

# Crop Profile for Cucumbers (Fresh Market) in Michigan

Prepared: June, 1999

## General Production Information

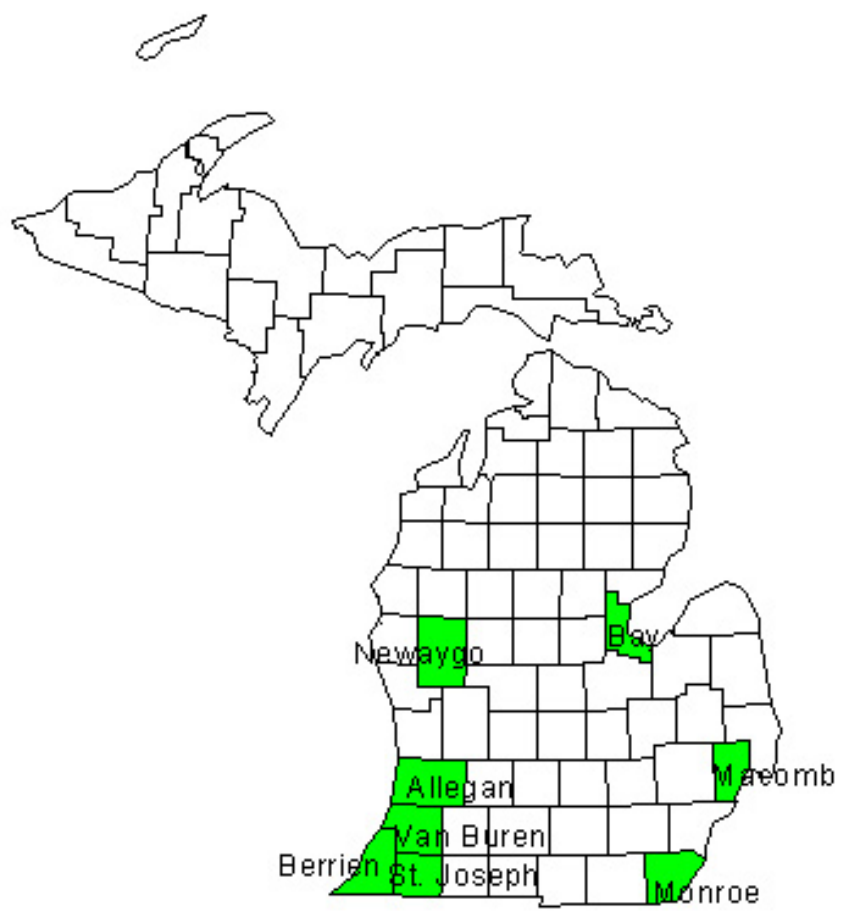


- Top states in fresh market cucumber production are Florida, Georgia, California and North Carolina.
- Cucumbers are produced in Michigan for fresh market and processing.
- Farms in Michigan: 230
- Acres in Michigan: 5700 (20)
- Fresh market cucumber production in Michigan has been increasing over recent years

	Cucumbers for Fresh Market
Michigan Ranking	4
Percent of U.S. Production	11.2
Area Planted (5 year average)	5,760
Area Harvested (5 year avg.)	5,500
Value of Production (thousands) (5 year average)	14,023
Production (thousands)	1,100

Counties in Michigan producing fresh market cucumbers include:

- West Central Region: Newago
- East Central Region: Bay
- South West Region: Allegan, Cass, Berrien and Van Buren
- Southeast Region: Macomb and Monroe (7)

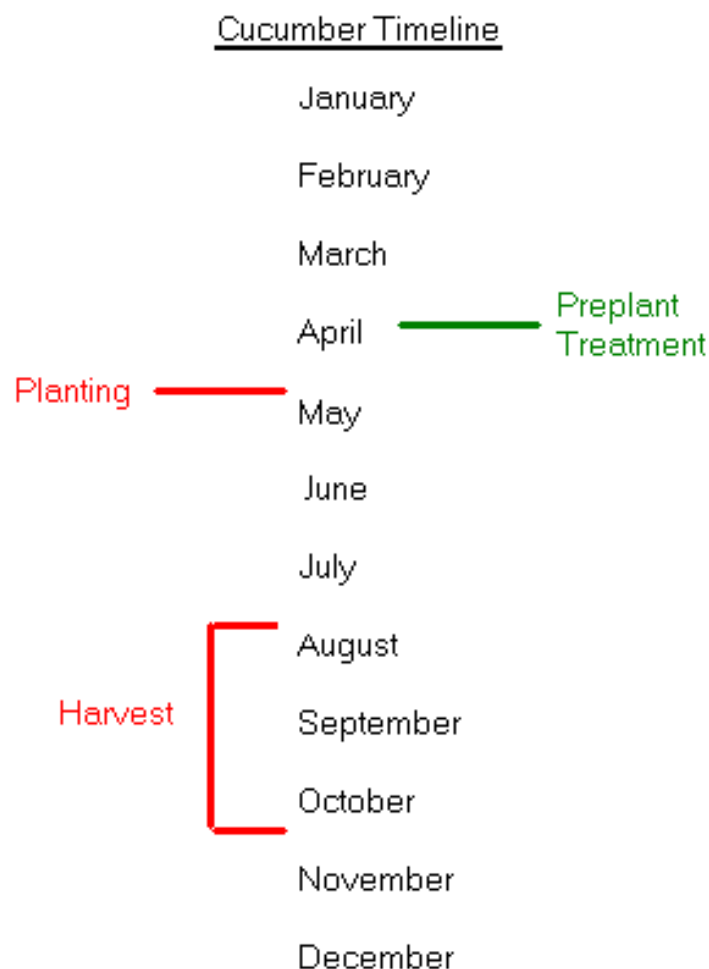


	Counties	District	Acres Planted	Yield (lb/acre)	Production in District
<b>Fresh Market cucumbers (from 1995-96 MASS, MRS statistics)</b>	<b>New aygo</b>	<b>West Central</b>	250	23,000	12,650
	<b>Bay</b>	<b>East Central</b>	120	8,000	3,350
	<b>Allegan &amp; Cass</b>	<b>Southwest</b>	2600	15,000	63,000
	<b>Berrien &amp; Van Buren</b>	<b>Southwest</b>	1680		
	<b>All</b>	<b>South Central</b>	300	10000	2,800
	<b>Macomb</b>	<b>So uthe ast</b>	65	16,000	3,200
	<b>Monroe</b>	<b>So uthe ast</b>	60		
<b>TOTAL 1996 Acres: 5700</b>					

## Cultural Practices

Cucumbers require a site with full sun and good air circulation. Cucumbers do best in light, well-drained soil with pH 6.0-6.8. Seeds started early indoors take about 4 weeks to produce a suitable transplant. Cucumbers are sensitive to low temperatures so are not planted outside until late May, when temperatures are greater than 68° F. Cucumbers are also sensitive to water stress, particularly during fruit set and development. Cucumbers generally mature after 55 to 60 days.(18)

Many flowers, especially early ones, are male and do not produce fruit. Pollinators are important for cucumber production, chemicals that interfere with bees should be avoided. Many growers keep beehives to increase pollination. Cucumbers are harvested when fruits are at the desired stage of development. Often cucumbers are harvested once, destructively. Development of mature fruit will reduce the number of other fruits the vine produces. (18)

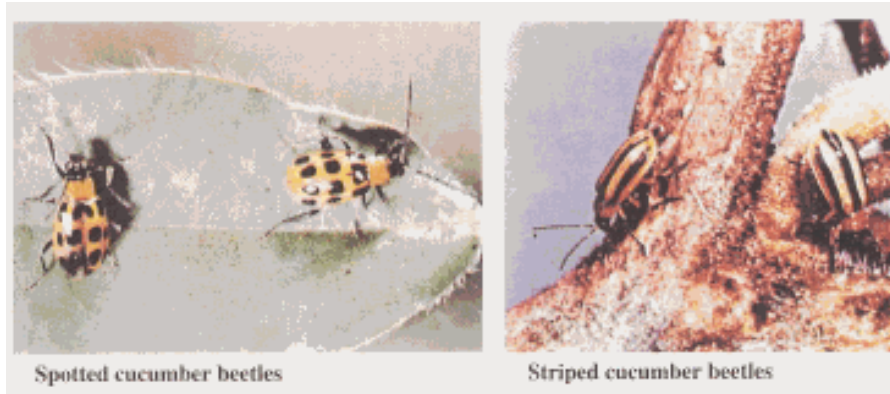


### Chemical Controls: Critical Use Issues

- Myclobutanil has a Section 18 for use on cucumbers to control powdery mildew. (24)
- Insecticide or fungicide sprays can disrupt natural control and result in aphid outbreaks.

## Insect Pests

### Cucumber beetles (striped and spotted)



Spotted cucumber beetles

Striped cucumber beetles

#### **Biology:**

Cucumber beetles are key pests in cucumbers. They defoliate plants as well as spread diseases.

Striped cucumber beetle larvae can be numerous enough to injure plant roots and reduce yields in extreme situations. They are a key pest in Michigan cucumber production and can cause up to 100% loss.(11)

The spotted cucumber beetle is a general feeder on over 200 plants, including weeds and crops such as corn. It can transmit bacterial wilt disease, but rarely occurs in high numbers in Michigan. The striped cucumber beetle, bright yellow or tan with black stripes attacks only cucurbits. It is the most serious pest and transmitter of bacterial wilt disease.(2)

Adults overwinter in fence rows, ditch banks, etc. They emerge in the spring and feed on foliage of new plants and transplants and lay eggs near the bases of the plants. Larvae feed on the plant roots. Adults can cause moderate to severe foliar injury, especially to new seedlings. Also, bacterial wilt disease overwinters only in the gut of cucumber beetles and is transmitted only by feeding of these beetles. Larvae pupate in the soil and emerge as adults in late July or August.(11)

Cucumber beetles can be monitored visually, checking fields at least twice per week for new seedlings and transplants. Use of a systemic insecticide at planting reduces the number of insecticide sprays required and reduces risk to honey bees and other beneficial insects.

#### **Cultural Controls:**

- Rotation – Growers usually rotate cucumbers with grain crops, tomatoes or a cover crop.
- Fine netting or floating row covers over young plants can protect them from cucumber beetles (21 )
- Delay planting to avoid first generation cucumber beetles (21)
- Less bitter cultivars are less attractive to cucumber beetles (21)

## **Chemical Controls:**

- Preplanting treatment-

Carbofuran

Carbaryl

- Alternative-

Esfenvalerate (Asana)

Endosulfan

Lannate

Azinphos-methyl (Guthion)

Permethrin

Pounce

Ambush

## **Alternative Controls:**

The use of cucurbitacin, a chemical which occurs naturally in cucumbers, causes beetles to feed excessively. This chemical can be used in conjunction with an insecticide such as carbaryl will help control cucumber beetle populations. (22)

## **Seed corn maggots**

### **Biology:**

Seed corn maggots injure seeds of a variety of crops, including cucurbits, corn, and beans. It is a key pest in cucumbers in Michigan. They eat cucumber seeds. Seed corn maggots prefer cool temperatures and soil with high organic matter. (22)

They overwinter as small, brown pupae in the soil. Adult flies emerge in late April to May. They are attracted for egg laying to soils that are high in decomposing organic matter, including plowed-down cover crops and animal manure. Eggs are laid on or beneath the soil surface. Larvae feed on decomposing plant material in the soil and especially on seeds of corn, beans, cucurbits, etc. Seeds may be attacked before or shortly after germination. Injury may kill seeds. If sprouting seeds are attacked, cotyledons and new leaves may show injury above ground. Damage is especially common in cool weather, because the seed corn maggot is well adapted to cool temperatures and seeds germinate slowly and are exposed longer to injury. There may be three or more generations per year. Monitoring for this insect is not practical, so seed treatment is generally recommended.(3)

### **Cultural Controls:**

Rotation

Cover crop such as rye, plowed down 3 to 4 weeks before planting. (22)

### **Chemical Controls:**

- Seed Treatment-

Methyl bromide fumigation

- Alternative-

Lindane (not used) and Lorsban

**Alternative Controls:**

No information available.

**Aphids**



**Biology:**

Aphids are small (1/16 inch) insects that suck sap from the plants. Aphids can occasionally be problems in cucurbits, especially during hot, dry years. They can injure plants by feeding on plant juices and can also transmit cucumber mosaic and other viral diseases. All aphids during the summer are females and give birth to large numbers of young, born as tiny aphids rather than as eggs. Eggs are produced only to overwinter. Aphids have an extremely high reproductive rate, but are usually held in check by natural enemies (lady beetles, hover fly larvae, lacewing larvae, fungal diseases and tiny wasps). Insecticide or fungicide sprays can sometimes disrupt this natural control and result in aphid outbreaks.(3)

Aphids can be monitored by careful inspection of plant foliage. Insecticides can be used to control aphids, but may not be effective at preventing the transmission of virus diseases by new aphids arriving in the field.(3)

**Cultural Controls:**

Mulch can repel aphids.

**Chemical Controls:**

- Endosulfan (Phaser, Thiodan) 3 EC, 1 1/3 pt or 50 WP, 1 lb
- Diazinon 4 EC 1 pt or 50 WP, 1 lb

- Lannate SP ½ lb or LV, 1 ½ pt
- Malathion 57 EC, 1 1/2 pt
- Metasystox-R2 SC, 1 ½ to 2 pt
- Trithion 8 EC ½ to 1 pt

**Alternative Controls:**

Natural enemy populations, such as lady beetles and parasites, should be maintained to control aphids.(22)

## INSECTICIDE PROFILES

**Carbofuran insecticide-nematicide** (carbamate)

Formulations: Furadan

Pests Controlled: cucumber beetles, wireworm and seed corn maggot

Percent of Crop Treated: applied to 23% of the acres in 1996, 99% of farms treated 100% acreage.

Types of Applications: ground spray, boom spray, banded

Application Rates: of 0.84 lb per acre totaling 5.5 (1,000) lbs,

Number of Applications: 1 application

Timing: routine at seeding

Pre-Harvest Interval: 60 days, since it is applied to seeds, the entire growing season

REI: 48 hours

Use in IPM Programs: no IPM concerns because this pesticide is sprayed early in the crop season on the soil.

Use in Resistance Management Programs:

Efficacy Issues: No information available.

Advantages: residual is systemic, therefore it protects against cucumber beetle as well as wireworm

Disadvantages: Furadan 4L(emulsified liquid)-not sure how well stays in place, not as resistant. 15G (granular)-worked well, held in place, no longer produced into seed furrow.

(3)(7)(11)(12)(14)(20)(21)(22)

**Carbaryl** (carbamate)

Formulations: Sevin

Pests Controlled: cucumber beetles and leaf hopper

Percent of Crop Treated: 5% of the acres in 1994, 20% of farms 100% of acreage in 1997

Types of Applications: ground spray

Application Rates: 0.89 lb per acre totaling 1.2 (1,000) lbs; 0.3 lbs AI /ac in 1997

Number of Applications: 1 application

Timing: mid season after "running"; not used at fruit set because of bees.

Pre-Harvest Interval: 1 day

REI: 12hours

Use in IPM Programs: used in response to scouting, concern with using during bloom time so growers spray at night and when cool

Resistance Management Concerns: None reported in grower interviews.

Efficacy Issues: No information available.

Advantages: Leaf hopper is the main reason for use; used when furadan has failed to control cucumber beetles because of its short PHI

Disadvantages: Do not use at fruit set because of bees.

(3)(7)(11)(12)(14)(20)(21)(22)

## **Endosulfan** (Organochlorine)

Formulations: Thiodan

Pests Controlled: alternative for carbaryl to control cucumber beetles

Percent of Crop Treated: 1% of the acres in 1994, 100% of growers use this AI (1997)

Types of Applications: Foliar treatment, prebloom.

Application Rates: 0.54 lb per acre totaling 1.0 (1,000) lbs

Number of Applications: 1.0 applications

Timing: used after bloom because it has low toxicity to bees

Pre-Harvest Interval: 2 days suggested

REI: 24 hours

IPM Concerns: None reported in grower interviews.

Resistance Management Concerns: None reported in grower interviews.

Efficacy Issues: Medium Efficacy

Advantages: inexpensive. Focus of treatment on cucumber beetle, but also helps control aphids and flea beetles.

Disadvantages: highly toxic to fish

Comments: alternative for carbaryl to control cucumber beetles

(3)(7)(11)(12)(14)(20)(21)(22)

## **Esfenvalerate** (Synthetic Pyrethroid)

Formulations: Asana, Conquer

Pests Controlled: alternative for carbaryl to control cucumber beetles

Percent of Crop Treated: no information available

Types of Applications: foliar treatment

Application Rates: (suggested) 5.8 to 9.6 oz (2)

Number of Applications: is used only pre-bloom because it is toxic to bees

Timing: no information available

Pre-Harvest Interval: no information available

REI: 12 hours

Use in IPM Programs: no information available

Use in Resistance Management Programs: no information available

Efficacy Issues: Medium

Advantages: effective at high temperatures (25)

Disadvantages: Kills predators of mites, which could lead to a mite outbreak, toxic to fish, some phytotoxicity has been reported.(25)

Comments: alternative for carbaryl to control cucumber beetles  
(3)(7)(11)(12)(14)(20)(21)

### **Methyl Bromide** (fumigant)

Pests Controlled: seed corn maggot

Percent of Crop Treated: 50% of growers

Types of Applications: fumigation

Application Rates: no information available

Number of Applications: 1

Timing: no information available

Pre-Harvest Interval: no information available

REI: 48 hours

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: methyl bromide is being phased out

(3)(7)(11)(12)(14)(20)(21)(22)

### **Kelthane** (chlorinated hydrocarbon)

Formulations: Kelthane 35, Kelthane WSP

Pests Controlled: mites

Percent of Crop Treated: no information available

Types of Applications: foliar or air

Application Rates: (suggested) Kelthane 35, 1 2/3 lb; Kelthane WSP 1 1/4 lb (2)

Number of Applications: no information available

Timing: no information available

Pre-Harvest Interval: no information available

REI: 2 days (2)

Use in IPM Programs: no information available

Use in Resistance Management Programs: no information available

Efficacy Issues: good

Advantages: good initial kill (25)

Disadvantages: no insecticidal activity (25)

(3)(7)(11)(12)(14)(20)(21)

# Diseases

## Fruit rot

### **Biology:**

Fruit rot is a severe concern in cucumbers in Michigan.(11) It is caused by phytophthora. The soilborne fungus attacks the fruit laying on the soil or can be splashed onto the fruit. It can cause partial or complete rotting of the fruit. Phytophthora fruit rots tend to be more severe is moist, humid and cool conditions.(1)

### **Cultural Controls:**

Rotation

### **Chemical Controls:**

- Chlorothalonil
- Thiophanate-Methyl
- Maneb
- Mancozeb

### **Alternative Controls:**

No information available

## Angular Leaf Spot

### **Biology:**

Angular leaf spot in cucumbers is caused by the bacterium *Pseudomonas lachrymans*. This disease can be seedborne. Angular leaf spot is a severe concern in cucumbers in Michigan. It is characterized by conspicuous leaf symptoms. Stem and fruit symptoms occur, but are less conspicuous. Leaf spots are angular and irregular in shape and size. Spots, water-soaked at first, later turn gray or tan and finally drop out, leaving ragged holes. Fruit infections appear as small sunken water-soaked spots; fruit rot soon follows. Bacteria that cause this disease overwinter on seed and persist in crop residue from diseased plants. Splashing rain and workers spread the bacteria within fields. (11)(17)

### **Cultural Controls:**

No information available

### **Chemical Controls:**

- Copper
- Mancozeb + copper

**Alternative Controls:**

No information available

### Alternaria Leaf Spot

**Biology:**

Alternaria leaf spot is caused by the fungus *Alternaria cucumerina*. Alternaria leaf spot is a severe concern in cucumbers in Michigan. Leaf spots are small, circular and water-soaked at first, and then expand up to ½ inch in diameter with dark concentric rings within the spots. Spots coalesce to affect large areas of leaves and cause defoliation that begins on crown leaves. This disease-causing fungus overwinters on and in seed, as well as in residue from diseased plants. Fungus spores are spread by wind, by running water, on workers, and on tools and implements. Weak and senescing plants are more susceptible to Alternaria leaf spot than are vigorous plants. (11)

**Cultural Controls:**

Rotation

**Chemical Controls:**

- Chlorothalonil Bravo 720
- Maneb
- Mancozeb

**Alternative Controls:**

No information available

### Damping off (*Rhizoctonia solani* and *Pythium* spp.)

**Biology:**

Damping off is a seed disease, caused by several fungi, most commonly Pythium. Pythium is an important cause of pre-emergence and post-emergence damping off. Damping off is a moderate concern in cucumbers in Michigan. Infection rates can be high, particularly during the periods of cool, wet weather. It can lead to a failure to germinate. Infected seedlings wilt, turn brown and die, resulting in poor stands. Yield loss due to pythium damping off can be up to 100%. (11)

Pythium grows as white mycelium which branch and form reproduction structures. The spores move in water to a host. They survive best on dead plant and animal matter, but can do well on living plants particularly in wet soils. The fungus enters plant cells, consumes cellular material and kills the cells. If the initial infection of a plant is at a more mature stage of growth, it is able to resist the fungal growth. At 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.

Seedlings that are attacked at the ground level develop a water-soaked, discolored stem and topple over. Infected plants seldom recover.(11)

**Cultural Controls:**

Resistant varieties

**Chemical Controls:**

- Bacillus subtilis GB03
- Oxadixyl
- Fludioxonil
- Metalaxyl
- Captan
- Thiram

**Alternative Controls:**

No information available

**Scab** (*Cladoporium cucumerinum*)

**Biology:**

Cucumber scab is caused by the fungus. Scab is occasionally a problem in cucumbers. Dry corky spots, up to ½ inch in diameter develop on cucumbers. Under moist conditions a dark olive-green velvety growth covers the spot. Spots also develop on young terminal stem growth and on petioles. When spots girdle young stems and petioles, growth beyond the spot dies. Affect areas on very young leaves are irregular in shape; the areas dry up. The disease-causing fungus overwinters on seed and in residue from diseased plants. Disease development is promoted by moist humid conditions and by cool night temperatures. (11)

**Cultural Controls:**

**Chemical Controls:**

- Chlorothalonil
- Mancozeb

**Alternative Controls:**

No information available

## Anthracnose

### **Biology:**

Anthracnose in cucumbers is caused by the fungus *Colletotrichum lagenarium*. Anthracnose is an occasional concern in cucumbers in Michigan. Leaf spots begin as yellowish or water-soaked areas that enlarge rapidly, turn brown, and shatter to form a ragged hole within the spot. Elongate spots with light centers often develop on petioles and stems and can cause death of tissue beyond these spots. Young fruit may be killed, but large fruit usually develop depressed dark-bordered cankers with creamy pink-colored ooze in the center. The fungus overwinters in seed and in residue from diseased plants, and is spread in splashing water. Humid weather and frequent rains promote disease development and spread.(11)

### **Cultural Controls:**

No information available

### **Chemical Controls:**

- Chlorothalonil
- Benomyl
- Mancozeb
- Maneb
- Mancozeb + Copper
- Thiophanate-Methyl

### **Alternative Controls:**

No information available

## Downy mildew

### **Biology:**

Downy mildew on cucumber is caused by the fungus *Pseudoperonospora cubensis*. Downy mildew is rarely a problem in cucumbers. Irregularly shaped yellowish to brown spots appear on upper sides of leaves, usually at the center of plants. Under moist conditions a purplish mildew develops on the underside of leaf spots. Leaves die as spots increase in size. Spread is rapid from the crown toward new growth. The causal fungus overwinters in areas with a relatively warm climate and can be introduced to other areas by wind. Moist conditions favor disease development. (11)

**Cultural Controls:**

No information available

**Chemical Controls:**

- Metalaxyl + Chlorothalonil
- Metalaxyl + Mancozeb
- Metalaxyl + copper
- Fosetyl-al + Maneb
- Fosetyl-al

**Alternative Controls:**

No information available

### Powdery mildew

**Biology:**

Powdery mildew is caused by the fungus *Erysiphe cichoraeacarum* that appears as a white powdery growth on leaves and stems. Crown leaves are affected first and may wither and die. Infected parts turn yellow, shrivel and plants are defoliated prematurely. Powdery mildew is occasionally a problem in cucumbers.

The fungus can be introduced on greenhouse-grown plants or by wind from areas with relatively warm winter climate where the fungus can over-winter. Disease development is favored by high temperatures between 70 and 90° F and by humid weather with frequent dew. Yield is reduced and fruit quality is poor.(11)

**Cultural Controls:**

No information available

**Chemical Controls:**

- Benomyl
- Thiophanate-Methyl
- Chlorothalonil
- Copper + sulfur
- Myclobutanil(Section 18)

**Alternative Controls:**

genetic resistance

**Gummy Stem Blight or Black Rot****Biology:**

Gummy Stem Blight or Black Rot are apparently caused by the same fungus, *Didymella bryoniae* (*Mycosphaerella melonis*). Gummystem blight or black rot can be an occasional problem in cucumbers in Michigan. Cucumbers are most affected by gummy stem blight, which begins as pale brown or gray spots on leaves, petioles and stems. Stem spots appear first at the nodes and elongate into stem streaks; a gummy exudate frequently appears near stem streaks. Leaves on affected vines turn yellow and die. Entire plants occasionally are killed. Tine black pycnidia develop on fruit, stem and leaf spots. The fungus overwinters in seed and residue from diseased plants.(11)

**Cultural Controls:**

No information available

**Chemical Controls:**

- Chlorothalonil
- Mancozeb
- Benomyl
- Mancozeb + copper
- Thiophanate-Methyl

**Alternative Controls:**

No information available

**FUNGICIDE PROFILES****Chlorothalonil** (nitrile compound)

Formulations: Bravo 500, Bravo Ultrex, Bravo Weather Stik or Bravo 720

Diseases Controlled: powdery mildew and downy mildew

Percent of Crop treated: no information available

Types of Applications: foliar

Application Rates: of 1.4 lb per acre totaling 12.9 (1,000) lbs

Number of Applications: 3.3 applications

Timing: suggested 7-14 day intervals (21)  
Pre-Harvest Interval: 0 days suggested (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: broad-spectrum foliage protectant fungicide  
Disadvantages: Chlorothalonil is a B2 carcinogen.  
(1)(4)(7)(11)(20)(22)

## **Metalaxyl (phenylamides)**

Formulations: Ridomil Gold EC, Ridomil Gold WSP, Ridomil Gold GR  
Diseases Controlled: damping off, fruit rot, anthracnose and downy mildew  
Percent of Crop Treated: applied to 55% of the acres planted in fresh cucumber production in Michigan in 1996  
Types of Applications: foliar  
Application Rates: 0.20 lb per acre totaling 0.7 (1,000) lbs  
Number of Applications: 1.1 applications, maximum 4 per year  
Timing: no information available  
Pre-Harvest Interval: 5 days suggested  
REI: 48 hours  
Use in IPM Programs: no information available  
Use in Resistance Management Programs: no information available  
Efficacy Issues: no information available  
Advantages: long lasting activity (27)  
Disadvantages: B2 carcinogen, resistance concerns, corrosive (27)  
(1)(4)(7)(11)(20)(22)

## **Copper Compounds**

Formulations: Copper hydroxide  
Diseases Controlled: angular leaf spot, scab, alternaria leaf spot, anthracnose, gummy stem blight or black rot, powdery mildew and downy mildew  
Percent of Crop Treated: Copper hydroxide was applied to 48% of the acres planted in fresh cucumber production in Michigan in 1996  
Types of Applications: foliar  
Application Rates: 0.36 lb per acre totaling 3.4 (1,000) lbs applied  
Number of Applications: 3.5 applications  
Timing: 5-14 day intervals suggested  
Pre-Harvest Interval: 0 days suggested  
REI: 24-48 hours  
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: toxic to fish

(1)(4)(7)(11)(20)(22)

## **Sulphur**

Formulations: Microthial Special, Thiolux DF

Diseases Controlled: powdery mildew

Percent of Crop Treated: <1%

Types of Applications: foliar

Application Rates: Microthial Special 2 to 4 lb, Thiolux DF 4 to 6 lb (2)

Number of Applications: no information available

Timing: 14 day intervals suggested (2)

Pre-Harvest Interval: 0 days suggested (2)

REI: 24 hours (2)

Use in IPM Programs: no information available

Use in Resistance Management Programs: no information available

Efficacy Issues: effectiveness is related to the fineness of the sulfur particles (27)

Advantages: very safe chemical(27)

Disadvantages: do not apply when temperatures exceed 90 °F(27)

(1)(4)(7)(11)(20)(22)(24)

## **Mancozeb (dithiocarbamate)**

Formulations: Penncozeb, Dithane 75 DF or M-45 4F or WSP, Dithane F-45, Manzate 200 DF

Diseases Controlled: angular leaf spot, alternaria leaf spot, fruit rot, gummy stem blight or black rot, scab, anthracnose and downy mildew

Percent of Crop Treated: <15%

Types of Applications: foliar

Application Rates: Dithane 75 DF or M-45 or WSP, 2 to 3 lb, Dithane F-45 4F, 1 3/5 to 2 2/5 qt, Manzate 200 DF 2 to 3 lb

Number of Applications: no information available

Timing: 7-10 day intervals (27) (2)

Pre-Harvest Interval: 5 days suggested (2)

REI: 24 hours

Use in IPM Programs: no information available

Use in Resistance Management Programs: no information available

Efficacy Issues: no information available

Advantages: Inexpensive

Disadvantages: a B2 carcinogen, processor restrictions

(1)(4)(7)(11)(20)(22)(24)

## **Benomyl** (carbamate)

Formulations: Benlate 50 W or SP

Diseases Controlled: anthracnose, gummy stem blight or black rot, powdery mildew and downy mildew

Percent of Crop Treated: <1%

Types of Applications: foliar treatment

Application Rates: 4 to 8 oz (2)

Number of Applications: no information available

Timing: 7-14 day intervals (2)

Pre-Harvest Interval: 1 day suggested (2)

REI: 24 hours (2)

Use in IPM Programs: no information available

Use in Resistance Management Programs: no information available

Efficacy Issues: no information available

Advantages: preventative and eradicating fungicide, excellent residual activity(27)

Disadvantages: resistance is a concern

(1)(4)(7)(11)(20)(22)(24)

## **Thiophanate-Methyl** (carbamate)

Formulations: Topsin M 70 W or WSB

Diseases Controlled: fruit rot, anthracnose, gummy stem blight or black rot, powdery mildew and downy mildew

Percent of Crop Treated: <1%

Types of Applications: foliar

Application Rates: 1/4 to 1/2 lb(2)

Number of Applications: no information available

Timing: 7-14 day intervals (2)

Pre-Harvest Interval: 0 days suggested (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: curative, preventative and systemic fungicide (27)

Disadvantages: resistant fungi have been reported, resistance is a concern (27)

(1)(4)(7)(11)(20)(22)(24)

## **Captan** (carboximide, sufenimide)

Formulations: Captan 30-DD or 300, Captan 400 or 400-DD

Diseases Controlled: damping off

Percent of Crop Treated: no information available

Types of Applications: seed treatment

Application Rates: Captan 30-DD or 300, 2 1/3 oz per 100 lb seed, Captan 400 or 400-DD, 2 1/2 to 3 oz per

100 lb seed  
Number of Applications: 1  
Timing: not applicable  
Pre-Harvest Interval: not applicable  
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: Captan is a B2 carcinogen  
(1)(4)(7)(11)(20)(24)

### **Thiram** (dithiocarbamate)

Formulations: 42-S Thiram or Thiram 50 WP Dyed  
Diseases Controlled: damping off  
Percent of Crop Treated: no information available  
Types of Applications: seed treatment  
Application Rates: 4 1/2 oz per 100 lb seed  
Number of Applications: 1  
Timing: not applicable  
Pre-Harvest Interval: not applicable  
Use in IPM Programs: no information available  
Use in Resistance Management Programs: no information available  
Efficacy Issues: no information available  
Advantages: compatible with common pesticides (27)  
Disadvantages: no information available  
(1)(4)(7)(11)(20)(22)(24)

### **Fosetyl-aluminum** (organophosphate)

Formulations: Aliette/Maneb  
Diseases Controlled: fruit rot, anthracnose and downy mildew  
Percent of Crop Treated: 20%  
Types of Applications: foliar  
Application Rates: Aliette/Maneb 4 lb  
Number of Applications: no information available  
Timing: 7-10 day intervals (2)  
Pre-Harvest Interval: 5 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: gives long persistent control (27)

Disadvantages: no preventative action (27)

(1)(4)(7)(11)(20)(22)(24)

### **Maneb** (organophosphate)

Formulations: Manex, Maneb 75 DF or 80 WP

Diseases Controlled: alternaria leaf spot, fruit rot, anthracnose and downy mildew

Percent of Crop Treated: <15%

Types of Applications: foliar

Application Rates: Manex 1 1/5 to 1 3/5 qt, Maneb 75 DF or 80 WP 1 1/2 to 2 lb(2)

Number of Applications: no information available

Timing: 7 - 10 day intervals (2)

Pre-Harvest Interval: 5 days suggested (2)

REI: 24 hours (2)

Use in IPM Programs: no information available

Use in Resistance Management Programs: no information available

Efficacy Issues: no information available

Advantages: compatible with common pesticides, controls a wider range of diseases than any other single fungicide (27)

Disadvantages: a B2 carcinogen

(1)(4)(7)(11)(20)(22)(24)

### **Metalaxyl** (acylalanine, phenylamides)

Formulations: Apron FL or Allegiance-FL

Disease Controlled: Damping-off

Percent of Crop Treated: no information available

Types of Applications: seed treatment

Application rate: Apron FL 1.5 oz / 100 lb seed, Allegiance-FL 0.75 fl oz/100 lb see d(2)

Timing: seed treatment, at planting, 14 day intervals (2)

Pre-Harvest interval: not applicable

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: long lasting activity (24)

Disadvantages: B2 carcinogen, resistance concerns, corrosive (24)

### **Fludioxonil** (Organic Compound)

Formulations: Maxim 4 FS

Diseases Controlled: Damping off

Percent of Crop Treated: no information available  
Types of Applications: seed treatment  
Application Rates: recommended 0.08 to 0.16 oz/100 lb seed (2)  
Number of Applications: no information available  
Timing: seed treatment  
Pre-Harvest Interval: no information available  
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

## **Oxadixyl (Oxaolidinone)**

Formulations: Anchor  
Diseases Controlled: Damping off  
Percent of Crop Treated: information not available  
Types of Applications: seed treatment  
Application Rates: recommended (2) 1 1/2 oz/100 lb seed  
Number of Applications: no information available  
Timing: seed treatment  
Pre-Harvest Interval: no information available  
REI: not applicable  
Use in IPM Programs: no information available  
Use in Resistance Management Programs: no information available  
Efficacy Issues: no information available  
Advantages: curative and eradicant (24)  
Disadvantages: no information available  
Comments: available in combination with fungicides to broaden spectrum of effect (24)

## **Nematodes**

### **Biology:**

Root knot and root lesion nematodes can be problems in cucumber, reducing yields.

**Root knot nematodes** can cause galls, forked roots and bunching of the roots. They are endoparasites. Adult female root knot nematodes feed on roots and become swollen. They produce an egg mass at the root surface. The first stage larva develops in the egg and the second stage larva exits the egg. The second stage larva is worm-like in shape and motile. It moves through the soil until it finds a suitable root. The larva enters the root and becomes sedentary. Nematode juveniles enter plant root tips, migrate through the tissue to feeding sites near the center of the root, and stop movement to feed. Crop rotation is usually not effective for control of root knot nematodes

because of their wide host range.(2)(11)

**Root lesion nematodes** are migratory endoparasites. They overwinter in soil or roots as eggs, larva and adults. Larva and adults are migratory. Adult females lay eggs inside roots. Eggs hatch in the roots or when root tissue decomposes they are released into the soil. First larva stage occurs in the egg, the second larval stage is motile and moves through the soil, into roots. Lesion nematodes burrow into the cortex and feed, causing necrosis and discoloration. Lesion nematodes repeatedly enter and exit roots, causing tissue damage and making the roots susceptible to secondary pathogens.

**Cultural Controls:**

Crop rotation with non-host crops.

**Chemical Controls:**

- Nematodes can be controlled chemically through nematicide fumigations in the fall, preplanting soil treatment and soil treatment at planting.
- Fall soil fumigation (Broadcast)
- 1,3-D (Telone II) at a rate of 15 gal

**Alternative Controls:**

No information available.

## NEMATICIDE PROFILES

**Dichloropropene** (fumigant)

Formulations: 1,3-D, Telone II

Pests Controlled: root knot and root lesion nematodes

Percent of Crop Treated: No information available

Types of Applications: fumigant

Application Rates: 15 gal on mineral soil is suggested

Number of Applications: 1

Timing: fall fumigant; injected into the soil

Pre-Harvest Interval: No information available

REI: 5 days

Use in IPM Programs: No information available

Use in Resistance Management Programs: No information available

Efficacy Issues: particular effective against cyst forming nematodes and meadow nematodes.(26)

Advantages: also helps control weeds and diseases

Disadvantages: cannot use on heavy soils(26)

(11)(22)

**Oxamyl** (carbamate)

Formulations: Vydate 2L

Pests Controlled: root knot and root lesion nematodes and insects

Percent of Crop Treated: no information available

Types of Applications: broadcast or band

Application Rates: 2 gal broadcast or 1 gal band

Number of Applications: no information available

Timing: preplant

Pre-Harvest Interval: no information available

REI: 48 hours

Use in IPM Programs: no information available

Use in Resistance Management Programs: no information available

Efficacy Issues: no information available

Advantages: A systemic insecticide

Disadvantages: no information available

RUP

(11)(22)

**Mocap** (organic phosphate)

Formulations: Mocap 6 EC, Mocap 10G

Pests Controlled: root knot and root lesion nematodes

Percent of Crop Treated: no information available

Types of Applications: in row

Application Rates: Mocap 6 EC 1 1/3 qt /A or 6.8 fl oz / 1000 ft row (band); Mocap 10G at 20 lbs/A or 3.2 lb/1000 ft row (band)

Number of Applications: 1

Timing: preplant or at planting

Pre-Harvest Interval:

REI: 48 hours

Use in IPM Programs: no information available

Use in Resistance Management Programs: no information available

Efficacy Issues: no information available

Advantages: contact nematicide and insecticide

Disadvantages: no information available

(11)(22)

# Weeds

## General:

Broadleaf and grasses are the primary weed concerns in cucumber production. **Crop rotation, cultivation and herbicide applications help to control weeds.** (15)

## Cultural Controls:

- Crop Rotation
- Cultivation

## Chemical Controls:(7)

- Ethalfluralin (Curbit 3E)
- Bensulide (Prefar 4E)
- Paraquat (Gramoxone extra)
- Trifluralin (Treflan)
- Naptalam (Alanap 2L)
- Oxyfluorfen (Goal 2XL)
- Sethoxydim (Poast 1.5E) (PHI 30 days)
- Glyphosate (Roundup)

## HERBICIDE PROFILES

### **Bensulide** (amides)

Formulations: Prefar 4E

Weeds Controlled: germinating annuals

Percent of Crop Treated: 33% of the acres planted in fresh cucumber production in Michigan in 1996

Types of Applications: preemergence, incorporate

Application Rates: 2.17 lb per acre totaling 4.0 (1,000) lbs applied; suggested rate: 4-6 lb ai/ac (15)

Number of Applications: 1.0 applications

Timing: before seeding or transplanting

Pre-Harvest Interval: not applicable

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: selective herbicide, fairly resistant to leaching (28)

Disadvantages: long residual so crop injury may occur (28)(7)

## **Ethalfluralin** (nitroaniline)

Formulations: Curbit 3E

Weeds Controlled: germinating annuals

Percent of Crop Treated: 86% of the acres planted in fresh cucumber production in Michigan in 1996

Types of Application

Application Rates: 0.73 lb per acre totaling 3.6 (1,000) lbs applied

Number of Applications: 1.0 applications

Timing: at seeding

Pre-Harvest Interval: not applicable

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(7)

## **Alternative Controls:**

No information available

References: (Zandstra, 1999)

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