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Sanitation: An Important Tool for Integrated Disease Management

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Most of us in the business of managing plant diseases on ornamental crops grown in greenhouses would agree that an integrated approach is the most effective, consistent, and cost efficient means of managing diseases over the long term. Integrated disease management is merely taking advantage of all available disease control options including cultural practices, chemical fungicides, biological control, and host resistance. Not all control options will be available in all situations. For some plant species, resistance to the more important diseases has not been identified, and biocontrol products just recently have become available commercially but have not been fully tested. One control option that is available to all growers, regardless of the plants species being grown, is the practice of proper sanitation. Unfortunately, sanitation practices often are overlooked or neglected in the daily operation of our greenhouses. The consequences of improper sanitation practices can be disastrous resulting in disease development to epidemic proportions and significant economic losses.

What is Sanitation??

Sanitation is the practice of running a clean operation or, more specifically the practice of preventing disease-causing organisms from becoming introduced in your plant production operation and eradicating them once they have been introduced. This is one of the most important aspects of an effective integrated disease management system because it is much easier and cost effective to prevent or eradicate pathogens before they become established than it is to treat an active infestation or a full-blown epidemic! To initiate and maintain an effective sanitation program, one should understand where pathogens come from. Plant pathogens are micro-organisms of various persuasions (including fungi, bacteria, phytoplasmas, nematodes, viruses, and viroids); therefore, anything capable of moving or carrying microorganisms has the potential of introducing pathogens into your production system including people; animals; plants cuttings, bulbs, corms, rhizomes, seeds, and weeds; field soil, container mix, and potting medium; water; and tools & equipment. The basics of sanitation are to start off with clean (i.e., pathogen-free) tools and equipment, containers, container mix, plant material, and water and then to not introduce pathogens on contaminated hands, feet, soil, container mix, water, tools, or equipment.

Some Sanitation Dos and Don't's

Here are some steps that should be followed in any good sanitation program:

Disinfest all tools, equipment, and work surfaces (like greenhouse benches, tables for grafting or budding, etc.) before working with plants that will be in contact with these surfaces. Heat (usually by steam or solarization) and various liquid disinfestants are available including chlorine products and quaternary ammonia products. See Clemson's *1997 Pest Management Handbook* or talk to your County Extension Agent for further details.

Use only new, uncontaminated pots, flats, or other containers; alternatively, ***be sure*** to wash and disinfest (see disinfestants described above) any containers that are to be re-used. Re-using containers and flats without any type of cleaning or disinfestation is asking for trouble from root rot organisms.

Use only composted or disinfested container mix; never use untreated field soil in any container mix. Field soil is likely to harbor root rot pathogens like *Rhizoctonia*, *Pythium*, *Phytophthora*, *Fusarium*, etc. Field soil or container mix can be disinfested by fumigation or by heat again, see Clemson's *1997 Pest Management Handbook* or talk to your County Extension Agent for further details.

Use pathogen-free plant material to start all new plants. Maintain clean, healthy stock plants from which to take cuttings or buy propagation stock (seeds, cuttings, liners, etc.) from a reputable supplier. Take cuttings from the tops of plants and not from the bottom where soilborne pathogens may have been splashed onto plant surfaces. Seeds and cuttings should be disinfested and can be treated with fungicides before stratifying, planting, or sticking.

Be cautious when using liquid rooting hormones. This is a very efficient method of transmitting pathogens among cuttings if the liquid becomes contaminated.

Never place containers directly on field soil. Root rot organisms can enter containers through drainage holes in the bottom, can be encountered if roots grow out through the holes in the bottom of the containers, or can be splashed into containers by rain or overhead irrigation. Pots should be placed on benches or cement floors in greenhouses and on plastic, gravel, or nursery cloth outside. When containers are on the ground outside, the soil should be prepared as raised beds or berms with sloping sides to carry runoff water away from the containers.

Use pathogen-free water for all watering purposes. Wells and city water supplies usually are pathogen-free. Ponds, lakes, creeks, and streams are potential sources of pathogen propagules particularly spores of the water mold fungi *Phytophthora* and *Pythium*. Re-circulated irrigation water is particularly prone to contamination because you are recycling that which already is present in the greenhouse. Irrigation water can be treated chemically (e.g., with chlorine, bromine, or ozone) or physically (e.g., with irradiation or filtration) to remove pathogens if necessary.

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Keep the nozzle end of hoses off the ground so they don't become inadvertently contaminated. A contaminated nozzle can effectively deliver pathogens to many plants during subsequent watering.

Isolate new plants received at the greenhouse in a separate Aquarantine area until you are sure these plants are not harboring unwanted pathogens.

Do not move people, plants, soil, or equipment from contaminated or infested parts of the greenhouse to clean part of the greenhouse. Always work in clean, uninfested areas before working in areas known to be contaminated or infested with pathogens.

Insist on employees washing their hands before working with plants particularly if they are involved with propagation efforts. This is especially true for smokers!! Tobacco in cigarettes can carry viruses like TMV (tobacco mosaic virus) that then can be transmitted to succulent plant parts by the touch of a hand!

There are many other steps you can take to keep things clean around the greenhouse, and I realize one can't follow all these steps all the time. However, the important thing is to remember to practice good sanitation whenever possible. Maintaining proper sanitation in and around the greenhouse will go a long way in preventing plant diseases from getting established or spreading and is an essential part of any effective integrated disease management program.

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