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Pine Tree Substrate, Nitrogen Rate, Particle Size, and Peat Amendment Affects Poinsettia Growth and Substrate Physical Properties

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BACKGROUND

It is recognized that alternatives to peat must be developed to meet environmental concerns pertaining to mining of peat bogs. Also, peat supplies can also be limited by wet weather conditions that restrict harvest during certain times of the year. These concerns, coupled with increasing fuel (transportation) costs, have led to increased costs of peat substrates. Therefore, there is an increased interest in less expensive and readily available substitutes.

Our research has shown that a pine tree substrate (PTS) manufactured by grinding loblolly pine trees with a hammer mill makes an excellent greenhouse container substrate. The trees can be ground to the correct particle size to give ideal water and air holding capacity for a wide range of greenhouse crops and container sizes. The material can be used fresh, i.e., without composting. The objectives of this research were to determine the effect of: (1) fertilizer rate, (2) substrate particle size, and (3) peat amendment on growth and floral quality, and on post-production time-to-wilting of potted poinsettias.

MATERIALS AND METHODS

'Prestige' poinsettias were grown at different fertilizer rates in three PTSs made from loblolly pine trees (*Pinus taeda* L.) and compared to a peat-based control. Pine tree substrates were produced from pine trees that were chipped, and hammer-milled to a desired particle size. Substrates used in this study included peat-lite (PL), PTS produced with a 2.38-mm screen (PTS1), PTS produced with a 4.76-mm screen (PTS2), and PTS produced with a 4.76-mm screen and amended with 25% peatmoss (v/v) (PTS3). Initial and final substrate physical properties and substrate shrinkage were determined to evaluate changes over the production period. Poinsettias were grown in 1.7-L containers in the fall of 2007 and fertilized at each irrigation with 100, 200, 300, or 400 $mg \cdot L^{-1}$ N.

RESULTS

At the 100 $mg \cdot L^{-1}$ N rate, shoot dry weight (Table 1) was higher in plants grown in PL than in the other substrates; shoot dry weight of plants grown in PTS1 and PTS3 were not different; and dry weight of plants grown in PTS2 was lowest. At the 200 $mg \cdot L^{-1}$ N rate, shoot dry weight was equal for PL, PTS1, and PTS3, with PTS2 being lowest. The 25% peat in PTS3 is most likely responsible for the improved shoot dry weight at the 100 and 200 $mg \cdot L^{-1}$ N fertilizer rates when compared to PTS2. This is due to the improved physical and chemical properties of the coarser

PTS. Shoot dry weight at the 300 mg·L^{-1} N rate was equal in all substrates. We have previously shown that an additional 100 mg·L^{-1} N is required for chrysanthemums that are grown in PTS2 to produce growth that is comparable to plants grown in a peat substrate. The 300 mg·L^{-1} N rate required for plants grown in PTS is within the recommended fertilizer range (200-300 mg·L^{-1} N) suggested for poinsettia production.

Bract length was generally the same or longer in all PTS-grown plants compared to plants grown in PL at each fertilizer rate. Post-production time-to-wilting was the same for poinsettias grown in PL, PTS1, and PTS3. Initial and final air space was higher in all PTSs compared to PL, and container capacity (CC) of PTS1 was equal to PL initially and at the end of the experiment. The initial and final CC of PTS2 was lower than PL. The incorporation of 25% peat (PTS3) increased shoot dry weight and bract length at lower fertilizer rates compared to 4.76-mm PTS alone (PTS2). Substrate shrinkage was not different between PL and PTS1, but greater than shrinkage with the coarser PTS2.

CONCLUSIONS

This study demonstrates that poinsettias can be successfully grown in a PTS with small particles (2.38-mm screen) or a PTS with large particles (4.76-mm screen) when amended with 25% peat moss which results in physical properties (CC and AS) similar to those of PL. Extra fertilizer for PTS compared to a PL substrate may be required.

IMPACT TO THE INDUSTRY

A PTS made from freshly ground pine trees can be produced near greenhouse operations from locally available trees with the result that fuel costs for shipping raw materials like peat from Canada and the costs of shipping the mix to growers will be dramatically reduced. Likewise, the harvest of pine trees is less weather dependent than peat harvest, and pine trees are a renewable resource and pose fewer environmental concerns associated with harvest. This is a unique approach to container substrate production in that the material is milled and prepared for use as a container substrate rather than mining peat (a non-renewable) or using a by-product of another industry. Wood chips—a common product of the forestry industry and used for a wide variety of purposes such as paper production, building products or fuel—can be further ground to produce a PTS designed for a wide variety of plant species and container sizes. The cost of freshly ground pine chips is about \$7 per yd^3. Therefore, production costs for a PTS, given further grinding plus additives should be under \$15 per yd^3, in contrast to \$40 or more per yd^3 for peat-based substrates.

Table 1. Effect of nitrogen rate and substrate on dry weight of poinsettia.

Nit. Rate (ppm)	PL	PTS1	PTS2	PTS3
100	20.6	15.9	11.0	14.1
200	35.8	36.6	27.9	32.2
300	48.2	49.0	43.3	47.7
400	37.3	42.1	41.0	49.1

For additional information contact Robert D. Wright at wrightr@vt.edu or for a full review of this work see HortScience 43:2155-2166.