

# Crop Profile for Lilies (Easter) in Ohio

## General Production Information

1. Area of production in Ohio: 549,000 sq. ft - 80% for wholesale market
2. Percent of US Acreage/Rank: 5%/5<sup>th</sup>
3. Number of Growers: 64
4. Wholesale Price Per Pot: \$4.18
5. Value of Wholesale Production in Ohio: \$2,356,000

### Production Methods:(5)

In the US Easter lilies are forced as seasonal pot plants. Bulbs are planted into a medium that is well drained and aerated 0.5 to 1 inch from the bottom of a 6 inch standard pot. A fungicide and miticide are applied to control root diseases and bulb mites. The bulbs are watered judiciously to provide enough water to avoid excessive drying but not too much to cause root rot and leaf yellowing. Supplying adequate nutrition is important. The choice of fertilizer depends on the desired pH response. The bulbs are left to develop roots between 1–3 weeks. Care is taken not to allow the stem to emerge during root development. Flower induction is achieved through a six-week vernalization (cold and moist) treatment with the length of the cooling treatment being most critical. Cooling is accomplished using one of three different methods, natural cooling, controlled-temperature forcing and case cooling. Then the lilies are exposed to 1-3 weeks of long days upon emergence from the growth medium following the cooling treatment to ensure flower induction. Long days are given by applying night-interruption lighting. As the lily develops growers use leaf counting to help ensure proper timing of a lily crop. Leaf counting usually starts 3 weeks after emergence or when plants are 3-5 inches tall. The rate of leaf unfolding is a linear function of average daily temperature. Temperature will also determine final plant appearance. Leaf and flower length, plant height and leaf orientation are all characteristics influenced by the day and night temperatures during this period. Once a visible bud has appeared the time to flower ranges between 24 to 42 days depending upon temperature regime chosen. As with all ornamental plants, managing pests and diseases is a critical component of lily production since any damage usually renders a plant unsaleable

## Insect Pests

### 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, that 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.

## **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 result from larval feeding, resulting in plants that show signs of wilting. The adult fungus gnat is primarily a nuisance pest.

## **Bulb Mites**

Mites are responsible for consuming the sloughed-off outer scales of the bulbs. Mites will tunnel into the stem, usually entering between the bulb and the medium surface. The tunneling can result in a lesion. However it is debated if the lesions are caused by the mites or secondarily by the fungus *Rhizoctonia*. The most severe bulb damage from mites has been seen in pot-cooled lilies. Plants with bulb damage are often bent because the lesions on one side of the stem stop growth while the opposite side elongates.

## **Chemical Insect Controls:(4)**

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

### **Chlorpyrifos (DuraGuard)**

Percent of total area treated: 43%

Target pests: Aphids, Fungus Gnats, and Thrips

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

DuraGuard ME – 43 oz/100 gal, twice

Application method: High Volume Spray

REI: 12 hours

Efficacy rating: Good

### **Imidacloprid (Marathon)**

Percent of total area treated: 31%

Target pests: Aphids

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

Marathon 1% - ¼ tsp (2 grams)/6 inch pot, once

Marathon 60 WSP– 2 (20gram) packets/100 gal (3 oz drench/6 inch pot), once

Application method: top dress for 1% and drench for 60 WSP

REI: 12 hours

Efficacy rating: Very Good

### **Methomyl (Lannate)**

Percent of total area treated: 30%

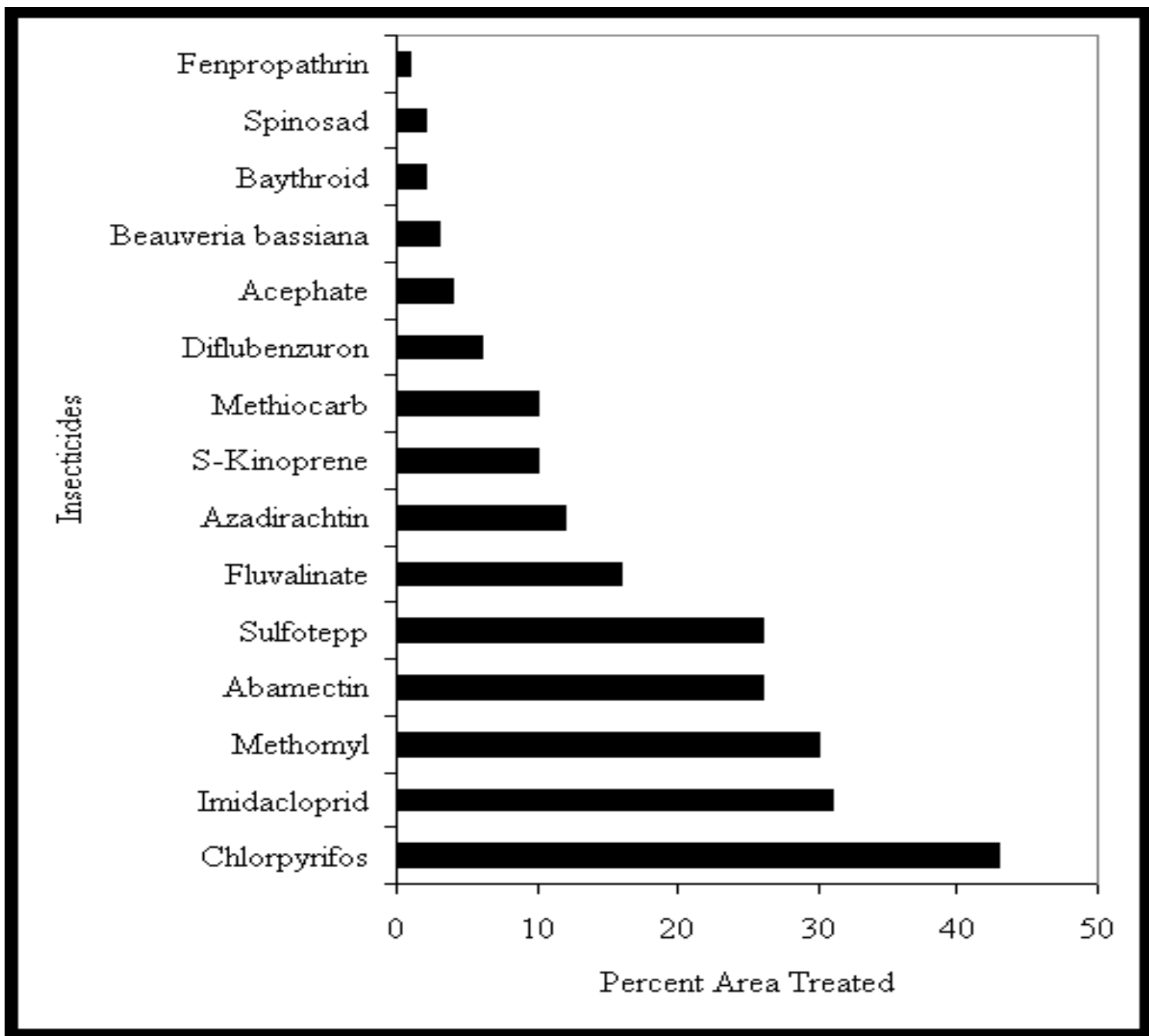
Target pests: Aphids

Average rate and frequency of application of most common formulations: (2)  
4 oz/100gal, 4 times

Application method: High Volume Spray

REI: 4 hours

Efficacy rating: Very Good



### Abamectin (Avid)

Percent of total area treated: 26%

Target pests: Mites and Aphids

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

Avid 0.15 EC – 7 oz/100 gal, 2 times

Application method: High Volume Spray or Fogger

REI: 12 hours

Efficacy rating: Good to Very Good

### **Sulfotepp (Plantfume and Dithio Aerosol)**

Percent of total area treated: 26%

Target pests: Aphids

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

Plantfume 103 – 1 can/20,000 sq.ft, once

Dithio Aerosol – 8 gms/A, once

Application method: Smoker or Aerosol

REI: 4 hours

Efficacy rating: Very Good

### **Fluvalinate (Mavrik Aquaflow)**

Percent of total area treated: 16%

Target pests: Aphids

Average rate and frequency of application of most common formulations:

Mavrik Aquaflow –10 oz/100 gal, 1.5 times

Application method: High Volume Spray

REI: 12 hours

Efficacy rating: Good

### **Azadirachtin (Azatin)**

Percent of total area treated: 12%

Target pests: Aphids

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

Azatin XL – 13 oz/100 gal, twice

Application method: High Volume Spray

REI: 12 hours

Efficacy rating: Good to Very Good

### **S-Kinoprene (Enstar)**

Percent of total area treated: 10%

Target pests: Thrips, and Aphids

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: Very Good

### **Methiocarb (Mesurol)**

Percent of total area treated: 10%

Target pests: Thrips and Aphids

Average rate and frequency of application of most common formulations: (2)  
Mesurol 75W – 32 oz/100gal, twice

Application method: High Volume Spray

REI: 24 hours

Efficacy rating: Good to Very Good

### **Diflubenzuron (Adept)**

Percent of total area treated: 6%

Target pests: Fungus Gnats

Average rate and frequency of application of most common formulations: (2)  
Adept 25 WP – 2 oz /100 gal, twice

Application method: Drench

REI: 12 hours

Efficacy rating: Good

## **Acephate (Orthene)**

Percent of total area treated: 4%

Target pests: Aphids

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

Orthene TT&O – 9 oz/100 gal, twice

PT1300 Orthene – 1 can/3000 ft<sup>2</sup>, 3 times

Application method: High Volume Spray or Aerosol

REI: 24 hours

Efficacy rating: Average to Good

## ***Beauveria bassiana* (Naturalis-O)**

Percent of total area treated: 3%

Target pests: Aphids

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

Naturalis-O – 32 oz/100 gal, twice

Application method: High Volume Spray

REI: 4 hours

Efficacy rating: Good to Very Good

## **Baythroid (Decathalon)**

Percent of total area treated: 2%

Target pests: Aphids

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

Decathalon 20WP – 1.5 oz/100 gal, once

Application method: High Volume Spray

REI: 12 hours

Efficacy rating: Good

## **Spinosad (Conserve)**

Percent of total area treated: 2%

Target pests: Thrips

Average rate and frequency of application of most common formulations: (2)  
Conserve SC – 6 oz/100 gal, once

Application method: High Volume Spray

REI: 4 hours

Efficacy rating: Very Good

## **Fenpropathrin (Tame)**

Percent of total area treated: 1%

Target pests: Aphids

Average rate and frequency of application of most common formulations: (2)  
Tame 2.4 EC – 9 oz/100 gal, twice

Application method: High Volume Spray

REI: 24 hrs.

Efficacy rating: Good

## **Cultural Controls:(2,3)**

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)**

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 caused 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.

## **Root Rots**

Root rots of lilies are caused by two different fungi, *Rhizoctonia* ssp. and *Pythium* ssp. The fungi cause the roots to turn brown and rot. Any deviation from a white root color suggests a potential root rot problem. The lilies become stunted and the lower leaves turn yellow. Leaf scorch often appears on the leaf margins. Root rots are favored in cool, moist soils. The fungi that attack root systems are natural inhabitants of the soil and therefore, have the ability to survive there indefinitely. They are easily introduced into a growth medium by soiled hands, tools, flats and colonized transplants.

## **Viral Diseases**

Fleck is a disease caused by two viruses, cucumber mosaic and lily symptomless. This disease can be crippling and normally the grower can do little to control it once symptoms appear. The symptoms include small brown elongated spots that appear parallel to the leaf vein. The flowers of infected plants are smaller than those of healthy plants. Sometimes distorted plants can cause economic loss. The disease is spread through feeding by aphids. Poor growing conditions can magnify virus symptoms. Low temperature at starting, low humidity and other conditions can cause the expression of more symptoms.

## **Chemical Disease Controls:94)**

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

### **Mefenoxam (Subdue MAXX)**

Percent of total area treated: 83%

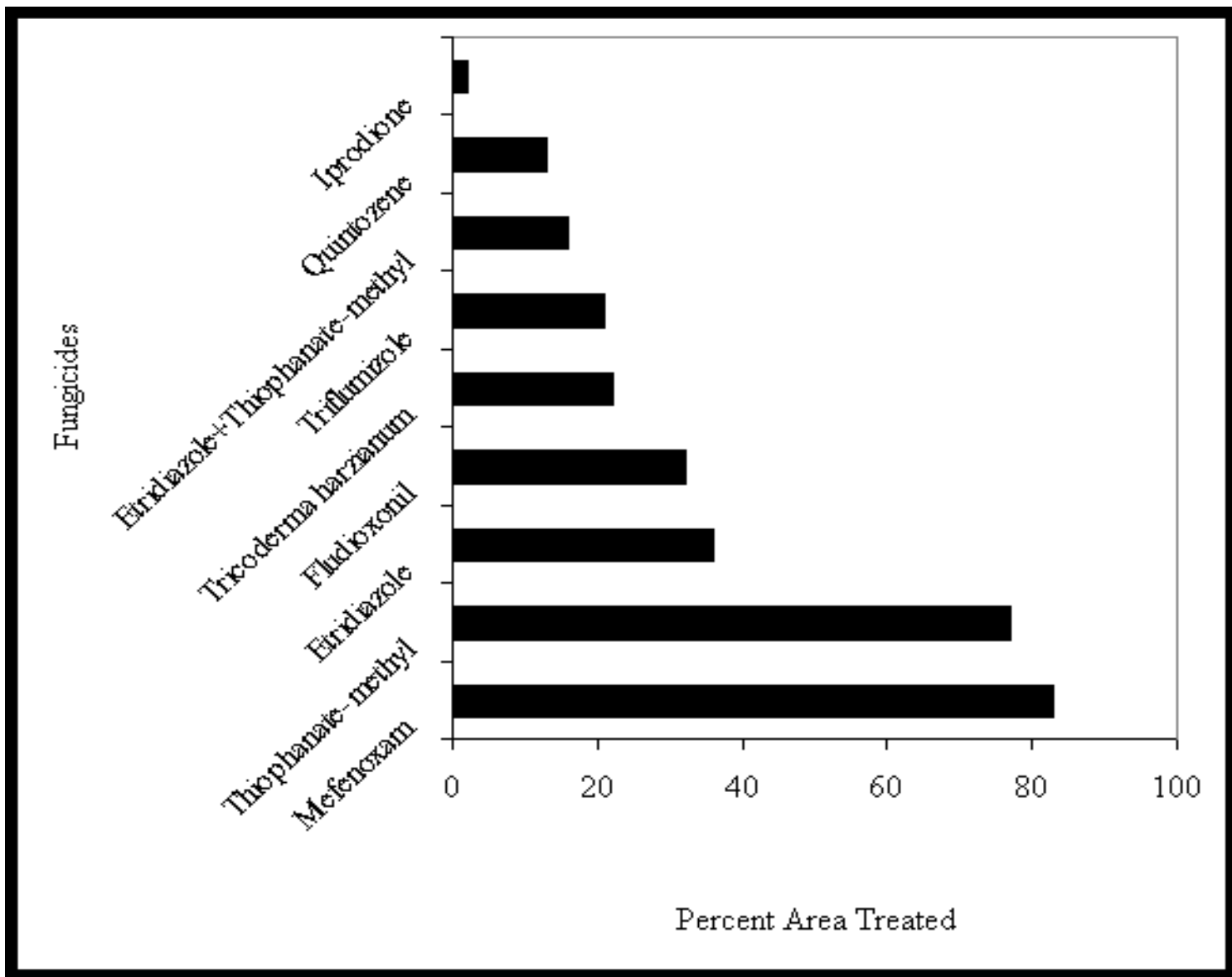
Target pests: Root Rots

Average rate and frequency of application of most common formulations:  
Subdue MAXX – 0.73 oz/100 gal, once

Application method: Drench

REI: None

Efficacy rating: Good to Very Good



**Thiophanate (Cleary's 3336, Domain)**

Percent of total area treated: 77%

Target pests: *Botrytis*, *Rhizoctonia* and Root Rots

Average rate and frequency of application of most common formulations:

Cleary's 3336 4.5F - 15 oz/100 gal, 1.8 times

Domain - 16 oz/100 gal, once

Application method: Drench

REI: 12 hours

Efficacy rating: Good to Very Good

**Etridiazole (Truban)**

Percent of total area treated: 36%

Target pests: Root Rots

Average rate and frequency of application of most common formulations:  
Truban 30WP – 6 oz/100 gal, 1.75 times

Application method: Drench

REI: 12 hours

Efficacy rating: Good to Very Good

### **Fludioxonil (Medallion)**

Percent of total area treated: 32%

Target disease: Botrytis and Rhizoctonia

Average rate and frequency of application of most common formulations:  
Medallion – 16 oz/100 gal, 1.5 times

Application method: Drench

REI:

Efficacy rating: Very Good

### ***Trichoderma harzianum* (Plantshield)**

Percent area treated: 22%

Target pests: Root Rots

Average rate and frequency of application of most common formulations:  
Plantshield – 6 oz/100 gal, once

Application method: Drench

REI:

Efficacy rating: Very Good

### **Triflumizole (Terraguard)**

Percent of total area treated: 21%

Target pests: *Rhizoctonia Pythium*

Average rate and frequency of application of most common formulations:  
Terraguard 50WP – 12 oz/100 gal, once

Application method: Drench and High Volume Spray

REI: 12 hours

Efficacy rating: Good to Very Good

### **Etridiazole + Thiophanae methyl (Banrot)**

Percent area treated: 16%

Target pests: Root Rots

Average rate and frequency of application of most common formulations:  
Banrot 40WP– 8 oz/100 gal, 1.4 times

Application method: Drench

REI: 12 hours

Efficacy rating: Very Good

### **Quintozene (Terrachlor)**

Percent of total area treated: 13%

Target pests: Rhizoctonia and Root Rots

Average rate and frequency of application of most common formulations:  
Terrachlor 75WP – 4 oz/100 gal, once

Application method: High Volume Spray (75% WP)

REI: 12 hours

Efficacy rating: Good to Very Good

### **Iprodione (Chipco 26019)**

Percent of total area treated: 2%

Target pests: *Botrytis*

Average rate and frequency of application of most common formulations:

Chipco 26019 50WP – 24 oz/100 gal, twice

Application method: Drench

REI: 12 hours

Efficacy rating: Good

### **Cultural Controls:(2,3)**

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 chemicals applied at a rate of 200 gal/A unless otherwise noted)

#### **Glyphosate (Roundup)**

Percent of total area treated: 25%, 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

### **Cultural Controls:(2,3)**

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 too.

## **Contacts**

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## **References**

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