Does Container Drainage Hole Size Affect Your Water Quality?

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One component of production influencing water quality at container nurseries is the amount of container leachate from the container substrate. The potential exists for reduced water use and less leachate volume by altering the container design. This project compares container leachate volume from a standard, 11.3 liter (# 3), container with seven 1.9-cm (¾-inch) diameter drainage holes to containers with one, three, five, or seven holes with diameters of 1.9, 0.9 and 0.5 cm (¾,⅜,and 3/16 inch). Leachate volume was about 41% less (312 ml to 182 ml) when the diameter of the drainage hole was reduced from 1.9 cm to 0.5 cm (¾, to 3/16 inch). Nitrate-nitrogen was about 70% less (6.4 ppm compared to 1.9 ppm) when container drainage holes were reduced from 1.9 cm to 0.5 cm (¾ to 3/16 inch). Plant growth of *Lagerstroemia fauriei* × *L. indica* 'Hopi', *Forsythia* ×*intermedia* 'Lynwood', and *Rhododendron* 'The Honorable Jean Marie de Montague' was similar in all container modifications.

INTRODUCTION

Water quality concerns are paramount in the nursery industry. Handling irrigation effluent on the nursery and measures to prevent effluent from leaving the nursery has become one of the top issues facing the industry as a whole. Researchers and producers are investigating the benefit of changing irrigation methods, modifying container media, and altering fertilizer recommendations to improve water quality at container nurseries. This project was to determine if modifying the container drainage hole size could impact the quality of the container leachate.

MATERIALS AND METHODS

Blow-molded plastic containers, 11.3 liter (#3), were obtained from Lerio Corp., Mobile, Alabama prior to the company drilling the drainage holes. We used drill bits with diameters of 1.9 cm (¾ inch), 0.9 cm (⅜ inch), and 0.5 cm (3/16 inch) to bore drainage holes in the containers. The number of drainage holes per container was 1, 3, 5, or 7 with each respective hole diameter. A standard 11.3 liter (#3) container has seven drainage holes with 1.9 cm (3/4 inch) diameters (six along the side edge and one in the center bottom).

Uniform liners of *Lagerstroemia indica* × *L. fauriei* 'Hopi' (3½-inch pot), *Forsythia* ×*intermedia* 'Lynwood' 9-cm (3-inch) pot, and *Rhododendron* 'The Honorable Jean Marie de Montague' 10.2-cm (4-inch) pot were potted in a pine bark and sand (12 : 1, v/v) substrate. Substrate was amended with 7.1 kg m^{-3} (12 lb yd^{-3}) of 18N-2.6P-10K controlled-release fertilizer (Osmocote 18N-6P-12K, Grace-Sierra, Milpitas, Calif.), 2.4 kg m^{-3} (5.0 lb yd^{-3}) dolomitic lime, and 0.9 kg m^{-3} (1.5 lb yd^{-3}) Micromax. Plants were grown in full sun and irrigated as needed with overhead irrigation. Each irrigation event applied about 1.3 cm (½ inch) of water.

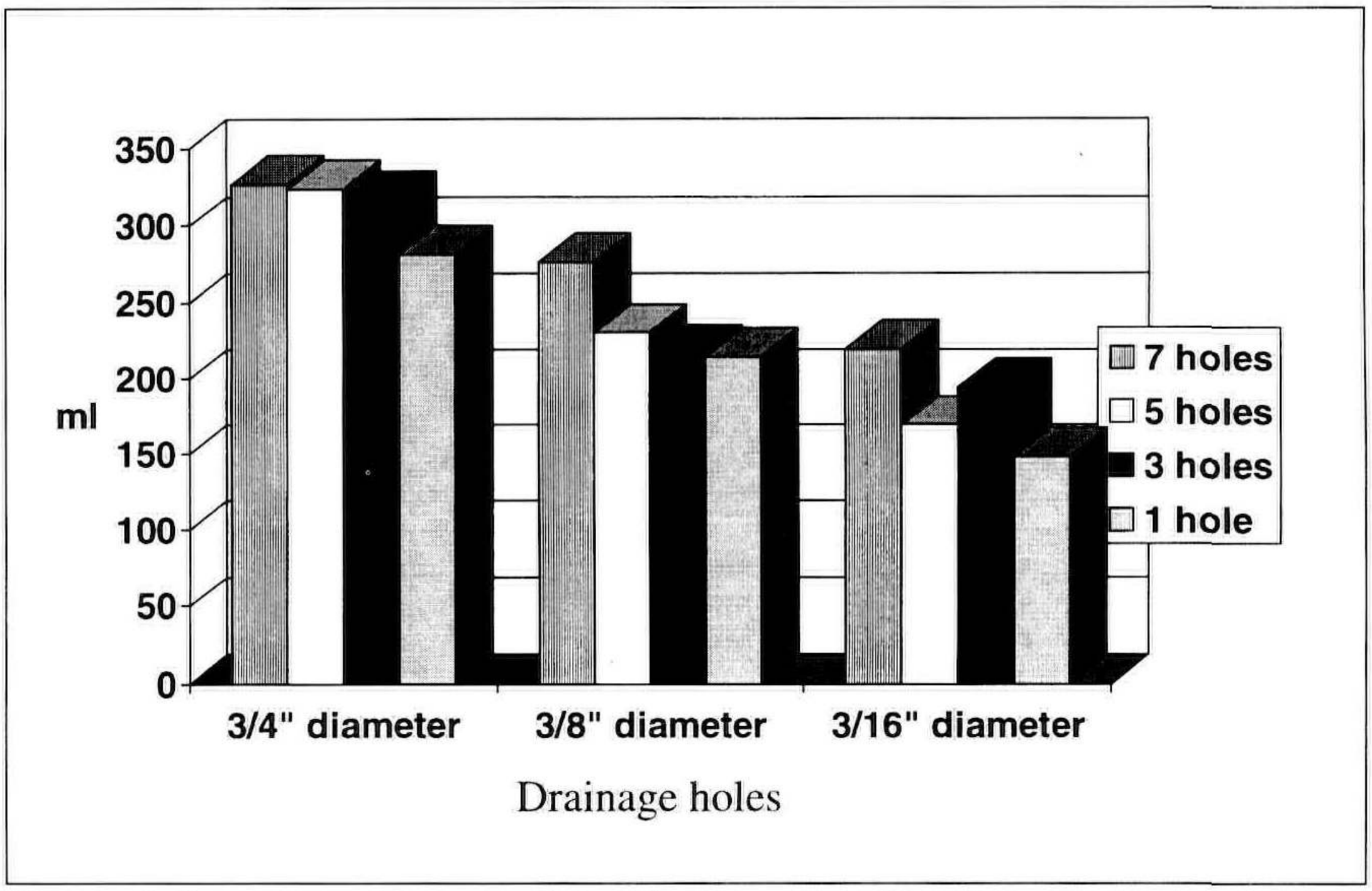

Figure 1. Average container leachate volume per sampling dates.

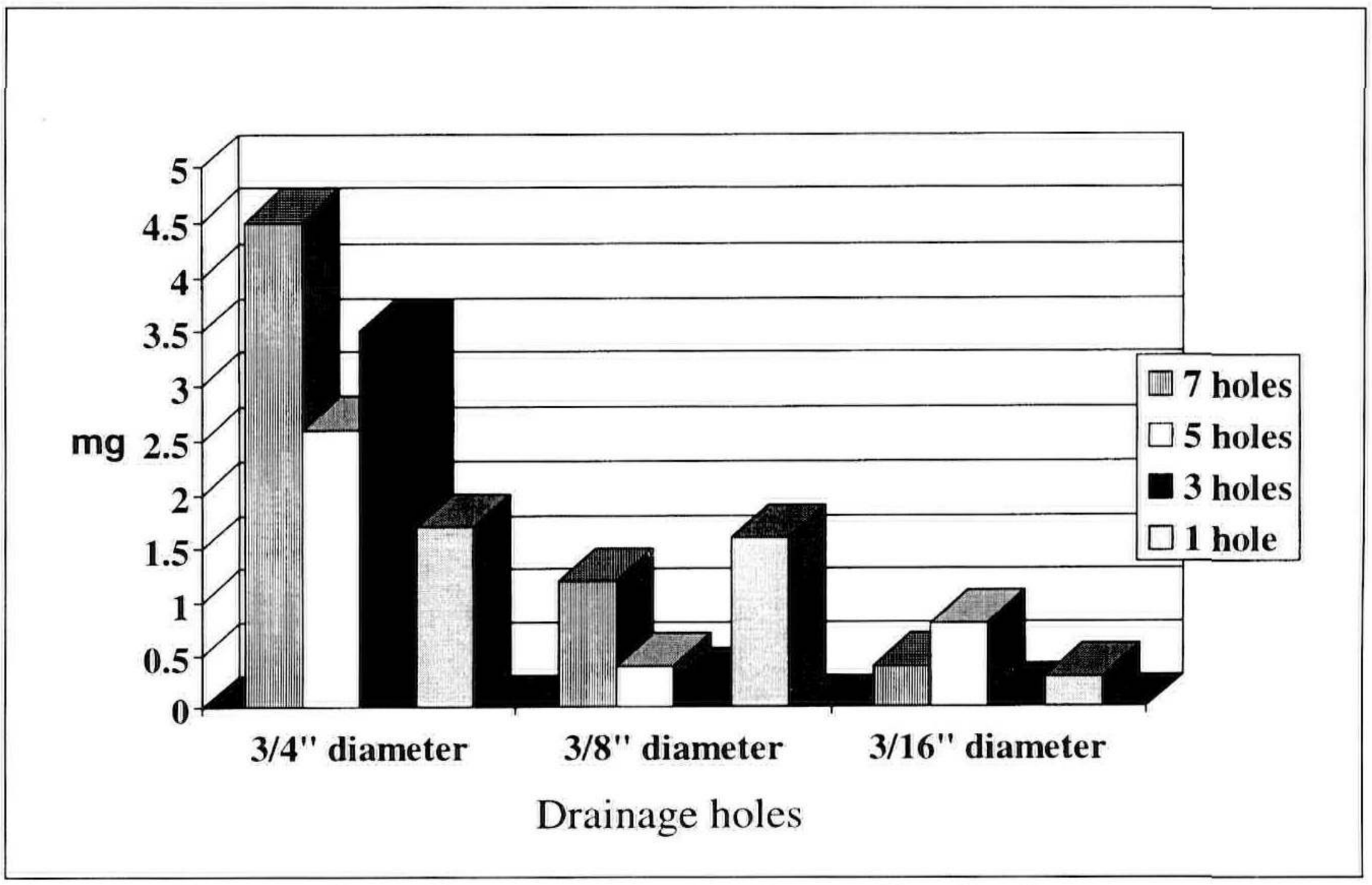

Figure 2. Average nitrate losses per container in container leachate.

Container leachate volume was collected at 15, 30, 45, 60, 90, 120, and 150 days after potting (DAP). During the irrigation cycle two containers from each treatment in each experimental unit were used to collect the leachate. An insulation board 0.9 m × 4.7 m × 1.6 cm (36 inches × 72 inches × ⅝ inch) was placed over two 5-gal buckets. Holes were cut in the insulation board to allow the containers to be suspended over the buckets such that container leachate could be collected without dilution from the irrigation system. Leachate volumes were measured about an hour after the irrigation event. Leachate was analyzed for pH, electrical conductivity, and nitrate-and ammonium-N levels (only nitrate-N data is shown). Plants were measured at 150 DAP to determine growth indices [(height + width at the widest point + perpendicular width)/3] (data not shown). The experimental design was a randomized block consisting of 4 replications with 3 plants per experimental unit.

RESULTS AND DISCUSSION

Container Leachate Volume. Container leachate volume was reduced in containers with fewer and smaller drainage holes than the industry standard with seven drainage holes at 1.9 cm (¾ inch) diameter (Fig. 1). About 4% less leachate was collected when the number of drainage holes 1.9 cm (¾ inches) in diameter were reduced from seven holes per container (standard container) to one hole. The volume of leachate was 41% less (312 ml to 182 ml) when the diameter of the drainage holes was reduced from 1.9 cm (¾ inch) to 0.5 cm (3⁄16 inch). The greatest reduction of container leachate occurred when the standard container was compared to containers with one, 0.5-cm (3⁄16 inch) diameter drainage hole. Fifty-five percent less leachate was collected from containers with one drainage hole.

Nitrate-N. The amount of nitrate-N (mg) was reduced in leachate from containers with fewer and smaller drainage holes than the industry standard with seven drainage holes at 1.9 cm (¾ inch) diameter (Fig. 2). About 62% less nitrate-N was detected in leachate when the number of drainage holes in containers with 1.9 cm diameter (¾ inch) were reduced to one drainage hole 1.9 cm (¾ inch). Nitrate-N was 86% less (3.1 mg compared to 0.4 mg) when the diameter of the drainage holes was reduced from 1.9 cm (¾ inch) to 0.5 cm (3⁄16 inch). About 93% less nitrate-N was leached from the container with one drainage hole 0.5 cm (3⁄16 inch) diameter compared to the industry standard.

Plant Growth. Plant growth of 'Hopi' crapemyrtle, 'Lynwood' forsythia, and 'The Honorable Jean Marie de Montague' rhododendron was similar among all plants of each species. The modification of container drainage holes had no effect on the flowering of 'Hopi' crapemyrtle. All plants flowered equally well during the experiment.

In conclusion, these results indicate that modifying the container with fewer and smaller drainage holes reduces container leachate volume and leachable nitrate-N, thus improving water quality.