

**PEST MANAGEMENT IN MONROVIA'S PROPAGATION
DEPARTMENT**

GARY PHIPPS

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Monrovia Nursery Company has a reputation of consistently producing large quantities of high quality plants. We have no secret cures nor magic potions. We do, however, approach our pest problems in a very logical, practical, and methodical manner.

Some nurserymen in California may think that pest problems cannot be managed because of the nature of their business and with pesticide regulations being what they are in California today. We have learned, however, that with time and patience, a solution can always be found. Consider the following facts about Monrovia Nursery:

- (1) We do not use any restricted pesticides, except for methyl bromide.
- (2) We do not use any pesticide with the word "Danger" on the label, except for methyl bromide.
- (3) We do not use any pesticides that have an established reentry interval other than "stay out of treated areas until the spray has dried."
- (4) We do not use pesticides that produce strong odors in the field.
- (5) We border an elementary school and sixty-five private homes.
- (6) We do not use biological controls because our customers will not accept beneficial insects on their plants and we cannot allow a pest population to exist to support the beneficial organisms.
- (7) We will not accept any plant damage either from plant pests or from pesticides.
- (8) We have 800 employees so hand labor is intensive and ever present (200 employees work in propagation).
- (9) We market a portion of our crop every day and must keep our crop pest-free at all times if possible.
- (10) We market our plants throughout the United States and in several foreign countries.
- (11) Our goal is to produce safely and economically plants that are pest-free and damage-free.

Let us now begin by analyzing our situation, our methods of operation, our kinds of pest problems and our control for these problems.

Monrovia Nursery Company in Azusa, California, consists of

about 400 acres of woody ornamentals ranging from liners to 14 gal. containers. We currently grow about 1000 cultivars that are shipped primarily in the spring of each year.

Our propagation department consists of 25 acres: 8 acres are under shade cloth, 3 acres are in glass houses, 2 acres are in outdoor mist and 12 acres are in full sun. Our propagation department produces 21 million liners each year. Our plants are propagated from seeds, cuttings, tissue culture, air layering, and grafting.

We exercise many sanitation practices to decrease our pest problems. All seed flats are steam pasteurized at 140°F for 30 minutes. All of our soil mixes are fumigated for 24 to 36 hours with methyl bromide to rid the mixes of viable weed seeds and other harmful organisms. The plastic bags we use to store cuttings are either new or washed thoroughly with a chlorine solution. Cuttings are dipped in 15ppm chlorine to clean them and then are dipped in a 200ppm Phosan solution. Grafting knives, clippers, and shears are all dipped frequently in Phosan and/or isopropyl alcohol. Steam is used to clean surfaces in greenhouses. Various copper compounds are used to sanitize benches, floors, etc. Stock plants are inspected regularly for any plant pests and are treated accordingly. The list of preventative practices at Monrovia can go on and on.

When pesticides are applied in our propagation department different methods are utilized depending on the particular pest and chemical involved. Much of the time hand-carried spray guns are used. These usually provide us with the most precise application. Mist blowers are used at Monrovia because they can provide very rapid pesticide applications. Granular pesticides are applied by seeder/spreaders that scatter the particles over the plants. Hand compression sprayers are used to apply post-emergence herbicides to weeds growing on the ground. These provide very low pressures needed to insure there will be no herbicide drift to the ornamentals. Some pesticides are applied as soil drenches by using a series of nozzles joined with plastic pipe. In this way, we can apply products such as Subdue 2E fungicide for the control of water molds.

We have many different pest problems in propagation. These include fungal and bacterial diseases, insects, mites, rodents, and mollusks. Let us now examine some of these in more detail.

One of our never ending foliar diseases is loquat scab on *Eriobotrya japonica* caused by the fungus *Spilocaea pyracanthae*. This disease is typical of many of our foliar diseases in that it probably would not occur if we spaced our plants properly and did not practice overhead irrigation. We make the situation worse by irrigating at night. The disease is favored under these cultural methods and thus becomes a pest problem. We currently use fungicides such as Daconil or Dithane M-45 to combat this pathogen.

The fungal disease I am asked about most frequently by retail nurserymen is a leaf spot on *Raphiolepis indica* caused by *Ento-*

mosporium maculatum. This pathogen causes numerous small round spots on the leaves which will usually result in severe defoliation. This disease appears in our cool, wet winters and we apply alternating foliar sprays of Daconil and Benlate fungicides every 10 to 14 days with excellent control.

Another serious fungal disease we see every year is a leaf spot on *Pittosporum tobira* caused by *Alternaria tenuissima*. This fungus causes small necrotic lesions with yellow holes to develop. Once this disease is established, it is very difficult to control as are many plant diseases. We generally use a broad spectrum fungicide for control such as Benlate or Dithane M-45 as a foliar spray. It is interesting to note that *Alternaria* fungi are found almost everywhere and yet, this is the only plant we grow that is actively infected by the pathogen as the organism is not usually a primary pathogen.

The fungus *Botrytis cinerea* known as common gray mold, is generally considered to be a serious disease problem in propagation areas. We seldom have a serious problem with this pathogen, probably because we have a preventative program in force wherein we apply foliar sprays of Chipco 26019, Dithane M-45, or Benlate in combination with streptomycin in certain areas of our propagation department that would be likely to have assorted disease organisms.

Another fungal disease we see every year is scab on our hardy orange-berried firethorns (*Pyracantha*) caused by *Spilocaea pyracanthae*. Instead of the characteristic blackish decay of berry clusters, we usually see the disease as a black spot or blotch on the underside of the leaves. This disease occurs primarily in our rainy season and can cause defoliation of the host. However, the plants quickly put out a flush of new growth and seem to "outgrow" the disease. We also make foliar applications of Benlate or a fixed copper fungicide. This disease is caused by the same pathogen that causes loquat scab.

Everyone has probably seen powdery mildew at one time or another. We are fortunate at Monrovia in that this fungus is not a serious problem for us. Several different pathogens can cause this disease and are rather host specific. We have had good success using Bayleton fungicide as a foliar spray but because its label is a bit restrictive, we sometimes use Benlate.

Of all the various fungal diseases, probably the most costly are the crown and root-rot pathogens. For the water molds, *Phytophthora* spp. and *Pythium* spp., we have a rather extensive preventative program of applying every 3 months a soil drench of Subdue 2E or a granular application of Subdue 5G to a group of selected host plants. If other pathogens, such as *Fusarium* spp. are suspected, we add Benlate fungicide to the soil drench.

We also have problems with some bacterial diseases such as crown gall caused by *Agrobacterium tumefaciens*. This pathogen

frequently attacks several *Euonymus* cultivars necessitating the disposal of the infected plants. We have tried many different ways to control this pathogen, but we obviously have not found a good practical control to date. No doubt our sanitation practices aid greatly in reducing the spread of this pathogen.

All but one of our deciduous *Magnolia* cultivars are subject to a bacterial leaf spot caused by *Pseudomonas syringae* and *Pseudomonas cichorii*. These diseases manifest themselves as black angular leaf spots which can be very numerous. These diseases have been shown to develop more rapidly in areas of high humidity and can be quite serious to our customers in the eastern parts of the United States. Chemical controls for bacterial diseases have not been very successful, but we continue trying with streptomycin or fixed copper fungicides. It is interesting to note that these bacteria tend to resist crossing major veins in a leaf. Therefore, infected monocots will show striping of the leaves as the bacterial infection follows the longitudinal veins.

We have learned that sometimes *Pseudomonas* bacteria will cause a "shot-hole" effect on some plants such as *Prunus laurocerasus*. In these instances, the plants do not seem to suffer except in appearance. The leaf tissue dies and literally drops out onto the soil surface below. For some unknown reason, the disease symptoms are reduced when the plants are grown under shade cloth.

Our *Hedera helix* cultivars are often attacked by the bacterium, *Xanthomonas hederae*, causing a black spotting of the foliage. Under our growing conditions we have found chemical controls to be inadequate. This disease is favored by our practice of overhead irrigation at night and inadequate plant spacing.

Our plants are also attacked by numerous species of aphids. We have found our aphid species to be easily controlled with foliar sprays of Orthene, Dursban, or Mavrik insecticides.

Mealybugs and scale insects sometimes infest our plants. Our best approach to controlling these pests has probably been to keep our parent stock free of these insect pests. In the cool winter months, we apply a superior oil to our parent stock which will control overwintering mealybugs and scale insects. In the warmer months when these pests are found we make foliar applications of Dursban. In the past, we had good control with Diazinon, but we switched over to Dursban because it would control two additional serious insect pests and did not cause defoliation of *Stephanotis floribunda*.

Of all the lepidopterous pests we have, the beet armyworm, *Spodoptera exigua*, has proven to be the most serious. This pest has an almost limitless host range and has proven to be capable of infesting the entire nursery almost overnight. Damage potential from this pest is very great. We no longer use *Bacillus thuringiensis* to control our lepidopterous pests because we found it would not

control the beet armyworm. We have had great success using foliar sprays of Orthene or Dursban insecticides. Dursban offers the advantage of producing a very quick "knock down" of the pest.

Whiteflies can sometimes be quite numerous on plants such as *Lantana* spp., *Abutilon* spp., and *Philadelphus* spp. I have never seen any damage from whiteflies but our customers will complain if their plants are infested. We are currently using a low rate of Mavrik Aquaflo with outstanding results.

Thrips are an interesting plant pest because the plant damage from their feeding is often evident even though a single thrip cannot be found. Thrips like to feed within the growing bud of a plant, and are seldom exposed. Many times we will see thrips on the flowers of ornamentals but see no sign of any damage. We usually will see thrips damage on plants such as *Acer palmatum* and *Gardenia jasminoides* during the warm summer months. The damage usually appears as a stippling of the foliage or severe distortion of the new growth. We have found the insecticide Dursban to be quite effective in controlling these pests. We currently are adding Pyrenone insecticide at a low rate to serve as an "exciter" to force the thrips out of the buds so that they might become more exposed to the Dursban. This appears to help but our conclusions are not final at this time.

Spider mites cause us many problems all over our nursery. Their host range is very broad and they are seldom seen by our employees. They require very good coverage of the plant by an effective miticide if chemical control is to be successful. We currently use Morestan, Mavrik, or Avid with good results. We use very little Avid since its California label is very restrictive.

Mollusks sometimes damage our plants in propagation and elsewhere. Our primary mollusks are various species of slugs. They are widespread over the nursery, but cause damage to few of our plants. Therefore, we restrict our control efforts to those plants that are likely to sustain damage from the slugs. We have found the molluskicide called Deadline Bullets to be very efficacious against our slugs. This material is applied through a seeder/spreader over the tops of the plants.

Rodents can cause us losses either by eating the seeds we plant or by girdling stems and trunks of our plants. We have tried different kinds of poison baits with varying results. With any bait, good results depend primarily on the bait being accepted by the rodent. We have found the rodenticide called Contrac Paraffinized Cake to be very readily accepted by mice and rats and to be extremely effective.

We at Monrovia know that first and foremost, we must go out and look at, or scout, our plants for pest problems. We scout our fields every thirty days. Our propagation department should be scouted more often. We utilize many preventative programs and

each one of them is based on our findings from field scouting. Currently, we do not rely on pheromone traps or yellow sticky cards for pest detection. We must scout all areas of our nursery for all plant pests continuously since we grow many different kinds of plants and we feel these "state of the art" methods would not serve us well.

Pest management in Monrovia's propagation department is a varied and complex part of our business. Prevention is the real key to our success and is achieved by sanitation, field scouting, and preventative programs.

A COMPARISON OF THE PROPERTIES OF SLOW-RELEASE FERTILIZERS IN CONTAINER PLANT PRODUCTION

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The subject to be presented today has been very effectively summarized in two recent publications: *Wise Fertilizer Selection and Application Enhance Container Success* (1) and the very recent book, *Fertilizer Technology and Use* (2).

Slow-release fertilizers can be placed in two categories: slowly degraded, and coated.

Some fertilizers that degrade slowly release nutrients gradually because the fertilizer formulation has low solubility; IBDU is an example. Others, such as urea-formaldehyde, degrade slowly because they require microbial activity to release the nutrients. Most fertilizers in the slowly degraded group are formulated to last effectively for 8 to 12 weeks and are usually surfaced-applied.

The other group of slow-release fertilizers, coated materials, contains soluble fertilizers encapsulated with either sulfur or resin. Typically, they are formulated to release nutrients for 3 to 12 months and vary in type, quality, longevity, and cost.

Sulfur-coated fertilizers contain soluble components coated with sulfur, a soft wax sealant, and a microbicide. The sealant slows the transfer of water vapor to the soluble components, thus delaying nutrient release. The microbicide slows the rate of sealant