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Plug & Cuttings: Losing to Root Rot and Crown Rot

Roger C. Styer

In my travels working with greenhouse growers around the country, I see a number of problems, some of which occur more often than you think they should. One of the more common problems I deal with is root and crown rots on plugs, liners and finished crops. Now, I'm no plant pathologist, so I refer any diagnostic tests to the experts, but I can recognize most of the common pathogens that cause these losses. And you should, too! I always encourage my clients to get the books or go online for pictures of these different diseases on various crops, to work with a plant diagnostic lab and to take their own pictures for their reference. But it's one thing to recognize the problem and quite another to know how to correct it and how to prevent it.

The damage done by root and crown rots can show quickly or build up over time. Many times, plugs and liners show no visible symptoms above the soil line, but upon closer inspection, roots don't look healthy. And other times, roots may look fine but decline after transplanting. I always advise my clients to inspect the roots of their plugs and liners before transplanting because they won't get better afterwards. It costs more money to fix finished flats and pots than it does to dump bad plugs and liners.

Some crops seem to always have more problems with root and crown rots, such as vinca, pansy, petunia, geranium, lisianthus, cyclamen and poinsettia. And within these crops, some varieties may show the disease symptoms quicker than others. Adverse weather conditions can promote these diseases. Vinca does not like temperatures below 65F (18C), whereas pansy does not like temperatures greater than 85F (29C). Your growing conditions, whether on the ground, on benches, or outside, can promote disease. Double-poly Quonset houses are the best for promoting root and crown rots, while high-gutter, glass houses with good ventilation are the best for controlling these diseases. In this article, I want to focus not so much on the individual fungal diseases that make up root and crown rots, but on the conditions that encourage their outbreaks and what you can do to control them without dumping all the plants.

Symptoms, diagnosis and susceptible crops

First, I want to emphasize, again, the need for proper diagnosis. There are some good books with lots of pictures of these diseases on different crops, as well as resources online. Work with a good plant disease diagnostic lab, and send in samples when needed for disease confirmation. There's nothing worse than applying the wrong fungicide because you thought it was one disease but it turned out to be a completely

different one and you made the problem worse. (You can contact me if you need more information on disease diagnostic labs.)

Here are my “Magnificent 7” diseases that make up the vast majority of root and crown rots in greenhouse crops and some of the crops most susceptible to them:
• Pythium: cyclamen, geranium, lisianthus, pansy, petunia, poinsettia, snaps, vinca
• Phytophthora: petunia, poinsettia, vinca
• Rhizoctonia: celosia, impatiens, poinsettia, vinca
• Thielaviopsis: pansy, petunia, vinca
• Fusarium: cyclamen, lisianthus
• Sclerotinia: lobelia, petunia
• Botrytis: geranium, lisianthus, poinsettia, vinca

Symptoms can range from damping-off in plug trays, brown to black roots, loss of root tips, wilting, collapse of stems at soil surface, brown to black growing tips, lower or upper yellow leaves, stunting and loss of plants. Some of the above diseases can have very similar symptoms on the same crop, so make sure to get a disease diagnosis from your lab as quickly as possible.

Spores of these pathogens can be spread by wind; water; soil; dirty floors and containers; contaminated seed, plugs or cuttings; and dirty hands, clothes and shoes. Pythium, phytophthora, thielaviopsis, fusarium, and sclerotinia can produce long-lived spores that survive years on or in the soil. Pythium and phytophthora can also produce short-lived spores that can swim in water and are easily distributed through the irrigation system. Botrytis can produce millions of spores that are easily blown around by air. Bottom line: These pathogens can produce spores that are everywhere and can last a long time!

Conditions for promoting disease
Whether you know it or not, you may be promoting root and crown rots in your greenhouse operation. Chemical controls won’t prevent occurrences of these diseases if you aren’t also focusing on the following conditions: reused plug trays; moisture management; water and media quality; growing temperatures; fungus gnats and shoreflies; water source; and chemical choices, rotation and resistance. Let’s examine these conditions to understand how they promote root and crown rots.

Reused trays. First, if you grow your own plugs or stick unrooted cuttings, you probably reuse your plastic trays until they break apart—especially with the cost of plastic these days! But if you don’t disinfect them properly, you’re increasing problems with root and crown rots. I really see this problem with growers who use the hard plastic plug trays because of their robotic transplanters. Ordinarily, you may wash or soak them in a solution of Greenshield or some other disinfectant for 10 minutes or longer and then stack them up until you’re ready to use them. However, research has shown that long-lived spores of thielaviopsis can survive these treatments. I know of some growers who also have had problems with pythium spores surviving their tray dip techniques as well. The more soil that’s stuck to the trays, the less effective the disinfectant will be.

Moisture management is a big issue in promoting healthy roots, which then are more resistant to diseases. Wet growers typically have more problems with root and crown rots because they’re afraid of drying out too far. Ventilated plug trays grown on expanded metal benches dry down much more evenly in the middle of the

tray. If your plug media is too fine, water-holding capacity increases and air porosity decreases. That means it'll take longer to dry out, thereby reducing root growth and promoting more diseases. Growing on the ground will keep containers wetter longer and inhibit air movement around the base of the plants. Regardless of the type of greenhouse you have, you need to focus on humidity control with good air movement (HAF fans), ventilation, and dehumidification cycles first thing in the morning and again before going home for the day.

Water and media quality can also adversely affect root growth and promote diseases. High sodium levels in your water will tie up calcium, which is needed for healthy roots. High soluble salts in the water will cause problems when drying down the media, burning off roots and opening them up to pythium. Some crops grow better when media pH is around 5.5 to 5.7, such as petunia, vinca, snaps and pansy. Other crops grow better when media pH is above 6.0, such as geranium and lisianthus. When you grow crops at the proper media pH, roots grow better. Thielaviopsis seems to be promoted at higher media pH levels, whereas fusarium likes low media pH and high ammoniacal nitrogen (NH_4) fertilizers.

Temp. During winter and early spring, growers typically have problems with providing proper soil temperatures for the best root growth, especially for vinca, celosia and other crops that like it warm. Conversely, during summer and early fall, it's difficult to get pansies to grow well due to high temperatures. Remember, air temperature can be 3 to 5 degrees F higher than soil temperature if you don't have under-bench heating. When you water your crops, measure the temperature of the water. If it's less than 70F (21C), it will take a long time for the soil to warm up to the desired temperature for good root growth. Root and shoot growth are both controlled by average daily temperature (ADT). Growing crops cool to control height can promote more root rots unless you closely monitor moisture management.

Fungus gnats and shoreflies, believe it or not, can spread spores of some of the root rots. Adult fungus gnats have long, thin bodies, with long antennae, and are lazy fliers like mosquitoes. Their larvae feed on decaying organic matter (peat-based mixes included) and roots. Adult shoreflies have short, thick bodies with short antennae and are vigorous fliers like flies. Shorefly larvae feed on algae. Both larvae and adults of fungus gnats and shoreflies can pick up and spread spores.

Water source. Your source of water and how you store it can cause problems with pythium and phytophthora, as these pathogens have very mobile spores that move in the water. I'm seeing more greenhouse operations using pond water or flood floors or benches due to water shortages. When the weather warms up, both of these pathogens increase in numbers in ponds. If your water treatment isn't up to the task, you spread spores all through the greenhouse every time you water. Recirculating systems are especially prone to disease outbreaks. In Europe, growers always have good water disinfection systems set up for recirculating systems, but in the U.S., growers seem to skip that step.

Fungicides. Finally, your choice of fungicide, how you rotate, and whether resistance has developed to your favorite fungicide can greatly determine whether you can control root and crown rots. Your plant disease diagnostic lab should be able to provide the best labeled fungicides for that particular disease. Read the labels carefully! I'm always amazed at how many growers don't really read chemical labels and then get into trouble with the wrong rates, tank mixes, adjuvants or phytotoxicity. For plugs and cuttings, I always recommend using the low end of the labeled rates. Just think of them as babies, and you'll know why you should use the low end. Generally, fungicides labeled for drenches should be used every four weeks. Using

them too closely together may cause problems with salt buildup, root growth and more disease due to stress on the plants. If you use a fungicide as a spray or sprench, you can apply more often. Rotate chemicals with every application. I'm also seeing more problems around the country with Subdue resistance. If Subdue isn't working as well for you as it did before, have your disease clinic test for resistance, and by all means, rotate chemicals for pythium and phytophthora.

Control measures
So, before we get into chemical and biological controls, let's recap what can be done with the above conditions.

❧ Cultural changes need to include proper disinfection of hard plastic plug trays. The best method is steam sterilizing at 160F (71C) for 1 hour as measured inside the stack. If reusing regular plug trays, make sure to wash them first, then use a strong enough disinfectant with a long enough soak time to kill any spores. Keep the disinfectant solution fresh! I recommend using new plug trays for highly susceptible crops, such as pansy and vinca.

❧ Avoid holding plugs and liners too long past normal transplant date, as the roots get old, damaged, and are more susceptible to root rots.

❧ Vinca plugs tend to increase the media pH past the danger point (6.5), causing loss of roots.

❧ Practice proper moisture management for your type of greenhouse, benching, tray or container size, growing media, weather conditions and crop time. Learn to become a drier grower.

❧ Monitor media pH and soluble salts (EC), and keep in the correct ranges for each crop.

❧ Control fungus gnats and shoreflies, both with moisture and algae management and with chemical and biological controls.

❧ Managing the environment is critical to controlling root and crown rots. Keep your growing temperatures where they need to be for the type of crop you're growing. Don't put warm crops into a cool house! If growing a crop cool, keep it on the drier side. Make sure to ventilate houses frequently, and get some air movement whenever possible. Do not water crops late in the day and expect them to be dry going into the night, especially if the days are short, cloudy, and cool. Understand the differences in environment with each type of greenhouse you have, and adjust your cultural practices accordingly.

❧ Monitor your water quality and source of water regularly. Have a lab test your water at least twice a year for pH, EC, alkalinity and nutrients. If you have high alkalinity water, use acid injection to control it. Otherwise, you'll always have problems with high media pH and crops that don't like that condition. If you have high EC or sodium in your water, look into alternative water sources; reverse osmosis (RO), especially for plugs and propagation; or leach with each watering. If using pond water, make sure to have a proper disinfection system in place, monitor it regularly and send out samples to a diagnostic lab periodically to make sure it's clean. If you use a recirculating system, always have a disinfection system working and clean out the holding tanks at least twice a year.

❧ There are a lot of fungicides labeled for the “Magnificent 7” pathogens. Some work better than others; some are cheaper than others. But remember, you need to rotate chemicals regularly. And understand that a fungicide that controls pythium does not necessarily control rhizoctonia or thielaviopsis. So, it may be necessary to tank mix to control the majority of root and crown rot pathogens. There are some good combination products available for greenhouse usage, including Banrot, Hurricane and Pageant. Just understand which chemicals are being combined and which diseases they control best. If you have Subdue resistance, you need to take this fungicide out of your rotation for at least a few months and use other chemicals in a rotation.

❧ There’s a lot of interest in using biological fungicides, particularly with chemical resistance, rotation, organic and sustainability issues, not to mention labor savings from not having to do monthly drenches and keeping containers wetter longer than desired. There are several good biological fungicides on the market, including Rootshield, Companion and Actinovate. Biological fungicides work best when applied early, with low disease pressure and with an understanding of compatibility with chemical fungicides. You’ll also need to concentrate on the various conditions mentioned earlier to make these biological fungicides work the best.

Dr. Roger C. Styer is president, Styer’s Horticultural Consulting, Inc., Batavia, Illinois, and can be reached at Tel: (630) 208-0542 or by e-mail: rcstyer@sbcglobal.net.