

# Good sanitation practices of citrus nurseries

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The new citrus nursery regulations implemented in 2007 considerably reduce the potential for pest and disease introduction into the nursery. However, the nursery environment that is ideal for growing young citrus trees is also ideal for many diseases, and if introduced, they can flourish. This article describes some basic principles of good nursery sanitation that should be implemented in all nurseries to minimize the risk of pest and disease introduction and spread within the nursery.

Effective nursery sanitation starts by developing a "state of awareness" among all employees that the nursery should be treated as a "clean" environment. Employees should be trained from their first day to recognize common pests and diseases, understand where these problems come from, how they are spread and how employee actions can mitigate or worsen them.

## TOOL AND EQUIPMENT SANITATION

Various tools used in day-to-day nursery operations such as pruners, trash and debris containers, budding knives, etc. should be cleaned and sanitized routinely. Depending on the item, sanitizing may be done when moving from one group of plants to another (within or between benches), when moving from one house to another within the nursery or at the

Table 1. Common disinfectants and some factors to consider when selecting for nursery use

Disinfectant	Factors affecting efficacy	Corrosive to metals	Residual activity
bleach (10%)	<ul style="list-style-type: none"><li>• efficacy reduced by organic matter</li><li>• degrades in sunlight, solutions need to be made fresh daily</li><li>• water pH</li></ul>	yes	low
alcohol (70%)	<ul style="list-style-type: none"><li>• ineffective in the presence of organic matter</li><li>• alcohol will evaporate if not kept in a closed container which will reduce efficacy</li></ul>	no	low
hydrogen peroxide	<ul style="list-style-type: none"><li>• efficacy reduced by organic matter</li><li>• degrades in sunlight</li></ul>	moderate	low
quaternary ammonium	<ul style="list-style-type: none"><li>• hard water (&gt;400 ppm Ca) reduces efficacy</li></ul>	no	good

start of each work day. All equipment should be re-sanitized if it is dropped or is used in a non-clean area.

Equipment and tools can be sanitized with a number of different common disinfectants. A 10 percent sodium hypochlorite (bleach) solution, 70 percent ethanol (alcohol), hydrogen peroxide and quaternary ammonium compounds are all common disinfectants that can be used in a nursery environment for tool and equipment sanitation. However, each of these chemicals has benefits and limitations to their use, and these are summarized in Table 1.

## IRRIGATION EQUIPMENT

Water is a critical component to any nursery operation, but it is also one of the easiest ways to move pathogens

within a nursery environment. Water should be from a well or a municipal source to minimize the risk of introducing pathogens through the water, such as *Phytophthora*. If water from other sources (e.g. retention ponds or rainwater capture) is used, it should be tested at least annually for the presence of harmful plant pathogens.

Nurseries using overhead irrigation generally don't have to be concerned with the sprinkler heads being a source of pathogen inoculum. However, those using drip irrigation or perhaps microsprinklers mounted near the surface of pots should take some precautions. Any irrigation emitter in close proximity to the growing media may become contaminated if the trees it is watering are infected with a pathogen, particularly a soilborne pathogen like *Phytophthora*. Before new plants are placed on a bench, the drip emitters or microsprinklers should be sanitized along with the bench itself as described below.

Overhead irrigation is a very risky practice when considering disease spread and infection in the nursery. The force of the water moves pathogen propagules from plant to plant, but also wets foliage, leading to long leaf wetness periods. The long leaf wetness periods allow for increased infection of foliar diseases such as alternaria brown spot, citrus scab and canker.

Greasy spot and black spot could also potentially be problematic in nurseries with overhead irrigation or without solid roofs. Although there should be no leaf litter on the floor that could supply inoculum for these diseases, their spores, being much smaller than the openings of psyllid screen, can easily enter through screened walls and ventilation openings. Plants

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around the air-intake locations will be most at risk. Symptoms of either disease will be minimal in the nursery, but for black spot, there is concern about moving the disease through asymptomatic nursery stock. If a nursery is located near an area with black spot, it will be important to move to under-tree irrigation. Fortunately, there are no nurseries currently located in the black spot-affected areas.

Irrigation scheduling is an important component of disease control, especially if overhead irrigation is used. It is best to schedule irrigation early in the morning so that the foliage can dry as quickly as possible.

Hose ends and hand-watering nozzles should never be allowed to contact the ground. The ground is not a clean environment and it is easy for watering nozzles and hoses to become contaminated if they are in contact with the ground and quickly spread a pathogen to a large number of plants.

## BENCHES

Bench tops should be considered a clean area. Dirty equipment should be kept off the benches. For example, containers used to dispose of plant trimmings should not be placed on the bench top if they have been in contact with the ground. If moving plants, the plants should never be placed on the ground and then back onto a clean bench.

Citrus is a relatively long-term nursery crop, so opportunities to sanitize benches do not arise frequently. Thus, it is very important to sanitize benches when the opportunity arises. Benches (and irrigation systems if using drippers or microsprinklers) can be sanitized with any of the products listed in Table 1 (page 28), but soil and other organic matter should be removed before sanitizing. Keep in mind that fumes from bleach are toxic to

plants and workers. Bleach should only be used in areas that are completely empty of plants, and the area should be vented for at least 24 hours prior to moving plants back into the area.

## PERSONNEL

The personnel working in a nursery are not themselves sources of pest and pathogen inoculum, but they can unknowingly help move inoculum throughout a nursery. Employees should wash their hands before beginning various nursery tasks and when moving from one location to another within the nursery. Unavoidable foot baths, containing a quaternary ammonium-based or other appropriate disinfectant, between sections of the nursery are also a good idea to limit the spread of pathogens within a nursery.

Each nursery should have a plan in place for when employees can work in certain areas. For example, the budwood house should be the cleanest environment in the nursery to ensure the cleanliness of propagation materials. Work there should be planned so that workers never enter the budwood house after working elsewhere in the nursery on a given day. The seedling house is a similarly clean environment and work there should be carefully scheduled.

Additionally, every effort should be made to avoid working with plants when they are wet. This is generally early in the morning, but if overhead irrigation is used, it may be any time of day. Again, water is a very efficient way to move pathogens from plant to plant and working with the plants when wet will exacerbate this situation. When scheduling irrigation, try to plan around work activities such as staking and tying trees or sprout removal so that those activities can be done while the trees are dry.

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## GENERAL NURSERY CLEANLINESS

In general, the cleaner a nursery is kept, the better off you will be. Weeds should be removed on a regular basis from beneath benches and wherever else they may appear within the nursery. Not only will the weeds disperse seeds that can colonize the tree pots, but they can also serve as refuges, especially for insects. Similarly, any debris from pruning or sprout removal should be removed from the nursery at the end of each day.

Any diseased or otherwise abnormal trees should be removed from the nursery immediately and care should be taken to minimize contact with surrounding healthy trees in the process. It is very important that diseased plants be completely removed from the growing environment. The remaining asymptomatic trees should be treated with an appropriate disease control treatment, such as copper or other approved compound, to prevent further infection and spread.

When it comes to pest and disease control within the nursery, prevention is the best practice. Many pest and disease risks can be greatly minimized, if not eliminated, with good nursery sanitation procedures and under-tree irrigation. It is important that all nursery workers actively participate in maintaining the cleanliness and sanitation of the nursery by following proper procedures for sanitizing tools and equipment, and cleaning up after themselves. In the nursery, an ounce of prevention truly is worth a pound of cure.

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## Coming events

Mid Florida Citrus Foundation Field Day will take place May 10 at Conserv II in Winter Garden.

The Florida State Horticultural Society will conduct its annual meeting, June 5-7, at the Marriott Vinoy Renaissance St. Petersburg Resort and Golf Club. Visit <http://www.fshs.org> for more information.

Florida Citrus Mutual's Florida Citrus Industry Annual Conference will be June 15-17 at Hyatt Regency Coconut Point in Bonita Springs.

The 2011 Citrus Expo takes places Aug. 17-18 at Lee Civic Center in Fort Myers. Visit [www.CitrusExpo.net](http://www.CitrusExpo.net) for more information.