Crop Profile for Cucumbers (Processing) in Michigan

Prepared: June, 1999

General Production Information

- Cucumbers are produced in Michigan for fresh market and processing.
- Farms in Michigan: 210 (20)
- Acres in Michigan: 28,000

	Cucumbers for Processing
Michigan Ranking	1
Percent of U.S. Production	24
Area Planted (5 year average)	25,900
Area Harvested (5 year avg.)	24,600
Value of Production ($) (thousands) (5 year average)	20,798
Production (thousands)	138

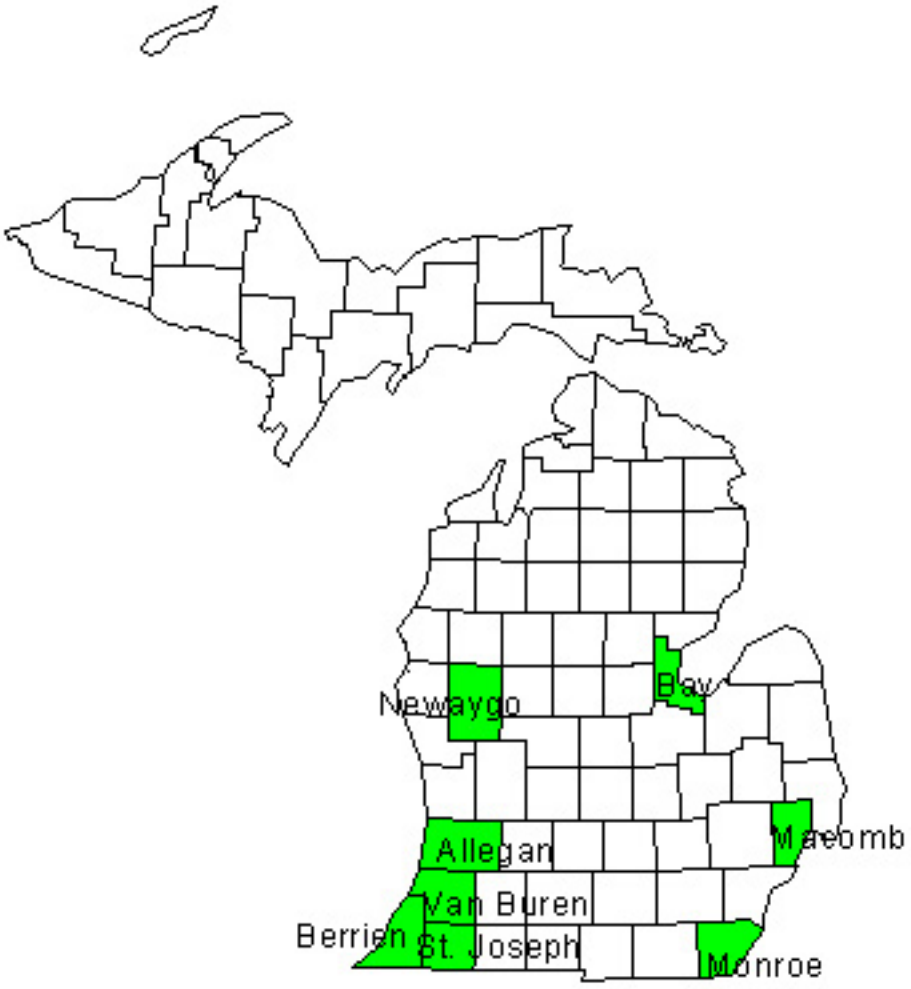
Production Regions:

Other top states in processing cucumber production are North Carolina and Texas.

Counties in Michigan producing processing cucumbers include:

- Northwest Region: Manistee County
- West Central Region: Muskegon and Oceana Counties
- Central Region: Gratiot and Midland Counties
- East Central Region: Arenac, Bay, Saginaw & Tuscola Counties
- South West Region: Allegan, Berrien, Kent and Van Buren Counties

- South Central Region: St. Joseph County
- South East Region: Lenawee County



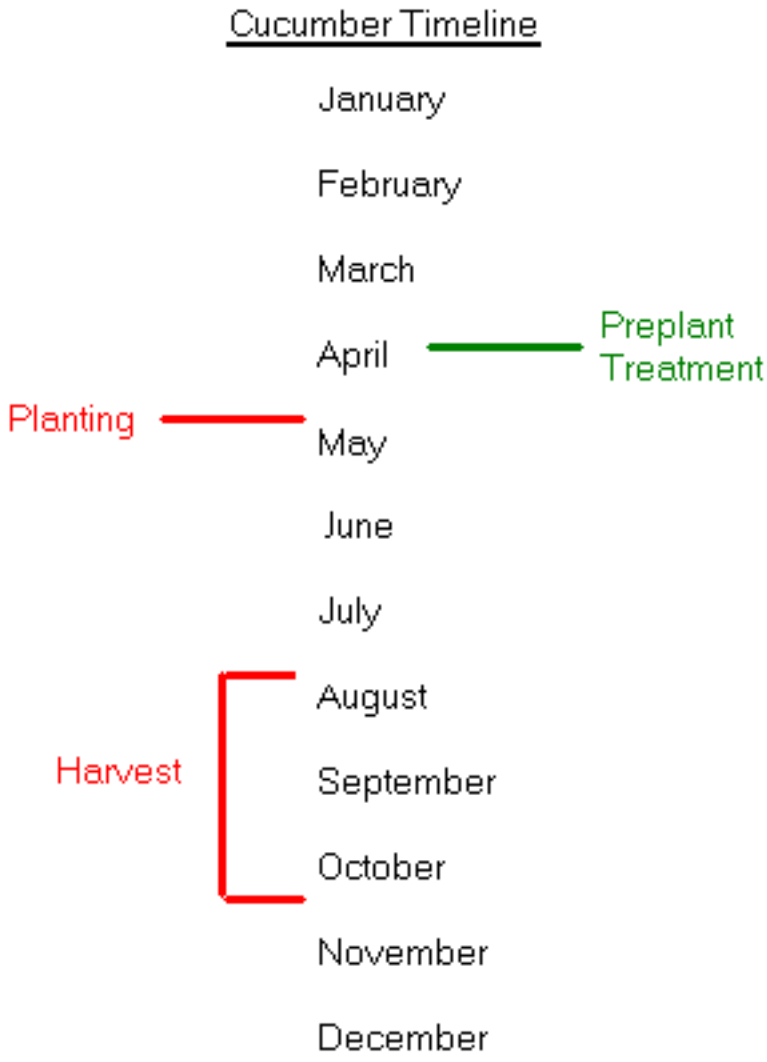
	Counties	District	Acres Planted	Yield (lb/acre)	Production in District
Processing cucumbers (from 1995-96 MASS, MRS statistics)	Manistee	Northwest	330	22,000	7,700
	Muskegon	West Central	1,400	10,000	21,000
	Oceana		630		
	Gratiot	Central	4200	9,000	54,400
	Midland		1,500		
	Arenac	East Central	870	9,000	53,900
	Bay		1,800		
	Saginaw		3,200		
	Tuscola		830		
	Allegan	Southwest	2,500	15,000	115,400
	Berrien		280		
	Kent		620		
	Van Buren		4,000		
	St Joseph	South Central	3,000	8,000	27,200
	Lenawee		300	16,000	6,400
TOTAL 1996 Acres: 28000					

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. (21)

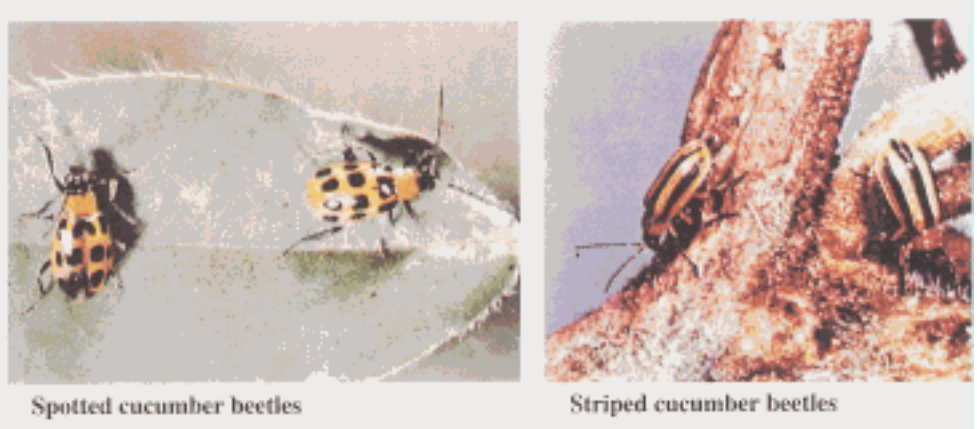


Chemical Controls: Critical Use Issues

Myclobutanil has a Section18 for use on cucumbers to control powdery mildew. (24)

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:

- Preplant 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,

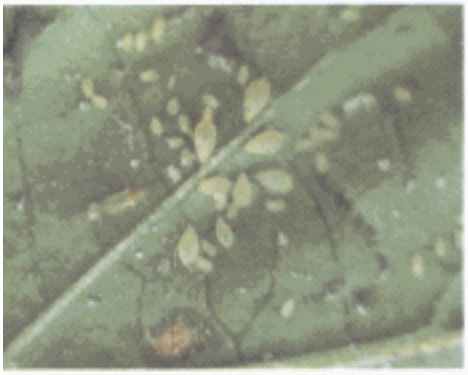
cotyledons and new leaves may show injury above ground. Damage is especially common in cool weather, because the seed corn maggot is well adapted to cool temperatures and seeds germinate slowly and are exposed longer to injury. There may be three or more generations per year. Monitoring for this insect 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: Lorsban

Alternative Controls:
No information available

Aphids



Green peach 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.

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.

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 tocontrol 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
Resistance Management Concerns: None reported in grower interviews.

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 it stays in place, it is not as resistant. Furadan 15G(granular)-worked well, held in place, is no longer produced into seed furrow.
(3)(7)(11)(12)(14)(20)(21)(23)

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,prebloom.
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: 12 hours
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)(23)

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: Foiliar 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 on treatment is on cucumber beetle, but also helps control aphids and flea beetles.
Disadvantages: highly toxic to fish
(3)(7)(11)(12)(14)(20)(21)(23)

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 (2)
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)
RUP
(3)(7)(11)(12)(14)(20)(21)(23)

RUP: Restricted Use Pesticide (23)

Diseases

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 infects 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
- Copper
- Maneb

Alternative Controls:
No information available

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

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. Fruit laying on or near the soil can be attacked. The fruit rots begin in the field, but continue to develop after harvest and during storage. Affected fruit develop white spots, then turn brown and dry. (11)(1)

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:
No information available

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. (Id Dis Veg)

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 occasionally 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. (Id Dis Veg)

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 cichoraecarum 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 bryonae (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 informatiom 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: was applied to 10% of the acres planted in processing cucumber production in Michigan in 1996
Types of Applications: foliar
Application Rates: of 1.27 lb per acre totaling 3.6 (1,000) lbs applied
Number of Applications: 1.1 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: B2 carcinogen.
(1)(4)(7)(11)(20)(23)

Copper Compounds

Formulations:Copper Count, Kocide 2000, Kocide 4.5 LF, Nu-Cop 3L, Basicop
Diseases Controlled: Powdery mildew, scab, alternaria leaf spot, anthracnose, angular leaf spot, gummy stem blight,
Percent of Crop Treated: Copper hydroxide was applied to 6% of the acres planted in processing cucumber production in Michigan in 1994
Types of Applications: foliar
Application Rates: 0.5 lb per acre totaling 1.3 (1,000) lbs
Number of Applications: 1.8 applications
Timing:5-14 day intervals suggested
Pre-Harvest Interval: 0 days suggested (2)
REI: 24-48 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: toxic to fish
(1)(4)(7)(11)(20)(23)

Metalaxyl (phenylamides)

Formulations: Ridomil Gold EC, Ridomil Gold WSP, Ridomil Gold GR
Diseases Controlled: damping off,
Percent of Crop Treated: applied to 34% of the acres planted in processing cucumber production in Michigan in 1996
Types of Applications: foliar
Application Rates: 0.18 lb per acre totaling 2.0 (1,000) lbs applied
Number of Applications: 1.2 applications, maximum 4 per year
Timing: no information available
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: long lasting activity (27)
Disadvantages: B2 carcinogen, resistance concerns, corrosive (27)
(1)(4)(7)(11)(20)(23)

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)(23)(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)
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: Inexpensive
Disadvantages: a B2 carcinogen, processor restrictions
(1)(4)(7)(11)(20)(23)(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)(23)(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)(23)(24)

Captan (carboximide, sulfenimide)

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 (2)
Number of Applications: 1
Timing: not applicable
Pre-Harvest Interval: not applicable
REI: 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)(23)(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: Alliette/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 persistant control (27)
Disadvantages: no preventative action (27)
(1)(4)(7)(11)(20)(23)(24)

Maneb (dithiocarbamate)

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, processor restrictions
(1)(4)(7)(11)(20)(23)(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 ox/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

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(26)
Disadvantages: cannot use on heavy soils(26)(11)(23)

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)(23)

Ethoprophos (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: 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: contact nematicide and insecticide
Disadvantages no information available
(11)(23)

RUP: Restricted Use Pesticide

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)

Paraquat is used to control emerged weeds before crop emergence or before transplanting at a rate of 1 pt per 100 gal.

Trifluralin (Treflan) can be incorporated into soils for pre-planting weed control on mineral soils. It is used to control broadleaves and annual grasses. This herbicide is not very effective on muck soils. Increase applications rate with increasing clay and organic content.

Napropamide is applied before seeding or transplanting and incorporated to a depth of 2-3 inches for controlling germinating grasses and broadleaves. It may also be applied after planting. Irrigate within 24 hours of application. Napropamide is most effective when applied with Goal.

Oxyfluorfen is used to control germinating broadleaf weeds in transplant beds. It is applied to the soil after the final tillage but before transplanting. It is suggested for use with trifluralin and napropamide.

Emerged grasses are controlled by sethoxydim. It is applied to actively growing grasses.

Roundup is used to control perennial weeds after they have emerged. Apply either before planting in the spring or after harvest in the fall.

HERBICIDE PROFILES

Clomazone (isoxazolidinone)(22)

Formulations: Command 4E
Weeds Controlled: germinating annuals
Percent of Crop Treated: 21% of the acres planted in processing cucumber production in Michigan in 1996
Types of Applications: incorporate
Application Rates: 2.0 lb per acre totaling 1.2 (1,000) lbs applied
Number of Applications: 1.0 applications
Timing: before seeding
Pre-Harvest Interval:
REI: 12 hours (2)
Use in IPM Programs: no information available
Use in Resistance Management Programs: no information available
Efficacy Issues: good control of velvet weed(28)
Advantages: relatively non-toxic to fish, may be tank mixed with ither herbicides, absorbed by the roots and shoots of weed plants, half life in the soil is 15-45 days(28)
Disadvantages:incorporate within 3 hours of application (28) (7)

Ethalfluralin (dinitoaniline)(22)

Formulations: Curbit 3E
Weeds Controlled: germinating annuals
Percent of Crop Treated: was applied to 62% of the acres planted in processing cucumber production in Michigan in 1996
Types of Applications: preplant soil incorporation
Application Rates: of 0.77 lb per acre totaling 13.4 (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: may be tank mixed with liquid fertilizers (28)
Disadvantages: rainfall or irrigation required wwithin 5 days of application (28) (7)

Naptalam (phthalic-acid)(22)

Formulations: Alanap 2L
Weeds Controlled: germinating annuals
Percent of Crop Treated: was applied to 20% of the acres planted in processing cucumber production in Michigan in 1996
Types of Applications: pre emergence or postemergence
Application Rates: 0.27 lb per acre totaling 8.2 (1,000) lbs applied
Number of Applications: 1.2 applications
Timing: pre emergence and post emergence
Pre-Harvest Interval: no information available
REI: 48 hours (2)
Use in IPM Programs: no information available
Use in Resistance Management Programs: no information available
Efficacy Issues: effective for 3-8 weeks (28)
Advantages: can be detrimental to crops under low clay, organics or high pH (28)
Disadvantages: irrigation or rainfall is necessary, does not control emerged weeds (28) (7)(10)

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