A Focus on Root-zone Temperature

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Successfully rooting tropical foliage plants and succulents.

Are foliage plant and succulent sales still booming as they were during and immediately after the pandemic? Depending on who you ask, the answers could be wildly different.

According to the latest USDA floriculture crops summary, the answer is definitely an astounding YES! From 2019 to 2022, the wholesale value of foliage plants and succulents sold for indoor or patio use increased by 34% from $616 to $826 million. However, for growers to continue to be profitable with these lucrative crops, we need to determine how to efficiently root them, especially in temperate parts of the country.

Our goal is to determine if environmental parameters, such as the daily light integral (DLI) and root-zone temperature during rooting of vegetative foliage and succulent cuttings, can be optimized to reduce rooting time and energy costs, and improve the quality of liners.

In our first article in the June issue of *GrowerTalks*, we reported that higher DLIs during rooting increased vegetative shoot growth, but had minimal impacts on rooting time. Thus, the use of supplemental lighting would not reduce rooting time by much. In this second article, we're sharing the results of our study that looked at the influence of root-zone temperature on rooting of foliage and succulent cuttings.

The experiment

Vegetative shoot-tip cuttings of *Pilea cadierei* Ellen (silver plated pilea), *Pilea depressa* Sao Paulo (baby toes), *Peperomia verticillata* Red Log (red log plant), *Peperomia prostrata* String of Turtles (string-of-turtles), *Fittonia albivenis* Mont Blanc (nerve plant), *Muehlenbeckia complexa* (maidenhair vine), and *Chlorophytum comosum* (spider plant) were excised from our in-house stock plants. The cuttings were stuck into 128-cell trays containing a propagation medium consisting of a mixture of 50% of a commercial substrate and 50% medium perlite, and without the use of a rooting hormone. The trays were divided into quarters (32-cell) and four trays of each cultivar were placed on a propagation bench with a root-zone temperature setpoint of 75F (24C) for a week to induce callus. The air temperature setpoint and target DLI in the glass-glazed greenhouse were 70F (21C) and 5 mol·m^{-2}·d^{-1} during callusing, respectively. A vapor-pressure deficit (VPD) of 0.3 kPa was maintained through steam injection.

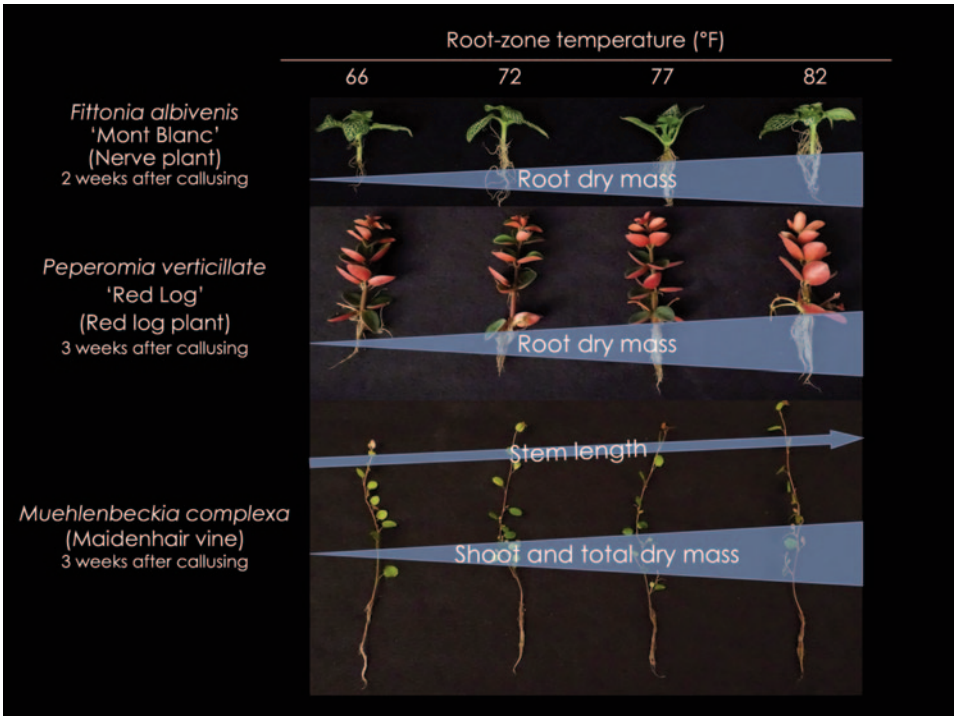
After callusing, one tray of each cultivar was randomly assigned to one of four benches with root-zone temperature setpoints of 66, 72, 77 or 82F (19, 22, 25 or 28C) for two, three or four weeks. The air temperature, DLI, daylength and VPD were maintained at 70F (21C), 10 to 12 mol·m^{-2}·d^{-1} for 18 hours (6:00 to 12:00 a.m.) and 0.4 kPa, respectively. Nerve plant, silver plated pilea and baby toes were harvested after two weeks under root-zone temperature treatments, while maidenhair vine and red log plant were harvested after three weeks, and spider plant and string-of-turtles were harvested after four weeks.

Our findings

The root dry mass or the measure of the quantity of roots and pullabilty of the liners was affected differently for each crop we investigated by the root-zone temperature provided during rooting. For instance, the root dry mass, but not the shoot dry mass (or the measure of the size of foliage) of nerve and red log plant rooted cuttings significantly increased as the root-zone temperature increased from 66F (19C) to 82F (28C) (Figure 1).

For silver plated pilea and string-of-turtles, the root and shoot dry mass was highest at a root-zone temperature of 72

Figure 1. Cuttings of nerve plant, red log plant and maidenhair vine grown on benches with root-zone temperature set points of 66, 72, 77 or 82F (19, 22, 25 or 28C) for two or three weeks.



to 77F (22 to 25C, Figure 2). In contrast, the root and shoot dry mass of spider plant significantly decreased with increasing root-zone temperature from 66F (19C) to 82F (28C, Figure 3). Surprisingly, root-zone temperature didn't affect the root dry mass of maidenhair vine or the root and shoot dry mass of baby toes. However, stem length and shoot dry mass increased for maidenhair vine with increasing root-zone temperature.

To summarize, we found that rooting and shoot growth were affected differently by the root-zone temperature for each genus. However, root dry mass was positively influenced by root-zone temperature for five out of the seven houseplants that we investigated in this study.

Another positive finding was that stem length or internode elongation wasn't influenced by increasing root-zone temperature, except for maidenhair vine. Therefore, we recommend utilizing in-ground or bench-top root-zone heating to maintain a root-zone temperature of 72 to 77F (22 to 25C) because those temperatures will be beneficial and not detrimental for a wide range of foliage and succulent crops.

Additionally, our study suggests that root-zone temperature has a greater impact than DLI on the root growth and development of foliage and succulent crops propagated by cuttings. While this is a different response than what's typically observed with vegetative cutting propagation of annual and perennial bedding plants, it shows that not all plants should be rooted under the same environmental conditions.

Acknowledgements: We thank J.R. Peters for fertilizer; Dümmen Orange, Henry Mast and Kalamazoo Specialty Plants for plant material; East Jordan Plastics for trays; and The American Floral Endowment, MSU Project GREEEN, the Western Michigan Greenhouse Association and the Metro Detroit Flower Growers Association for funding.

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Figure 2. Cuttings of silver plated pilea and string-of-turtles grown on benches with root-zone temperature set points of 66, 72, 77 or 82F (19, 22, 25 or 28C) for two or four weeks.

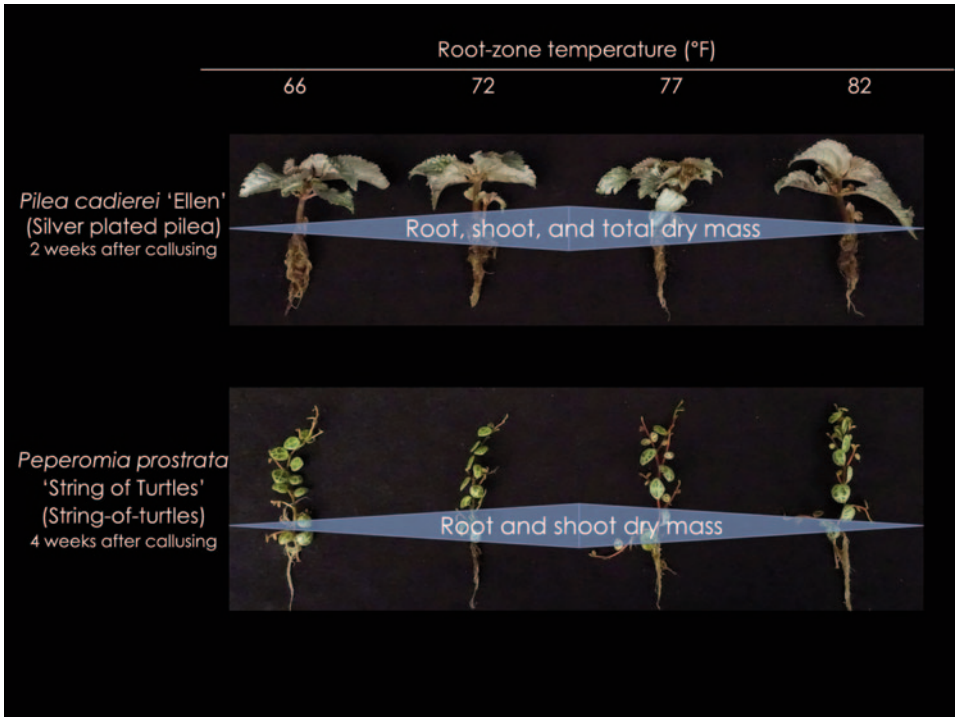

Figure 3. Cuttings of spider plant and baby toes grown on benches with root-zone temperature set points of 66, 72, 77 or 82F (19, 22, 25 or 28C) for two or three weeks.