plant. Young roots can be attacked by fungus at any stage of plant growth. (12)

### *Cultural Controls*

Regulation of soil and seedling moisture-- although this is not always in the growers control-is practiced. Ensuring good drainage, crop rotation and planting at times conducive to rapid plant growth are used to minimize the opportunity for infection. Compost and other soil amendments are used to improve drainage and air circulation and thereby decrease infection. (12)

### *Chemical Controls*

Seed treatment

### *Alternative Controls*

No information available.

## **Seedling Rhizoctonia**

### *Biology*

*Rhizoctonia solani* can cause seedling death, root and hypocotyl rot, stem cankers and pot rot. Initial symptoms appear on roots or hypocotyls as linear or circular reddish-brown sunken lesion delimited by a brown to reddish-brown margin. These cankers enlarge, become darker, rough textured, underrated plant growth.

The fungus can invade the central part of the lower stem and produce a brick-red discoloration. Disease symptoms often occur on scattered plants in a somewhat circular field patter. Severe seedling infection may cause plant death. Lesions may also develop on pods that are in contact with the moist soil surface and cause pod rotting or seed discoloration. Mixed infection with *Fusarium* and *Pythium* root rot organisms are common. (22)

The fungus survives in infected plant debris, and inoculum concentrations in the soil can be increased by continually cropping fields to susceptible crops such as beans and sugarbeets. *Rhizoctonia* can be spread within fields by irrigation water and soil movement. *Rhizoctonia* root rot of germinating seedlings is favored by moderate to high soil moisture and low soil temperatures. Damage is generally restricted to young seedlings, but can affect older plants, especially when the plants are stressed by extremes in temperatures between warm soil and cool water from deep irrigation wells. (22)

### *Cultural Controls*

Rotating crops to reduce residual populations of the pathogen is practiced. Incorporating previous crop residue deeply and early enough to promote complete decomposition before planting is proven to help educe outbreaks. Planting in warm soil (60 degrees F or 16 degrees C) with adequate moisture for rapid germination and emergence. Shallow planting (1-1.5 inches or 2.5-4 cm) is recommended for fields with anticipated *Rhizoctonia* problems. (22)

### *Chemical Controls*

Treating seed with recommended fungicides to protect the seedling during its early growth is practiced. (22)

### *Alternative Controls*

No information available.

### **Tap Root Tip Rot (*Aphanomyces cochloides*)**

#### *Biology*

Foliage yellows and wilts. Unthrifty plant growth occurs. Lateral roots and the terminal portion of the tap root continually will rot if left untreated. Favored conditions are warm, wet weather and poor soil drainage. The soil-borne fungus enters the plant through the roots. (21)

#### *Cultural Controls*

Planting early and providing good soil drainage are methods to reduce the occurrence of tap root tip rot. Cultivating crops promptly to aerate the soil, rotation, and planting tolerant varieties all are practiced to control outbreaks. (21)

#### *Chemical Controls*

None Recommended.

#### *Alternative Controls*

No information available.

### **Phoma Seedling Blight(*Phoma betae*)**

#### *Biology*

Seedlings die before or after emergence. Seedlings may wilt as well. Roots and lower portions of leaf stems rot. Cool, wet weather and poor drainage conditions will favor phoma seedling blight. Pathogens are seed-borne and will survive in sugarbeet plants that do not damp-off. This is a source of inoculum for storage rot. (21)

#### *Cultural Controls*

Planting clean, disease free seeds is a common control. (21)

#### *Chemical Controls*

None Recommended.

#### *Alternative Controls*

No information available.

## **Cercospora Leaf Spot (*Cercospora beticola*)**

### *Biology*

Small, brown to gray spots with purple borders appear on the leaves and stems of afflicted beet. As the spots emerge, leaves turn yellow to brown and finally collapse. High humidity and high temperatures are ideal conditions for cercospora leaf spot. The fungus survives on crop residue. The spores are wind borne. (21)

### *Cultural Controls*

Planting disease tolerant varieties and crop rotation (done every 2 years) are practices that reduce occurrences of Cercospora leaf spot. Cleaning the plow to reduce crop residue is also practiced. (21)

### *Chemical Controls*

Foliar fungicides even on tolerant varieties are applied. (21) Application at row closure or first sign of disease.(17)

### *Alternative Controls*

No information available.

## **Powdery Mildew (*Erysiphe polygoni*)**

### *Biology*

Light gray mold growth covers the leaf surface. The leaves then yellow, become dry and collapse. Warm, dry weather favors the growth of powdery mildew. The spores are wind borne. Plants are afflicted late in the season and usually suffer little or no damage. (21)

### *Cultural Controls*

No information available.

### *Chemical Controls*

None recommended.

### *Alternative Controls*

No information available.

## **Fungicide Profiles**

Currently, the recommendation is an application of super tin or manzate at row closure. This is followed

by an application of benlate or topsin 7-10 days later. This is then followed up with super tin or manzate at 14-21 days after the benlate or topsin and then at 7-10 day intervals. The first application can be anywhere from mid July to early August and the last application around Labor day. This recommendation applies only to *Cercospora* leaf spot.(17)

- Formulations: Benlate
- Pests Controlled: Cercospora leaf spot (13)(17)
- Percent of Crop Treated:
- Types of Applications:
- Application Rates: 0.5 lb/Acre (13)
- Number of Applications: 1(17)
- Timing:7-10 days after Supertin(17)
- Pre-Harvest Interval:21 days (13)
- REI: 24 hours (13)
- Use in IPM Programs:
- Use in Resistance Management Programs:
- Efficacy Issues:
- Advantages:
- Disadvantages:
- Critical Use Issue: Benlate has the potential for selection of resistant strains of the pathogens. (17)

- Formulations: Topsin)(13)(17)
- Pests Controlled: Cercospora Leaf Spot (13)
- Percent of Crop Treated:
- Types of Applications:
- Application Rates: 0.5 lb/Acre (13)
- Number of Applications:1
- Timing: 7-10 days after Supertin (17)
- Pre-Harvest Interval: 21 days (13)
- REI:12 hours (13)
- Use in IPM Programs:
- Use in Resistance Management Programs:
- Efficacy Issues:
- Advantages:
- Disadvantages:.
- Critical Use Issue:

- Formulations: Supertin (13)(17)
- Pests Controlled: Cercospora Leaf Spot (13)(17)
- Percent of Crop Treated:
- Types of Applications:
- Application Rates: 5.0 oz/Acre (13)

- Number of Applications: 7-10 day intervals as needed. Rotate with EDDC.(17)
- Timing:
- Pre-Harvest Interval: 21 days (13)
- REI: 48 hours (13)
- Use in Resistance Management Programs:
- Efficacy Issues:
- Advantages:
- Disadvantages:
- Critical Use Issue: Supertin has the potential for selection of resistant strains of the pathogens. (17)

## EDDC

- Formulations: Manzate(17)
- Pests Controlled: Cercospora Leaf Spot (13)(17)
- Percent of Crop Treated:
- Types of Applications:
- Application Rates: 1-2 lb/ac (17)
- Number of Applications: 7-10 day intervals as needed.Use in rotation with Supertin and benlate/ topsin M. (17)
- Timing:
- Pre-Harvest Interval: 21 days (13)
- REI: 48 hours (13)
- Use in IPM Programs
- Use in Resistance Management Programs:
- Efficacy Issues:
- Advantages:
- Disadvantages:
- Critical Use Issue: Supertin has the potential for selection of resistant strains of the pathogens. (17)

## Nematodes

### Sugarbeet Cyst Nematode (*Heterodera schachtii*)

#### *Biology*

Nematodes survive in soil as cysts and on weed hosts. They are spread by irrigation water and contaminated soil on machinery. This nematode is a small, pinhead-sized cyst that attaches to the feeder

roots. Plants sprawl and turn yellow and leaf petioles wilt above ground. Soil temperature between 55 and 80 degrees F favor nematodes.

In district field areas, plants appear stunted or dead. (21)

### *Cultural Controls*

Practices that reduce threat of nematodes include the rotation of crops, sanitation of fields and controlling weeds. (21)

### *Chemical Controls*

The use nematicides is effective against infestations. (21)

## **Root-Knot Nematode (*Meloidogyne spp.*)**

### *Biology*

Foliage yellows and wilts on warm days. Galls form on tap and lateral roots. Favored conditions are soil temperatures between between 55 and 80 degrees F. Nematodes survive in soil as cysts and on weed hosts. They are spread by irrigation water and contaminated soil on machinery. Damage is evident in mid-season. (21)

### *Cultural Controls*

Practices that reduce threat of nematodes include the rotation of crops, sanitization of fields and controlling weeds. (21)

### *Chemical Controls*

The use nematicides is effective against infestations. (21)

## **Nematicide Profiles**

### **Dichloropropene (2)**

- Formulations: Telone II (2)
- Pests Controlled: Sugarbeet Cyst Nematode(2)
- Percent of Crop Treated:(2)
- Types of Applications: Soil fumigant (2)
- Application Rates: 15 gal/acre (2)
- Number of Applications: 1 (2)
- Timing: treated injected 6-8 in in the soil the fall before planting or in spring at least two weeks before planting. Can be applied over the whole field or in a band centered over the whole row. (2)

- Pre-Harvest Interval: 120 days (2)
- REI: 72 hours (2)
- Use in IPM Programs:
- Use in Resistance Management Programs:
- Efficacy Issues:
- Advantages:
- Disadvantages:
- Critical Use Issue:

### **Aldicarb** (carbamate) (2)

- Formulations: Temik 15 G (2)
- Pests Controlled: Sugarbeet Cyst Nematode and leafminer (2)
- Percent of Crop Treated:
- Types of Applications: Nematode-18-22 oz/1000 row ft at planting time in a furrow to the side and below the seed or in a 4-6 in band centered over the row and incorporated into the soil. Leafminer-drill granules 1-3 in below seed line. Postemergence, apply granules on both sides of row and work into soil. (2)
- Application Rates: Nematode-27-33 lb/acre, 4-5 lb/acre active ingredient. Leafminer-14-20 lb (or 9.5-13.5 oz/1000 row ft), 2.1-3 lb/acre active ingredient (2)
- Number of Applications:
- Timing:
- Pre-Harvest Interval: Nematode- 120 days. Leafminer- 90 beets, 120 tops (2)
- REI:
- Use in IPM Programs:
- Use in Resistance Management Programs:
- Efficacy Issues:
- Advantages:
- Disadvantages:
- Critical Use Issue: Restricted Use Pesticide- A pesticide application certificate is required from the MDA for the purchase and use of these pesticides. (2)

## **Weeds**

### *Biology*

Farmers report a variety of weeds in their sugarbeet fields. Specified weeds include common lambsquarter, redroot pigweed, smartweed, thistle (Canada and perennial sow), black nightshade (hairy and eastern), common ragweed, annual grasses, quackgrass, velvetleaf, cocklebur, wild buckwheat,

Jimson weed and wild mustard. Of these, common lambsquarter, redroot pigweed, velvetleaf and smartweed seem to occur most frequently in the interview data, although many of the others listed are highly problematic. (5)

### *Chemical Controls*

Growers apply various herbicides to control weeds in their sugarbeet fields. Those reported are Select, Stinger, Upbeet, POAST, Treflan, Assure II, Betamix, H-273, Norton, Pyramin/Bonus, RoNeet, Penncozeb, Benlate and Progress. Most used herbicides are Pyramin/Bonus and RoNeet. (5)

### *Cultural Controls*

The two main cultural controls practiced are cultivation and hoeing. (5)

### *Alternative Controls*

No information available.

## **Herbicide Profiles**

### **cycloate** (thiocarbamate compound)(16)(3)

- Formulations:Ro-Neet (16)
- Pests Controlled:Annual grasses (16)
- Percent of Crop Treated: 18%
- Types of Applications: Must be broadcast and preplant incorporated prior to planting (9)(5)
- Application Rates: 3 lbs/acre ai; 2 qt Formulation/A(16)
- Number of Applications: 1
- Timing:Preplant Incorporated, immediately to 2-3 inches.(16)
- Pre-Harvest Interval:
- REI: 12 hours (16)
- Use in IPM Programs: N/A
- Use in Resistance Management Programs: N/A
- Efficacy Issues: Good (16)
- Advantages: Provides good velvetleaf suppression
- Disadvantages: Injury may occur when Betamix or Betanex or Progress is applied postemergence before the 6 true leaf stage (16)
- Critical Use Issue:

### **pyramin** (Pyridazone compound) (16)(3)

- Formulations:Pyramin
- Pests Controlled: Annual broadleaves (16)

- Percent of Crop Treated: 40%
- Types of Applications: Banded (5)
- Application Rates: 4 lbs/acre ai; 6.2 lb or 7.4 pt SC Formulation/acre (16)
- Number of Applications: 1
- Timing: Preemergence (16)
- Pre-Harvest Interval
- REI: 12 hours (16)
- Use in IPM Programs: N/A
- Use in Resistance Management Programs: N/A
- Efficacy Issues: Excellent on lambsquarter and common ragweed
- Advantages: Needs rainfall to activate preemergence herbicide application.
- Disadvantages: To approach 100% weed control, a postemergence application will be necessary (16) Critical Use Issue: Injury may occur if used on sands or loamy sands. This herbicide is used with Nortron, for velvetleaf suppression. Ro-Neet however is more effective than Pyramin plus Nortron preemeyne(9) (16)

### **ethofumesate** (benzofuran compound) (16)(3)

- Formulations: Nortron
- Pests Controlled: Annual broadleaves (16)
- Percent of Crop Treated: 30%
- Types of Applications: Banded (5)
- Application Rates: 1.5 lbs/acre ai; 3 pt SC formulation/acre(16)
- Number of Applications: 1
- Timing: Preemergence
- Pre-Harvest Interval:
- REI: 12 hours (16)
- Use in IPM Programs: N/A
- Use in Resistance Management Programs: N/A
- Efficacy Issues: Poor on common ragweed
- Advantages:
- Disadvantages: Needs rainfall for preemergence herbicide activation
- Critical Use Issue: This herbicide is used with the preceding herbicide, Pyramin, for velvetleaf suppression. Ro-Neet is more effective than Pyramin plus Nortron together (16)

### **desmedipham + phenmedipham** (carbamate compounds) (16)(3)

- Formulations: Betamix (16) Most effective when used with Stinger (below) (16)
- Pests Controlled: annual broadleaf weed seedlings at the cotyledon stage(16)
- Percent of Crop Treated: 98%
- Types of Applications: Banded (5)
- Application Rates: .5 lb/acre ai; 3 pt Formulation/acre (16)
- Number of Applications: 2, second application at least 7 days later and when another flush of

- weeds germinate (16)
- Timing: Early Postemergence & Postemergence (16)
- Pre-Harvest Interval: 105 days (16)
- REI: 24 hours (16)
- Use in IPM Programs: N/A
- Use in Resistance Management Programs:
- Efficacy Issues: Excellent on lambsquarter (16)
- Advantages: Used with Stinger, below, improves control of smartweed, buckwheat, nightshade and lambsquarter. (16)
- Disadvantages: Timing is critical. Must be applied to weeds less than 1/2 inch tall. No soil residual so must apply to each new flush of weeds and/or cultivate. (9)
- Critical Use Issue:

### **clopyralid** (picolinic-acid derivative) (16)(3)

- Formulations: Stinger (used with Betamix) (16)
- Pests Controlled: cocklebur, common and giant ragweed and volunteer alfalfa, sweet clover, Canada thistle and perennial sow thistle (16)
- Percent of Crop Treated:
- Types of Applications: Banded and Broadcast (5)
- Application Rates: Rates based on use with Betamix. (16) 0.094 lbs/acre ai; 1/4 pt formulation/acre. (16)
- Number of Applications: 2, second application at least 7 days later and when another flush of weeds germinate (16)
- Timing: Early postemergence (16)
- Pre-Harvest Interval: 105 days (16)
- REI: 12 hours (16)
- Use in IPM Programs
- Use in Resistance Management Programs:
- Efficacy Issues: When added to Betamix, consistency of some broadleaf weed control increases.
- Advantages: Will control larger (4 inch) ragweed and clovers. Suppresses Canada thistle and sow thistle.
- Disadvantages: Most weed species must be 1/2 inch or less at time of application. Must be combined with Betamix to control these weeds.
- Critical Use Issue:

### **triflurosulfuron methyl** (sulfonyleurea) (16)(3)

- Formulations: UpBeet (used with Betamix) (16)
- Pests Controlled: annual broadleaves (16)
- Percent of Crop Treated:
- Types of Applications: banded (5)
- Application Rates: Rates based on use with Betamix. (16) 0.0156 lbs/acre ai; 1/2 oz formulation/

- acre (16) Apply in 10 gal. of water/A at 20 to 40 psi. (16)
- Number of Applications: 2, 2nd application must be made at least 7 days but not more than 10 days after first. (16)
- Timing: Early postemergence (with Betamix) and postemergence (with surfactant at 1/4 %) (16)
- Pre-Harvest Interval
- REI: 12 hours (16)
- Use in IPM Programs
- Use in Resistance Management Programs:
- Efficacy Issues:
- Advantages: Adding UpBeet to Betamix results in velvetleaf control, and more consistent lambsquarter, pigweed, smartweed and buckwheat control (16)
- Disadvantages: Rainfall within 6 hours of application may reduce control (16)
- Critical Use Issue: The maximum amount of UpBeet that can be applied in one year is 2.5 oz/A (16)

### **endothall** (carboxylic acid)

- Formulations: H-273 (16)
- Pests Controlled: Annual broadleaves (16)
- Percent of Crop Treated: 4%
- Types of Applications: Banded (5)
- Application Rates: .5 lbs/acre ai; 1 1/3 pt formulation/acre. Rates based on use with Betamix. (16)
- Number of Applications: 2. with Betamix for second application at least 7 days after first application of Betamix (16)
- Timing: early postemergence with Betamix. Postemergence with Pyramin and Betanex
- Pre-Harvest Interval
- REI: 48 hours (16)
- Use in IPM Programs
- Use in Resistance Management Programs:
- Efficacy Issues:
- Advantages: UpBeet has replaced H-273 on most of the sugarbeet acres to control broadleaf weeds
- Disadvantages: Injurious to small weeds
- Critical Use Issue: Betanex with H-273 and Pyramin offers better control of pigweed than Betamix but does not control green or yellow foxtail. This combination is less effective than Betamix on lambsquarter, common ragweed and wild buckwheat. (16)

### **sethoxydim** (oxime compound) (16)(3)

- Formulations: Poast (16)
- Pests Controlled: annual grasses and broadleaves, actively growing barnyard grass or foxtails up to 2 inches (16)

- Percent of Crop Treated: 12%
- Types of Applications:banded (5)
- Application Rates:with Betamix: 0.29 lbs/acre; 1.5 pt formulation/acre (16)
- Number of Applications: 1
- Timing: postemergence
- Pre-Harvest Interval
- REI: 12 hours (16)
- Use in IPM Programs
- Use in Resistance Management Programs:
- Efficacy Issues:Excellent on all annual grasses except crabgrass (16)
- Advantages:No soil activity (16)
- Disadvantages: controls only grasses present when sprayed(16)
- Critical Use Issue:

### **quizalofop-P-ethyl** (organic compound) (16)(3)

- Formulations: Assure II (16)
- Pests Controlled: volunteer corn up to 18 in. tall (16)
- Percent of Crop Treated: 4%
- Types of Applications:banded and broadcast (5)
- Application Rates:with crop oil concentrate: 0.031 lbs/acre; 5 oz formulation/acre (16)
- Number of Applications: 1
- Timing:Postemergence (16)
- Pre-Harvest Interval
- REI:12 hours (16)
- Use in IPM Programs
- Use in Resistance Management Programs:
- Efficacy Issues:
- Advantages:volunteer corn less than 18 in., application rate may be reduced (16)
- Disadvantages: rainfall with 1 hour of application will reduce control (16)
- Critical Use Issue:

### **clethodim** (oxime compound) (16)(3)

- Formulations:Select (16)
- Pests Controlled:volunteer corn and small grains (16)
- Percent of Crop Treated: 2%
- Types of Applications:banded (5)
- Application Rates: with crop oil concentrate-0.096 lbs/acre ai; 6 oz formulation/acre for volunteer corn up to 18 in. 4 oz/acre if corn is between 4-12 in. tall (16)
- Number of Applications: 1
- Timing:Postemergence (16)
- Pre-Harvest Interval:

- REI: 24 hours (16)
- Use in IPM Programs
- Use in Resistance Management Programs:
- Efficacy Issues: good to excellent on all annual grasses (16)
- Advantages:
- Disadvantages: rainfall with 1 hour of application will reduce control (16)
- Critical Use Issue: Select is more effective than Poast for volunteer corn control(16)

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