



# Is Root Zone Heating Really Necessary?

*Part One—the Basics*

**What are you actually doing when you heat your root zones? The science behind keeping your roots warm and cozy is explained.**

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The benefits of root zone heating to help extend a plant's growing season or increase plant yield have been recognized and employed by gardeners for centuries. Growers have devised hundreds of methods to keep plant roots warm and looked for ways to heat the ambient air for plant foliage as well. The reasons for keeping roots and foliage warm might seem obvious, but the physiological processes occurring in the root zone are quite complex and affect the growth and development of your plants profoundly—in fact, what happens under the surface is far more important than what happens above.

With proper root zone management you can grow tropical plants in 45°F ambient air as long as the root zone is in the 70s. Sound farfetched? It's not. The biochemical processes that sustain a healthy plant are based on the root zone environment—the

foliage propels the photosynthetic process and as long as the leaf tissue does not freeze (it should not fall below 40°F for sustained periods) and the root zone stays in the 65° to 80°F range, you can grow plants in an ambient temperature of 45°F. Many growers start seeds or small plants in cold frames, heating the soil but keeping the air at cooler-than-normal temperatures. Their efforts extend their plants' growing seasons and—in some cases—their yields as well, while conserving the energy normally wasted on heating the ambient air.

How does root heating benefit plants? First, you have to look at the soil as a living entity, not just a substrate whose purpose is to support and stabilize plants and act as a reservoir for water and nutrients—the traditional soil science viewpoint. All living things have a temperature 'comfort zone' that they are most comfortable within. Living things that exist in environments that fluctuate from cold to hot or dry to soaked, however, are constantly under stress. Under ideal conditions, though, if the root zone is properly maintained in a consistent environment—where temperature, water and aeration remain within optimal levels—the plant will be stress-free. Typical root environments fluctuate constantly. They go from being flooded after watering to dry between waterings and from cold at night to warm in the day—the living soil is constantly trying to adapt to this ever-changing environment and so the plant roots do not function as efficiently as they could. If root zone environments are maintained consistently in the comfort zone, however, plants actually become more photosynthetically efficient—using all the energy they produce to focus on efficient growth and reproduction. As the plants use energy more efficiently, they begin to process nutrients better and they use light and water more efficiently as well, with less 'stretching.' In short, the plants can now utilize resources at the level of their needs, not in excess to overcompensate for stress.

Temperature has an enormous impact on these processes. There are a few basic concepts that need to be considered when trying to understand the dynamics of root zone management of temperature. Soil science breaks up into three main areas: biological, physical and chemical. The biological aspect of soil science is concerned with the living constituents of the

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soil—microbes, organic materials, soil fauna and flora, bacteria and so on. The physical aspect of soil deals with the solids, liquids and gases found within it and the chemical aspect refers to things like pH levels, nutrients and fertilizers.

All three areas are directly affected by temperature in differing ways. The key is to optimize the root zone conditions to conform to your plants’ comfort zone and then consistently deliver the appropriate temperature to the root area.

The biological area—that is, the living components found within the soil—has been shown to have the most impact on the health and productivity of plants. For years, soil sterility was thought to be the key to successful growing and gardeners fed their plants with soluble synthetically produced nutrients delivered to the root zone in a sterile medium. The realization that plants grow dynamically in living soil and are actually more productive and healthier has only come to light in the last 20 years. Today’s mantra? Feed the soil and feed the plant!

Temperature impacts soil biology by promoting the growth of beneficial soil microbes, bacteria and fauna—biological elements that interact with the roots by allowing the uptake of nutrients and water by root cells—and by promoting the reproduction of root cells. Maintaining consistent temperature levels in the root zone keeps both the biological elements and the roots in a stress-free condition and allows them to both focus on what we as growers need them to do—facilitate plant growth and reproduction.

When it comes to the physical area as it pertains to maintaining ideal temperatures in the root zone the thing to remember is that soils do not conduct or retain heat very well—mostly due to air and water concentrations in the soil—but delivering water to the roots at a managed temperature in the form of vapor can help maintain the heat in your soil without drying



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it out. Water and air conduct heat in the soil and need to be balanced so as not to occupy too much or too little pore space. Water vapor is readily absorbed by plant roots and is a delivery mechanism that provides just what the plant needs, while top watering or liquid film watering requires the flooding of pore spaces to deliver water to the roots, which causes anaerobic conditions harmful to soil biologicals.

Variations in temperature as they affect the biological and physical aspects of your soil will also impact the chemical aspect through pH (soil acidity), which directly affects nutrient availability. Plants uptake nutrients all the time, but only certain nutrients are available to be absorbed at certain pH levels—the optimal soil pH level is on average six to 6.5. Soils that are too acidic don't release nitrogen, more basic soils don't release micronutrients and so on. Temperature impacts the health of the biologicals, which impacts cellular absorption, organic decomposition, water chemistry and the aerobic/anaerobic process, all of which result in modifications to the soil pH.

Soil science is not magic and finding the right soil to grow plants in is not really that difficult. Using a soil that is nicely balanced in its physical aspect—with enough pores and spaces to hold water and air in sufficient quantities—and biologically active (like compost-based soils) is the right way to start and these products are abundantly available on the market today.

Root zone management is a bit more complex to understand, but can be accomplished with simple tools, creating the right balance of the three soil areas to result in a consistent root environment. Temperature management and water delivery methods are key aspects to managing these three areas and there are products and technologies available to you that will work well in any soil-based growing system. Finding the right balance and managing the root zone environment will result in optimizing your plants' living conditions and will make them healthier and more productive, giving you what you want most out of your garden—less work, less worry and better results. **MY**