

# Healthy roots lead to healthy plants

By Sharon M. Douglas

Plants with healthy roots have fewer disease problems and should bring higher returns.

Ask any grower and he'll tell you it's just common sense that roots are fundamental to plant health. Plant roots serve three key functions:

1. To absorb water and mineral nutrients from the potting medium.
2. To anchor, stabilize, and support the plant in the growing medium and container.
3. To store food (for some plants).

These functions are essential for plant health. Unfortunately, the demands of daily production often get in the way of maintaining conditions that favor healthy roots. Many problems stem from the ever-changing variety of plants that growers handle.

Growers not only need to know insect, mite and disease problems of new crops, but also their production requirements. Plants growing under less-than-optimum conditions have an increased risk of root-health problems.

## Maintaining a healthy root system

Both living (biotic) and non-living (abiotic) factors can negatively impact a healthy root system. In most production settings, plants are commonly affected by both living and non-living problems. Growers are faced with the old chicken-egg scenario — which came first? Did the pH of the growing medium weaken the roots and provide conditions for *Thielaviopsis* root rot or vice versa?

Studies have shown that unfavorable abiotic root environments weaken plants and make them more vulnerable to pathogens. Concerns about root health not only involve traditional diseases, such as root rots caused by *Pythium* and *Rhizoctonia*, but also involve abiotic factors such as fertility, potting methods, growing mixes, tem-

perature and watering. The root health problems that I've observed in the plant disease diagnostic laboratory are frequently associated with cultural and environmental factors.

The best way to understand root health problems is to get to the root of the matter. Knock the plant out of the container and examine the roots and the environment in which they are growing.

## Root-disease pathogens

Although many pathogens are associated with root rots, four pathogens — *Rhizoctonia*, *Thielaviopsis*, *Phytophthora* and *Pythium* — are responsible for most root problems.

Most root-rot pathogens infect a broad range of plant hosts. This is unlike many foliar





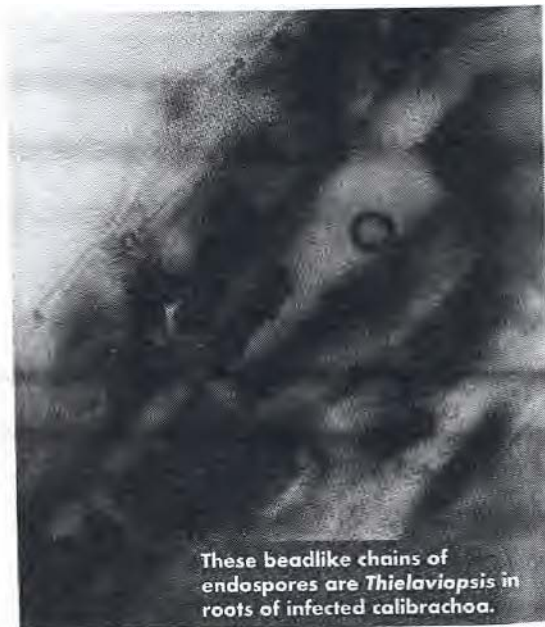
Poinsettias infected with *Pythium* have rat-tail symptoms on root tips.

pathogens, such as rust and powdery mildew fungi, which are relatively host-specific.

By contrast, *Pythium* root rot on petunias can easily spread to geranium or vinca in the same greenhouse. Root diseases frequently occur when roots are weakened by growing in saturated or poorly draining media, growing under suboptimal temperatures, by over- or under-fertilizing or by growing in media with the wrong pH.

### 5 steps for maintaining healthy roots

Any program for maintaining plant health requires planning before, during and after each production cycle. This involves integrating many different practices into daily production



These beadlike chains of endospores are *Thielaviopsis* in roots of infected calibrachoa.

## Are you guilty of any of these practices?

If you say "yes" to even a few of these, you're inviting root health problems that will cost you money.

### Potting

- Fail to break open the rootball of the plug or liner at the time of planting, especially perennials and woody plants.
- Plant at the wrong depth, usually too deep.
- Pack growing medium too tight into the pot, making it difficult for tender roots to penetrate.
- Select the wrong potting mix ("one-mix-will-do" mentality).

### Watering

- Overwater plants by having all crops on the same system or schedule, regardless of individual plant needs.
- Water plants unevenly, too much, too little. Fail to customize watering based on plant requirements.

### Fertilizing

Fail to provide adequate nutrition. One-size-fits-all fertilizing not taking the needs of the plant into account, especially since some newer introductions are very heavy feeders.

- Fail to monitor pH and soluble salts levels.

### Environmental parameters

- Use the same light and temperature parameters for rooting, growing out and holding.





activities to prevent root diseases from developing.

### 1. Start with pathogen-free plants.

Carefully inspect all incoming plant material, paying particular attention to roots. Root pathogens may be introduced on transplants or on equipment.

Pull random plants from trays and inspect roots with a hand lens. Look for discoloration or unusual coloring of the roots. If you see something suspicious, submit a sample to a disease diagnostic laboratory. Accurate diagnosis and correct identification of the pathogen are critical when selecting effective products for control.

Discard plants with advanced root rot. They can't be saved and only serve as a source of pathogens.

Quarantine new plant material, if possible. Try to segregate all new plant shipments from existing plants for the first several weeks. This helps prevent potential movement of pathogens from diseased to healthy plants and also helps to track sources of pathogens to specific shipments.

2. Maintain **plant vigor**. Optimize environmental parameters. Keep plants healthy since they are less prone to disease.

Monitor environmental factors (e.g., light, temperature, air flow) and group plants with similar requirements.

Watch plant nutrition. Closely look at medium pH and soluble salts levels. Meet nutrition requirements for each crop.

Monitor watering practices and water quality. Optimize water requirements for each crop, if possible. Locate plants with similar water requirements in the same house or production area.

If irrigation ponds are used for watering, test the water for the presence of pathogens such as *Phytophthora* and *Pythium*. This can be done with assistance from experts at a plant disease diagnostic laboratory.

Select appropriate growing media for the crops and use pathogen-free potting mixes. Match the characteristics of the growing media to the crops.

Assess physical (aeration, water retention and stability), chemical (pH and buffering capacity) and biological (the presence of beneficial and/or pathogenic organisms) properties of the media.

Select the right growing media to

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# What to look for

**Overall root health:** Roots should be healthy and white, not brown, soft or mushy.

**Rooting quality:** Roots should fill the volume of the container and should not be limited to growing in the top few inches of the medium.

**Potting depth:** Look at the depth of the plant with regard to the root system.

**Compaction and texture of the growing medium:** The medium should be firm enough to support the plant but not compacted into an impenetrable layer.

**Moisture level:** There should be adequate moisture for the plant, but the mix shouldn't be so wet that water can be squeezed out.

After a quick assessment, you might need to conduct additional tests on pH and soluble salts (electrical conductivity values). Review watering schedules and methods and light and temperature parameters, which might be affecting root health.

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create a favorable environment for healthy root growth.

**3. Practice good sanitation.** This factor is often overlooked as a waste of time and money. Control weeds and algae in and around the greenhouses and production areas. This helps to suppress fungus gnat and shore fly populations. Adults may be contaminated with and move spores of *Thielaviopsis* and *Pythium*.

Keep hose nozzles off the floor. Nozzles are easily contaminated when left on the greenhouse floors.

Clean benches and equipment after each crop. Contaminated equipment is a key way to introduce and quickly spread plant pathogens. Disinfect and rinse all containers, trays and tools before reuse. Thoroughly clean irrigation lines.

Store equipment and growing media off the ground or in a place where they can't be contaminated.

When appropriate, use soilless mixes. Soil-based mixes can develop problems with compaction, poor root aeration and water movement, which predispose plants to root rots. Soilless mixes usually have better drainage, resist compaction and are generally less favorable for root-rot pathogens. They are generally free of soil-borne plant pathogens. *Pythium*

and *Thielaviopsis* have been found at low levels in some non-steamed sources of peat moss.

Assume growing mixes containing untreated soil or sand are contaminated with root pathogens. Treat all soil-based mixes or potentially contaminated soilless mixes before use.

**4. Scout.** Monitor crops for diseases on a regular basis. Check for healthy roots by knocking plants out of pots when scouting for foliar diseases. This helps with early detection of problems that might be developing and sets the course for measures to slow down or eliminate the problem.

When disease is detected, destroy infected material. A common mistake among growers is to try to salvage and not destroy infected material. In most cases, this results in throwing good money after bad and sets the stage for widespread disease outbreaks that could have been avoided.

Monitor and suppress insect and mite populations. Good arthropod management helps reduce other sources of stress and to maintain plant health.

**5. Use chemical** and biological controls. Although fungicides are important tools for managing root-rot diseases, they are most effective when used in conjunction with other management practices. In most cases, fungicides don't completely eradicate plant pathogens, especially root-rot pathogens.

Most fungicides act by suppressing pathogen development long enough to create an environment that favors growth of the plant and not the pathogen. Fungicides are usually more effective when applied before or as soon as symptoms are detected. For example, if you have consistent problems with root rots on certain plants, such as *Thielaviopsis* on vinca, consider a routine preventive fungicide program.

If you grow other plants without a history of specific root-rot problems, it probably isn't necessary to routinely use preventive fungicides. No fungicide can effectively control all types of root-rot pathogens.

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