

Nursery Crops: Diseases

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The most cost-effective way to managing nursery crop diseases is a systems approach. This approach includes three major components. The first and most important component is to prevent pathogens from entering a production facility or production system by using new containers, fresh potting mixes and healthy plant materials including liners and plugs, and irrigating with decontaminated water. It is advisable to use locally propagated plant materials whenever possible. When bringing in plant materials from another nursery is absolutely necessary, buy them from an accredited nursery and place incoming materials in an isolated areas for several weeks to observe whether they are free of high-impact diseases such as boxwood blight and sudden oak death. The second component is to create an environment that is against pathogens while promoting plant growth. This includes fertilizing and irrigating crops as needed and reducing free water on foliage. The third component is to treat the disease with right product in a timely manner when a disease emerges.

Fungicides and bactericides play an important part in the prevention of container and field-grown ornamental and flower diseases. They do not take the place of cultural control methods, but should be used

to complement them. In some disease situations there are no effective chemicals available. Only chemicals registered by the Environmental Protection Agency (EPA) are recommended.

Most fungicides on the market protect woody shrubs, ground cover plants, and flowers against diseases. This protection is accomplished by preventing plant pathogens from becoming established. Systemic fungicides are therapeutic and may eradicate pathogens that are already established. Because chemicals are subject to weathering and degradation, they must be reapplied to the soil or container or susceptible parts at regular intervals as long as the danger of plant disease exists. In general, protectants must not be reapplied more frequently than recommended treatment intervals, or applied in excess of recommended rates.

In every instance, the manufacturer's label should be read carefully and attention should be directed particularly to the safety measures listed on the label regarding mixing, handling, compatibility with other chemicals, and application methods and rate. It is always essential that the user familiarize himself with the antidote given on the label. In many instances, the addition of a surfactant will improve retention of the chemical.

Plant Disease	Fungicide Rate/100 Gal	Remarks
Ajuga Sclerotium rot	Terraclor (75% WP) 2.0 lb/1,000 sq ft or 2.5 lb/300.0 gal water; pentachloronitrobenzene	Dust or drench on soil surface before planting and thoroughly work into the top 2 inches of soil.
	Heritage (50%); 1.0-4.0 oz (spray) 0.2-0.9 oz (drench) azoxystrobin	Apply every 1 to 4 weeks.
	Palladium (62.5% WDG) 2.0 to 4.0 oz cyprodinil and fludioxonil	Apply at 7- to 14-da intervals
	Pageant (38%) 12.0 to 18.0 oz pyraclostrobin and boscalid	Apply every 7 to 14 days
Andromeda (Japanese) (<i>Pieris</i> spp.) <i>Phytophthora</i> dieback	Alude 1.0-2.0 qt Vital 2.0-4.0 pt; phosphite	Spray every 7 days.
	Alliette (80% WDG) 1.3-4.0 lb; fosetyl-Al	Spray at new leaf emergence or at first sign of diseases and at 7- to 14-day intervals.
	FenStop 7.0-14.0 fl oz; fenamidone	Spray plants at a 28-day interval.
	Micora (23.3%) 8.0 fl oz; mandipropamid	Apply every 7 to 14 days
	Orvego (46.2%) 14.0 fl oz ametoctradin and dimethomorph	Apply at 10 to 14 day intervals
	Stature (43.5% SC) 6.0-13.0 fl oz dimethomorph	Apply at 10- to 14-day intervals. Constant agitation required.
	Adorn (39.5%) 1.0-4.0 fl oz; fluopicolide	Apply at 14- to 28-day intervals but not more than twice per crop cycle.
	Disarm (40.3% SC) 1.0-6.0 fl oz; fluoxastrobin	Apply at 14- to 28-day intervals.
	Pageant (38.0% WDG) 4.0-18.0 oz; pyraclostrobin	Apply at 7- to 14-day intervals.
	Segway (34.5% SC) 2.0-6.0 fl oz cyazoflamid	Apply at 14- to 28-day intervals.
Andromeda <i>Phytophthora</i> root rot	Alliette (80% WDG) 1.0-2.0 lb/1,000 sq ft; fosetyl-Al	Drench Alliette monthly (2.0 pt/sq ft) over the surface of the potting medium.
	Micora (23.3%) 8.0 fl oz; mandipropamid	Apply every 7 to 14 days

Table 5.1 - Common Diseases and Chemical Control Options (continued)		
Plant Disease	Fungicide Rate/100 Gal	Remarks
Andromeda <i>Phytophthora</i> root rot (continued)	Orvego (46.2%) 14.0 fl oz ametoctradin and dimethomorph	Apply at 10 to 14 day intervals
	Subdue MAXX 1.0-2.0 fl oz; mefenoxam	Repeat at 3-month intervals. Provide good drainage. After application, irrigate to thoroughly wet soil.
	Terrazole (35% WP) 3.5-10.0 oz; etridiazole	Treat soil at 4- to 12-week intervals.
	FenStop 7.0-14.0 fl oz; fenamidone	Drench 1.0-2.0 pints per square foot at a 28-day interval.
	Stature (43.5% SC) 6.0-13.0 fl oz dimethomorph	Apply at 10- to 14-day intervals. Constant agitation required.
	Adorn (39.5%) 1.0-4.0 fl oz; fluopicolide	Apply at 14- to 28-day intervals but not more than twice per crop cycle.
	Disarm (40.3% SC) 1.0-6.0 fl oz; fluoxastrobin	Apply at 14- to 28-day intervals.
	Pageant (38.0% WDG) 4.0-18.0 oz; pyraclostrobin	Apply at 7- to 14-day intervals.
Segway (34.5% SC) 2.0-6.0 fl oz cyazoflamid	Apply at 14- to 28-day intervals.	
Arborvitae Phomopsis needle twig blight	Cleary 3336-F, 12.0 to 16.0 fl oz; thiophanate methyl	Begin application at bud break and repeat at 7- to 10-day intervals throughout the growing season.
	Heritage (50%) 1.0-4.0 oz; azoxystrobin	Apply at 1- to 4-week intervals.
Arborvitae Cercospora blight	Cleary 3336-F, 12.0 to 16.0 fl oz; thiophanate methyl	Cleary 3336 should be applied when disease first appears and repeat on 10- to 14-day intervals. Shorten interval during humid, rainy weather.
	Tourney (50% WDG) 1.0 to 4.0 oz; metconazole	Apply every 14 to 28 days as needed
	Concert II (41.4%) 22.0 to 35.0 fl oz propiconazole and chlorothalonil	Apply at 14- to 21-day intervals
	Dithane Rainshield or Fore Rainshield, 1.5 lb; mancozeb	Mancozeb should be applied at 7- to 10-day intervals.
Aucuba <i>Phytophthora</i> root rot	Alude 1.0-2.0 qt Vital 2.0-4.0 pt phosphite	Spray every 7 days.
	Micora (23.3%) 8.0 fl oz; mandipropamid	Apply every 7 to 14 days
	Orvego (46.2%) 14.0 fl oz ametoctradin and dimethomorph	Apply at 10 to 14 day intervals
	Subdue MAXX 1.0-2.0 fl oz; mefenoxam	See Andromeda.
	Terrazole (35% WP) 3.5-10.0 oz; etridiazole	Treat soil at 4- to 12-week intervals.
	FenStop 7.0-14.0 fl oz; fenamidone	Drench 1.0-2.0 pints per square foot at a 28-day interval.
	Stature (43.5% SC) 6.0-13.0 fl oz dimethomorph	Apply at 10- to 14-day intervals. Constant agitation required.
	Adorn (39.5%) 1.0-4.0 fl oz; fluopicolide	Apply at 14- to 28-day intervals but not more than twice per crop cycle.
	Disarm (40.3% SC) 1.0-6.0 fl oz; fluoxastrobin	Apply at 14- to 28-day intervals.
	Pageant (38.0% WDG) 4.0-18.0 oz; pyraclostrobin	Apply at 7- to 14-day intervals.
Segway (34.5% SC) 2.0-6.0 fl oz; cyazoflamid	Apply at 14- to 28-day intervals.	
Azalea <i>Cylindrocladium</i> root rot	Dithane Rainshield or Fore Rainshield, 1.5 lb; mancozeb	See Arborvitae.
	Cleary 3336-F, 12.0 to 16.0 fl oz; thiophanate methyl	Drench Cleary 3336 on the surface of growing medium to prevent disease development. Repeat at 2- to 4-week intervals during disease pressure period.
	Concert II (41.4%) 22.0 to 35.0 fl oz propiconazole and chlorothalonil	Apply every 14 to 21 days
	Pageant (38%) 12.0 to 18.0 oz pyraclostrobin and boscalid	Apply every 7 to 14 days
	Spectro TM (90% WDG) 1.0 to 2.0 lb chlorothalonil and thiophanate-methyl	Apply every 14 days
	Terraguard 50W; triflumizole	Soil drenched for propagation beds, 6.0-8.0 oz or established root systems 6.0-12.0 oz.
	Torque (38.7%) 4.0 to 10.0 fl oz; tebuconazole	Apply every 14 to 21 days
	OHP 26 GT-O 1.0 qt; iprodione	Dip cuttings for 5 minutes prior to planting.

Table 5.1 - Common Diseases and Chemical Control Options (continued)		
Plant Disease	Fungicide Rate/100 Gal	Remarks
Azalea Exobasidium leaf and flower gall	Dithane Rainshield or Fore Rainshield, 1.5 lb; mancozeb	Hand pick infected leaves and remove from plant. Apply mancozeb just before leaves unroll in spring and 10 days later.
Azalea Rust	Strike (25% WDG) 2.0-4.0 oz; triadimefon	Spray to run-off when rust first appears.
Azalea Botrytis blight (Gray mold)	Broadform 4.0 to 8.0 fl oz fluopyram and trifloxystrobin	Spray at 7 to 14 day intervals.
	Compass 2.0-4.0 oz; trifloxystrobin	Spray at 7- to 14-day intervals.
	Chipco 26019 (50% WP) 1.0-2.0 lb Sextant (23.3%) 1.0-2.5 lb; iprodione	Apply to petals to protect from disease. Continue at 10- to 14-day intervals as long as disease conditions are favorable.
	Cleary 3336-WP (50% WP) 0.8 lb, thiophanate methyl	Repeat every 7 to 10 days as needed during disease periods.
	Decree (50 WDG) 0.7-1.5 lb; fenhexamide	Repeat at 7- to 10-day intervals.
Azalea Ovulinia petal blight	Pageant (38%) 12.0-18.0 oz pyraclostrobin and boscalid	Apply every 7 to 14 days as needed
	Strike (25% WDG) 8.0-16.0 oz; triadimefon	Apply Strike to all flower buds to point of run-off. Application should be made during the expanded bud stage (color showing). A second application may be needed.
	Cleary 3336-F, 12.0 to 16.0 fl oz; Fungo 50 AGC 12.0-16.0 oz thiophanate methyl	Apply Cleary 3336 as flowers open. Repeat every 4 to 6 days as needed during disease periods.
	Systhane (40% WSP) 4.0 oz; myclobutanil	Apply at 10- to 14-day intervals.
	Daconil Weather Stik 1.4 pt; chlorothalonil	Spray Daconil every 7 days during wet weather.
	Dithane Rainshield or Fore Rainshield, 1.5 lb; mancozeb	Spray mancozeb or ziram at 7- to 10-day intervals when flowers start to show color.
Azalea Phomopsis dieback	Ziram (F-4) 3.0-4.0 pt; ziram	Spray mancozeb or ziram at 7- to 10-day intervals when flowers start to show color.
	Cleary 3336-F 12.0-16.0 fl oz Fungo 50 AGC 12.0-16.0 oz; thiophanate methyl	Spray at 7- to 10-day intervals. Prune out all diseased branches. Avoid stress.
Azalea Phytophthora root and crown rot	Alude 1.0-2.0 qt Vital 2.0-4.0; phosphite	Spray every 7 days.
	Subdue MAXX 0.6-1.2 fl oz; mefenoxam	Thoroughly wet soil after application of Subdue and repeat at 3-month intervals.
	Terrazole (35% WP) 3.5-10.0 oz; etridiazole	Treat soil at 4- to 12-week intervals.
	Micora (23.3%) 8.0 fl oz; mandipropamid	Apply every 7 to 14 days
	Orvego (46.2%) 14.0 fl oz ametocradin and dimethomorph	Apply at 10 to 14 day intervals
	Banol (66.5%) 20.0-30.0 fl oz propamocarb hydrochloride	Treat soil at 3-week to 3-month intervals.
	FenStop 7.0-14.0 fl oz; fenamidone	Drench 1.0-2.0 pints per square foot at a 28-day interval.
	Stature (43.5% SC) 6.0-13.0 fl oz dimethomorph	Apply at 10- to 14-day intervals. Constant agitation required.
	Adorn (39.5%) 1.0-4.0 fl oz; fluopicolide	Apply at 14- to 28-day intervals but not more than twice per crop cycle.
	Disarm (40.3% SC) 1.0-6.0 fl oz fluoxastrobin	Apply at 14- to 28-day intervals.
	Pageant (38.0% WDG) 4.0-18.0 oz; pyraclostrobin	Apply at 7- to 14-day intervals.
Azalea Phytophthora shoot blight	Segway (34.5% SC) 2.0-6.0 fl oz cyazoflamid	Apply at 14- to 28-day intervals.
	Alliette (80% WDG) 2.5-5.0 lb; fosetyl-AI	One application every 30 days.
	Alude 1.0-2.0 qt Vital 2.0-4.0; phosphite	Spray every 7 days.
	FenStop 7.0-14.0 fl oz; fenamidone	Spray plants at a 28-day interval.
	Micora (23.3%) 8.0 fl oz; mandipropamid	Apply every 7 to 14 days
	Orvego (46.2%) 14.0 fl oz ametocradin and dimethomorph	Apply at 10 to 14 day intervals
Stature (43.5% SC) 6.0-13.0 fl oz dimethomorph	Apply at 10- to 14-day intervals. Constant agitation required.	

Table 5.1 - Common Diseases and Chemical Control Options (continued)		
Plant Disease	Fungicide Rate/100 Gal	Remarks
Azalea Phytophthora shoot blight (continued)	Adorn (39.5%) 1.0-4.0 fl oz; fluopicolide	Apply at 14- to 28-day intervals but not more than twice per crop cycle.
	Disarm (40.3% SC) 1.0-6.0 fl oz fluoxastrobin	Apply at 14- to 28-day intervals.
	Pageant (38.0% WDG) 4.0-18.0 oz; pyraclostrobin	Apply at 7- to 14-day intervals.
	Segway (34.5% SC) 2.0-6.0 fl oz cyazoflamid	Apply at 14- to 28-day intervals.
Azalea Powdery mildew	Concert II (41.4%) 22.0 to 35.0 fl oz propiconazole and chlorothalonil	Apply at 14 to 21 day intervals
	Strike (25% WDG) 2.0-4.0 oz; triadimefon	Spray to run-off when mildew first appears.
	Tourney (50% WDG) 1.0 to 4.0 oz; metconazole	Apply every 14 to 28 days
	Triact 70 0.5-1.0 gal, neem oil	Apply every 14 days.
	Trinity (19.2%) 8.0 to 12.0 fl oz; triticonazole	Apply at 7 to 14 day intervals
	Sythane (40% WSP) 4.0 oz; myclobutanil	Apply at 10- to 14-day intervals.
	Cygnus (50%) 1.6-3.2 oz; kresoxim-methyl	Apply at 10- to 14-day intervals.
	Banner Maxx 2.0-4.0 fl oz; propiconazole	Apply at 2- to 3-week intervals.
	Azalea Rhizoctonia web blight	Cleary 3336-F 12.0-16.0 fl oz Fungo 50 AGC 12.0-16.0 oz; thiophanate methyl
Empress (23.3%) 2.0 to 6.0 fl oz; Pyraclostrobin		Repeat application at 7- to 28-day intervals as needed.
Hurricane (48%) 1.5 oz; fludioxonil and mefenoxam		Apply at 21- to 28-day intervals
Medallion (50% WP) 1-2 packets; fludioxonil		Only in greenhouses and closed structures at 7- to 14-day intervals.
Pageant (38%) 12.0 to 18.0 oz pyraclostrobin and boscalid		Apply at 7- to 14-day intervals
Palladium (63.5% WDG) 2.0 to 4.0 oz Cyprodinil and fludioxonil		Apply at 7- to 14-day intervals
OHP 26 GT-O 1.0-2.5 qt; iprodione		Spray plants every 7 to 14 days.
Tourney (50% WDG) 1.0 to 4.0 oz; metconazole		Apply at 14- to 28-day intervals
Trinity (19.2%) 8.0 to 12.0 fl oz; triticonazole		Apply at 7- to 14-day intervals
Azalea Septoria leaf spot	Cleary 3336-F 12.0-16.0 fl oz thiophanate methyl	Repeat at 10- to 14-day intervals throughout the growing season.
Boxwood (English, American, Korean, Japanese) Phytophthora root rot	Alude 1.0-2.0 qt	Spray every 7 days.
	Vital 2.0-4.0; phosphite	
	Alliette (80% WDG) 6.4-12.8 oz (drench) sq ft fosetyl-AI	See Azalea.
	Subdue MAXX 1.0-2.0 fl oz; mefenoxam	See Azalea.
	FenStop 7.0-14.0 fl oz; fenamidone	Drench 1.0- 2.0 pints per square foot at a 28-day interval.
	Micora (23.3%) 8.0 fl oz; mandipropamid	Apply every 7 to 14 days
	Orvego (46.2%) 14.0 fl oz ametoctradin and dimethomorph	Apply at 10 to 14 day intervals
	Terrazole (35% WP) 3.5-10.0 oz; etridiazole	See Azalea.
	Stature (43.5% SC) 6.0-13.0 fl oz; dimethomorph	Apply at 10- to 14-day intervals. Constant agitation required.
	Adorn (39.5%) 1.0-4.0 fl oz; fluopicolide	Apply at 14- to 28-day intervals but not more than twice per crop cycle.
	Disarm (40.3% SC) 1.0-6.0 fl oz fluoxastrobin	Apply at 14- to 28-day intervals.
	Pageant (38.0% WDG) 4.0-18.0 oz; pyraclostrobin	Apply at 7- to 14-day intervals.
	Segway (34.5% SC) 2.0-6.0 fl oz; cyazoflamid	Apply at 14- to 28-day intervals.
Boxwood boxwood blight	Banol (66.5%) 20.0-30.0 fl oz propamocarb hydrochloride	Treat soil at 3-week to 3-month intervals.
	Concert II 1.4-2.2 pt; propiconazole + chlorothalonil	Apply at 14- to 21-day intervals only under open field conditions and rotate with fungicides of different modes of action.
	Daconil weather Stik 2.0 pt; chlorothalonil Medallion WDG 2.0-4.0 oz, fludioxonil 2.0-4.0 oz Cleary 3336-F, 12.0 to 16.0 fl oz Dithane 75 DF Rainshield 1.5 lb; mancozeb Pageant 12.0-18.0 oz; boscalid + pyraclostrobin Torque 10 fl oz; tebuconazole Spectro 90WDG 1.5 lb chlorothalonil + thiophanate methyl	Apply and repeat at 7- to 14-day intervals during prolonged wet periods in spring and fall. Every 14 days, 3 applications maximum Every 14 days

Table 5.1 - Common Diseases and Chemical Control Options (continued)		
Plant Disease	Fungicide Rate/100 Gal	Remarks
Boxwood boxwood dieback/ anthracnose	Daconil Weather Stik 2.0 pt; chlorothalonil Mural 4.0 to 7.0 oz azoxystrobin + benzovindiflupyr	Apply every 7 to 14 days.
Camellia Leaf gall	See Azalea.	Hand pick infected leaves.
Camellia Sclerotinia flower blight	Pageant (38%) 12.0 to 18.0 oz pyraclostrobin and boscalid	Apply every 7 to 14 days
	Palladium (62.5% WDG) 2.0 to 4.0 oz cyprodinil and fludioxonil	Apply at 7- to 14-day intervals
	Terraclor (75% WP) 1 cup in enough water to give thorough coverage of 100 sq ft pentachloronitrobenzene	Drench soil surface in late December or early January.
Camellia Phytophthora root rot	See Azalea.	
Cedar Phomopsis needle and twig blight	Heritage (50%) 1.0-4.0 oz; azoxystrobin	Apply every 1 to 4 weeks.
	Cleary 3336-F, 12.0 to 16.0 fl oz; thiophanate methyl	Begin application at bud break and repeat at 7- to 10-day intervals throughout the growing season.
Cedar Cercospora blight	Cleary 3336-F 12.0-16.0 fl oz thiophanate methyl	Spray at 7- to 10-day intervals, starting when plants are well leafed out or at first sign of disease.
	Concert II (41.4%) 22.0 to 35.0 fl oz propiconazole and chlorothalonil	Apply at 14- to 21-day intervals
	Dithane Rainshield or Fore Rainshield, 1.5 lb; mancozeb	Spray at 7- to 10-day intervals, starting when plants are well leafed out or at first sign of disease.
	Tourney (50% WDG) 1.0 to 4.0 oz; metconazole	Apply every 14 to 28 days as needed
Chrysanthemum Rhizoctonia root rot	Cleary 3336-F 12.0-16.0 fl oz or Fungo 50 AGC 12.0-16.0 oz; thiophanate methyl	Apply Cleary 3336-F as a heavy drench or spray.
	Chipco 26019 (50% WP) 0.4 lb; iprodione	Apply after transplant (1.0-2.0 pt/sq ft). Repeat every 14 days.
	Empress (23.3%) 2.0 to 6.0 fl oz; Pyraclostrobin	Repeat application at 7- to 28-day intervals as needed.
	Hurricane (48%) 1.5 oz fludioxonil and mefenoxam	drench to completely wet root zone at 21- to 28-day intervals
	Medallion (50% WP) 1 packet; fludioxonil	Apply after transplant (1.0-2.0 pt/sq ft). Repeat every 14 days.
	Pageant (38%) 12.0 to 18.0 oz pyraclostrobin and boscalid	Drench to completely wet root zones at 7- to 14-day intervals
	Palladium (63.5% WDG) 2.0 to 4.0 oz Cyprodinil and fludioxonil	Apply at 7- to 14-day intervals
	Trinity (19.2%) 8.0 to 12.0 fl oz; triticonazole	Apply at 7- to 14-day intervals
Tourney (50% WDG) 1.0 to 4.0 oz; metconazole	Apply at 14- to 28-day intervals	

Chrysanthemum Mycosphaerella ray blight	Banner Maxx 2.0-4.0 fl oz; propiconazole	Apply on a 14-day schedule.
	Chipco 26019 (50% WP) 1.0-2.0 lb; iprodione	Apply at 7- to 10-day intervals.
	Daconil Weather Stik 1.4 pt; chlorothalonil	Apply first spray of Daconil just before flower color shows and at 7-day intervals.
	Dithane Rainshield or Fore Rainshield, 1.5 lb mancozeb	Apply mancozeb at 7- to 10-day intervals. Apply at transplant of cuttings.
	Chipco 26019 (50% WP) 1.0-2.0 lb Sextant (23.3%) 1.0-2.5 lb; iprodione	Apply at first sign of disease and repeat at 10- to 14- day intervals.
	Cleary 3336-F, 12.0 to 16.0 fl oz; Fungo 50 AGC 12.0-16.0 oz; thiophanate methyl	Apply Cleary 3336 at 7- to 10-day intervals as needed.
Table 5.1 - Common Diseases and Chemical Control Options (continued)		
Plant Disease	Fungicide Rate/100 Gal	Remarks
Chrysanthemum Botrytis gray mold and Septoria leafspot	Broadform 4.0 to 8.0 fl oz fluopyram and trifloxystrobin	Spray at 7 to 14 day intervals.
	Cleary 3336-F 12.0-16.0 fl oz Fungo 50 AGC 12.0-16.0 oz; thiophanate methyl	Apply at prebloom and repeat at 7- to 14-day intervals.
	Daconil Weather Stik 2.0 pt Concorde (54% SST) 1.4 pt; chlorothalonil	Apply at prebloom and repeat at 7- to 14-day intervals.
	Dithane Rainshield or Fore Rainshield, 1.5 lb; Junction (15% DF) 1.5 lb; mancozeb	Apply at 7- to 10-day intervals.
	Pageant (38%) 12.0-18.0 oz pyraclostrobin and boscalid	Apply every 7 to 14 days as needed
Chrysanthemum Leaf rust	Strike (25% WDG) 2.0-4.0 oz; triadimefon	Apply at first sign of disease and repeat at 7- to 14-day intervals.
	Systhane (40% WSP) 4.0 oz; myclobutanil	Apply at 10- to 14-day intervals.
	Cygnus (50%) 3.2-6.4 oz; Kresoxim-methyl	Apply at 10- to 14-day intervals.
	Dithane Rainshield or Fore Rainshield, 1.5 lb; mancozeb	Spray at 7- to 10-day intervals.
Chrysanthemum Pythium root rot	Adorn (39.5%) 1.0-4.0 fl oz; fluopicolide	Apply at 14- to 28-day intervals but not more than twice per crop cycle.
	Alude 1.0-2.0 qt Vital 2.0-4.0 pt; phosphite	Spray every 7 days.
	Banol (66.5%) 20.0-30.0 fl oz propamocarb hydrochloride	Treat soil at 3-week to 3-month intervals.
	Disarm (40.3% SC) 1.0-6.0 fl oz fluoxastrobin	Apply at 14- to 28-day intervals.
	FenStop 7.0-14.0 fl oz; fenamidone	Drench 1.0-2.0 pints per square foot at a 28-day interval.
	Micora (23.3%) 8.0 fl oz; mandipropamid	Apply every 7 to 14 days
	Orvego (46.2%) 14.0 fl oz ametoctradin and dimethomorph	Apply at 10 to 14 day intervals
	Pageant (38.0% WDG) 4.0-18.0 oz; pyraclostrobin	Apply at 7- to 14-day intervals.
	Segway (34.5% SC) 2.0-6.0 fl oz cyazoflamid	Apply at 14- to 28-day intervals.
	Stature (43.5% SC) 6.0-13.0 fl oz dimethomorph	Apply at 10- to 14-day intervals. Constant agitation required.
	Subdue MAXX 0.05-1.0 fl oz; mefenoxam	See Azaleas
Chrysanthemum Powdery mildew	Concert II (41.4%) 22.0 to 35.0 fl oz propiconazole and chlorothalonil	Apply at 14 to 21 day intervals
	Rubigan 3.0-5.0 fl oz; fenarimol	Spray every 10 to 14 days.
	Strike (25% WDG) 2.0-4.0 oz; triadimefon	See manufacturer's directions. Spray to run-off when mildew first appears.
	Triact 70 0.5-1.0 gal, neem oil	Apply every 14 days.
	Trinity (19.2%) 8.0 to 12.0 fl oz; triticonazole	Apply at 7 to 14 day intervals
	Tourney (50% WDG) 1.0 to 4.0 oz; metconazole	Apply every 14 to 28 days

Chrysanthemum Southern blight (Sclerotium)	Pageant (38%) 12.0 to 18.0 oz pyraclostrobin and boscalid	Apply every 7 to 14 days
	Palladium (62.5% WDG) 2.0 to 4.0 oz cyprodinil and fludioxonil	Apply at 7- to 14-da intervals
	Terraclor (25% WP) 8.0 oz ; pentachloronitrobenzene	See manufacturer's directions.
Crabapple Cedar-apple rust	Banner Maxx 2.0-4.0 fl oz; propiconazole	Three applications every 14 days starting at green tip.
	Systhane (40% WSP) 4.0 oz; myclobutanil	Apply at 10- to 14-day intervals.
	Daconil Weather Stik 1.4 pt; chlorothalonil	Start as flower buds open and spray 3 times at 10-day intervals.
	Dithane Rainshield or Fore Rainshield, 1.5 lb; mancozeb	Begin application at 1/4 inch to 1/2 inch green tip and continue on a 7- to 10-day schedule.
Table 5.1 - Common Diseases and Chemical Control Options (continued)		
Plant Disease	Fungicide Rate/100 Gal	Remarks
Crabapple Cedar-apple rust (continued)	Maneb 80 (80% WP) 1.5 lb; maneb	Begin application at 1/4 inch to 1/2 inch green tip and continue on a 7- to 10-day schedule.
	Cleary 3336-F, 12.0 to 16.0 fl oz; thiophanate methyl	Apply at 10- to 14-day intervals.
	Triact 70 0.5-1.0 gal, neem oil	Apply every 14 days.
Crabapple Fire blight	Alliette (80% WP) 2.5 lb; fosetyl-Al	Apply every 7 days.
	Agri-Strep 0.5 lb; streptomycin sulfate	Apply at early, mid, and late flowering.
Crabapple Powdery mildew	Banner Maxx, 2.0-4.0 fl oz; propiconazole	Apply Banner every 14 to 21 days.
	Concert II (41.4%) 22.0 to 35.0 fl oz propiconazole and chlorothalonil	Apply at 14 to 21 day intervals
	Strike (25% WDG) 2.0-4.0 oz; triadimefon	Spray to run-off when mildew first appears.
	Terraguard 50W 4.0-8.0 oz; triflumizole	Apply as foliar spray as needed.
	Tourney (50% WDG) 1.0 to 4.0 oz; metconazole	Apply every 14 to 28 days
	Trinity (19.2%) 8.0 to 12.0 fl oz; triticonazole	Apply at 7 to 14 day intervals
	Triact 70 0.5-1.0 gal, neem oil	Apply every 14 days.
Crabapple Scab	Systhane (40% WSP) 4.0 oz; myclobutanil	Apply at 10- to 14-day intervals.
	Banner Maxx, 2.0-4.0 fl oz; propiconazole	Banner applied on a 14-day schedule. Begin at green tip.
	Daconil Weather Stik 2.0 pt Concorde (54% SST) 1.4 pt; chlorothalonil	Apply at bud break and at 7-day intervals during wet weather.
	Cleary 3336-F, 12.0 to 16.0 fl oz; thiophanate methyl	Apply at 7- to 10-day intervals from bud break until two weeks after petal fall.
	Dithane Rainshield or Fore Rainshield, 1.5 lb; Junction (15% DF) 1.5 lb; mancozeb	Apply at 7- to 10-day intervals from bud break until two weeks after petal fall.
	Manzate 80 (80 % WP) 1.5 lb; maneb	Apply at 7- to 10-day intervals from bud break until two weeks after petal fall.
Crape Myrtle Powdery mildew	Banner Maxx 2.0-4.0 fl oz; propiconazole	Apply Banner every 21 days.
	Concert II (41.4%) 22.0 to 35.0 fl oz propiconazole and chlorothalonil	Apply at 14 to 21 day intervals
	Strike (25% WDG) 2.0-4.0 oz; triadimefon	Spray Strike to run-off when mildew first appears.
	Systhane (40% WSP) 4.0 oz; myclobutanil	Apply at 10- to 14-day intervals.
	Terraguard 50W 4.0-8.0 oz; triflumizole	Use higher rates under severe conditions.
	Tourney (50% WDG) 1.0 to 4.0 oz metconazole	Apply every 14 to 28 days
	Triact 70 0.5-1.0 gal, neem oil	Apply every 14 days.
	Trinity (19.2%) 8.0 to 12.0 fl oz triticonazole	Apply at 7 to 14 day intervals

Daffodil Botrytis blight	Chipco 26019 (50% WP) 1.0-2.0 lb Sextant (23.3%) 1.0-2.5 lb iprodione	Apply every 10-14 days.
	Decree (50 WDG) 0.7-1.5 lb; fenhexamid	Repeat at 7- to 10-day intervals.
	Pageant (38%) 12.0-18.0 oz pyraclostrobin and boscalid	Apply every 7 to 14 days as needed
Daffodil Fusarium and Penicillium bulb rots	Cleary 3336-F, 12.0 to 16.0 fl oz; Fungo 50 AGC 12.0-16.0 oz thiophanate methyl	Soak bulbs for 15 to 30 minutes in a warm dip (80° to 85°F.)
Dahlia Powdery mildew	Concert II (41.4%) 22.0 to 35.0 fl oz propiconazole and chlorothalonil	Apply at 14 to 21 day intervals
	Strike (25% WDG) 2.0-4.0 oz; triadimefon	Spray to run-off when mildew first appears.
	Systhane (40% WSP) 4.0 oz; myclobutanil	Apply at 10- to 14-day intervals.
	Tourney (50% WDG) 1.0 to 4.0 oz; metconazole	Apply every 14 to 28 days
	Trinity (19.2%) 8.0 to 12.0 fl oz; triticonazole	Apply at 7 to 14 day intervals

Table 5.1 - Common Diseases and Chemical Control Options (continued)

Plant Disease	Fungicide Rate/100 Gal	Remarks
Dahlia Botrytis blight (Gray mold)	Dithane Rainshield or Fore Rainshield, 1.5 lb; mancozeb	
	Chipco 26019 (50% WP) 1.0-2.0 lb Sextant (23.3%) 1.0-2.5 lb; iprodione	Apply to protect against disease. Repeat at 10- to 14- day intervals.
	Cleary 3336-F, 12.0 to 16.0 fl oz; Fungo 50 AGC 12.0-16.0 oz thiophanate methyl	Apply to protect against disease. Repeat at 10- to 14- day intervals.
	Decree (50 WDG) 0.7-1.5 lb; fenhexamid	Repeat at 7- to 10-day intervals.
Dogwood Rhizoctonia root rot	Chipco 26019 (50% WP) 6.5 lb; iprodione	Use as a drench and apply 1.0-2.0 pts of solution/sq ft.
	Empress (23.3%) 2.0 to 6.0 fl oz; Pyraclostrobin	Repeat application at 7- to 28-day intervals as needed.
	Hurricane (48%) 1.5 oz fludioxonil and mefenoxam	drench to completely wet root zone at 21- to 28-day intervals
	Pageant (38%) 12.0 to 18.0 oz pyraclostrobin and boscalid	Drench to completely wet root zones at 7- to 14-day intervals
	Palladium (63.5% WDG) 2.0 to 4.0 oz Cyprodinil and fludioxonil	Apply at 7- to 14-day intervals
	Tourney (50% WDG) 1.0 to 4.0 oz; metconazole	Apply at 14- to 28-day intervals
	Trinity (19.2%) 8.0 to 12.0 fl oz; triticonazole	Apply at 7- to 14-day intervals
Dogwood Botrytis petal blight	Chipco 26019 (50% WP) 1.0-2.0 lb Sextant (23.3%) 1.0-2.5 lb; iprodione	Apply Chipco 26019 at 7- to 14-day intervals.
	Cleary 3336-F, 12.0 to 16.0 fl oz; Fungo 50 AGC 12.0-16.0 oz thiophanate methyl	Apply Cleary 3336 at 10- to 14-day intervals.
	Decree (50 WDG) 0.7-1.5 lb; fenhexamid	Repeat at 7- to 10-day intervals.
	Pageant (38%) 12.0-18.0 oz pyraclostrobin and boscalid	Apply every 7 to 14 days as needed
Dogwood Botrytisphaeria canker	Pageant (38%) 12.0 to 18.0 oz pyraclostrobin and boscalid	Apply every 7 to 14 days as needed

Dogwood Phytophthora root rot	Adorn (39.5%) 1.0-4.0 fl oz; fluopicolide	Apply at 14- to 28-day intervals but not more than twice per crop cycle.
	Alude 1.0-2.0 qt Vital 2.0-4.0 pt; phosphite	Spray every 7 days.
	Disarm (40.3% SC) 1.0-6.0 fl oz; fluoxastrobin	Apply at 14- to 28-day intervals.
	FenStop 7.0-14.0 fl oz; fenamidone	Drench 1.0-2.0 pints per square foot at a 28-day interval.
	Micora (23.3%) 8.0 fl oz; mandipropamid	Apply every 7 to 14 days
	Orvego (46.2%) 14.0 fl oz ametoctradin and dimethomorph	Apply at 10 to 14 day intervals
	Pageant (38.0% WDG) 4.0-18.0 oz; pyraclostrobin	Apply at 7- to 14-day intervals.
	Segway (34.5% SC) 2.0-6.0 fl oz cyazoflamid	Apply at 14- to 28-day intervals.
	Stature (43.5% SC) 6.0-13.0 fl oz dimethomorph	Apply at 10- to 14-day intervals. Constant agitation required.
Subdue MAXX 1.0-2.0 fl oz; mefenoxam	See Azalea.	
Dogwood Septoria leaf spot	Dithane Rainshield or Fore Rainshield, 1.5 lb; Junction (15% DF) 1.5 lb; mancozeb	Begin at first sign of disease and spray at intervals of 7 to 10 days.
	Daconil Weather Stik 1.4 pt Concorde (54% SST) 1.4 pt; chlorothalonil	Apply at early bloom. Apply at 7- to 14-day intervals.
	Cleary 3336-F 12.0-16.0 fl oz thiophanate methyl	Spray when disease first appears and repeat at 10- to 14-day intervals.
Table 5.1 - Common Diseases and Chemical Control Options (continued)		
Plant Disease	Fungicide Rate/100 Gal	Remarks
Dogwood Spot anthracnose, Leaf and flower blight Anthracnose (<i>Discula</i> sp.)	Dithane Rainshield or Fore Rainshield, 1.5 lb; mancozeb	Apply when buds begin to open, when bracts have fallen, 4 weeks later, and again in late summer after flower buds for next season have formed.
	Banner Maxx, 2.0-4.0 fl oz ; propiconazole	Apply Banner at 14-day intervals.
	Daconil Weather Stik 2.0 pts.; chlorothalonil	For spot anthracnose and leaf and flower blight apply when buds begin to open. Repeat when bracts have fallen, 4 weeks later and in the late summer after flower buds have formed. For anthracnose (<i>Discula</i> sp.) apply 3 to 4 sprays during leaf expansion in the spring, at 10- to 14-day intervals.
	Maneb 80 (80% WP) or Maneb Plus Zinc F4 Fungicide (37% F) 1.0-1.5 lb or 0.8-1.2 qt; maneb Junction (15% DF) 1.5 lb; mancozeb	For spot anthracnose, leaf and flower blight apply when buds begin to open. Repeat when bracts have fallen, 4 weeks later and in the late summer after flower buds have formed. For anthracnose (<i>Discula</i> sp.) apply 3 to 4 sprays during leaf expansion in the spring, at 10- to 14-day intervals.
Dogwood Powdery mildew	Concert II (41.4%) 22.0 to 35.0 fl oz propiconazole and chlorothalonil	Apply at 14 to 21 day intervals
	Cygnus (50%) 1.6-3.2 oz; kresoxim-methyl	
	Strike (25% WDG) 2.0-4.0 oz; triadimefon	Spray to run-off when mildew first appears.
	Systhane (40% WSP) 4.0 oz; myclobutanil	Apply at 10- to 14-day intervals.
	Tourney (50% WDG) 1.0 to 4.0 oz; metconazole	Apply every 14 to 28 days
	Triact 70 0.5-1.0 gal, neem oil	Apply every 14 days.
	Trinity (19.2%) 8.0 to 12.0 fl oz; triticonazole	Apply at 7 to 14 day intervals
Euonymus Powdery mildew	Concert II (41.4%) 22.0 to 35.0 fl oz propiconazole and chlorothalonil	Apply at 14 to 21 day intervals
	Cygnus (50%) 1.6-3.2 oz; kresoxim-methyl	
	Strike (25% WDG) 2.0-4.0 oz; triadimefon	Spray to run-off when mildew first appears.
	Systhane (40% WSP) 4.0 oz; myclobutanil	Apply at 10- to 14-day intervals.
	Triact 70 0.5-1.0 gal, neem oil	Apply every 14 days.
	Trinity (19.2%) 8.0 to 12.0 fl oz; triticonazole	Apply at 7 to 14 day intervals
	Tourney (50% WDG) 1.0 to 4.0 oz; metconazole	Apply every 14 to 28 days

Euonymus Crown gall	Galltrol-A	See manufacturer's directions. Purchase healthy plants. Do not replant in beds where infected plants have been removed.
Euonymus Anthracnose (<i>Colletotrichum</i>)	Dithane Rainshield or Fore Rainshield, 1.5 lb; Junction (15% DF) 1.5 lb; mancozeb	Spray at bud break, then repeat at 14-day intervals.
	Daconil Weather Stik 1.375 pt Concorde (54% SST) 1.37 pt; chlorothalonil	Spray at bud break, then repeat at 14-day intervals.
Euonymus Botrytis blight (Gray mold)	Decree (50 WDG) 0.7-1.5 lb; fenhexamid	Repeat at 7- to 10-day intervals.
	Chipco 26019 (50% WP) 1.0-2.0 lb Sextant (23.3%) 1.0-2.5 lb; iprodione	Repeat at 10- to 14-day intervals.
	Pageant (38%) 12.0-18.0 oz pyraclostrobin and boscalid	Apply every 7 to 14 days as needed
Forsythia Rhizoctonia	Chipco 26019 (50% WP) 0.4 lb; iprodione	Apply after transplanting (1.0-2.0 pt/sq ft). Repeat after 14 days.
	Cleary 3336-F 12.0-16.0 fl oz thiophanate methyl	Apply as a drench or heavy spray.
	Empress (23.3%) 2.0 to 6.0 fl oz; Pyraclostrobin	Repeat application at 7- to 28-day intervals as needed
	Hurricane (48%) 1.5 oz; fludioxonil and mefenoxam	Drench to completely wet root zone at 21- to 28-day intervals
	Pageant (38%) 12.0 to 18.0 oz pyraclostrobin and boscalid	Drench to completely wet root zones at 7- to 14-day intervals

Table 5.1 - Common Diseases and Chemical Control Options (continued)

Plant Disease	Fungicide Rate/100 Gal	Remarks
Forsythia Rhizoctonia (continued)	Palladium (63.5% WDG) 2.0 to 4.0 oz Cyprodinil and fludioxonil	Apply at 7- to 14-day intervals
	Tourney (50% WDG) 1.0 to 4.0 oz; metconazole	Apply at 14- to 28-day intervals
	Trinity (19.2%) 8.0 to 12.0 fl oz; triticonazole	Apply at 7- to 14-day intervals
Forsythia Phytophthora shoot blight	See Azalea shoot blight	
Gladiolus Botrytis leaf blight	Chipco 26019 (50% WP) 1.0-2.0 lb Sextant (23.3%) 1.0-2.5 lb; iprodione	Chipco 26019 at 10- to 14-day intervals.
	Daconil Weather Stik 1.4 pt; chlorothalonil	Apply Daconil every 7 to 10 days during normal weather, every 2 to 3 days during wet periods.
	Decree (50 WDG) 0.7-1.5 lb, fenhexamid	Apply at 7- to 10-day intervals.
	Pageant (38%) 12.0-18.0 oz pyraclostrobin and boscalid	Apply every 7 to 14 days as needed
Gladiolus Penicillium and Fusarium corm rots (pre-planting)	Cleary 3336-F, 12.0 to 16.0 fl oz; Fungo 50 AGC 12.0-16.0 oz; thiophanate methyl	Submerge clean corms for 15-30 minutes in warm water (80° to 85°F). Stir solution constantly to be sure chemical remains in suspension.
Gladiolus Curvularia and Leaf spots <i>Stemphylium</i>	Maneb 80 (80% WP) or Maneb Plus Zinc F4 Fungicide (37% F) 1.5 lb or 1.2 qt; maneb	Begin when flower spikes are developing. Repeat 2 to 3 times at weekly intervals.
Hawthorn Rust and <i>Fabraea</i> leaf spot	Systhane (40% WSP) 4.0 oz; myclobutanil	Apply at 10- to 14-day intervals.
	Daconil Weather Stik 1.4 pt; chlorothalonil	Spray at prebloom with cover sprays at 7- to 10-day intervals as needed.
	Dithane Rainshield or Fore Rainshield, 1.5 lb; mancozeb	
Holly (Japanese) Root rot (<i>Thielaviopsis</i> <i>basicola</i> , <i>Rhizoctonia</i>)	Affirm or Veranda-O (11.3%) 0.3 to 0.5 lb polyoxin D zinc salt	Drench to completely wet root zone at 14- to 28-day intervals as needed
	Cleary 3336-F 12.0-16.0 fl oz Fungo 50 AGC 12.0-16.0 oz; thiophanate methyl	Sanitation in propagation. Apply as heavy drench or spray to 800 sq ft of bench area (1.0-2.0 pts/sq ft). Repeat at 2- to 4-week intervals.
	OHP 26 GT-0 13.0 fl oz	Drench 1.0 to 2.0 pints of solution per square foot every 14 days.

Holly (Japanese) Rhizoctonia web blight (<i>Rhizoctonia solani</i>)	Cleary 3336-F 12.0-16.0 fl oz Fungo 50 AGC 12.0-16.0 oz; thiophanate methyl	Apply as a heavy drench or spray to 800 sq ft of bench or bed area, (1.0-2.0 pts/sq ft). Repeat at 2- to 4-week intervals.
	Empress (23.3%) 2.0 to 6.0 fl oz; Pyraclostrobin	Repeat application at 7- to 28-day intervals as needed.
	Hurricane (48%) 1.5 oz fludioxonil and mefenoxam	Apply at 21- to 28-day intervals
	Pageant (38%) 12.0 to 18.0 oz pyraclostrobin and boscalid	Apply at 7- to 14-day intervals
	Palladium (63.5% WDG) 2.0 to 4.0 oz Cyprodinil and fludioxonil	Apply at 7- to 14-day intervals
	Tourney (50% WDG) 1.0 to 4.0 oz; metconazole	Apply at 14- to 28-day intervals
	Trinity (19.2%) 8.0 to 12.0 fl oz; triticonazole	Apply at 7- to 14-day intervals
Holly (Japanese) Phytophthora and Pythium root rot	Adorn (39.5%) 1.0-4.0 fl oz; fluopicolide	Apply at 14- to 28-day intervals but not more than twice per crop cycle.
	Alliette (80% WDG) 1.0-2.0 lbs/1000 sq ft fosetyl-AI	
	Alude 1.0-2.0 qt Vital 2.0-4.0 pt; phosphite	Spray every 7 days.
	Disarm (40.3% SC) 1.0-6.0 fl oz fluoxastrobin	Apply at 14- to 28-day intervals.
	FenStop 7.0-14.0 fl oz; fenamidone	Drench 1.0-2.0 pints per square foot at a 28-day interval.
	Subdue MAXX 1.0-2.0 fl oz; mefenoxam	See Azalea.
Table 5.1 - Common Diseases and Chemical Control Options (continued)		
Plant Disease	Fungicide Rate/100 Gal	Remarks
Holly (Japanese) Phytophthora and Pythium root rot (continued)	Micora (23.3%) 8.0 fl oz; mandipropamid	Apply every 7- to 14 days
	Orvego (46.2%) 14.0 fl oz ametoctradin and dimethomorph	Apply at 10- to 14 day intervals
	Pageant (38.0% WDG) 4.0-18.0 oz; pyraclostrobin	Apply at 7- to 14-day intervals.
	Segway (34.5% SC) 2.0-6.0 fl oz cyazoflamid	Apply at 14- to 28-day intervals.
	Stature (43.5% SC) 6.0-13.0 fl oz dimethomorph	Apply at 10- to 14-day intervals. Constant agitation required.
Hydrangea Botrytis leaf blight	Chipco 26019 (50% WP) 1.0-2.0 lb Sextant (23.3%) 1.0-2.5 lb; iprodione	Spray every 10 to 14 days.
	Cleary 3336-F 12.0-16.0 fl oz Fungo 50 AGC 12.0-16.0 oz; thiophanate methyl	Apply when disease first appears, repeat at 10- to 14-day intervals.
	Decree (50 WDG) 0.7-1.5 lb; fenhexamid	Repeat at 7- to 10-day intervals.
	Dithane Rainshield or Fore Rainshield, 1.5 lb; mancozeb	Apply at 7- to 14-day intervals.
	Pageant (38%) 12.0-18.0 oz pyraclostrobin and boscalid	Apply every 7 to 14 days as needed
Juniper Phomopsis needle and twig blight	Cleary 3336-F, 12.0 to 16.0 fl oz; thiophanate methyl	Begin application at bud break and repeat at 7-day intervals through the growing season.
	Dithane Rainshield or Fore Rainshield, 1.5 lb; mancozeb	Begin application at bud break and repeat at 7-day intervals through the growing season.

Juniper Rhizoctonia web blight (<i>Rhizoctonia solani</i>)	Cleary 3336-F 12.0-16.0 fl oz Fungo 50 AGC 12.0-16.0 oz; thiophanate methyl	Apply as a heavy drench or spray to 800 sq ft of bench or bed area, (1.0-2.0 pts/sq ft). Repeat at 2- to 4-week intervals. Avoid crowding plants.
	Empress (23.3%) 2.0 to 6.0 fl oz; Pyraclostrobin	Repeat application at 7- to 28-day intervals as needed.
	Hurricane (48%) 1.5 oz fludioxonil and mefenoxam	Apply at 21- to 28-day intervals
	OHP 26 GT 1.0-2.5 qt; iprodione	Spray plants every 7 to 14 days.
	Pageant (38%) 12.0 to 18.0 oz pyraclostrobin and boscalid	Apply at 7- to 14-day intervals
	Palladium (63.5% WDG) 2.0 to 4.0 oz Cyprodinil and fludioxonil	Apply at 7- to 14-day intervals
	Trinity (19.2%) 8.0 to 12.0 fl oz; triticonazole	Apply at 7- to 14-day intervals
	Tourney (50% WDG) 1.0 to 4.0 oz; metconazole	Apply at 14- to 28-day intervals
Juniper Phytophthora and Pythium root rot	Adorn (39.5%) 1.0-4.0 fl oz; fluopicolide	Apply at 14- to 28-day intervals but not more than twice per crop cycle.
	Alliette (80% WP) 1.0-2.0 lbs/1000 sq ft; fosetyl-AI	See Azalea.
	Alude 1.0-2.0 qt Vital 2.0-4.0 pt; phosphite	Spray every 7 days.
	Disarm (40.3% SC) 1.0-6.0 fl oz fluoxastrobin	Apply at 14- to 28-day intervals.
	FenStop 7.0-14.0 fl oz; fenamidone	Drench 1.0-2.0 pints per square foot at a 28-day interval.
	Micora (23.3%) 8.0 fl oz; mandipropamid	Apply every 7 to 14 days
	Orvego (46.2%) 14.0 fl oz ametoctradin and dimethomorph	Apply at 10 to 14 day intervals
	Pageant (38.0% WDG) 4.0-18.0 oz; pyraclostrobin	Apply at 7- to 14-day intervals.
	Segway (34.5% SC) 2.0-6.0 fl oz cyazoflamid	Apply at 14- to 28-day intervals.
	Stature (43.5% SC) 6.0-13.0 fl oz dimethomorph	Apply at 10- to 14-day intervals. Constant agitation required.
	Subdue Maxx 1.0-2.0 fl oz; mefenoxam	See Azalea.
Table 5.1 - Common Diseases and Chemical Control Options (continued)		
Plant Disease	Fungicide Rate/100 Gal	Remarks
Lilac Powdery mildew	Concert II (41.4%) 22.0 to 35.0 fl oz propiconazole and chlorothalonil	Apply at 14 to 21 day intervals
	Strike (25% WDG) 2.0-4.0 oz; triadimefon	Spray to run-off when mildew first appears.
	Sythane (40% WSP) 4.0 oz; myclobutanil	Apply at 10- to 14-day intervals.
	Triact 70 0.5-1.0 gal, neem oil	Apply every 14 days.
	Trinity (19.2%) 8.0 to 12.0 fl oz; triticonazole	Apply at 7 to 14 day intervals
	Tourney (50% WDG) 1.0 to 4.0 oz; metconazole	Apply every 14 to 28 days
Liriope Fusarium root and crown rot	Empress (23.3%) 2.0 to 6.0 fl oz; pyraclostrobin	Apply at 7- to 28-day intervals as needed
Mountain Laurel (<i>Kalmia latifolia</i>) Cercospora leaf spot	Concert II (41.4%) 22.0 to 35.0 fl oz propiconazole and chlorothalonil	Apply at 14- to 21-day intervals
	Daconil Weather Stik 2.0 pt; chlorothalonil	Spray at 7-day intervals during wet weather. Spray when buds break in the spring and twice more at 2-week intervals.
	Sythane (40% WSP) 4.0 oz; myclobutanil	Apply at 10- to 14-day intervals.
	Tourney (50% WDG) 1.0 to 4.0 oz; metconazole	Apply every 14 to 28 days as needed
Pachysandra Volutella leaf and stem blight	Dithane Rainshield, 1.5 lb; mancozeb	Apply first spray in the spring. Make 5 applications at 10- to 14-day intervals.
	Fixed Copper (WP) 1.0 lb; copper	Apply Fixed Copper at 7- to 10-day intervals.

Peony Botrytis blight (Gray mold)	Cleary 3336-F 12.0-16.0 fl oz, thiophanate methyl	Begin when disease first appears and repeat at 10- to 14-day intervals.
	Decree (50 WDG) 0.7-1.5 lb; fenhexamid	Repeat at 7- to 10-day intervals.
	Pageant (38%) 12.0-18.0 oz pyraclostrobin and boscalid	Apply every 7 to 14 days as needed
Peony Alternaria leaf spot and Phytophthora blight	Maneb 80 (80% WP) or Maneb Plus Zinc F4 Fungicide (37% F) 1.5 lb or 1.2 qt; maneb	Begin when disease first appears and repeat at 10- to 14-day intervals.
Peony Leaf blotch, red spot or measles (Cladosporium paeoniae)	Mancozeb DG (75%) 1.0 to 2.0 lb; mancozeb	Apply every 7 to 14 days after removing symptomatic plant parts
Peony Rhizoctonia root and stem rot	Cleary 3336-F 12.0-16.0 fl oz Fungo 50 AGC 12.0-16.0 oz; thiophanate methyl	Apply as a heavy drench or spray to 800 sq ft of bench or bed area, (1.0-2.0 pts/sq ft). Repeat at 2- to 4-week intervals. Avoid crowding plants.
	Empress (23.3%) 2.0 to 6.0 fl oz; Pyraclostrobin	Repeat application at 7- to 28-day intervals as needed.
	Hurricane (48%) 1.5 oz fludioxonil and mefenoxam	Apply at 21- to 28-day intervals
	OHP 26 GT 1.0-2.5 qt; iprodione	Spray plants every 7 to 14 days.
	Pageant (38%) 12.0 to 18.0 oz pyraclostrobin and boscalid	Apply at 7- to 14-day intervals
	Palladium (63.5% WDG) 2.0 to 4.0 oz Cyprodinil and fludioxonil	Apply at 7- to 14-day intervals
	Trinity (19.2%) 8.0 to 12.0 fl oz; triticonazole	Apply at 7- to 14-day intervals
Tourney (50% WDG) 1.0 to 4.0 oz; metconazole	Apply at 14- to 28-day intervals	
Periwinkle (Vinca minor) Phomopsis stem rot	Cleary 3336-F 12.0-16.0 fl oz thiophanate methyl	Begin when disease first appears and repeat at 10- to 14-day intervals.
Photinia Powdery mildew	Concert II (41.4%) 22.0 to 35.0 fl oz propiconazole and chlorothalonil	Apply at 14 to 21 day intervals
	Strike (25% WDG) 2.0-4.0 oz; triadimefon	
	Sythane (40% WSP) 4.0 oz; myclobutanil	Apply at 10- to 14-day intervals.
	Triact 70 0.5-1.0 gal, neem oil	Apply every 14 days.
	Trinity (19.2%) 8.0 to 12.0 fl; oztriconazole	Apply at 7 to 14 day intervals
Tourney (50% WDG) 1.0 to 4.0 oz; metconazole	Apply every 14 to 28 days	

Table 5.1 - Common Diseases and Chemical Control Options (continued)

Plant Disease	Fungicide Rate/100 Gal	Remarks
Photinia Entomosporium leaf spot (Entomosporium maculatum)	Banner MAXX 2.0-4.0 fl oz; propiconazole	Apply in early spring as growth starts and reapply on 14-day schedule until new growth is fully expanded.
	Strike (25% WDG) 16.0 oz; triadimefon	
	Daconil Weather Stik 1.4 pt Concorde (54% SST) 1.4 pt; chlorothalonil	Spray at 2- to 4-week intervals. Avoid overhead irrigation. Avoid crowding containers.
	Dithane Rainshield or Fore Rainshield, 1.5 lb; mancozeb	Spray at 7- to 14-day intervals.
	Cleary 3336-F 12.0-16.0 fl oz thiophanate methyl	Spray at 7- to 14-day intervals.

Pine (White, Japanese, Black) Phytophthora root rot	Adorn (39.5%) 1.0-4.0 fl oz; fluopicolide	Apply at 14- to 28-day intervals but not more than twice per crop cycle.
	Alliette (80% WP) 1.0-2.0 lbs/100 sq ft fosetyl-Al	See Azalea.
	Alude 1.0-2.0 qt Vital 2.0-4.0 pt; phosphite	Spray every 7 days.
	Disarm (40.3% SC) 1.0-6.0 fl oz fluoxastrobin	Apply at 14- to 28-day intervals.
	FenStop 7.0-14.0 fl oz; fenamidone	Drench 1.0-2.0 pints per square foot at a 28-day interval.
	Micora (23.3%) 8.0 fl oz; mandipropamid	Apply every 7 to 14 days
	Orvego (46.2%) 14.0 fl oz ametoctradin and dimethomorph	Apply at 10 to 14 day intervals
	Pageant (38.0% WDG) 4.0-18.0 oz; pyraclostrobin	Apply at 7- to 14-day intervals.
	Segway (34.5% SC) 2.0-6.0 fl oz cyazoflamid	Apply at 14- to 28-day intervals.
	Stature (43.55% SC) 6.0-13.0 fl oz; dimethomorph	Apply at 10- to 14 day intervals. Constant agitation required.
Subdue Maxx 1.0-2.0 fl oz; mefenoxam	See Azalea.	
Pyracantha (Firethorn) Fire blight	Alliette (80% WP) 2.5 lb; fosetyl-Al	Begin spray at pre-bloom. Repeat as necessary but do not exceed one application every 7 days until blooming period ends.
	Streptomycin agric. compd. 100 ppm streptomycin sulfate	Spray when 20% of the blossoms are open and repeat 5 to 7 days during bloom period. COMMERCIAL ORNAMENTAL USE ONLY.
	Fixed copper 1.0 lb; copper	Apply the first spray at bud break, 10 to 14 days later and at petal fall.
Pyracantha Scab	Systhane (40% WSP) 4.0 oz; myclobutanil	Apply at 10- to 14-day intervals.
	Daconil Weather Stik 1.4 pt Concorde (54% SST) 1.4 pt; chlorothalonil	Spray at bud break and repeat twice at 10-day intervals.
	Dithane Rainshield or Fore Rainshield, 1.5 lb; Junction (15% DF) 1.5 lb; mancozeb	Spray at 7- to 14-day intervals.
	Fixed Copper 1.0 lb; copper	Spray at 7- to 14-day intervals.
	Cleary 3336-F, 12.0 to 16.0 fl oz; thiophanate methyl	Begin when disease appears and repeat at 10- to 14-day intervals.
Rhododendron Ovulinia petal blight	Same as for Azalea.	Same as for Azalea.
Rhododendron Phytophthora root rot and wilt	Adorn (39.5%) 1.0-4.0 fl oz; fluopicolide	Apply at 14- to 28-day intervals but not more than twice per crop cycle.
	Alliette (80% WDG) 2.5-5.0 lb; fosetyl-Al	Spray to run-off at monthly intervals.
	Alude 1.0-2.0 qt Vital 2.0-4.0 pt; phosphite	Spray every 7 days.
	Banol (66.5%) 20.0-30.0 fl oz propamocarb hydrochloride	Repeat every 3 weeks to 3 months.
	Disarm (40.3% SC) 1.0-6.0 fl oz fluoxastrobin	Apply at 14- to 28-day intervals.
Table 5.1 - Common Diseases and Chemical Control Options (continued)		
Plant Disease	Fungicide Rate/100 Gal	Remarks
Rhododendron Phytophthora root rot and wilt (continued)	Micora (23.3%) 8.0 fl oz; mandipropamid	Apply every 7 to 14 days
	Orvego (46.2%) 14.0 fl oz ametoctradin and dimethomorph	Apply at 10 to 14 day intervals
	Pageant (38.0% WDG) 4.0-18.0 oz; pyraclostrobin	Apply at 7- to 14-day intervals.
	Terrazole (35% WP) 4.0-10.0 oz; etridiazole	See Azalea.
	Segway (34.5% SC) 2.0-6.0 fl oz cyazoflamid	Apply at 14- to 28-day intervals.
	Stature (43.5% SC) 6.0-13.0 fl oz dimethomorph	Apply at 10- to 14-day intervals. Constant agitation required.
	Subdue Maxx 1.0-2.0 fl oz; mefenoxam	See Azalea.
Rhododendron Rust	Same as for Azalea.	Same as for Azalea.

Rhododendron Botrytis gray mold	Chipco 26019 (50% WP) 1.0-2.0 lb Sextant (23.3%) 1.0-2.5 lb; iprodione	See Azalea.
	Cleary 3336-F, 12.0 to 16.0 fl oz; Fungo 50 AGC 12.0-16.0 oz; thiophanate methyl	See Azalea.
	Decree (50 WDG) 0.7-1.5 lb; fenhexamid	Apply at 7- to 10-day intervals.
	Pageant (38%) 12.0-18.0 oz pyraclostrobin and boscalid	Apply every 7 to 14 days as needed
Rose Crown gall	Galltrol-A	See manufacturer's directions. Purchase healthy rose bushes. Do not injure the roots or crowns of roses.
Rose Black spot	Banner EC Maxx, 2.0-4.0 fl oz; propiconazole	Tank mix with a registered contact fungicide labeled for black spot control.
	Cleary 3336-F, 12.0 to 16.0 fl oz; Fungo 50 AGC 12.0-16.0 oz; thiophanate methyl	Start applications in the spring as leaves expand. During dry weather, treat at 7- to 10-day intervals for Daconil.
	Daconil Weather Stik 1.375 pt; chlorothalonil	Start applications in the spring as leaves expand. During dry weather, treat at 7- to 10-day intervals for Daconil.
	Dithane Rainshield or Fore Rainshield, 1.5 lb; Junction (15% DF) 1.5 lb; mancozeb	Apply at 7- to 14-day intervals.
	Maneb 80 (80% WP) or Maneb Plus Zinc F4 Fungicide (37% F) 1.5 lb or 1.2 qt; maneb	Apply at 7- to 14-day intervals.
	Triact 70 0.5-1.0 gal, neem oil	Apply every 14 days.
	Torque (38.7) 4.0 to 10.0 fl oz; tebuconazole	Apply every 14 to 21 days as needed
	Sythane (40% WSP) 4.0 oz; myclobutanil	Apply at 10- to 14-day intervals.
Rose Botrytis blight (Gray mold)	Decree 0.7-1.5 lb; fenhexamid	Spray every 7 to 14 days.
	Cleary 3336-F, 12.0 to 16.0 fl oz; Fungo 50 AGC 12.0-16.0 oz; thiophanate methyl	Apply to buds to protect against disease. Repeat at 10- to 14-day intervals.
	Chipco 26019 (50% WP) 1.0-2.0 lb Sextant (23.3%) 1.0-2.5 lb; iprodione	Apply to buds to protect against disease. Repeat at 10- to 14-day intervals.
	Pageant (38%) 12.0-18.0 oz pyraclostrobin and boscalid	Apply every 7 to 14 days as needed
Rose Downy mildew	Adorn (39.5%) 1.0-4.0 fl oz; fluopicolide	Apply at 14- to 28-day intervals but not more than twice per crop cycle.
	Alliette (80% WDG) 2.5 lb; fosetyl-AI	Apply every 7 to 14 days.
	Alude 1.0-2.0 qt Vital 2.0-4.0 pt; phosphite	Spray every 7 days.
	Cygnus (50%) 3.2-6.4 oz; kresoxim-methyl	
	Disarm (40.3% SC) 1.0-6.0 fl oz fluoxastrobin	Apply at 14- to 28-day intervals.
	FenStop 7.0-14.0 fl oz; fenamidone	Spray plants at a 28-day interval.
	Heritage (50%) 2.0-4.0 oz; azoxystrobin	Apply every 1 to 3 weeks.
Table 5.1 - Common Diseases and Chemical Control Options (continued)		
Plant Disease	Fungicide Rate/100 Gal	Remarks
Rose Downy mildew (continued)	Micora (23.3%) 8.0 fl oz; mandipropamid	Apply every 7 to 14 days
	Orvego (46.2%) 14.0 fl oz ametoctradin and dimethomorph	Apply at 10 to 14 day intervals
	Pageant (38.0% WDG) 4.0-18.0 oz pyraclostrobin	Apply at 7- to 14-day intervals.
	Segway (34.5% SC) 2.0-6.0 fl oz cyazoflamid	Apply at 14- to 28-day intervals.
	Stature (43.5% SC) 6.0-13.0 fl oz dimethomorph	Apply at 10- to 14-day intervals. Constant agitation required.

Rose Powdery mildew	Banner Maxx, 2.0-4.0 fl oz; propiconazole	Thorough coverage is needed for best results.
	Concert II (41.4%) 22.0 to 35.0 fl oz propiconazole and chlorothalonil	Apply at 14 to 21 day intervals
	Cygnus (50%) 1.6-3.2 oz; kresoxim-methyl	Start applications in the spring as leaves expand. Treat at 10- to 14-day intervals to protect. Spray at 7-day intervals if mildew is present.
	Strike (25% WDG) 2.0-4.0 oz triadimefon	Start applications in the spring as leaves expand. Treat at 10- to 14-day intervals to protect. Spray at 7-day intervals if mildew is present.
	Systhane (40% WSP) 4.0 oz; myclobutanil	Apply at 10- to 14-day intervals.
	Terraguard 50W 4.0-16.0oz triflumizole	Apply on a 7- to 14-day interval as needed. Use the high rate on an existing infection.
	Trinity (19.2%) 8.0 to 12.0 fl oz; triticonazole	Apply at 7 to 14 day intervals
	Tourney (50% WDG) 1.0 to 4.0 oz; metconazole	Apply every 14 to 28 days
Willow Crown gall	Galltrol-A	See manufacturer's directions.
Yew (<i>Taxus</i>) Phytophthora root rot and crown rot	Adorn (39.5%) 1.0-4.0 fl oz; fluopicolide	Apply at 14- to 28-day intervals but not more than twice per crop cycle.
	Alliette (80% WDG) 1.0-2.0 lbs/1000 sq ft; fosetyl-AI	See Azalea.
	Alude 1.0-2.0 qt Vital 2.0-4.0 pt; phosphite	Spray every 7 days.
	Disarm (40.3% SC) 1.0-6.0 fl oz fluoxastrobin	Apply at 14- to 28-day intervals.
	FenStop 7.0-14.0 fl oz; fenamidone	Drench 1.0-2.0 pints per square foot at a 28-day interval.
	Micora (23.3%) 8.0 fl oz; mandipropamid	Apply every 7 to 14 days
	Orvego (46.2%) 14.0 fl oz ametoctradin and dimethomorph	Apply at 10 to 14 day intervals
	Pageant (38.0% WDG) 4.0-18.0 oz; pyraclostrobin	Apply at 7- to 14-day intervals.
	Terrazole (35% WP) 4.0-10.0 oz; etridiazole	Repeat every 4 to 12 weeks.
	Segway (34.5% SC) 2.0-6.0 fl oz; cyazoflamid	Apply at 14- to 28-day intervals.
Stature (43.5% SC) 6.0-13.0 fl oz; dimethomorph	Apply at 10- to 14-day intervals. Constant agitation required.	

Nursery Crops: Organic Controls for Insect Pests

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Table 5.2 - Organic Controls, Predators and Pathogens		
Products or pathogens	Insects Controlled	Remarks
Azadirachtin	Thrips, aphids, caterpillars, mealybugs, leafhoppers, leafminers	Sold under many trade names including; Aza-Direct, AzaGuard, Azatin, AzaSol, Azatrol, Triact, Molt-X, Ornazin, Trilogy
<i>Bacillus thuringiensis</i>	Leaf-feeding caterpillars, elm and willow leaf beetle	Known as "Bt;" sold under many trade names, including Dipel, Javelin. A strain of <i>Bt</i> is sold as Trident for beetle control
<i>Beauveria bassiana</i>	Beetles, aphids, others	Various trade names, including BioCeres, BotaniGard, BoteGHA, Mycotrol
<i>Burkholderia</i> spp. strain A396	Aphids, leafhoppers, stinkbugs, thrips	Sold as Venerate
<i>Capsicum oleoresin</i> extract, garlic and soybean oils	Thrips and mites	Sold as Captiva Prime
<i>Chromobacterium subsugae</i> strain PRRA4-1	Caterpillars, cottonwood leaf beetle	Sold as Grandevo; See label for rates for specific pests.
Entomopathogenic nematodes (<i>Steinernema</i> and <i>Heterorhabditis</i>)	Root-feeders, borers, black vine weevil	For grubs or weevil larvae, apply to ground at base of plants. Rates are on product label; soil temperature should exceed 60° F. Apply late in the day, irrigate immediately. For borers, inject directly into galleries using syringe or turkey baster. Not effective against foliar feeding pests as desiccation and exposure to ultraviolet light on the leaf surface kills the nematodes within hours.
Garlic juice	Repels a wide variety of insects	Sold as Garlic Barrier
GS-omega/kappa-Hctx-Hv1a peptide	Aphids, mites, thrips, whiteflies, lepidopterans	Sold as Spear-T or Spear-Lep
Insecticidal soap	Works well on soft bodied insects in particular aphids, mites, lacebugs, mealybugs	This product is sold under many trade names and is a fatty acid soap, including M-Pede. Least impact on natural enemies.
<i>Isaria fumosorosea</i> Apopka Strain 97	Aphids, thrips, whiteflies, weevils, psyllids, leafminers, spider mites, mealybugs	See label. Foliar and soil applications. Sold as PFR-97.
Kaolin clay	Beetles, aphids, caterpillars, others	Various trade names
Pyrethrins	Broad spectrum, works on a wide variety of insects	Sold under numerous trade names, including Pyganic. Pycana is mixed with canola oil and is labeled for use on flowers, shrubs, fruits, and vegetables in shadehouse, nursery, hoophouse, container-grown nursery crops, and greenhouses.
Soybean and corn oils	Broad spectrum, works on a wide variety of insects	Sold as PureCrop1
Spinosad	Many insect pests, including thrips, caterpillars, and leaf beetles	Entrust is for certified organic production.
Predators	Insects Controlled	Remarks
Lady beetles	Feed on aphids and other soft bodied insects	Lady beetles may leave to find other prey after release. <i>Cryptolaemus</i> is used for mealybug, <i>Delphastus</i> is used for whitefly. <i>Chilocorus</i> is used for scales.
Lacewings	Aphids, scales, mealybugs, other soft bodied insects	Immature are called aphid lions. Usually sold as eggs. Several Chrysoperla species being sold, including <i>C. rufilabris</i> .
Predatory mites	Mostly for control of spider mites, thrips	<i>Phytoseiulus persimilis</i> will feed on spider mites and <i>Amblyseius</i> spp. will feed on thrips.
Parasitic wasps	Many insect pests on the foliage including caterpillars, whiteflies	<i>Trichogramma</i> wasps work well on many Lepidoptera eggs; <i>Encarsia formosa</i> for whiteflies; <i>Diglyphus</i> for leaf miners; <i>Aphytis</i> for armored scale; <i>Aphidius colemani</i> for aphids.

Table 5.3 – Organic Controls, Predators and Pathogens

UPDATED List of Commercial Suppliers and Insectaries/Laboratories selling predators and parasitoids for augmentative biocontrol

*The following table was completed using information from the 2015 Directory of Least-Toxic Pest Control Products, published on The IPM Practitioner Magazine (<https://www.birc.org/Final2015Directory.pdf>). There are more companies/suppliers offering beneficial arthropods and are not included in this table. Appearance on this table does not reflect endorsement by VCE.

**Companies might offer additional products, besides the ones listed in this table. Check the respective company's website for a complete list of products, prices and availability.

Company Name*	City	State	Products**	Website for Ordering
A-1 Unique	Citrus Height	California	Lacewings, Lady beetles	http://a-1unique.com/
Arbico Organics	Oro Valley	Arizona	Lacewings, Lady beetles	https://www.arbico-organics.com/
Associates Insectaries	Santa Paula	California	Lady beetles	http://www.associatesinsectary.com/
Beneficial Insectaries	Redding	California	Parasitic wasps, Lacewings, Predatory mites	https://www.insectary.com/
BFG Supply	Burton	Ohio	Lacewings	https://www.bfgsupply.com/
Biobest	Romulus	Michigan	Parasitic wasps, Lady beetles	http://www.biobestgroup.com/en/
Bioline Agrosiences	Oxnard	California	Parasitic wasps, Lacewings, Predatory mites	http://www.biolineagrosiences.com/
Bioworks	Victor	New York	Parasitic wasps, Lacewings, Predatory mites	https://bioworksinc.com/
Buglogical	Tucson	Arizona	Lacewings, Lady beetles	https://www.buglogical.com/
Evergreen Grower Supply	Clackamas	Oregon	Parasitic wasps, Lacewings	http://www.evergreengrowers.com/
Garden Alive	Lawrenceburg	Indiana	Lacewings, Lady beetles	https://www.gardensalive.com/
Greenmethods	Redding	California	Parasitic wasps, Lacewings, Lady beetles	https://greenmethods.com/
IPM Laboratories Inc.	Locke	New York	Parasitic wasps, Lacewings, Lady beetles	http://www.ipmlabs.com/
Koppert	Howell	Michigan	Parasitic wasps, Lacewings, Lady beetles, Predatory mites	https://www.koppertus.com/
Kunafin	Quemado	Texas	Lacewings	http://www.kunafin.com/
Natural Pest Control	Orangevale	California	Lacewings, Lady beetles	http://www.natpestco.com/
Nature's Control	Medford	Oregon	Parasitic wasps, Lacewings, Lady beetles	http://www.naturescontrol.com/
Organic Control	Harbor City	California	Lacewings	https://www.organiccontrol.com/
Peaceful Valley	Grass Valley	California	Lacewings, Lady beetles	https://www.groworganic.com/
Planet Natural	Bozeman	Montana	Lacewings, Lady beetles	https://www.planetnatural.com/
Rincon-Vitova Insectaries	Ventura	California	Parasitic wasps, Lacewings, Lady beetles	http://www.rinconvitova.com/
Tip Top	Westlake Village	California	Parasitic wasps, Lacewings, Lady beetles	https://tiptopbiocontrol.com/

Nursery Crops: Insects

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These recommendations are for use by nursery producers, commercial and municipal arborists, and other certified applicators, Category 3, who are responsible for the production, care, and protection of herbaceous, shade trees, shrubs, and other woody ornamental plants.

There is no simple magic formula for pest control on herbaceous plants, trees and shrubs. More than 250 species of insects and mites are commonly found which damage or are potentially injurious to over 100 genera of ornamental plants. Great diversity by insects in host preferences, seasonal development, periods of activity, habits, and susceptibility to insecticides requires careful planning and critical timing of control measures. It is a simple fact that insects and mites will occur, multiply, and cause serious losses if ignored or inadequately controlled. The most frequent cause of insect problems is the failure of nursery personnel and arborists to carry out necessary control procedures properly at the right time due to pressures from other phases of production and maintenance.

The best way to control insects and mites is a preventive program. First, do not introduce pest problems. In nursery production, propagate or buy **ONLY** clean, uninfested stock plants. In municipal tree plantings or private landscaping, set out **ONLY** insect-free plant materials. The presence of a few hardly noticeable insects or mites at planting time is a sure source of extra work and costly effort later on. Second, draw up a seasonal pest monitoring schedule to prevent the establishment and buildup of insects and mites. Third, maintain regular surveillance of established plant materials and be prepared to schedule control measures for difficult or complex pest problems which arise. Take advantage of assistance from your local Extension faculty and the Extension specialists at Virginia Tech.

■ How to Use These Recommendations

Prepare a seasonal monitoring and management schedule for your specific plant types and pest problems. Each nursery, municipality, or local area tends to have its own unique pest situations depending on routine cultural and control practices. If the pest situation is not known, conduct a thorough survey to determine which problems exist and what the control needs are. Select those treatments which most conveniently fit the work plan in your own operation. With careful study and planning these recommendations can be adapted to an effective, seasonal, preventive control program. It is essential to carry out the control program precisely. Thoroughness and proper timing are critical in obtaining effective results. Some degree day (DD) accumulations to the susceptible life stage are included (50°F base temperature) in the timing section. Beware that using DD information without scouting can lead to unnecessary insecticide applications.

PRECAUTIONS

Be absolutely sure to read and follow ALL of the directions and precautions on the labels and accompanying brochures of the pesticides used. Every statement included is important and can prevent serious injuries or losses. Be sure that those involved in the application of pesticides are fully informed of all precautions for use and are certified applicators. Formulations and amounts to mix in preparing sprays are given; however, consult the labels for precise directions. It is illegal to use pesticides inconsistent with uses specified on the label. Be sure the host plants and pests to be controlled are stated on the label of the product you use.

TOXICITY AND HAZARD TO HUMANS AND ANIMALS

As a guide to general hazards of chemicals, know the relative toxicities of common insecticides. Also study the precautionary statements on pesticide labels. Certain chemicals may be more readily absorbed through the skin than if ingested, or vice versa. Some may be relatively non-toxic to bees and birds, but highly toxic to fish. Other chemicals may be acutely or chronically toxic to bees. Read the label for special precautions. When spraying, it is essential to stay out of drift and direct spray. Wear protective equipment as directed by the label.

SPECIAL PRECAUTIONS FOR POLLINATORS

Some insecticides may be acutely or chronically toxic to bees. Read the label for special precautions. Certain labels contain special precaution section titled "Protection of Pollinators". A bee hazard icon may warn applicators of special application restrictions to protect pollinators. Follow instructions from the label to mitigate any potential hazard for pollinators originated by the application of a selected pesticide.

PLANT INJURY

Insecticides vary greatly in their phytotoxicity. Be sure to avoid treating sensitive or stressed plants. Cautions on the label usually indicate plants which should not be sprayed. Read the entire label carefully. Petroleum oils for dormant or summer spraying are much safer, but may injure birch, beech, sugar and Japanese maple, hickory, walnut, butternut, douglas fir, spruces, or juniper.

It is important not to mix pesticides which are not compatible with each other, and avoid formulations not intended for use on plants. Formulations used for structural pest control should never be applied to plants.

Table 5.4 - Control Measures for Major Pests and Pest Groups			
Pest	Control	Timing of Treatment	Remarks
Adelgids spruce gall adelgid	bifenthrin cyclanilprole imidacloprid	Treat just before buds break in the spring, and/or in September and early October after galls have opened.	Spring treatments should be applied before cottony egg masses are evident on buds in the spring. Cooley spruce gall adelgid on Douglas fir does not produce galls; it feeds openly on the needles.
pine bark adelgid	bifenthrin cyclanilprole deltamethrin horticultural oil imidacloprid insecticidal soap	Treat in late April or early May and repeat 2-3 weeks later.	Use a forceful spray to penetrate cottony secretions. Use less-toxic materials in public areas and around homes. For additional information on this pest, refer to: https://www.pubs.ext.vt.edu/2907/2907-1402/2907-1402.html
hemlock woolly adelgid	bifenthrin cyclanilprole dinotefuran horticultural oil insecticidal soap imidacloprid thiamethoxam	Treat in late June and/or in September or October.	When spraying, thoroughly wet entire plant including the bark of branches and the trunk. Use a forceful spray; be sure the new growth is thoroughly wet. Use care when treating soil to avoid runoff from site. For additional information on this pest, refer to: https://www.pubs.ext.vt.edu/3006/3006-1451/3006-1451.html
Ambrosia Beetles	bifenthrin permethrin	Treat trunk and larger branches in April when the daytime temperature exceeds 70°F for the first time.	Sawdust projecting from the trunk like a toothpick is diagnostic for this insect. Trees can often survive a small infestation.
Ants see "imported fire ant"			
Aphids general	abamectin acephate acetaprimid afidopyropen azadirachtin <i>Beauveria bassiana</i> cyantranilprole dinotefuran flonicamid flupyradifurone fluralinate imidacloprid insecticidal soap pymetrozine rotenone spinetoram+sulfoxaflor spirotetramat thiamethoxam tolfenpyrad	Some aphids (spirea, willow twig, white pine) occur in the spring. Others (crape myrtle, giant bark, willow leaf, linden, maple and oak) build up in mid-summer. Many (white pine aphid) may migrate to hosts throughout the season and in the fall. Look for honeydew or sooty mold.	Apply control measures before populations become large. Aphids may infest buds, leaves, stems, branches, or trunks of the host plants. Be sure to follow all label directions and precautions. Use less toxic and less hazardous materials in public areas, around homes, and where plants are to be moved or transplanted. Be aware of lady beetles, aphids lions, syrphid larvae, and other beneficial populations. Do not apply when plants are flowering and honeybees are active. Do not apply dinotefuran to linden, basswood or other tilia. For additional information on this pest, refer to: https://www.pubs.ext.vt.edu/444/444-220/444-220.html
Bagworm	acephate azadirachtin bifenthrin chlorantranilprole cyantranilprole cyclanilprole cyfluthrin emamectin benzoate fluralinate indoxacarb gamma-cyhalothrin lambda-cyhalothrin methoxyfenozide permethrin spinosad tebufenozide	Apply treatments when bags are less than 1/2 inch. Late May in coastal Virginia, early to mid-June elsewhere. Degree Days DD-600 controls less effective in mid-late summer.	Lightly misting the foliage is sufficient. Mist blower treatments are effective. Do not use the more toxic or hazardous materials in public areas or around homes. Permethrin may lead to mite increases. Light infestations can be handpicked and destroyed. Indoxacarb and chlorantranilprole are for landscape use only. For additional information on this pest, refer to: https://www.pubs.ext.vt.edu/2808/2808-1008/2808-1008.html
	<i>Bacillus thuringiensis (Bt)</i>	Treat when larvae are young in mid to late June.	
	sanitation	Remove and burn bags from August to May for light infestation of a few infested trees.	Overwintering eggs remain inside the bags until hatching in late May. Destroy the bags; eggs will hatch from bags thrown on the ground.

Table 5.4 - Control Measures for Major Pests and Pest Groups (continued)			
Pest	Control	Timing of Treatment	Remarks
Bark Beetles deciduous trees	bifenthrin cypermethrin permethrin	Treatments should be applied to prevent infestation of and breeding in the bark. Treat weakened or injured trees in late April and repeat 2 or 3 times at monthly intervals.	Thoroughly soak the bark of the trunk and branches. For additional information on this pest, refer to: https://www.pubs.ext.vt.edu/444/444-216/444-216.html
	sanitation	Immediately destroy all branches larger than 1-1/2" in diameter as soon as they begin to die or are cut to prevent infestation and breeding by beetles.	Wood should NEVER be piled or stored unless all of the bark is removed. Where possible, susceptible wood should be burned or buried with at least 18 inch fill.
	bifenthrin methoxychlor permethrin	As late in the spring as possible before LEAF BUDS open. This treatment can be supplemented with a second spray in early June.	Complete coverage of all bark is absolutely essential, especially the one year-old twigs in the tops and outer reaches of the trees. The trunk and larger branches should be soaked thoroughly. Spraying is supplementary to sanitation.
conifers	bifenthrin permethrin	Treat unhealthy, weakened, or damaged trees in early April, early June, and August if near infested trees. Also effective in preventing spread if sprayed on infested trees or wood before beetles emerge, or in preventing infestations in uninfested wood that is cut but cannot be disposed of immediately.	Thoroughly wet the bark. Healthy vigorous trees are not likely to be attacked and do not require spraying. Beetles will not reinfest or attack wood or trees dead more than one year.
	sanitation	Throughout the year, particularly during the growing season, when trees begin dying or wood is cut. Prune out large, dying, or recently dead branches.	Dispose of susceptible wood, slash, and bark from stumps by burning, burying where feasible. Beetles will not reinfest or attack wood or trees dead longer than one year.
shot-hole borer, fruit tree bark beetles, ash bark beetle (<i>Scolytus</i>)	bifenthrin permethrin	Spray the bark of healthy trees in late April and early June.	
Borers banded ash borer	bifenthrin permethrin	Treat trunk and main stems in late July and again in early September	Control measures are aimed at newly hatched larvae prior to tunneling into the tree. For additional information on this pest, refer to: https://www.pubs.ext.vt.edu/ENTO/ENTO-133/ENTO-133.html
lilac borer ash borer	bifenthrin permethrin	Treat trunk and branches in early May and again 6 weeks later. DD-148	Treatments kill emerging as well as entering borers. Thorough wetting and soaking of the bark is necessary. Foliage need not be treated. For additional information on this pest, refer to: https://www.pubs.ext.vt.edu/444/444-278/444-278.html
dogwood borer	bifenthrin permethrin	Treat trunk and larger branches in mid-May and repeat after 6 weeks. DD-250	Brown frass around bark cracks and wounds indicate an infestation. For additional information on this pest, refer to: https://www.pubs.ext.vt.edu/444/444-625/444-625.html
peach tree borer	acelepryn bifenthrin chlorantraniliprole permethrin	Treat trunks and soil around the base in July and repeat in 6 weeks.	Cracked bark, frass, and gummosis at the root crown are signs of infestation.
rhododendron borer	bifenthrin permethrin	Treat the trunks and larger branches in late June. DD-192	Wilting foliage and dieback are symptoms.
bronze birch borer	bifenthrin permethrin emamectin benzoate	Treat all bark surfaces, especially in the uppermost part of the tree in mid-May, early, mid-, and late June. DD-440	Emamectin benzoate could be applied by injection.
Borers emerald ash borer	bifenthrin cyfluthrin dinotefuran emamectin benzoate imidacloprid spinosad permethrin	Branch and trunk applications in early May and early June.	Additional insecticides are labeled as soil drenches and tree injections. See PMG 456-018 Insects of trees and shrubs. Do not move firewood. For additional information on this pest, refer to: https://www.pubs.ext.vt.edu/ENTO/ENTO-76/ENTO-76.html

Table 5.4 - Control Measures for Major Pests and Pest Groups (continued)			
Pest	Control	Timing of Treatment	Remarks
round-headed and flat-headed tree borer	bifenthrin permethrin	Treat bark of trunk and branches in early May, early June, and early July.	Bifenthrin is labeled for flatheaded appletree borer in landscapes. For additional information on this pest, refer to: https://www.pubs.ext.vt.edu/444/444-215/444-215.html
oak borer	bifenthrin permethrin	Treat trunk to ground level early June.	Populations are larger in even-numbered years.
locust borer	permethrin	Treat the trunk and larger branches in late August to mid-September or in spring.	Sprays applied in early spring are directed at small larvae. For additional information on this pest, refer to: https://www.pubs.ext.vt.edu/ENTO/ENTO-141/ENTO-141.html
Cicada (periodical cicada)	bifenthrin	Treat bark of twigs on susceptible hosts soon after adult male singing becomes evident, usually around early May.	Cicada damage is caused by adult females inserting eggs in deep slits in twigs. Control is necessary only for young trees.
Defoliators general	acephate azadirachtin <i>Bacillus thuringiensis</i> (Bt) bifenthrin chlorantraniliprole clothianidin cyantraniliprole cyclaniliprole methoxychlor novaluron permethrin spinetoram+sulfoxaflor tolfenpyrad	When insects are first observed feeding. Timing varies with the species. It is critical to observe plants regularly to detect feeding as soon as it begins.	Insecticide combinations marketed by formulators and distributors are available. Consult the labels for specific uses and precautions. Mist blowers are effective. (Use Bt only for caterpillars).
cankerworms	acephate azadirachtin <i>Bacillus thuringiensis</i> (Bt) cyfluthrin emamectin benzoate fluvinate lambda-cyhalothrin methoxychlor permethrin spinosad tebufenozide	In May when leaves are half to two-thirds full size, treatments must be applied when larvae are small. DD-148	Do not use methoxychlor on Chinese elm, Japanese or red maple, or redbud. Mist blowers are very effective.
elm leaf beetle	bifenthrin cyfluthrin cypermethrin fluvinate imidacloprid lambda-cyhalothrin methoxychlor spinosad spinetoram+sulfoxaflor	Treat in mid-to-late May, when eggs have hatched but larvae are small. Second generation may need treatment in mid-to-late July.	Do not use methoxychlor on Chinese elm.
flea beetles	bifenthrin cyantraniliprole cyfluthrin fluvinate lambda-cyhalothrin spinosad	When insects are found feeding on host plants as adults or as larvae.	Flea beetles can appear suddenly and cause serious injury to foliage. Monitoring of susceptible plants is critical. For additional information on this pest, refer to: https://www.pubs.ext.vt.edu/3104/3104-1549/3104-1549.html
grasshoppers	bifenthrin lambda-cyhalothrin	When grasshoppers are found feeding.	Grasshoppers are infrequent pests but can be destructive when abundant. For additional information on this pest, refer to: https://www.pubs.ext.vt.edu/3104/3104-1550/3104-1550.html

Table 5.4 - Control Measures for Major Pests and Pest Groups (continued)			
Pest	Control	Timing of Treatment	Remarks
japanese beetle	azadirachtin bifenthrin chlorantraniliprole clothianidin cyantraniliprole cyclaniliprole cyfluthrin dinotefuran gamma-cyhalothrin imidacloprid lambda-cyhalothrin methoxychlor permethrin tolfenpyrad	In late June or early July after adults have begun to congregate on selected hosts. Repeat as necessary into August. (DD-1029)	Since adults actively fly and move continuously, they seem to be present constantly even where treatments have been applied. Do not apply dinotefuran to linden, basswood and other tilia. For additional information on this pest, refer to: https://www.pubs.ext.vt.edu/2902/2902-1101/2902-1101.html
rose chafer	azadirachtin methoxychlor	During June and mid-summer when insects are found.	Adults are active flyers and move continually onto susceptible hosts. For additional information on this pest, refer to: https://www.pubs.ext.vt.edu/3104/3104-1564/3104-1564.html
rose slugs	chlorantraniliprole methoxychlor	Throughout the growing season when young larvae are seen on plants, especially in May, June.	Time treatments to when larvae are young and damage is not yet severe.
spongy moth	acephate <i>Bacillus thuringiensis (Bt)</i> bifenthrin cyantraniliprole cyclaniliprole cypermethrin diflubenzuron emamectin benzoate fluvinate indoxacarb gamma-cyhalothrin lambda-cyhalothrin methoxychlor methoxyfenozide permethrin spinosad spinetoram+sulfoxaflor tebufenozide	When leaves have expanded but caterpillars are small, usually in mid-May. (DD-90)	Mist blowers and aerial applications are effective.
tussock moth	azadirachtin bifenthrin cyfluthrin fluvinate gamma-cyhalothrin indoxacarb lambda-cyhalothrin methoxychlor methoxyfenozide tebufenozide spinetoram+sulfoxaflor spinosad	In mid-May or late August.	Treat when larvae are small.
willow leaf beetle	methoxychlor spinetoram+sulfoxaflor spinosad	In May, June, and later if infestations persist. There may be several generations in a season.	Be sure to treat the undersides of the leaves. For additional information on this pest, refer to: https://www.pubs.ext.vt.edu/ENTO/ENTO-139/ENTO-139.html
Gall Insects	fenoxycarb spinetoram+sulfoxaflor spinosad thiamethoxam	Treatments are effective when insects are active, before galls appear in spring.	Spinosad is labeled for dipterous gall midges (e.g. honeylocust pod gall midge). Fenoxycarb is labeled for honeylocust pod gall midge. Thiamethoxam is labeled for honeylocust podgall, nipple gall, and blister gall. For additional information on this pest, refer to: https://www.pubs.ext.vt.edu/ENTO/ENTO-146/ENTO-146.html

Table 5.4 - Control Measures for Major Pests and Pest Groups (continued)			
Pest	Control	Timing of Treatment	Remarks
Imported Fire Ant	abamectin (bait) acephate bifenthrin dinotefuran fenoxycarb (bait) fipronil hydramethylnon (bait) indoxacarb (bait) lambda-cyhalothrin metaflumizone methoprene (bait) pyriproxyfen (bait) spinosad	When ants or mounds are observed.	Nurseries and landscapers shipping out of the quarantine area must contact VDACS. The Two-Step method of a bait followed in several days by mound treatments to sensitive or highly trafficked areas is effective within the quarantine area. Combinations of chemicals are also available. Many products are sold under multiple trade names.
Lacebugs	acephate bifenthrin chlorantraniliprole cyantraniliprole cyclaniliprole cyfluthrin dinotefuran fenpropathrin flupyradifurone imidacloprid lambda-cyhalothrin methoxychlor permethrin spinetoram+sulfoxaflor spirotetramat	On evergreens, overwintering eggs hatch in mid-late May. Treat in late May or early June. On deciduous hosts, adults emerge in May. Treat in late May.	Nonsystemic treatments must cover the undersides of the leaves thoroughly. Control of the first generations is most important to slow populations buildup. Examine foliage for lacebugs. Repeat at 3-week intervals if using a low residual product. Do not apply dinotefuran to linden, basswood and other tilia. For additional information on this pest, refer to: https://www.pubs.ext.vt.edu/3104/3104-1581/3104-1581.html
Leafhoppers	acetaprimid azadirachtin bifenthrin buprofezin clothianidin cyfluthrin dinotefuran flonicamid flupyradifurone fluvinate gamma-cyhalothrin imidacloprid lambda-cyhalothrin permethrin spirotetramat thiamethoxam tolfenpyrad	When leafhoppers are first seen and before stippling on leaves becomes extensive.	Thorough coverage of the undersides of the leaves improves control when using nonsystemics. Do not apply dinotefuran to linden, basswood and other tilia. For additional information on this pest, refer to: https://www.pubs.ext.vt.edu/ENTO/ENTO-412/ENTO-412.html
Leafminers arborvitae leafminer	bifenthrin cyantraniliprole imidacloprid permethrin	Larvae overwinters in the foliage. Treat adults when present during the summer. Systemic insecticide can be used to control larvae of this pest.	Bifenthrin and permethrin can control adult moths.
azalea leafminer	abamectin acephate azadirachtin bifenthrin clothianidin cyantraniliprole diazinon fenoxycarb lambda-cyhalothrin permethrin	Treat in mid-late May or when mines are first seen on the plants.	Fenoxycarb will not control adult stages. For additional information on this pest, refer to: https://www.pubs.ext.vt.edu/3104/3104-1554/3104-1554.html
boxwood leafminer adults	cyromazine lambda-cyhalothrin permethrin spinosad	Treat in late April or early May when adults are active. DD-448	Numerous adults can be eliminated before eggs are laid.

Table 5.4 - Control Measures for Major Pests and Pest Groups (continued)			
Pest	Control	Timing of Treatment	Remarks
boxwood leafminer larvae	cyromazine dinotefuran imidacloprid	Treat in May-June after eggs have hatched.	Systemic treatment are most effective in eliminating miners. They are also effective later in the fall season, and persist into the following year.
holly leafminer adults	cyromazine lambda-cyhalothrin permethrin spinosad	Treat in mid-May when new leaves are unfolding and adults are active on the foliage. (DD-192)	Helps reduce feeding punctures on undersides of leaves but may not prevent all mines in the foliage.
holly leafminer larvae	acephate cyromazine dinotefuran imidacloprid	Treat in mid-late June after eggs have hatched.	Systemics are effective in eliminating miners.
oak leafminer	acephate permethrin lambda-cyhalothrin fenoxycarb	Treat when mines are first seen - less than 1/4 inch. Several generations occur each summer.	Rake and destroy leaves in fall.
Leaf-rollers, Leaf Tiers	azadirachtin <i>Bacillus thuringiensis (Bt)</i> bifenthrin cyfluthrin emamectin benzoate gamma-cyhalothrin lambda-cyhalothrin methoxyfenozide permethrin	Treat when insects are first seen. On some hosts, injury occurs in early spring when new buds are opening.	
Mealybugs	horticultural oil	Treat in late spring, before new growth begins.	Spray on warm days when the temperature remains above 40°F (5°C) for 12-24 hours. Do not spray sensitive plants listed on the label.
	acephate acetaprimid afidopyrophen azadirachtin Beauveria bassiana bifenthrin buprofezin cyclaniliprole cyfluthrin dinotefuran fenpyroximate flonicamid flupyradifurone imidacloprid lambda-cyhalothrin permethrin pyridaben spinetoram+sulfoxaflor spirotetramat thiamethoxam tolfenpyrad	Treat whenever mealybugs are first noticed. Repeat 2-3 applications if necessary until infestation is eliminated.	Forceful spray streams help penetrate cracks and crevices in the bark and waxy secretions that protect the mealybugs. Destroying infested plants is another option. Fenpyroximate for suppression only. Do not apply dinotefuran to linden, basswood and other tilia.
Mites hemlock rust mite eriphyid mites	horticultural oil	Treat in early spring before new growth develops.	Do not use on sensitive plants indicated on the label.
	abamectin azadirachtin fenazaquin fenpyroximate spiromesifen	Treat when mites are found in very early spring, in late fall, or during the growing season.	Thoroughly wet the undersides of leaves with a full coverage spray.

Table 5.4 - Control Measures for Major Pests and Pest Groups (continued)			
Pest	Control	Timing of Treatment	Remarks
spruce mite, southern red mite, boxwood mite	abamectin acequinocyl azadirachtin bifenazate clofentazine etoxazole fenazaquin fenbutatin-oxide fenpropathrin fenpyroximate fluvalinate hexythiazox milbectin pyridaben spinosad spiromesifen	Treat in late April or early May and/or in September and October.	Thoroughly wet all of the foliage and stems with a full coverage spray. Fenpropathrin and etoxazole are labeled for shade and lath house use only. Acequinocyl is labeled for spruce spider mite and two-spotted spider mite. See spiromesifen label for list of mite species. For additional information on the spruce mite, refer to: https://www.pubs.ext.vt.edu/444/444-235/444-235.html For additional information on the boxwood mite, refer to: https://www.pubs.ext.vt.edu/ENTO/ENTO-42/ENTO-42.html
honeylocust mite	abamectin fenazaquin spiromesifen	Treat when mites occur, repeat after 10 days.	Thoroughly wet the undersides of leaves with a full coverage spray.
two spotted spider mite	abamectin acequinocyl bifenthrin cyflumetofen etoxazole fenazaquin fenbutatin-oxide fenpyroximate fluvalinate hexythiazox milbectin pyridaben spiromesifen	Treat whenever mites first appear. Infestations may occur from spring to fall. Mite infestations are directly proportionate to increasingly warmer temperatures.	Thoroughly wet the foliage and stems with a full coverage spray. Do not use acequinocyl on miniature roses. Etoxazole for shade and lath house use only. See bifenthrin label for special instructions. For additional information on this pest, refer to: https://www.pubs.ext.vt.edu/444/444-221/444-221.html
Oriental Beetle	bifenthrin imidacloprid	Treat when small larvae are present.	Most effective against early instars. Beneficial nematodes may be effective for immatures. Apply bifenthrin as granules, other materials as soil drenches.
Plant Bugs, Planthoppers	bifenthrin buprofezin cyfluthrin flonicamid flupyradifurone fluvalinate lambda-cyhalothrin permethrin thiamethoxam	Treat when insects or signs of damage first appear. Treat honeylocust as soon as new growth begins.	Control is difficult because plant bugs are active flyers and move around continuously. Fluvalinate is labeled for plant bugs. Permethrin is labeled for Lygus bugs.
Psyllids boxwood psyllid, hackberry psyllid	azadirachtin <i>Beauveria bassiana</i> bifenthrin cyclaniliprole dinotefuran flupyradifurone lambda-cyhalothrin spirotetramat	Treat in late April or early May as new growth begins to develop.	Addition of a wetting agent or spreader-sticker is advised.
Red Headed Flea Beetle	bifenthrin cyantraniliprole cyclaniliprole dinotefuran imidacloprid spinosad thiamethoxam tolfenpyrad	Treat when adults first appear. Repeated applications may be necessary.	<i>Hydrangea paniculata</i> , hollies, and iteas are especially susceptible. Drench, sprench or the use of granulated formulations on the pots (top dressed) might aid to reduce immature populations inside pots. For more information on this pest, refer to: https://www.pubs.ext.vt.edu/ENTO/ENTO-464/ENTO-464.html

Table 5.4 - Control Measures for Major Pests and Pest Groups (continued)			
Pest	Control	Timing of Treatment	Remarks
Sawflies	acetaprimid azadirachtin bifenthrin chlorantranilprole cyclaniliprole cyfluthrin dinotefuran gamma-cyhalothrin imidacloprid lambda-cyhalothrin methoxychlor spinetoram+sulfoxaflor spinosad thiamethoxam	Treat when insects are first seen. Treat in April for Virginia pine sawfly. Larvae are gregarious and broods often cluster on one branch.	Do not apply dinotefuran to linden, basswood and other tilia.
Scale Insects all scales	cyantraniliprole dinotefuran flonicamid horticultural oil imidacloprid lambda-cyhalothrin pyriproxyfen spinetoram+sulfoxaflor spirotetramat thiamethoxam	Treat with horticultural oil in late March or early April before new growth develops, and when temperatures are not likely to go below 40°F (5°C) for 12 to 24 hours. Oils can also be used as summer sprays when indicated on the label.	Do not spray oil-sensitive plants listed under precautions on the label. Thiamethoxam and Cyantraniliprole are labeled for soft scales. Pyriproxyfen, Deltamethrin and spirotetramat are labeled for scale crawlers.
azalea bark scale	insecticidal soap lambda-cyhalothrin	Crawlers: June 5-25.	Scale is often mistaken for mealybugs.
brown soft scale	bifenthrin buprofezin fenoxycarb insecticidal soap lambda-cyhalothrin pyriproxyfen	Treat when scale insects appear. Treat 2-3 times at 10-day intervals.	This scale insect does not winter outside in colder plant zones of Virginia.
calico scale	insecticidal soap lambda-cyhalothrin pyriproxyfen	Crawlers: June 1-20. Treat June 15-30.	Often seen on Zelcova and honeylocust trees.
camellia scale	insecticidal soap lambda-cyhalothrin	Crawlers first appear in May. Treat at 2-week intervals as needed.	
cottony camellia scale	insecticidal soap lambda-cyhalothrin	Crawlers: June 1-10.	
cottony maple leaf scale	acephate insecticidal soap lambda-cyhalothrin	Crawlers: June 1-10.	Ovisacs are found on foliage.
cottony maple scale	insecticidal soap lambda-cyhalothrin pyriproxyfen	Crawlers: June 5-25.	Be sure to thoroughly cover stems and branches near the ground. Dinotefuran is also effective as a bark spray. More information at: https://www.pubs.ext.vt.edu/2808/2808-1011/2808-1011.html
crape myrtle bark scale	buprofezin clothianidin dinotefuran imidacloprid pyriproxyfen thiamethoxam	Best control May-July	Allow several weeks after drenching to be effective. See label regarding bark sprays. See label for dinotefuran commercial landscapes. Do not spray or drench when lady beetle larvae or adults are present. More information at: https://www.pubs.ext.vt.edu/ENTO/ento-465/ento-465.html
euonymus scale	afidopyropen fenoxycarb insecticidal soap lambda-cyhalothrin	Crawlers: first generation May 1-10; second July 5-15.	Do not spray when beneficial lady beetles are present. Afidopyropen is for suppression. More information at: https://www.pubs.ext.vt.edu/444/444-277/444-277.html
euonymus alatus scale	lambda-cyhalothrin	Crawlers: in June and July.	

Table 5.4 - Control Measures for Major Pests and Pest Groups (continued)			
Pest	Control	Timing of Treatment	Remarks
european elm scale	insecticidal soap lambda-cyhalothrin	Crawlers: June 5-25.	
fern scale	buprofezin insecticidal soap lambda-cyhalothrin	Crawlers: first appear in mid-May. Treat at 2-week intervals as needed.	Often on liriopse, near the base of the plant.
fletcher scale	insecticidal soap lambda-cyhalothrin	Crawlers: in early to mid-June.	On Taxus and Arborvitae.
florida red scale	acephate buprofezin insecticidal soap lambda-cyhalothrin	Crawlers: May 5-15.	Found on burford holly.
forbes scale	insecticidal soap lambda-cyhalothrin	Crawlers: June 1-15.	
gloomy scale	insecticidal soap lambda-cyhalothrin	Crawlers: peak June 10-20.	Serious pest of maples that is difficult to control.
golden oak scale	insecticidal soap lambda-cyhalothrin	Crawlers: June 1-30.	
hemlock scale	insecticidal soap lambda-cyhalothrin	Crawlers: peak May 15-June 20, some produced throughout the season.	Also called fiorinia hemlock scale. More information at: https://www.pubs.ext.vt.edu/ENTO/ento-552/ento-552.html
japanese maple scale	buprofezin lambda-cyhalothrin pyriproxyfen spinetoram+sulfoxaflor	Crawlers: June 1-September 1. Treat at 2-week intervals June-September when crawlers present.	Serious pest that is difficult to control. Thorough coverage is needed. More information at: https://www.pubs.ext.vt.edu/ENTO/ento-572/ento-572.html
juniper scale	insecticidal soap lambda-cyhalothrin	Crawlers: April 5-20 and June 5-20.	Crawler dates vary based on temperature. More information at: https://www.pubs.ext.vt.edu/ENTO/ento-533/ento-533.html
latania scale	insecticidal soap lambda-cyhalothrin	Crawlers: continuous from June through season.	
lecanium scale	lambda-cyhalothrin	Crawlers: May 25-June 25.	Avoid harming beneficials by using soaps or oils in March-April.
oak kermes	lambda-cyhalothrin	Crawlers: June 1-20.	
obscure scale	diazinon lambda-cyhalothrin	Crawlers: on red oak during July.	Also treat with oil as a dormant spray. Can be a serious pest. More information at: https://www.pubs.ext.vt.edu/3104/3104-1583/3104-1583.html
oystershell scale	buprofezin insecticidal soap lambda-cyhalothrin	Crawlers: May 1-20 and July 15-25.	Hatches at around 370 DD. Oils and soaps are also effective.
peony scale	insecticidal soap lambda-cyhalothrin	Crawlers: mid-May.	Often found on azaleas.
pine needle scale	bifenthrin gamma-cyhalothrin insecticidal soap lambda-cyhalothrin	Crawlers: April 20-May 30 and July 10-20.	Sporadic outbreaks can occur.
pine tortoise scale	insecticidal soap gamma-cyhalothrin lambda-cyhalothrin	Crawlers: June 10-July 5.	More information at: https://www.pubs.ext.vt.edu/3104/3104-1529/3104-1529.html
rose scale	insecticidal soap lambda-cyhalothrin	Crawlers: late May-June 30, possible second generation in August.	More information at: https://www.pubs.ext.vt.edu/3104/3104-1565/3104-1565.html
san jose scale	bifenthrin buprofezin insecticidal soap lambda-cyhalothrin pyriproxyfen	Crawlers: at least 3 generations June, July, and September.	

Table 5.4 - Control Measures for Major Pests and Pest Groups (continued)			
Pest	Control	Timing of Treatment	Remarks
tea scale	afidopyropen insecticidal soap lambda-cyhalothrin	Crawlers: throughout season in overlapping generations. Treat 2-3 times at 10-day intervals when infested.	Afidopyropen is for suppression
wax scale	buprofezin fenoxycarb lambda-cyhalothrin	Crawlers: June 1-25. Treat June 5-30.	Thoroughly wet foliage and bark with a full-coverage spray. More information at: https://www.pubs.ext.vt.edu/444/444-622/444-622.html
white peach scale, white prunicola scale	buprofezin diazinon fenoxycarb insecticidal soap lambda-cyhalothrin	Crawlers: April 25-May 15, July 1-15, August 20-September 15.	
Spittle Bug	bifenthrin cyfluthrin gamme-cyhalothrin lambda-cyhalothrin spirotetramat	Treat if yellowing or damage occurs.	Often noticed on pines, but rarely causes any injury.
Spotted Lanternfly	acetamiprid bifenthrin dinotefuran imidacloprid thiamethoxam	Treat in early spring and summer	Dinotefuran is labeled as a basal trunk spray on tree-of-heaven only in Virginia. See label for rate. For additional information on this pest, refer to: https://www.pubs.ext.vt.edu/ENTO/ENTO-180/ENTO-180.html
Slugs and Snails	Iron phosphate metaldehyde methiocarb orthoboric acid	Apply when pests are observed.	Iron phosphate is available in homeowner packaging.
Stink Bug	bifenthrin flonicamid	Apply when pests are observed.	Some pansy cultivars may be sensitive. For additional information on this pest, refer to: https://www.pubs.ext.vt.edu/444/444-356/444-356.html
Tent Caterpillars	azadirachtin <i>Bacillus thuringiensis (Bt)</i> bifenthrin chlorantraniliprole cyantraniliprole cyfluthrin emamectin benzoate gamma-cyhalothrin indoxacarb lambda-cyhalothrin methoxychlor methoxyfenozide permethrin spinetoram+sulfoxaflor spinosad tebufenozide	Treat in early spring as new growth is developing and when caterpillars are small.	Caterpillars leave the nests to feed on the foliage during the day. Apply full coverage spray to the entire tree. Forest tent caterpillar does not make a tent. Spinosad and lambda-cyhalothrin are labeled for eastern tent caterpillar only. For additional information on this pest, refer to: https://www.pubs.ext.vt.edu/444/444-274/444-274.html

Table 5.4 - Control Measures for Major Pests and Pest Groups (continued)			
Pest	Control	Timing of Treatment	Remarks
Thrips	abamectin acephate acetaprimid azadirachtin Beauveria bassiana bifenthrin cyantraniliprole cyfluthrin dinotefuran flonicamid fluvinate imidacloprid lambda-cyhalothrin novaluron permethrin spinetoram+sulfoxaflor spinosad spirotetramat tolfenpyrad	Treat when thrips are active on new foliage.	Spirotetramat provides suppression at low levels. Dinotefuran and flonicamid are for suppression. Pyrethroid applications may result in higher levels of western flower thrips. For additional information on this pest, refer to: https://www.pubs.ext.vt.edu/444/444-281/444-281.html
Tip Moths	acephate azadirachtin bifenthrin cyfluthrin diflubenzuron gamma-cyhalothrin lambda-cyhalothrin methoxyfenozide permethrin tebufenozide	Treat with liquid formulation when moths are flying.	Spray entire tree to runoff. Two and three-needle pines are susceptible to tip moth. Younger trees are preferred.
Treehoppers	bifenthrin	Treat when nymphs are seen on twigs (usually in clusters) before adults are present to begin egg-laying, usually in late summer and fall.	Apply sprays to cover the small twigs thoroughly.
Webworms cotoneaster webworm	cyfluthrin gamma-cyhalothrin lambda-cyhalothrin permethrin	Treat when larvae are first found.	Apply a full-coverage spray, wetting foliage to the point of runoff.
juniper webworm	bifenthrin cyfluthrin gamma-cyhalothrin lambda-cyhalothrin permethrin	Treat when larvae are small. Spring treatments may be applied when plants are found to be infested.	Apply a forceful spray to penetrate severely webbed foliage. Thoroughly wet the foliage to runoff.
fall webworm	<i>Bacillus thuringiensis (Bt)</i> bifenthrin chlorantraniliprole cyantraniliprole cyfluthrin emamectin benzoate indoxacarb gamma-cyhalothrin lambda-cyhalothrin methoxychlor permethrin methoxyfenozide spinetoram+sulfoxaflor spinosad tebufenozide	Treat when larvae are small and webs just starting to form. Treat for second generation in August or early September.	Caterpillars are gregarious and infest individual branches. Apply full-coverage foliar spray to infested area, or entire tree in years of high populations. Indoxacarb and chlorantraniliprole are for landscape use only. For additional information on this pest, refer to: https://www.pubs.ext.vt.edu/2808/2808-1013/2808-1013.html

Table 5.4 - Control Measures for Major Pests and Pest Groups (continued)			
Pest	Control	Timing of Treatment	Remarks
mimosa webworm	cyfluthrin emamectin benzoate gamma-cyhalothrin lambda-cyhalothrin permethrin	Apply foliage sprays at 4-5 day intervals until the infestation is controlled.	
pine webworm	bifenthrin cyfluthrin gamma-cyhalothrin lambda-cyhalothrin permethrin		
Weevils two banded japanese weevil, black vine weevil	acephate <i>Beauveria bassiana</i> bifenthrin dinotefuran flupyradifurone lambda-cyhalothrin	Apply as a full-coverage spray when foliar feeding is first observed.	Lambda-cyhalothrin is for black vine weevil adults. Flupyradifurone is for black vine weevil larvae. Do not apply dinotefuran to linden, basswood and other tilia. For additional information on the Japanese weevil, refer to: https://www.pubs.ext.vt.edu/444/444-624/444-624.html For additional information on the black vine weevil, refer to: https://www.pubs.ext.vt.edu/444/444-210/444-210.html
white pine weevil	bifenthrin gamma-cyhalothrin diflubenzuron	Apply sprays in the late spring before adults lay eggs.	Treat only the main terminal leaders of the tree down to the first whorl of branches. Thoroughly wet the bark.
	Cut out and burn infested leaders.	Prune out infested leaders during June.	Adults begin emerging from infested leaders in July. For additional information on the white pine weevil, refer to: https://www.pubs.ext.vt.edu/444/444-270/444-270.html
Whiteflies	abamectin acetaprimid afidopyropen azadirachtin <i>Beauveria bassiana</i> bifenthrin clothianidin cyantraniliprole cyfluthrin dinotefuran fenoxycarb flonicamid flupyradifurone fluvalinate imidacloprid lambda-cyhalothrin novaluron permethrin pymetrozine pyridaben pyriproxyfen spinetoram+sulfoxaflor spiromesifen spirotramat thiamethoxam	When whiteflies are found. Treat every three weeks until infestation is controlled.	See labels for whitefly species. Do not apply dinotefuran to linden, basswood and other tilia. For additional information on this pest, refer to: https://www.pubs.ext.vt.edu/444/444-280/444-280.html
Zimmerman Pine Moth	bifenthrin methoxyfenozide	Treat in early- to mid-April and in early September. (DD-121)	Apply as full coverage spray to the point of runoff.

Table 5.5 - Directions for Pesticide Usage				
Chemical	Chemical Formulation	Pests Controlled	Amount to Use per 100 gal	Phytotoxicity and Remarks
abamectin (Avid)	0.15EC	aphids, eriophyid mites, leafminers, thrips, whiteflies, imported fire ants	4.0-8.0 fl oz	Do not use on ferns or Shasta Daisy. Generic products exist. 12-hr REI. SIGNAL WORD - WARNING
acephate (Orthene)	97	All labeled uses	See label for rates	Rates differ as to pests. See label for phytotoxicity list. 24-hr REI. Some formulations are labeled for use as a basal soil injection for trees. SIGNAL WORD - CAUTION
acequinocyl (Shuttle)	15SC	two-spotted spider mite, spruce spider mite	6.4-12.8 fl oz	Do not use on miniature roses or impatiens. Use low rate on standard roses. See label for resistance management. 12-hr REI. SIGNAL WORD - CAUTION
acetaprimid (Tristar)	70WSP 30SG	aphids, European pine sawfly, tentiform leaf miner, mealybug, leafhopper, whiteflies, thrips	See label for rates	See label for resistance management, restrictions, and precautions. 12-hr REI. SIGNAL WORD - CAUTION
afidopyropen (Ventigra)	0.83DC	aphids whiteflies mealybugs scales	See label for rates	See label for resistance management, restrictions and precautions. 12-hr REI. SIGNAL WORD - CAUTION
azadirachtin (Azatin, Triact, Ornazin, Neemazid, Trilogy, Azatrol)	various	All labeled uses.	See label for rates	Product is sold by several companies, and in many formulations. 4-hr REI. SIGNAL WORD - CAUTION
<i>Bacillus thuringiensis</i> (Bt)	various	defoliating caterpillars (see label)	See label for rates	Product is sold by many companies, and in many formulations. 4-hr REI. SIGNAL WORD - CAUTION
<i>Beauveria bassiana</i> (BotaniGard)	22WP ES	aphids, mealybugs, thrips, whiteflies	0.5-2.0 lb 0.5-2.0 qt	12-hr REI. SIGNAL WORD - CAUTION
bifenazate (Floramite, Sirocco)	50WP	mites	See label for rates	See label for species controlled. 12-hr REI. SIGNAL WORD - CAUTION. Sirocco is a bifenazate/abamectin combo for ornamentals and greenhouses.
bifenthrin (Talstar, Onyx Pro, Allectus, Aloft)	F	All labeled uses	See label for rates	Onyx Pro is labeled for nurseries. Generic products exist. 12-hr REI. SIGNAL WORD - WARNING.
	0.2G	All labeled uses.	See label for rates	SIGNAL WORD - CAUTION
	various	All labeled uses	See label for rates	Allectus is a bifenthrin/imidacloprid combo for landscape ornamentals. Aloft is a bifenthrin/clothianidin combo for landscape ornamentals.
buprofezin (Talus)	70WSP 40SC 70DF	leafhoppers, mealybugs, planthoppers, scales, whiteflies	See label for rates	Sold in water soluble bags. Consult label for rate. 12-hr REI. Do not mix with oils. SIGNAL WORD - CAUTION

Table 5.5 - Directions for Pesticide Usage				
Chemical	Formulation	Pests Controlled	Amount to Use per 100 gal	Phytotoxicity and Remarks
chlorantraniliprole (Acelepryn)	1.67SC	Leaf-feeding caterpillars, lacebugs, bagworms, birch leaf miner, clearwing borers, Japanese beetles, Viburnum leaf beetle	See label for rates	No signal word required. 4-hr REI. For optimum suppression of Japanese beetle, apply when feeding is first observed and repeat in 10-14 days if required. For dogwood borer, apply to bottom 60cm of tree trunk at first sign of feeding.
clofentezine (Ovation)	5SC	mites	2.0 fl oz	Not for landscape use. 12-hr REI. SIGNAL WORD - CAUTION
clothianidin (Arena, Aloft)	50WDG .25G	See label	See label	Landscape use only. Aloft also contains bifenthrin. Do not apply this product while bees are foraging. Do not apply this product until flowering is complete and all petals have fallen. 12-hr REI. SIGNAL WORD - CAUTION
Cyantraniliprole (Mainspring)	SC	aphids, whiteflies	2.0 - 8.0 fl. oz	4-hr REI. SIGNAL WORD - WARNING
cyclaniliprole (Sarisa)	.42SC	See label for pests	See label for rates	4-hr REI. SIGNAL WORD-CAUTION. Pradia is a cyclaniliprole/flonicamid combination product
cyflumetofen (Sultan)	18.7SC	mites	13.7 fl. oz	12-hr REI. SIGNAL WORD - CAUTION
cyfluthrin (Discus, Decathlon)	20WP F	See label.	1.3-1.9 oz	Discus also contains imidacloprid. 12-hr REI. SIGNAL WORD - WARNING
cypermethrin (Cynoff)	EC, WP	box elder bug, elm leaf beetle	See label for rates	Only in landscapes. 12-hr. - REI. SIGNAL WORD - WARNING (WP) CAUTION (EC).
cyromazine (Citation)	75WP	leaf miners, shoreflies, fungus gnats	2.66 oz	Sold in water-soluble pouches. Not to exceed 6 applications/crop. Shoreflies on greenhouse crops only. 12-hr REI. SIGNAL WORD - CAUTION
diflubenzuron (Dimilin, Adept)	25W	Pine tip moth, gypsy moth	see label	12-hr REI. SIGNAL WORD - CAUTION
dinotefuran (Safari, Transtect, Zylam)	20SG	All labeled uses.	See label for rates.	Apply as foliar spray or drench. 12-hr REI. SIGNAL WORD - CAUTION Make applications post-bloom when bees are not present. Do not apply this product while bees are foraging. Do not apply this product until flowering is complete and all petals have fallen. Zylam and Transtect also labeled for trunk banding or soil injection.
emamectin benzoate (Tree-age, Enfold)	F 5SG	All labeled uses	See label for rates	Applied by injection to base of tree. Effective against fall webworm 12-hr REI. SIGNAL WORD - CAUTION
etoxazole (TetraSan)	5WDG 5WSP	spider mites	See label for rates	Shade and lath house use only. 12-hr REI. SIGNAL WORD - CAUTION
fenazaquin (Magus)	200SC	mites, whiteflies	12.0-24.0 fl oz	Do not exceed 24 oz per acre per year. Do not use on roses. 12-hr REI. SIGNAL WORD - WARNING
fenbutatin oxide (Promite)	50WP	mites	8.0-16.0 oz	Sold in soluble pouches. 48-hr REI. SIGNAL WORD - DANGER
fenoxycarb (Precision)	25WP	All labeled uses.	2.0-8.0 oz	See label for proper rate for target pest. Sold in 1-oz pouches. 12-hr REI. SIGNAL WORD - CAUTION
fenpropathrin (Tame)	2.4EC	All labeled uses.	5.33-16.0 oz	24-hr REI. SIGNAL WORD - DANGER
fenpyroximate (Akari)	5SC	mites, mealybugs	16.0-24.0 fl oz	Good coverage is essential. 12-hr REI. SIGNAL WORD - WARNING

Table 5.5 - Directions for Pesticide Usage				
Chemical	Formulation	Pests Controlled	Amount to Use per 100 gal	Phytotoxicity and Remarks
fipronil (Topchoice)	G	ants, fire ants	—	Broadcast application: 87 lb per acre. 12-hr REI, SIGNAL WORD - CAUTION
flonicamid (Aria)	WSP	All labeled uses	0.7-2.1 oz	Sold in 20.0 g packets 12-hr REI. SIGNAL WORD - CAUTION.
flupyradifurone (Altus)	1.67SC	All labeled uses	See label for rates.	4-hr REI. SIGNAL WORD - CAUTION
fluvalinate (Mavrik)	2F	All labeled uses.	4.0-10.0 fl oz	See label for precautions and rates for root weevils. For outdoor plantings and containerized nursery stock. 12-hr REI. SIGNAL WORD - CAUTION
gamma-cyhalothrin (Proaxis)	(0.5F)	All labeled uses	2.56-5.12 fl oz	SIGNAL WORD - CAUTION
hexythiazox (Hexygon)	50WP	mites	1.0-2.0 oz or 4.0-6.0 oz/A	Use only once/crop cycle. 12-hr REI. SIGNAL WORD - CAUTION.
horticultural oils	various	All labeled uses.	See label for rates.	Numerous companies sell this product. See label for phytotoxicity. 4- to 12-hr REI. SIGNAL WORD - CAUTION
hydramethylnon (Amdro, Max Force)	various	imported fire ant	See label for rates	Apply when ants are foraging. 12-hr REI. SIGNAL WORD - CAUTION
imidacloprid (Marathon, Discus, Allectus, Merit, Zenith)	Various	All labeled uses	See label for rates	Labeled for soil and foliar application. Discus also contains cyfluthrin. Allectus also contains bifenthrin. Generic products exist. Merit and Zenith are labeled for landscape ornamentals. Do not apply this product while bees are foraging. Do not apply this product until flowering is complete and all petals have fallen. 12-hr REI. SIGNAL WORD - CAUTION
indoxacarb (Provaunt, Advion)	30WDG 0.45G	caterpillars, sawfly, leafhoppers, imported fire ant	1.25-5.0 oz	Granular form for imported fire ants. SIGNAL WORD - CAUTION.
insecticidal soap	various	All labeled uses.	See label for rates.	Several companies sell this product. 12-hr REI. SIGNAL WORD - WARNING
iron phosphate	1% bait	snails, slugs	Per 100 gal 2.56 to 10 fl. oz	Rate is 1.0 lb per 1000 sq ft. SIGNAL WORD - CAUTION.
lamba-cyhalothrin (Warrior II)	22.8CS	All labeled uses	Per 100 gal 2.56 to 10 fl. oz Per 3 gal	Labeled for commercial and residential turf and landscape ornamental plants. Generic products are sold by many companies. 24-hr REI. SIGNAL WORD - WARNING
lamba-cyhalothrin (Scimitar)	9.7GC 9.7CS	All labeled uses.	1.5-5.0 fl oz	Scimitar CS is only labeled for commercial landscapes; 24-hr REI. SIGNAL WORD - CAUTION
metaflumizone (Siesta)	G	ants, fire ants	—	Broadcast application: 1.5 lb per acre. 12-hr REI, SIGNAL WORD - CAUTION
metaldehyde (Deadline, Metarex)	Bait	slugs, snails	Ready-to-use.	12-hr REI. SIGNAL WORD - CAUTION
methoprene s-methoprene (Extinguish)	various	imported fire ant	See label for rates	Also sold in combination with hydramethylnon. 4-hr REI. SIGNAL WORD - CAUTION
methoxychlor (Marlate)	50WP	All labeled uses.	2.0-3.0 lb	Do not use on Chinese elm, Japanese and red maple, redbud, privet and viburnum, repeated uses on evergreens. 12-hr REI. SIGNAL WORD - CAUTION
methoxyfenozide (Intrepid)	2F	All labeled uses	4.0 to 16.0 fl. oz/acre	4-hr REI. SIGNAL WORD - CAUTION

Table 5.5 - Directions for Pesticide Usage				
Chemical	Formulation	Pests Controlled	Amount to Use per 100 gal	Phytotoxicity and Remarks
novaluron (Pedestal)	10SC	whiteflies, thrips, leafminers, armyworms	6.0-8.0 oz	Registered for container-grown ornamentals. 12-hr REI. SIGNAL WORD - CAUTION
orthoboric acid (Niban)	5G	snails and slugs	See remarks for rates	4-hr REI. Apply evenly at 6.0 oz per 100 sq ft.
permethrin (Astro, Perm-up)	2E 3.2EC	All labeled uses.	6.4-12.8 oz 4.0-8.0 oz	Permethrin is sold under several trade names. Do not apply to salvia or snapdragon. 12-hr REI. SIGNAL WORD - CAUTION
pymetrozine (Endeavor)	50WG	aphids, whiteflies	2.5-5.0 oz	Sold in WSP. 12-hr REI. Labeled for spray and drench applications. SIGNAL WORD - CAUTION
pyriproxyfen (Distance, Fulcrum)	0.86EC 0.5G	scale crawlers, imported fire ant, whiteflies	See label for rates	See label for sensitive species. 12-hr REI. SIGNAL WORD - CAUTION
pyridaben (Sanmite)	75SP	All labeled uses.	2.0-6.0 oz	Sold in 1.0 oz soluble bags only. 12-hr REI. SIGNAL WORD - WARNING
spinetoram + sulfoxaflor (XXpire)	SG	aphids, lepidopterous larvae, mealybugs, plant bugs, thrips, whiteflies and scales	2.0-3.5 fl oz	See label for rates for target pests. 12-hr REI. SIGNAL WORD - CAUTION
spinosad (Conserve, Entrust)	SC	All labeled uses.	6.0-22.0 fl oz	See label for resistance management strategies. Compatible with IPM programs. 4-hr REI. SIGNAL WORD - CAUTION
spiromesifen (Forbid, Judo, Savate)	4F	spider and eriophyid mites, whiteflies	2.0-4.0 fl oz	Forbid registered for outdoor landscapes only; Judo registered for nursery and greenhouse sites. 12-hr REI. SIGNAL WORD - CAUTION
spirotetramat (Kontos)	240SC	See label.	1.7-3.4 fl oz	24-hr REI. as foliar spray; no REI. for drench. SIGNAL WORD - CAUTION
tebufenozide (Confirm)	2E	See label.	4.0-16.0 fl oz	4-hr REI. SIGNAL WORD - CAUTION
thiamethoxam (Flagship, Meridian)	25WG .22G .33G	All labeled uses.	See label	Granular is labeled for aphids, mealybugs, whiteflies, and beetle larvae (grubs). Meridian is for landscape ornamentals. Refer to label for special application restrictions for protection of pollinators. Do not apply this product while bees are foraging. Do not apply this product until flowering is complete and all petals have fallen. 12-hr REI. SIGNAL WORD - CAUTION
tolfenpyrad (Hachi-Hachi)	15%EC	aphids, leafhoppers, lepidopteran early instars, scale, thrips, whiteflies	See label	See label for phytotoxicity. Rate for cuttings (cut flowers) is lower than other plants. 12-hr REI. SIGNAL WORD - WARNING

Abbreviations

W, WP = wettable, wettable powder; WSP = water-soluble packets; S, SP = sprayable powder; L, LS = liquid, liquid spray; E, EC = emulsifiable, emulsifiable concentrate; SC = spray concentrate; CS = capsule suspension; GS = granule suspension; DC = Dispersible concentrate

Precautions:

Do not apply liquid concentrate when the temperature is above 85°F (29-30°C.) or any spray when the temperature is above 90°F (32°C).

Do not apply oil sprays if the temperature is below 40°F (4-5°C) or is likely to approach or go below freezing within 24 hours.

Never use a sprayer or a tank that has been used previously to apply herbicides.

Use only the recommended dosage rates. The label directions are the final authority. Wettable powders and other suspensions (flowable) require continuous agitation in the tank to avoid settling. Do not allow spray suspensions to remain in the tank without agitation, or any spray mixture to remain in a non-operating sprayer for more than 1 hour.

Clean all spraying equipment thoroughly after each use.

Use spreader-stickers only for hard-to-wet foliage and special uses. Unnecessary wetting agents and spreaders cause excess run-off.

Equivalents:

1 pt liquid in 100 gal = 1 tsp in 1 gal

1 lb powder in 100 gal = 1 tbsp in 1 gal

1 gal = 4 qt = 8 pts = 128 fl oz

1 cup = 1/2 pt = 8 fl oz = 16 tbsp

1 fl oz = 1/8 cup = 2 tbsp = 29.57 milliliter

1 lb = 16 oz = 454 grams

1 tbsp = 1/2 fl oz = 3 tsp = 14.78 milliliter

1 oz = 28.3 grams

Nursery Crops: Weeds

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■ Nonchemical Weed Control

Use a 2- to 4-inch depth of mulch. Avoid overmulching. Suitable mulch materials include pine bark, hardwood bark, pine straw, leaves, or similar organic materials. Rock mulches can also be used in certain landscape situations for weed management and tend to provide greater weed control than an organic mulch. Consider placing a landscape fabric under a rock mulch to act as a soil separator. Do not spread mulch that has an off-odor (rotten egg/sulfur smell or an ammonia odor) or plant injury can occur. Mulches will suppress annual weeds but generally will not control perennial weeds.

Landscape fabrics overcome the porosity problem inherent to solid black plastic. Use a shallow mulch layer (1 inch) above the fabric. A rock mulch/fabric combination would be expected to provide greater weed control than an organic mulch/fabric combination. Fabric/mulch combinations improve weed control over mulch alone. Use a landscape fabric with limited open space. Use landscape fabrics only in woody landscape beds. Fabrics will inhibit emergence of herbaceous perennials and will inhibit rooting in of groundcovers. Certain weeds, such as yellow nutsedge, can penetrate through landscape fabrics. Biobarrier with slow release trifluralin provides greater weed control than do landscape fabrics that do not contain an herbicide.

■ Chemical Weed Control

There is now a selection of herbicides for use in nursery stock. Selection of a given herbicide must be based on the particular weed and crop situation. None of the preemergent herbicides are effective against all weed species. Tank-mixing of herbicides often broadens

the spectrum of weed control. If a chemical application kills all but one species, that species will multiply. This results in a shift in weed population and eventually weed control with that product becomes ineffective. Chemical rotation can reduce the buildup of a tolerant species. Use of directed sprays of a nonselective herbicide (diquat, glufosinate, paraquat, or glyphosate) or cultivation is usually necessary to give control of all species.

One application of a preemergent herbicide will not give adequate weed control for an entire year. Late fall or winter applications of isoxaben, simazine, dichlobenil, or pronamide will provide weed control well into the growing season. When control begins to decrease, the area can be cultivated or a postemergence herbicide could be applied and application of one of the other preemergent herbicides can be made.

Applications should be made to limited areas until experience is gained with a given herbicide. Any application of a new herbicide should include an untreated area to allow observation of weed control and possible injury. Small and shallow-rooted plants are more easily injured than large established plants. Sandy soil and excessive watering also increases chances of injury. Irrigate after a granular herbicide application to wash the granules off the leaf surfaces. Certain granular herbicides can cause spotting of foliage if granules are not washed off leaves.

Tables 4.6, 4.7, 4.8, and 4.9 list which herbicides are registered for use on individual nursery species. Check herbicide labels to determine specific cultivars that can be treated. These registrations are only for liners or rooted cuttings planted into the field or planted in containers which are maintained outdoors. Consult herbicide labels to determine which compounds can be used in propagation, be it seedbeds or vegetative propagation. See the section on weed control in the greenhouse for plants maintained indoors.

It is wise to keep a separate sprayer for herbicides since certain ones are difficult to clean from the spray tank.

Time of Application	Weed Problem	Chemical Rate/Acre	Remarks
Preplant soil fumigation	Most annual and perennial weeds	dazomet (Basamid 218-421 lb/A or 5.0 to 9.6 lb/1000 sq ft)	Incorporate after application. Irrigate or cover with plastic after application. Do not use below soil temperature of 43° F. Waiting period for transplants ranges from 10 to over 25 days.
Postplant but preemergence to weeds	Annual grasses and certain broadleaf weeds	dithiopyr 0.38-0.5 lb (Dimension 2EW 1.5-2.0 pt/A)	Apply to established ornamentals. Combine with a broadleaf herbicide such as isoxaben for improved broadleaf weed control. Do not apply more than 2 pt/A/application or 6 pt/A/year. For small areas apply 0.7 fl oz/1000 sq ft.
		napropamide 4.0-6.0 lb (Devrinol 2-XT 2.0-3.0 gal or Devrinol DF-XT Ornamental 8.0-12.0 lb)	Use on container or field grown nursery stock. Apply to weed-free soil or include an appropriate postemergence herbicide. Safe on a wide variety of plant material. May be used on newly transplanted stock after soil has settled from first watering. Needs incorporation (mechanical or irrigation). For small areas, apply 2.9-4.4 oz Devrinol 50DF/1000 sq ft.

Table 5.5 - Herbicides (continued)			
Time of Application	Weed Problem	Chemical Rate/Acre	Remarks
Postplant but preemergence to weeds (continued)	Annual grasses and certain broadleaf weeds (continued)	oryzalin 2.0-4.0 lb (Surflan 4AS 2.0-4.0 qt, Oryzalin 4AS 2.0-4.0 qt)	Can be applied overtop or as a directed spray on field and container grown ornamentals. Will not control established weeds. Irrigation will improve weed control. For small areas, apply 1.5-2.9 fl oz Surflan 4AS/1000 sq ft. For those desiring a granular formulation of Surflan, XL contains 1% oryzalin and 1% benefin (Balan). The list of registered species and weeds controlled is very similar to that of Surflan. Oryzalin is currently unavailable so consider other options.
		prodiamine 0.65-1.5 lb (Barricade 65WG 1.0-2.3 lb, Barricade 4FL 21.0-48.0 oz)	Apply prior to weed germination. Do not apply more than 2.3 lb Barricade 65WG or 48 fl oz Barricade 4FL/year. For small areas apply 0.4-0.8 oz Barricade 65WG or 0.5-1.1 fl oz Barricade 4FL/1000 sq ft.
		pendimethalin 2.0-4.0 lb (Corral 2.7G 76.0-113.0 lb, Pendulum 2G 100.0-200.0 lb, Pendulum AquaCap 2.1-4.2 qt, Pendulum 3.3EC 2.4-4.8 qt)	Can be applied to container and field grown ornamentals. Do not apply to moist foliage. Will not control established weeds. For small areas apply 1.7-2.6 lbs Corral 2.7G, 2.3-4.6 lbs Pendulum 2G, or 1.6-3.2 fl oz Pendulum AquaCap, Pendulum 3.3EC 1.8-3.6 fl oz/1000 sq ft. DO NOT APPLY PENDULUM 3.3EC OVERTOP ACTIVELY GROWING NURSERY PLANTS.
		trifluralin 0.5-4.0 lb (Treflan 5G 10.0-80.0 lb, Preen Garden Weed Preventer 270 lb)	Will not control established weeds. Use lower rate if incorporated or higher rate and irrigate after application. Apply as a directed spray. Consult label for use on specific soil types. For small areas, apply 0.3-1.8 lb Treflan 5G/1000 sq ft or 6.2 lb Preen Garden Weed Preventer.
	Annual grasses, dodder, and certain other broadleaf weeds	DCPA 10.5-12.0 lb (Dacthal W-75 14.0-16.0 lb/A, Dacthal Flowable 7-8 pt)	Apply after transplanting or to established ornamentals. For small areas, apply 0.3 lb/1000 sq ft.
	Annual grasses and broadleaf weeds	flumioxazin 0.375 lb (BroadStar 150.0 lb/A)	Apply granules to dry foliage prior to weed germination and follow with irrigation or use a leaf blower to remove granules from the nursery foliage. For use in woody ornamental production and in landscape maintenance. For small areas, apply 3.4 lb/1000 sq ft. DO NOT APPLY TO NEWLY PLANTED LINERS.
		flumioxazin 0.25-0.375 lb (SureGuard 8.0-12.0 oz/A)	Preemergence and early postemergence action. Apply as a directed spray to dormant nursery trees or to established woody landscape ornamentals prior to weed germination or to small emerged weed seedlings. Combine with a labeled postemergence herbicide for control of larger annual weeds or perennials. Can be applied overtop dormant conifers. For small areas, apply 0.18-0.275 oz/1000 sq ft.
		indaziflam 0.029-0.058 lb (Specticle FLO 6-12 fl oz, Specticle G 100-200 lb) indaziflam 0.036-0.075 lb (Marengo 7.5-15.5 fl oz, Marengo G 100-200 lb)	Use Marengo in nursery production and Specticle in landscape beds. Apply to established trees and shrubs as a direct spray, ideally when the plants are dormant. Do not exceed 18.5 fl oz/acre/year or 400 lb/acre/year. Long residual herbicide for preemergence control of many annual weeds. Include a postemergence herbicide for control of emerged weeds as indaziflam has limited postemergence activity. Do not apply to herbaceous ornamentals. For small areas, apply Specticle G or Marengo G at 2.3-4.6 lb/1,000 sq ft
		isoxaben 0.5-1.0 lb (Gallery 75DF 0.6-1.3 lb, Gallery SC 16-31 fl oz)	Do not apply to new plantings until soil has settled and no cracks are present. Apply prior to weed germination. Combine with oryzalin for improved control of annual grasses. For small areas, apply 0.25-0.5 oz Gallery 75DF or 0.3-0.7 fl oz Gallery SC/1000 sq ft.
		isoxaben 0.5-0.1.0 lb + prodiamine 0.75-1.5 lb (Gemini 3.7SC 43.5-87 fl oz/A)	Apply to established plants or after the soil has settled with root development for new plantings. Do not apply more than 87 fl oz/A/year. For small areas, apply 1.0-2.0 fl oz/1,000 sq ft.

Table 5.5 - Herbicides (continued)			
Time of Application	Weed Problem	Chemical Rate/Acre	Remarks
Postplant but preemergence to weeds (continued)	Annual grasses and broadleaf weeds (continued)	isoxaben 0.75 lb + dithiopyr 0.375 lb (Fortress 150 lb, Crew 150 lb)	Maximum 2 applications per year. Do not apply to containers less than 4 inches wide. Do not apply to unrooted cuttings. For small areas apply 3.4 lb/1000 sq ft. The focus for Fortress is nursery production while the focus for Crew is landscape maintenance.
		isoxaben 0.25-0.5 lb + proflaminate 0.4-0.8 lb (Gemini Granular 100-200 lb)	Apply to established plants or after the soil has settled with root development for new plantings. Do not apply more than 375 lb/A/year. For small areas apply 37-75 oz/1000 sq ft.
		isoxaben 0.5-1.0 lb + trifluralin 2.0-4.0 lb (Snapshot 2.5TG 100-200 lb)	A prepackaged mix of the active ingredients in Gallery and Treflan. For small areas apply 2.3- 4.6 lb Snapshot 2.5TG/1000 sq ft. Apply prior to weed germination.
		flumioxazin 0.125 lb + proflaminate 0.75 lb (Fuerte 100 lb)	Apply after soil has settled for new plantings. Primarily used in woody ornamentals. For small areas apply 2.29 lb/1000 sq ft. Maximum 2 applications per year. Irrigate after application.
		oxadiazon 2.0-4.0 lb (Ronstar 2G 100.0-200.0 lb, Ronstar 50WP 4.0-8.0 lb)	Use on container or field grown nursery stock. The granular formulation is safe on a wide variety of plant material. Apply prior to weed germination. Disturbing soil after application may result in reduced weed control. Do not apply when foliage is wet. For continued weed control, an additional application to certain ornamentals can be made 60-120 days later. Toxic to fish. Do not contaminate water by washing equipment or disposal of waste. For small areas, apply 2.3-4.5 lb Ronstar 2G/1000 sq ft. Ronstar WP can cause foliar injury to certain species that are not injured by Ronstar G. Check WP label to determine which species can be treated.
		oxyfluorfen 1.0-2.0 lb - conifers (Goal 2XL 4.0-8.0 pt, GoalTender 2.0-4.0 pt) oxyfluorfen 0.5-1.5 lb Shadetrees (Goal 2XL 2.0-6.0 pt, GoalTender 1.0-3.0 pt)	Apply to seedbeds, containers, or transplants of many conifer species and to certain field-grown trees. Apply before bud-break or after new growth has hardened-off. Goal has preemergence and postemergence activity if applied to weeds less than 3-4 inches in height.
		oxyfluorfen 2.0 lb + proflaminate 0.75 lb (Biathlon100.0 lb)	Apply to weed-free soil immediately after transplanting or to established ornamentals grown in containers or in the field. Do not apply to ornamentals when foliage is moist or foliar injury can result. Apply overhead irrigation or use leaf blowers to remove granules from leaf surfaces. For small areas, apply 2.3 lb Biathlon/1000 sq ft.
		oxyfluorfen 2.0 lb + pendimethalin 1.0 lb (Ornamental Herbicide 2 100.0 lb)	Apply to weed-free soil immediately after transplanting or to established ornamentals grown in containers or in the field. Do not apply to ornamentals when foliage is moist or foliar injury can result. Apply overhead irrigation to wash granules off leaf surfaces. For small areas, apply 2.3 lb OH2/1000 sq ft.
		oxyfluorfen 2.0 lb + oryzalin 1.0 lb (Rout Ornamental Herbicide 100 lb)	Apply to a weed-free soil surface when foliage is dry and plants are not making a flush of growth. Use on container and field grown stock. Apply overhead irrigation to wash granules off leaf surface. Do not apply to ornamentals when foliage is moist or foliar injury can result. For small areas, apply 2.3 lb Rout/1000 sq ft.
		simazine 1.0-3.0 lb (Princep Liquid 1.0-3.0 qt, or other labeled formulation)	Apply to weed-free soil in the fall or spring before new weed growth appears. Apply no more than once per year. Apply at least one year after transplanting. For small areas, apply 0.8-2.2 fl oz Princep Liquid/1000 sq ft.
Annual broadleaf weeds and yellow nutsedge		sulfentrazone 0.08-0.25 lb (Dismiss Turf 4-12 fl oz)	Provides preemergence control of certain annual broadleaf weeds plus postemergence yellow nutsedge control. Apply as a directed spray. Add a herbicide such as oryzalin for improved annual grass control and add a postemergence herbicide if weeds are present.
Annual and certain perennial weeds		dichlobenil 4.0-6.0 lb (Barrier, Casoron 100.0-150.0 lb)	Apply in the late fall, winter, or early spring. If dichlobenil remains on the soil surface during warm weather, activity will be lost. Do not apply until 4 weeks after transplanting. NOTE: Use higher rate for control of certain perennials in ornamentals established at least one year. Do not remove old weed growth before making a surface application in the fall for control of perennial weeds. For small areas, apply 2.3-3.4 lb Barrier or Casoron/1000 sq ft.

Table 5.5 - Herbicides (continued)			
Time of Application	Weed Problem	Chemical Rate/Acre	Remarks
Postplant but preemergence to weeds (continued)	Primarily annual grasses and yellow nutsedge	metolachlor 1.2-2.4 lb (Pennant Magnum 1.3-2.6 pt)	Apply to weed-free soil. Direct toward base of ornamentals established for at least 2 weeks. For additional broadleaf weed control, tank-mix with Princep where labeled. For small areas, apply 0.5-0.9 fl oz Pennant Magnum/1,000 sq ft.
	Annual grasses, yellow nutsedge, and certain annual broadleaf weeds	pendimethalin + dimethenamid 1.75-3.5 lb ai (FreeHand 1.75G 100-200 lbs)	Apply to established plantings prior to weed emergence. Delay application for 2-4 weeks after transplanting bare-root liners. Irrigate after transplanting to settle the soil prior to application. For small areas, apply 2.3-4.6 lb/1000 sq ft.
	Annual grasses, yellow nutsedge, and certain annual broadleaf weeds	dimethenamid 0.98-1.5 lb (Tower 6EC 21.0-32.0 fl oz)	Apply to established plantings prior to weed emergence or include a postemergence herbicide to control emerged weeds. Apply as directed spray either prior to bud break or after new growth has hardened. Combine with a preemergence broadleaf herbicide for broader-spectrum control. Use a shielded spray if ornamentals have been in the ground less than one year. For small areas, apply 0.48-0.73 fl oz/1000 sq ft.
	Annual weeds and certain perennial grasses	pronamide 1.0-2.0 lb (Kerb 50W 2.0-4.0 lb, Kerb SC 2.5-5.0 pt)	Fall application when temperatures are below 60° F. High rate has given quackgrass control as well as control of other cool season grasses. Do not use on fine-textured soils of high organic content. Kerb should not be applied to transplants less than 1 year old. For small areas, apply 0.7-1.4 oz Kerb 50W or 0.9-1.8 fl oz Kerb SC/1,000 sq ft. RESTRICTED USE.
Postemergence to weeds	All weeds contact kill	diquat 0.5 lb (Reward 2.0 pt + nonionic surfactant, Diquat SPC 2.0 pt + a nonionic surfactant)	Avoid contact with desired foliage. For spot treatment, mix 3/4 fl oz Reward plus a nonionic surfactant per gallon. Thorough coverage of weed foliage is needed for best results.
		pelargonic acid (Scythe 3-7% V/V)	Rapid acting contact herbicide. Can be used to control weeds prior to crop emergence and can be applied under greenhouse benches. Treat weeds when they are less than 4 inches tall. Avoid contact with desired foliage.
		glufosinate 0.75-1.5 lb (Finale 3-6 qts)	Apply as a directed spray. Do not contact bark or foliage of desired plants. Contact herbicide with some systemic action. For spot application use 2.0-4.0 fl oz/gal on a spray to wet basis, prior to runoff. Ensure complete coverage of weed foliage.
	All weeds controlled	glyphosate 0.75-3.75 lb ae (Roundup Pro 1.0-5.0 qt, Roundup Pro Max 1.0-3.3 qt, or other labeled formulation. For wiper application, use 1 part herbicide to 2 parts water; for cut stump treatments, use a 50% to 100% solution)	Apply as a directed spray in established plantings. Adjust rate of application to weed species according to label instructions. Do not contact bark or foliage of desired plants or serious systemic injury may occur. For small area application with a hand sprayer, use 2.0 fl oz/gal water and lightly wet the foliage. Also cleared for site preparation prior to planting nursery stock. Other glyphosate formulations are available. See label for application rates. Compare products based on the lb/gal glyphosate acid and the presence of a surfactant.
	Annual and perennial grasses including bermudagrass, quackgrass, and johnsongrass	clethodim 0.09-0.25 lb (Envoy Plus 9.0-32.0 fl oz + 0.25% nonionic surfactant)	Apply to actively growing grasses. For spot treatment use a 0.44-0.88 fl oz/gal solution plus 0.25% nonionic surfactant (0.33 fl oz/gal). A repeat application may be required for perennial grass control.
	fenoxaprop-ethyl 0.06-0.17 lb (Acclaim Extra 13.0-39.0 fl oz)	Primarily useful in landscape maintenance. Controls annual grasses and suppresses bermudagrass and johnsongrass. Apply when grasses are small and actively growing. Do not apply under drought stress. For spot treatment, mix 0.3-0.46 fl oz Acclaim Extra/gal.	
Postemergence to selected weeds	Annual and perennial grasses including bermudagrass, quackgrass, and johnsongrass	fluazifop-P-butyl 0.25-0.375 lb (Ornamec 64.0-96.0 fl oz, Fusilade II 16.0-24.0 fl oz, or other labeled formulation + 0.5 pt nonionic surfactant/25.0 gal)	May be applied overtop to ornamentals and as a directed spray to others. Treat bermuda- grass when runners are 4-8" long, quackgrass when 6-10" tall and johnsongrass when 8-10" tall. Treat annual grasses prior to tillering. Apply only to actively growing grasses not under moisture stress. For spot treatment, use 2.5 fl oz Ornamec or 0.75 fl oz Fusilade II plus 0.5 fl oz nonionic surfactant/gal and lightly wet grass.

Time of Application	Weed Problem	Chemical Rate/Acre	Remarks
Postemergence to selected weeds (continued)	Annual and perennial grasses including bermudagrass, quackgrass, and johnsongrass	sethoxydim 0.28-0.46 lb (Segment II 1.5-2.5 pt/A) + 2 pt/A crop oil concentrate or 1.5 pt/A methylated seed oil	Apply otop of ornamentals to actively growing grasses. Use lower rate on annual grasses less than 6 inches tall and higher rate on grasses up to 12 inches in height. Treat perennial grasses with higher rate as follows: bermudagrass, 6 inch runners; johnsongrass, 15-20 inches tall; quackgrass, 6 inches tall; wirestem muhly, 6 inches tall. Repeat applications may be necessary on perennial grasses. Less than optimum results are likely if treatments are applied during moisture stress. For spot treatment, use 1.3 fl oz Segment II + 0.6 fl oz COC or 0.5 fl oz MSO per gal.
	Yellow nutsedge and certain broadleaf weeds	bentazon 0.75-1.0 (Basagran T/O 1.5-2.0 pt + 1 qt crop oil concentrate)	Apply as a directed spray to small, actively growing weeds. A second application 7-10 days later may be needed for acceptable yellow nutsedge control. Minimize contact with foliage of desired trees and shrubs. For small areas, mix 3/4 to 1 1/2 fluid ounces Basagran T/O plus 3/4 fl oz crop oil concentrate/gal.
	Yellow and purple nutsedge	halosulfuron 0.0321-0.062 lb (SedgeHammer 0.66-1.33 oz plus 0.25-0.5% V/V nonionic surfactant)	Apply as a directed spray around woody ornamentals that have been established at least 3 months after transplanting in landscapes. Do not contact leaves of desired woody plants. Do not apply to herbaceous perennials or bedding plants. For small areas, mix 0.9 g SedgeHammer plus 2 tsp (0.33 fl oz) nonionic surfactant/gal and wet entire foliage of sedges.
	Certain broadleaf weeds	clopyralid 0.09-0.5 lb (Lontrel 0.25-1.33 pt)	Provides postemergence control of primarily legume and composite weeds such as clover, vetch, thistles, ragweed, and horseweed. Do not apply to container-grown ornamentals. Avoid drift to sensitive ornamentals such as daisy, redbud, locust, or linden. Apply as a directed spray.
	Poison ivy	glyphosate (Roundup Pro 2.67 fl oz/gal, Roundup Pro Max 2.0 fl oz/gal or other labeled formulation) triclopyr (Bioadvanced Brush Killer Plus 4 fl oz per gallon)	Apply glyphosate as a foliar spray when poison ivy is actively growing. Do not allow herbicide to contact leaves or green bark of desired plants. Use shielded sprays or other techniques. For wiper applications, use a 33% to 70% solution. For cut stump treatments, apply a 50% to 100% solution immediately after cutting stems. Apply triclopyr to the leaves of actively growing poison ivy. Keep the spray off desired broadleaf plants and off warm season turf species.
	Phragmites (common reed)	glyphosate (various)	Apply to foliage during active growth. Repeat applications will be needed for control. Use a formulation registered for aquatic sites if treating near water, such as AquaNeat or Glyphomate 41.

	Acclaim	Barricade	Dacthal	Devrinol	Envoy	Fortress	FreeHand	Gallery	Ornamec	Pendulum G	Pennant	Segment	Ronstar G	Snapshot	Surflan	trifluralin	Tower
Annual And Perennial Flowers																	
Alyssum	-	-	F	-	C,F	-	C,F	-	-	C,F	F	C,F	-	-	-	F	-
Aster	-	C,F	F	C	-	C,F	C,F	-	-	C,F	F	-	-	C,F	-	F	-
Begonia	F	-	-	-	-	-	-	-	-	C,F	-	C,F	-	-	-	-	-
Chrysanthemum	F	-	F	C	C,F	-	-	-	-	C,F	F	C,F	-	C,F	F	F	C,F
Coleus	F	-	F	-	C,F	-	C,F	-	-	-	-	C,F	-	-	-	-	C,F
Daffodil	-	C,F	-	C	-	-	C,F	-	-	C,F	F	-	-	-	F	F	C,F
Dahlia	-	-	F	C	C,F	C,F	-	-	-	C,F	-	-	-	-	-	F	-
Daylily	F	C,F	-	-	C,F	C,F	C,F	C,F	C,F	C,F	F	F	-	C,F	-	-	C,F
Delphinium	-	-	F	-	-	-	-	-	-	-	F	-	-	-	-	-	-
Ferns	-	-	-	-	-	-	-	-	-	C,F	-	-	-	-	-	-	-

Table 5.6 - Guide for Herbicide Selection - Annual and Perennial Flowers, Vines, and Groundcovers¹

	Acclaim	Barricade	Dacthal	Devrinol	Envoy	Fortress	FreeHand	Gallery	Ornaneec	Pendulum G	Pennant	Segment	Ronstar G	Snapshot	Surflan	trifluralin	Tower
Annual And Perennial Flowers (continued)																	
Forget-me-not	F	-	F	-	-	-	-	-	-	-	-	-	-	-	-	F	-
Four-o'clock	-	-	F	-	-	-	-	-	-	-	-	-	-	-	-	F	-
Geranium	F	-	F	C	C,F	-	-	-	-	C,F	F	C,F	-	-	F	-	-
Gladiolus	-	F	F	C	-	-	C,F	-	-	C,F	F	C,F	-	-	F	F	-
Hosta	F	C,F	-	C	C,F	C,F	C,F	C,F	C,F	C,F	C,F	C,F	-	C,F	-	-	C,F
Impatiens	-	-	-	-	-	-	-	-	-	C,F	-	C,F	-	-	F	F	-
Iris	F	C,F	F	-	C,F	C,F	C,F	-	-	C,F	F	C,F	-	C,F	F	F	C,F
Lily	-	C,F	F	-	-	-	-	-	-	C,F	F	-	-	-	-	-	C,F
Marigold	-	-	-	-	C,F	-	C,F	-	C,F	C,F	F	C,F	-	-	F	F	C,F
Nasturtium	-	-	F	-	-	-	-	-	-	-	-	-	-	-	-	F	-
Pansy	-	-	-	-	-	-	-	-	-	C,F	-	C,F	-	-	F	-	-
Peony	F	-	F	-	-	-	C,F	-	-	C,F	-	-	-	-	-	-	-
Periwinkle	F	-	-	-	-	-	C,F	-	-	C,F	-	C,F	-	-	-	-	-
Petunia	F	-	F	C	C,F	-	C,F	-	-	C,F	F	C,F	-	-	-	F	C,F
Phlox	F	-	-	-	C,F	-	C,F	-	-	C,F	F	-	-	-	-	F	-
Salvia	-	-	-	-	C,F	C,F	C,F	-	-	C,F	-	C,F	-	-	-	F	C,F
Shasta daisy	F	-	-	C	-	C,F	C,F	-	C,F	C,F	-	C,F	-	-	-	F	-
Snapdragon	F	-	-	-	C,F	-	-	-	-	C,F	F	C,F	-	-	-	F	-
Sunflower	-	-	F	-	-	-	C,F	-	-	C,F	-	-	-	-	-	F	-
Sweetpea	-	-	F	-	-	-	-	-	-	-	-	-	-	-	-	F	-
Sweet William	F	-	-	-	-	-	C,F	-	C,F	C,F	F	C,F	-	-	-	F	-
Tulip	-	C,F	-	-	-	-	C,F	-	-	C,F	F	-	-	-	F	F	-
Zinnia	F	-	F	C	C,F	-	C,F	-	C,F	C,F	F	C,F	-	-	F	F	C,F
Vines And Groundcovers																	
Ajuga	F	-	-	F	C,F	-	-	-	-	C,F	C,F	-	F	-	-	-	-
Bamboo	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Clematis	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	C,F
English ivy	F	C,F	-	F	C,F	C,F	-	C,F	C,F	C,F	C,F	C,F	F	C,F	F	F	-
Euonymus	-	C,F	F	-	-	-	-	-	C,F	C,F	C,F	-	F	C,F	C,F	-	-
Honeysuckle	-	C,F	F	-	C,F	C,F	-	-	-	-	F	-	F	F	-	-	-
Jasmine	-	C,F	-	-	C,F	C,F	C,F	-	-	C,F	-	-	-	-	-	-	-
Liriope	F	C,F	-	F	C,F	C,F	C,F	C,F	C,F	C,F	C,F	C,F	-	C,F	C,F	F	C,F
Pachysandra	-	-	F	F	C,F	-	C,F	C,F	C,F	C,F	C,F	C,F	F	C,F	-	F	-
Pampasgrass	-	C,F	-	-	-	-	-	C,F	-	C,F	F	-	-	C,F	-	-	-
Santolina	-	C,F	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Sedum	-	C,F	-	F	C,F	-	C,F	-	-	C,F	F	-	F	C,F	-	F	-
Vinca (Periwinkle)	F	C,F	-	F	C,F	C,F	-	-	C,F	C,F	F	C,F	F	F	F	F	-
Yucca	-	C,F	-	-	-	-	-	-	C,F	C,F	C,F	-	-	-	C,F	-	-

¹This table should be used only as a guide. A 'C' indicates the herbicide is registered for use on that species when container-grown. An 'F' indicates the herbicide is registered for use on that species when field-grown or planted in landscapes. Check the herbicide label for special considerations such as variety, plant growth stage, rate adjustment, or application precautions prior to application.

Table 5.9 - Guide to Weeds Which May Be Controlled by Preemergence Herbicides Approved for Use in Ornamentals (continued)

Weed	Barricade	BroadStar, SureGuard	Casoron	Dacthal	Devrinol	Fortress	FreeHand	Pendulum	Pennant	Gallery	Goal	Kerb	Specticle	Dismiss
Broadleaf weeds														
Carpetweed	G	-	G	G	G	-	G	G	F	-	-	-	E	G
Chamberbitter	P	G	-	-	-	-	F	F	P	P-F	-	-	G	-
Chickweed	G	F-G	G	G	G	-	G	G	F	G	F	G	G	-
Cutleaf evening primrose	P	-	G	-	G	-	-	P	P	F	F	-	-	-
Dandelion	-	-	G	N	-	-	-	-	-	-	-	-	-	-
Dock	-	-	G	N	-	-	-	-	-	-	-	-	-	-
Dodder	-	-	G	F	-	-	-	-	-	-	-	-	-	-
Dogfennel	-	-	G	N	-	-	G	-	-	G	-	-	-	-
Eclipta	P	G	-	-	P	-	F-G	P	P	G	F	-	F	-
Filaree	-	-	-	-	F	-	-	-	-	-	-	-	-	-
Galinsoga (quickweed)	-	-	-	P	F	-	F	N	G	G	G	P	-	F
Groundsel, common	-	G	G	-	F	-	F	P	P	F	G	-	G	-
Henbit (deadnettle)	-	-	G	-	G	-	-	-	G	G	G	-	G	-
Horseweed (marestail)	-	-	G	-	N	-	-	-	P	F	G	-	G	-
Knotweed	-	-	-	F	G	-	-	-	-	-	G	-	P	-
Lambsquarters	-	E	G	G	F	-	-	F	P	G	G	F	F-G	G
Long-Stalk Phyllanthus	F	G	-	-	-	-	F	F	P	P-F	-	-	G	-
Morningglory	-	G	G	P	N	-	-	P	N	P	G	-	P	-
Mulberry weed	F-G	G	-	-	-	-	G	F-G	F-G	G	-	-	-	-
Mustard	-	-	-	P	N	-	-	-	-	-	G	-	-	-
Nightshade	-	-	-	P	N	-	-	P	G	-	G	-	-	-
Pigweed	-	G	G	F	F	-	G	F	G	G	G	F	-	G
Poison Ivy	N	-	-	N	N	-	-	N	N	N	N	-	-	-
Prickly lettuce	-	-	-	-	G	-	-	-	-	-	G	-	-	-
Prickly sida	-	E	G	-	P	-	-	-	P	-	-	-	-	-
Purslane	-	-	G	G	G	-	-	F	F	G	G	G	-	G
Pusley, Florida	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Ragweed	P	E	G	N	P	-	-	N	N	G	F	P	F-G	P
Red sorrel	-	-	G	N	-	-	-	-	-	-	-	-	-	-
Shepherds' purse	-	-	-	P	P	-	-	N	-	G	G	-	-	-
Smartweed	-	-	G	N	P	-	-	-	P	G	G	F	-	G
Sowthistle	-	G	-	-	G	-	F	F	-	-	G	-	G	-
Spurge, prostrate (spotted)	G	G	-	F	P	-	G	G	P	F	F	-	F-G	-
Tassel flower	N	G	-	-	-	-	F-G	N	N	F	-	-	-	-
Velvetleaf	-	G	-	N	N	-	-	G	P	F	G	P	-	-
Veronica (speedwell)	-	-	-	G	-	-	-	-	-	-	G	-	-	-
Virginia copperleaf	-	P-F	-	-	-	-	-	-	-	-	-	-	-	-
Wild aster	-	-	-	N	-	-	-	-	-	-	-	-	-	-
Wild carrot	-	-	G	-	-	-	-	-	-	-	-	-	-	-
Yellow woodsorrel (<i>Oxalis</i>) from seed	G	G	G	G	N	-	G	G	P	F	G	-	G	-

Table 5.9 - Guide to Weeds Which May Be Controlled by Preemergence Herbicides Approved for Use in Ornamentals (continued)								
	OH2	Princep	Ronstar	Rout	Snapshot	Surflan	Tower	Treflan
Monocots								
Annual bluegrass	G	G	F	G	G	G	-	-
Barnyardgrass	G	G	G	G	G	G	G	G
Bermudagrass	N	P	N	N	N	N	N	N
Cheat	-	-	-	-	-	-	-	-
Crabgrass	G	F	G	G	G	G	G	G
Doveweed	P-F	-	P-F	P-F	N	N	G	N
Fall panicum	G	F	-	G	G	G	G	G
Foxtails	G	F	G	G	G	G	G	G
Goosegrass	G	G	G	G	G	G	G	G
Johnsongrass (seedling)	G	P	-	G	G	G	P	G
Microstegium	-	-	G	-	-	G	-	-
Orchardgrass, fescue	N	F	N	N	N	N	N	N
Quackgrass	N	F	-	N	N	N	N	N
Small grains (volunteer)	G	-	-	G	-	-	-	-
Stinkgrass	-	-	-	-	-	-	-	-
Yellow Nutsedge	N	N	N	N	N	N	F-G	N
Broadleaf Weeds								
Artemisia (wild chrysanthemum)	-	-	-	-	-	-	-	-
Bittercress	G	-	G	G	G	G	-	F
Canada thistle	N	N	N	N	-	N	-	N
Carpetweed	-	-	-	-	-	-	-	-
Chamberbitter	G	-	G	G	F	G	-	N
Chickweed	F	G	N	F	G	F	-	G
Cutleaf evening primrose	G	F	G	G	G	F	-	-
Dandelion	G	-	-	G	-	-	-	-
Dock	-	-	-	-	-	-	-	-
Dodder	-	-	-	-	-	-	-	-
Dogfennel	-	F	P	G	G	G	-	-
Eclipta	F	-	P	G	F-G	F-G	-	-
Filaree	-	-	-	-	-	-	-	-
Galinsoga (quickweed)	G	G	G	G	G	N	-	N
Groundsel, common	G	G	F	G	F-G	P	-	-
Henbit (deadnettle)	G	G	G	G	G	G	-	-
Horseweed (marestail)	G	-	G	G	G	-	-	-
Knotweed	G	-	-	G	-	-	-	-
Lambsquarters	G	G	G	G	G	G	P	F
Long-Stalk Phyllanthus	G	-	G	G	F	F	-	P
Morningglory	G	F	P	G	-	N	N	N
Mulberry weed	G	-	F-G	G	F-G	G	-	P
Mustard	G	G	-	G	-	-	-	-
Nightshade	G	G	-	G	G	P	-	P
Pigweed	G	G	G	G	-	F	-	F

Table 5.9 - Guide to Weeds Which May Be Controlled by Preemergence Herbicides Approved for Use in Ornamentals (continued)

	OH2	Princep	Ronstar	Rout	Snapshot	Surflan	Tower	Treflan
Broadleaf Weeds								
Poison Ivy	N	N	N	N	N	N	N	N
Prickly lettuce	G	G	-	G	-	-	-	-
Prickly sida	-	G	-	-	-	P	P	P
Purslane	G	G	G	G	G	F	-	F
Pusley, Florida	-	-	-	-	-	-	-	-
Ragweed	-	G	P	G	G	N	P	N
Red sorrel	-	-	-	-	-	-	-	-
Shepherds'purse	G	G	G	G	-	N	-	N
Smartweed	G	G	-	G	-	P	P	P
Sowthistle	G	F	-	G	-	-	-	-
Spurge, prostrate (spotted)	G	G	F	G	G	G	-	-
Tassel flower	G	-	N	G	P-F	P-F	-	N
Velvetleaf	-	P	F	G	G	P	N	P
Veronica (speedwell)	G	-	-	G	-	-	-	-
Virginia copperleaf	P	-	-	P	F	-	-	-
Wild aster	-	-	-	-	-	-	-	-
Wild carrot	-	-	-	-	-	-	-	-
Yellow woodsorrel (Oxalis) from seed	G	-	G	G	G	F	-	-
Wild aster	N	-	N	-	N	-	G	N
Wild carrot	N	-	N	-	N	-	G	N
Yellow woodsorrel (Oxalis) from seed	N	N	N	G	N	-	G	N

G = good control, F = fair, P = poor, N = no control, and - = no information.

Table 5.10 - Guide to Weeds Which May Be Controlled by Postemergence Herbicides Approved by Use in Ornamentals

Weed	Acclaim	Basagran	Envoy	Finale	Lontrel	Ornamec	Reward	Roundup	Segment
Monocots									
Annual bluegrass	N	N	G	G	N	P	G	G	N
Bamboo	-	-	-	P	N	-	-	F	-
Barnyardgrass	-	N	G	G	N	G	G	G	G
Bermudagrass	F	N	G	F	N	G	P	G	G
Cheat	-	N	-	-	N	-	-	G	-
Crabgrass	G	N	G	G	N	G	G	G	G
Doveweed	N	-	N	G	N	N	-	F	N
Fall panicum	-	N	G	G	N	G	G	G	G
Foxtails	G	N	G	G	N	G	G	G	G
Goosegrass	G	N	G	G	N	G	G	G	G
Johnsongrass (seedling)	-	N	G	-	N	G	-	G	G
Microstegium	G	-	G	G	N	G	-	G	G

Table 5.10 - Guide to Weeds Which May Be Controlled by Postemergence Herbicides Approved by Use in Ornamentals

Weed	Acclaim	Basagran	Envoy	Finale	Lontrel	Ornamec	Reward	Roundup	Segment
Monocots									
Orchardgrass, fescue	N	N	F	P	N	F	F	G	F
Quackgrass	P	N	G	P	N	G	-	G	G
Small grains (volunteer)	-	N	-	-	N	G	-	G	G
Stinkgrass	-	N	-	-	N	-	-	G	-
Yellow Nutsedge	N	F	N	F	N	N	F	G	N
Broadleaf Weeds									
Artemisia (wild chrysanthemum)	N	-	N	-	F	N	-	F	N
Bittercress	N	G	N	-	N	N	G	G	N
Canada thistle	N	-	N	-	G	N	F	G	
Carpetweed	N	-	N	-	-	N	G	G	N
Chickweed	N	-	N	G	-	N	G	G	N
Cutleaf evening primrose	N	N	N	G	-	N	-	F	N
Dandelion	N	-	N	G	F	N	-	G	N
Dock	N	-	N	-	-	N	-	G	N
Dodder	N	-	N	-	-	N	-	G	N
Dogfennel	N	N	N	-	-	N	F	G	N
Eclipta	N	G	N	G	E	N	-	G	N
Filaree	N	-	N	-	-	N	-	G	N
Galinsoga (quickweed)	N	-	N	-	-	N	G	G	N
Groundsel, common	N	F	N	G	G	N	G	G	N
Henbit (deadnettle)	N	-	N	G	-	N	G	G	N
Horseweed (maretail)	N	N	N	G	F	N	F	G	N
Knotweed	N	-	N	-	-	N	-	G	N
Lambsquarters	N	F	N	G	P	N	F	G	N
Morningglory	N	P	N	-	N	N	G	F	N
Mustard	N	-	N	G	-	N	G	G	N
Nightshade	N	N	N	-	F	N	G	G	N
Pigweed	N	P	N	G	P	N	G	G	N
Poison Ivy	N	-	N	-	-	N	P	G	N
Prickly lettuce	N	-	N	G	-	N	G	G	N
Prickly sida	N	G	N	-	-	N	F	G	N
Purslane	N	-	N	G	-	N	G	G	N
Pusley, Florida	N	-	N	-	-	N	-	G	N
Ragweed	N	G	N	G	E	N	G	G	N
Red sorrel	N	-	N	G	-	N	F	G	N
Shepherds' purse	N	-	N	G	-	N	G	G	N
Smartweed	N	G	N	G	F	N	F	G	N
Sowthistle	N	-	N	-	F	N	-	G	N
Spurge, prostrate (spotted)	N	N	N	G	-	N	G	G	N
Velvetleaf	N	G	N	G	-	N	-	G	N
Veronica (speedwell)	N	-	N	-	-	N	-	G	N

G = good control, F = fair, P = poor, N = no control, and - = no information.

