Crop Profile for Petunias in Ohio

Prepared: November, 2000

General Production Information

- Area of production in Ohio: 921,000 sq. ft - 76% for wholesale market
- Percent of US Acreage/Rank: 8%/4th
- Number of Growers: 203
- Wholesale Price Per Flat: $6.12
- Value of Wholesale Production in Ohio: $5,575,000

Cultural Practices

The commercial propagation of petunias is done by seed. The seeds are planted in a light well-drained medium with a pH between 6.0 and 6.5 in plug trays or in furrows 2 cm deep in seed flats. Seeds are sown on the surface of the planting medium and the trays or flats are covered with plastic to retain moisture. After germination the seedlings are watered and given a weekly dose of a well-balanced fertilizer. The plants are watered well and receive a starter fertilizer. As they grow, the petunias are exposed to full sun. Light and temperature determine time of flowering, height of the plant and branching. The temperature and amount of artificial light used is determined by the quality needs of the grower. High temperatures and exposure to long periods of daylight hastens flowering but may produce a lower quality plant. The amount of watering and fertilizer applied can affect plant height. The plants are not stressed but grown in the planting medium slightly dry to keep height under control. A well-balanced fertilizer is applied at 150 to 200 ppm N using a constant liquid-feed program. Salts and pH are monitored to avoid nutrient problems. In 8-10 weeks the petunias are ready to be marketed. As with all ornamental plants, managing pests and diseases is a critical component of petunia production since any damage usually renders a plant unsaleable

Insect Pests

Thrips

Thrips are often the most serious insect pest in greenhouses. They are very difficult to control once a population becomes well established. Thrips feed on leaves and flowers of a wide variety of host plants. The feeding injury can render a plant unmarketable and the act of feeding by thrips can transmit viruses to a susceptible host plant. The thrips lifecycle begins as an egg is deposited in plant tissue. After the larvae emerge they begin feeding on the plant. Thrips pass through 2 larval and transformation stages before becoming an adult. Feeding injury is done by the larvae and adults but only the adults can transmit viruses. The lifecycle of the thrips is temperature dependant with development occurring between 50 – 90°F. The egg to adult cycle lasts between 10-38 days at these temperatures. At temperatures below 50°F thrips can survive but no development occurs.

Aphids

There are many species of aphids that can attack greenhouse plants but the two most common species are the green peach aphid (Myzus persicae) and the melon/cotton aphid (Aphis gossypii). Both of these species are green in color but it can vary from light to dark green for the melon aphid and from light green to nearly pink for the green peach aphid. Aphids have small soft bodies with piercing-sucking mouth parts which they use to insert into the phloem tissue of plants and remove fluid. Aphids cause problems from injury by feeding, the transmission of viruses and by spreading sticky honeydew over the surface of leaves and flowers. In the greenhouse most aphids are female and they produce live young called nymphs. An average female produces between 50 to 200 nymphs during her lifetime. The nymphs, which are all female, begin reproducing in 7-10 days. Adult aphids appear in 2 forms, winged and wingless, depending on population density and /or host plant conditions. Winged aphids are troublesome because they are able to disperse throughout the greenhouse and are also able to fly into the greenhouse from outdoors.

Whiteflies

Whiteflies are a very common pest in greenhouse production. The most common species are the greenhouse whitefly (Trialeurodes vaporariorum) and the silverleaf white fly (Bemisia arentifolii). The adult silverleaf whiteflies are smaller, more yellow and active than the greenhouse whiteflies. In the pupal state the silverfleaf whiteflies are flat without spines or fringes whereas the greenhouse whitefly pupae have vertical sides with spines. The adult whitefly lifecycle lasts from 21-36 days. Each female produces 60 to 100 eggs that hatch in 7-10 days. The newly emerged crawlers move for a short distance before settling down to feed. After molting 3 times the pupae emerge and in 6 days will grow into adults. During development whiteflies are usually found on the underside of leaves. The adult and immature stages of whiteflies use their piercing-sucking mouth parts to extract fluid from plant tissue. A few adult whiteflies on plants are a nuisance. However, feeding by a large number of adults and especially immatures can weaken or kill a plant. Whiteflies also produce a sticky honeydew that can be a growth

medium for black sooty fungus.

Fungus Gnats

The fungus gnat is a common pest of greenhouse plants. The adults are tiny, dark, slender, fragile looking flies. They have long antennae and legs and a small head in relation to their bodies. The lifecycle of the fungus gnat is completed in 25-30 days. The adults live about one week and lay up to 200 eggs. The eggs hatch in about 4 days into larvae. The fungus gnat larvae are white and translucent with shiny black heads. The larvae live in the soil for two weeks and feed on the roots of plants. The pupal stage lasts 3-4 days before the adults emerge. Extensive damage can be caused by larval feeding, resulting in plants that show signs of wilting. The adult fungus gnat is primarily a nuisance pest.

Spider Mites

Spider mites are a persistent pest problem in the greenhouse. Many species of spider mites are found in the greenhouse, but the most common is the two-spotted spider mite (Tetranychus urticae). Spider mites are very small arthropods that develop mostly on the undersides of leaves. Their lifecycle lasts between 7-14 days but varies considerably depending on temperature. An adult female spider mite can produce 100-200 eggs in her lifetime. The eggs hatch into tiny larvae in a few days. The larvae pass quickly through several nymph stages before becoming adults. Spider mites cause injury to plants while feeding. Using their piercing-sucking mouth parts, they extract plant fluids. Feeding injury often give the upper leaf surface a characteristic mottled or speckled appearance. Large numbers of spider mites produce a webbing that can completely cover leaves and flowers.

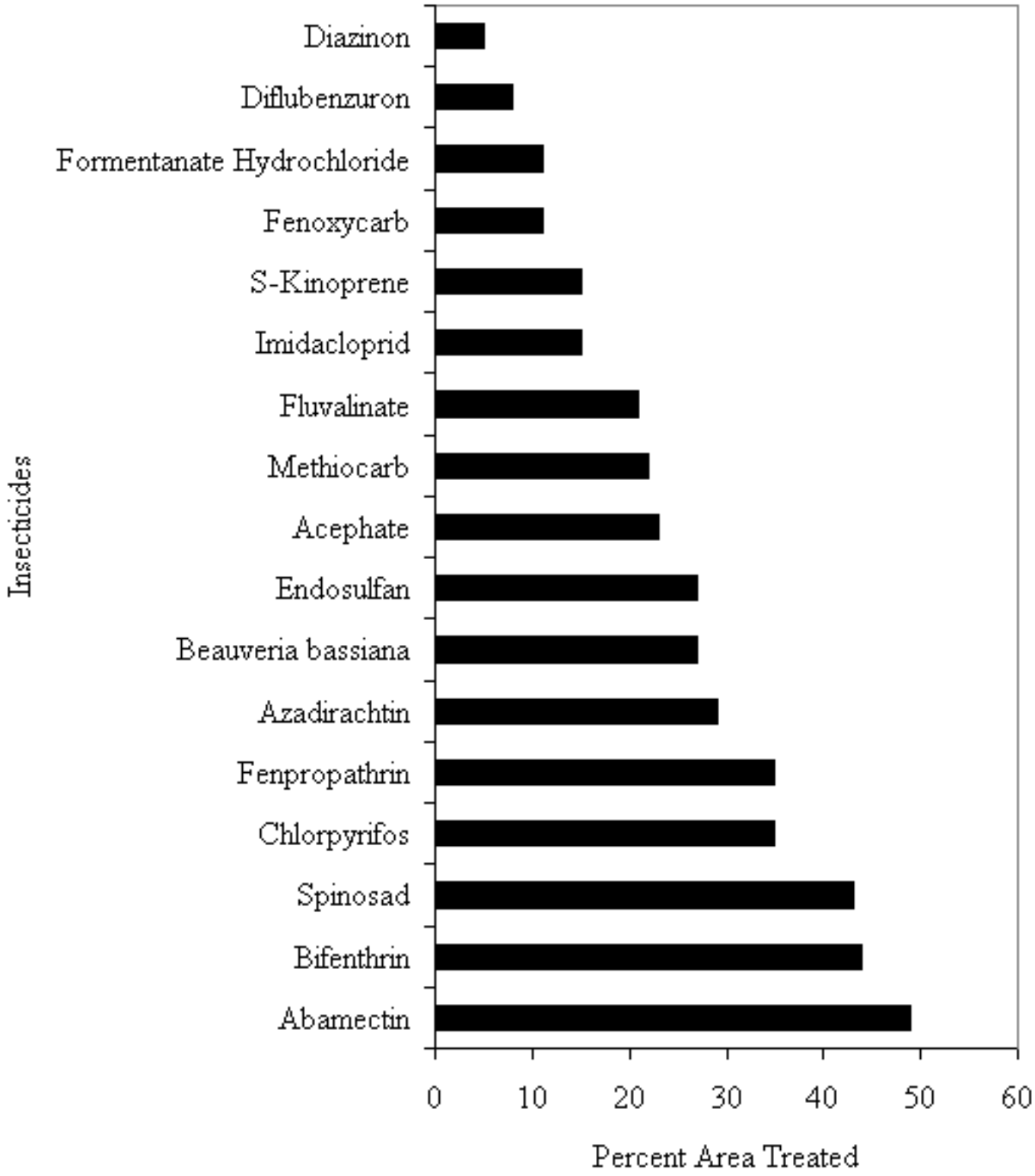
CHEMICAL INSECT CONTROLS(4)

(all chemicals applied at an average rate of 200 gal/A unless otherwise noted)

Abamectin (Avid)

- Percent of total area treated: 49%
- Target pests: Thrips, Aphids, Whiteflies and Mites

  Average rate and frequency of application of most common formulations: (2)
- Avid 0.15 EC – 6.7 oz/100 gal, twice
- Application method: High Volume or Low Volume Spray
- REI: 12 hours
- Efficacy rating: Good to Very Good



Bifenthrin (Talstar)

- Percent of total area treated: 44%
- Target pests: Thrips, Aphids

Average rate and frequency of application of most common formulations: (2)

- Talstar F – 18 oz/100 gal, twice
- Application method: High Volume Spray
- REI: 12 hours
- Efficacy rating: Good

Spinosad (Conserve)

- Percent of total area treated: 43%
- Target pests: Thrips, Whiteflies and Aphids

Average rate and frequency of application of most common formulations: (2)
- Conserve SC – 6 oz/100 gal, twice
- Application method:
- REI: 4 hours
- Efficacy rating: Very Good to Excellent

Chlorpyrifos (DuraGuard)

- Percent of total area treated: 35%
- Target pests: Thrips, Aphids, Whiteflies and Fungus Gnats

Average rate and frequency of application of most common formulations: (2)
- DuraGuard ME – 54 oz/100 gal, twice
- Application method: High Volume Spray
- REI: 12 hours
- Efficacy rating: Good

Fenpropathrin (Tame)

- Percent of total area treated: 35%
- Target pests: Aphids and Whiteflies

Average rate and frequency of application of most common formulations: (2)
- Tame 2.4 EC – 8 oz/100 gal, twice
- Application method: High Volume Spray
- REI: 24 hrs.
- Efficacy rating: Good
- Used with Orthene TT&O for best results.

Azadirachtin (Azatin)

- Percent of total area treated: 29%

- Target pests: Thrips, Whiteflies and Fungus Gnats

Average rate and frequency of application of most common formulations: (2)
- Azatin XL – 13.5 oz/100 gal, twice
- Application method: High Volume or Low Volume Spray
- REI: 12 hours
- Efficacy rating: Good to Very Good

Beauveria bassiana (Naturalis-O)

- Percent of total area treated: 27%
- Target pests: Whiteflies, Aphids and Thrips

Average rate and frequency of application of most common formulations: (2)
- Naturalis-O – 31 oz/100 gal, twice
- Application method: High Volume Spray
- REI: 4 hours
- Efficacy rating: Average to Good

Endosulfan (Thiodan)

- Percent of total area treated: 27%
- Target pests: Thrips and Aphids

Average rate and frequency of application of most common formulations: (2)
- Thiodan 50 WP – 16 oz/100 gal, twice
- Thiodan 3EC – 48 oz/A, twice
- Fulex Thiodan – 1 can (16 oz)/ 10,000 cu. ft, twice
- Application method: High Volume Spray for 50 WP and 3EC, Fogger for Fulex
- REI: 24 hours
- Efficacy rating: Good to Very Good

Acephate (Orthene)

- Percent of total area treated: 23%
- Target pests: Aphids, Thrips, Whiteflies

Average rate and frequency of application of most common formulations: (2)
- Orthene TT&O – 13.5 oz/100 gal, twice
- Application method: High Volume Spray
- REI: 24 hours
- Efficacy rating: Good to Very Good

Methiocarb (Mesurol)

- Percent of total area treated: 22%
- Target pests: Thrips and Aphids

Average rate and frequency of application of most common formulations: (2)

- Mesurol 75W – 1lb/A in 50 gals, twice
- Application method: High Volume Spray
- REI: 24 hours
- Efficacy rating: Very Good

Fluvalinate (Mavrik Aquaflow)

- Percent of total area treated: 21%
- Target pests: Aphids, Thrips, Whiteflies and Mites
- Average rate and frequency of application of most common formulations:
- Mavrik Aquaflow – 8 oz/100 gal twice
- Application method: High Volume and Low Volume Spray
- REI: 12 hours
- Efficacy rating: Good to Very Good

Imidacloprid (Marathon)

- Percent of total area treated: 15%
- Target pests: Aphids, Whiteflies and Thrips

Average rate and frequency of application of most common formulations: (2)

- Marathon 1% - ½ tsp (2 grams)/10 inch pot, once
- Marathon 60 WSP– 4.2-20gram packets/100 gal (5 oz drench/10 inch pot), once
- Application method: top dress for 1% and drench for 60 WSP
- REI: 12 hours
- Efficacy rating: Very Good

S-Kinoprene (Enstar)

- Percent of total area treated: 15%
- Target pests: Aphids, Whiteflies and Fungus Gnats (larvae)

Average rate and frequency of application of most common formulations: (2)

- Enstar II – 7.5 oz/100 gal, twice
- Application method: High Volume spray
- REI: 4 hours
- Efficacy rating: Good to Very Good

Fenoxycarb (Precision)

- Percent of total area treated: 11%
- Target pests: Thrips, Aphids, and Whiteflies

Average rate and frequency of application of most common formulations: (2)

- Precision – 4 oz/100 gal, twice
- Application method: High Volume Spray
- REI: 12 hours
- Efficacy rating: Good to Very Good

Formentanate Hydrochloride (Carzol)

- Percent of total area treated: 11%
- Target pests: Thrips

Average rate and frequency of application of most common formulations: (2)

- Carzol – 8 oz/A, twice
- Application method:
- REI:
- Efficacy rating: Very Good

Diflubenzuron (Adept)

- Percent of total area treated: 8%
- Target pests: Fungus Gnats (larvae) and Whiteflies

Average rate and frequency of application of most common formulations: (2)

- Adept 25 WP – 1 oz (l bag)/100 gal, once
- Application method: Drench
- REI: 12 hours
- Efficacy rating: Very Good

Diazinon (Knox Out)

- Percent of total area treated: 5%
- Target pests: Fungus Gnats (larvae)

Average rate and frequency of application of most common formulations: (2)

- Knox Out GH - 75 oz/100 gal, once
- Application method: Spray to potting mix surface
- REI: 12 hours

- Efficacy rating: Average

CULTURAL CONTROLS (2,3,5)

Quarantine new plant material for at least one week. Use screens on ventilation system and doors to exclude pests. Practice proper sanitation and weed control in and around the greenhouse. Avoid excessive fertilization since some pests thrive on plant tissue high in nitrogen.

BIOLOGICAL CONTROLS (2,3,5)

Some new and effective biological control products are available for the greenhouse grower. Most growers are taking a cautious approach to these new products and only applying them to small portions of their operations.

Diseases

Botrytis Gray Mold

The most common disease of greenhouse floral crops is gray mold. Gray mold is cause by the fungus Botrytis cinerea. It is a common fungus, with a very wide host range and can persist in the greenhouse year-round. The fungus produces a large amount of spores that move throughout the greenhouse via air currents. Under environmental conditions of relative humidity at or above 85%, little or no air circulation and free water on the leaf surface, the fungal spores land on plant surfaces, germinate and penetrate the host. The symptoms of gray mold vary depending on the host and the environmental conditions associated with the host. In most cases the disease is characterized by the production of leaf spots, flower blight, bud rot, stem canker, stem and crown rot, cutting rot, damping off and in extreme cases, plant death. The fungal growth is characterized by the presence of fluffy gray/brown mycelium that produces a cloud of spores if disturbed. Affected tissue is soft and brown, and sometimes has a water soaked appearance. This disease can be anything from a common nuisance to an economic disaster depending on the host and the conditions under which the crop is grown.

Powdery Mildew

Powdery mildew is one of the most wide spread diseases in the floriculture production industry. It is caused by the fungus Oidium spp. whose spores are easily spread by physical movement and air currents. In most cases, symptoms of this disease are relatively easy to identify. The disease is characterized by the fluffy white fungal growth on the leaves, stems, and flowers of infected plants. The

disease typically shows up on leaves first and if left unchecked it will spread to the stems and flowers. Tissues infected with powdery mildew can eventually become necrotic. This disease is responsible for significant economic losses in the greenhouse. Powdery mildew tends to be more of a problem later in the growing season when night temperatures get cooler. High humidity is also necessary for development of the fungus. However, it depends on the individual organism as to when and where the disease shows up.

Downey Mildew

The fungus that causes Downey Mildew is more specific to its hosts than the fungus that causes Powdery Mildew. The fungal spores, which are usually short lived, are spread though the air and are able to infect a susceptible host if free water is present. High humidity is required for sporulation and the growth of the fungi is favored by cool temperatures (40-60° F). The fungus also produces a sexual spore that can survive in dry conditions, enabling the fungus to live in the absence of a host. Symptoms of a Downey Mildew infection include the appearance of sporulation on the undersides of leaves that is sometimes angular in shape and delimited by veins. Pale yellow or necrotic areas are sometimes visible from the upper side of the leaf. In some plants when the young shoots are infected the fungus may become systemic and cause stunted growth, malformations and yellowing of plant tissue.

Alternaria

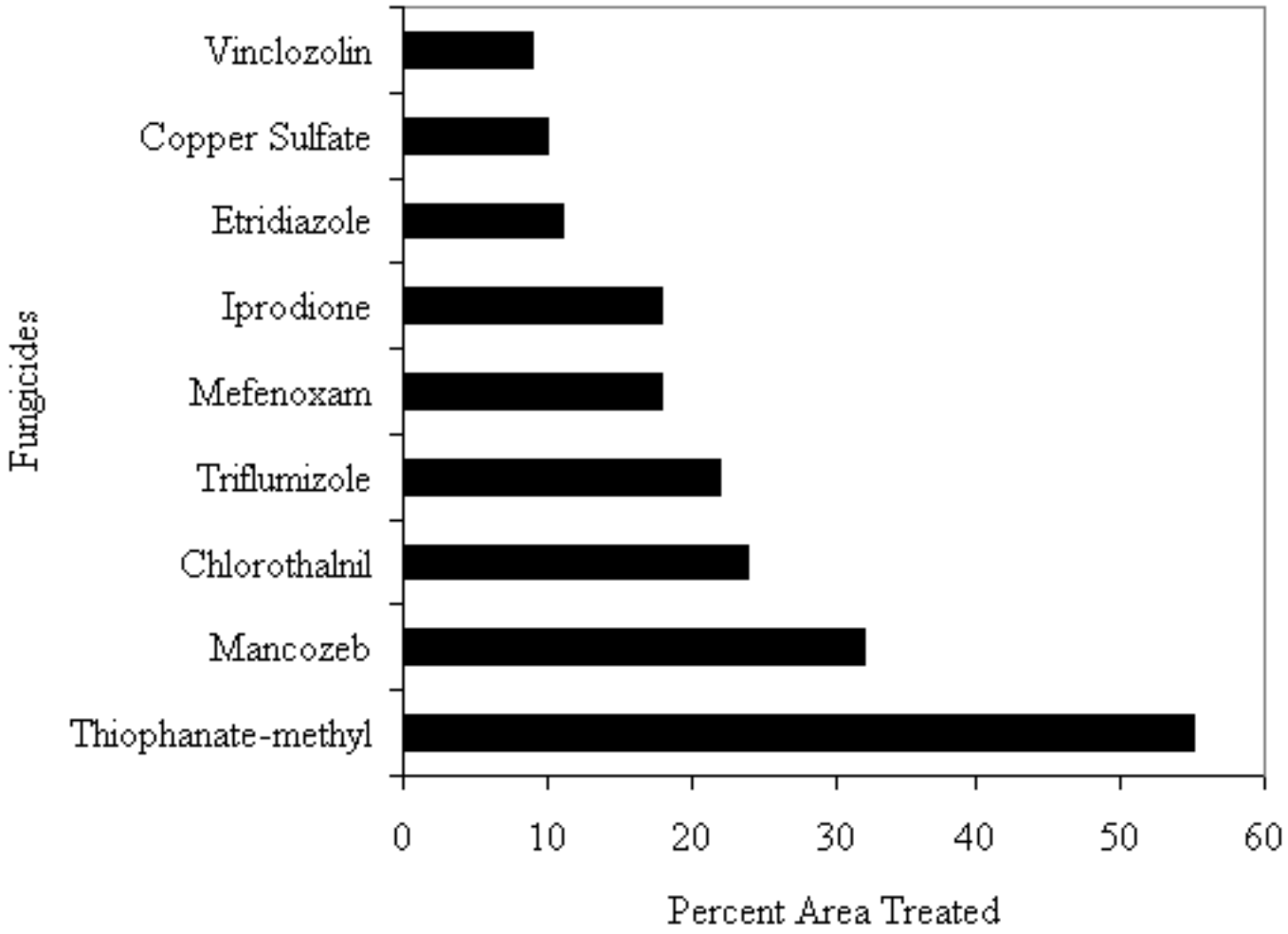
Alternaria is a widespread fungus that attacks the leaves, stems and flowers of a wide variety of plants. The fungus survives on infected plant debris or on seeds. Spores are produced from these or other hosts and can spread by air currents to neighboring plants. Under warm and humid conditions the spores germinate on the leaves causing spots of various sizes and colors. Leave may wither and die.

Leaf Spots

Leaf diseases that occasionally damage ornamental plants can be caused by fungi or bacteria. Most of these pathogenic organisms require a wet leaf surface for an extended time, usually 24 hours. The wet leaf surface allows the fungal spores to swell, geminate and penetrate the plant and the bacteria to swim to a natural opening in the leaf surface such as a stomate. Bacterial leaf spots are initially light green and look water soaked. Later these leaf spots turn brown or black and may have definite margins. Fungal leaf spots are characterized by brown or black spots randomly scattered across the leaf. The spots may have the appearance of concentric rings. The margins of the spot can be a different color than the center of the spot.

CHEMICAL DISEASE CONTROLS

(all chemicals applied at an average rate of 200 gal/A unless otherwise noted)



Thiophanate-methyl (Cleary's 3336, Fungo)

- Percent of total area treated: 55%
- Target pests: Botrytis

Average rate and frequency of application of most common formulations:

- Cleary's 3336 4.5F - 20 oz/100 gal, twice
- Fungo Flo 50WP – 20 oz/100 gal, twice
- Application method: High Volume Spray or Drench
- REI: 12 hours
- Efficacy rating: Good to Very Good

Mancozeb (Protect T/O)

- Percent area treated: 32%
- Target pests: Botrytis and Leaf Spots

Average rate and frequency of application of most common formulations:

- Protect T/O 80 WP - 1.5 lbs/100 gal, once
- Application method: High Volume Spray
- REI: 24 hours
- Efficacy rating: Good to Very Good

Chlorothalnil (Daconil)

- Percent of total area treated: 24%
- Target pests: Botrytis

Average rate and frequency of application of most common formulations:

- Daconil Ultrex 82.5 WDG – 1lb/100 gal, once
- Daconil 2787 Flo 4F – 32 oz/100 gal, once
- Exotherm Termil 20 Fum – 1 smoke can (3.5 oz)/1000 sq. ft, twice
- Application method: High Volume Spray and Smoke Fumigation
- REI: 48 hours
- Efficacy rating: Good to Very Good for Daconil products, Average for Exotherm Termil

Triflumizole (Terraguard)

- Percent of total area treated: 22%
- Target pests: Leaf Spots

Average rate and frequency of application of most common formulations:

- Terraguard 50WP – 12 oz/100 gal, once
- Application method: High Volume Spray
- REI: 12 hours
- Efficacy rating: Very Good

Mefenoxam (Subdue MAXX)

- Percent of total area treated: 18%
- Target pests: Root Rots

Average rate and frequency of application of most common formulations:

- Subdue Maxx – ½ oz/100 gal, one to two times
- Application method: High Volume Spray
- REI: None
- Efficacy rating: Very Good

Iprodione (Chipco 26019)

- Percent of total area treated: 18%

- Target pests: Botrytis, Root Rot

Average rate and frequency of application of most common formulations:
- Chipco 26019 50WP – 1.5 lb/100 gal, one to two times
- Application method: High Volume Spray or Drench
- REI: 12 hours
- Efficacy rating: Good to Very Good

Etridiazole (Truban)

- Percent of total area treated: 11%
- Target pests: Water Molds

Average rate and frequency of application of most common formulations:
- Truban 30WP – 8 oz/100 gal, once
- Application method: Drench
- REI: 12 hours
- Efficacy rating: Excellent

Copper Sulfate (Phyton-27)

- Percent of total area treated: 10%
- Target pests: Leaf Spots

Average rate and frequency of application of most common formulations:
- Phyton-27 5.5EC – 13 oz/100 gal, one to two times
- Application method: High Volume Spray or Low Volume Spray
- REI: 12 hours
- Efficacy rating: Very Good

Vinclozolin (Ornalin, Vorlin)

- Percent of total area treated: 9%
- Target pests: Botrytis

Average rate and frequency of application of most common formulations:
- Ornalin – 18 oz/100 gal, once
- Vorlin – 1½ Tbs/gal, once
- Application method: High Volume Spray
- REI: 12 hours
- Efficacy rating: Good

CULTURAL CONTROLS (2,35)

Buy resistant varieties whenever possible. Quarantine new plant materials for at least a week. Screen the greenhouse doors and vents. Plant disease free cuttings and seeds. Keep growing area clean. Remove all diseased plants as soon as they have been detected. Periodically disinfect the hose end, especially after touching the growing mix or the contaminated water on the floor or benches. Benches should also be disinfected at the end of each crop cycle. Eliminate all weeds and algae. Fertilize plants judiciously. Adjust the pH of the growing medium appropriately. Control relative humidity of the greenhouse, especially during the evening hours. This can require simultaneously ventilating and heating the greenhouse during critical hours. Providing adequate air circulation will also help. The use of well draining growth mediums will help reduce the incidence of root diseases.

Weeds

Weeds are a persistent problem in greenhouse production. Weeds are unsightly and can harbor insect pests and diseases. Therefore, weed management in and around the greenhouse is important to assist with pest and disease control and well as to improve aesthetics.

CHEMICAL CONTROLS (4)

(all chemical applied at a rate of 200 gal/A unless otherwise noted)

Glyphosate (Roundup)

- Percent of total area treated: 29%, primarily used as a spot spray in the work area.
- Target pests: Annual and Perennial Weeds

Average rate and frequency of application of most common formulations:

- Roundup Pro – 2 oz/gal, as needed
- Application method: High Volume Spray
- REI: 4 hours
- Efficacy rating: Good to Very Good

Glufosinate-ammonium (Finale)

- Percent of total area treated: 12%
- Target pests: Annual and Perennial Weeds

Average rate and frequency of application of most common formulations:

- Finale – 1.5 gal/100 gal, once
- Application method: High Volume Spray
- REI: 12 hours
- Efficacy rating: Very Good

CULTURAL CONTROLS

Use weed block fabric to cover the floor and remove any weeds that grow in along the edges of the fabric. Hand weeding and solarization can also be used to control weeds. Managing weeds outside the greenhouse is important to eliminate the major source of air borne weed seeds and to prevent perennial weeds from growing in under the foundation. Regular mowing can help prevent the most weed seed formation. However, maintaining a weed-free barrier around the greenhouse may be more effective. Adding lime to soil can help to

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