Affects of Container Size and Shape on the Rooting of Cuttings

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INTRODUCTION AND OBJECTIVES

After many years of work with rooting cuttings of both perennials and woody plants I have formed some opinions on what works, however, not all of these hunches and intuitions are accurate.

We should reexamine our convictions from time to time to insure their accuracy. One such hunch is to suppose that deep celled pots are superior to those of lessor volume or depth. I am not alone with this idea as a recent conversation with the vice president of production at a major nursery will attest when he suggested the very same thing! What we both believed to be true did not tell the whole story and the data presented here suggest that other factors in addition to volume and depth play a major role in the successful rooting of cuttings in plugs.

MATERIALS AND METHODS

Individual pots and vacuum-formed trays commonly found in suppliers catalogs were the subject of this study. Table 1 outlines the particulars with respect to physical shape and size. The study was designed so that only pot size and shape were the varying factors and all other factors were kept as standards. Three species were selected as test plants based upon varying degrees of rooting potential.

Experience has shown that *Callicarpa dichotoma* 'Alba' to be an exceptionally easy plant to root and most closely mimics perennials in terms of ease of production. It was thought that an easy-to-root plant might not show appreciable differences due to container variations.

Hydrangea macrophylla 'Tokyo Delight' was chosen because it is somewhat harder to root than *Callicarpa* and previous work has shown some degree of sensitivity to container size and shape.

The third test subject was *Acer rubrum* 'Franksred' Red Sunset® red maple. Woody plants in general are more reluctant to root than more herbaceous material and *A. rubrum* was selected because it can be rooted but requires more time and effort; the supposition being that a more difficult-to-root plant might show a larger sensitivity to container size and shape variation. The medium selected was Progro Perennial Mix, a proprietary mix of Sphagnum peat moss, composted pine bark, composted peanut hulls, and 5% sand. The mix also contains a starter fertilizer with trace elements and has a pH of 5.4 to 5.9.

Cuttings of *C. dichotoma* 'Alba' were about 5 cm long, those of *H. macrophylla* 'Tokyo Delight' were 15 cm long, and those of *A. rubrum* 'Franksred' Red Sunset® red maple were approximately 35 cm long. All cuttings were treated with Dip 'N Gro rooting compound diluted to a rate of 1 : 10 with water. This equates to a solution of1000 ppm IBA and 500 ppm NAA. The *Callicarpa* and *Hydrangea* cuttings were not wounded, those of *A. rubrum* were wounded on two sides by dragging across a horizontally mounted blade resulting in a shallow scrape along each side. Cuttings were inserted up to the first set of leaves with at least one set of nodes beneath the soil surface. This left a basal end of 1.5 to 2 cm in the soil for the *Callicarpa* and the *Hydrangea* and 2 to 3 cm basal end on the *A. rubrum*. Mist was provided every 15 min with a 30-sec burst. All the cuttings were rooted in a 70% milky-poly-covered house with no bottom heat or forced ventilation.

Cuttings were stuck in lots of 50 of which five were selected for evaluation after being assigned a random number. The entire block of a single species was removed for evaluation once it was determined that at least 80% of the cuttings in any one of the test treatments was rooted. The 80% evaluation mark was determined by checking individual trays and counting the " pulls" verses the " tug backs"; tug backs indicating a positive rooting response. The intent was to capture the rooting process early on in order to clearly see the differences, if any, due to the containers.

Had the cuttings been allowed more time to develop the most obvious and early differences in rooting might be obscured by the lesser rooted plants being given extra time to catch up.

Evaluations were based upon the length of the longest root, root number and where applicable, rooting percentage. If rooting percentage was not listed in the following charts, it was because there was no difference at the time of evaluation.

RESULTS

Callicarpa dichotoma 'Alba' rooted earliest and with the greatest of ease (Table 2). As was expected and subsequently verified those cuttings in 32-celled square pots with a rating of a 5 were superior to the other trays. The 50 squares were a close second if not equal to the 32s with a rating of a 5 as well, but varied slightly with shorter root lengths. This was followed by 70 squares which were adequate with an over all rating of 2, beyond this point round 50 cells and 70 cells were poor with very short root lengths which gave a rating of 1. The 50 round cells showed both a reduced level of root length and number of roots, whereas the round 70 cells showed only reduced root length, with root numbers that were comparable to the other cells.

Hydrangea macrophylla 'Tokyo Delight' (Table 3) showed a similar pattern with respect to cell shape as the *Callicarpa*. Again, the 32 squares earned high marks with a rating of a 5, followed by 50 squares with a rating of a 4, and 70 squares coming in at a 3. Once again, the 50 and 70 roundcells, were poorest, both earned a 1. Here the important criteria was the number of roots as rooting percentage and root length did not indicate significant differences amongst the containers.

Acer rubrum 'Franksred' Red Sunset® red maple (Table 4) followed the trend of performing best in 32 squares, however, this trend was not repeated in 50 squares nor in the 70 squares, with ratings of 5, 1, 2 respectively. Round cells (50s and 70s) provided a rating of 2. In this test the 50 squares yielded the poorest results with the exception of rooting percentage, which was comparable to that of 70-deep round cells. Rooting percentage was poorest in 50 rounds and in 70 squares. Root quality was comparable between 32 squares and 50 rounds but 50 rounds did not provide the higher rooting percentages that 32 squares allowed. Root quality was poorest in 50 squares, 70 squares, and 70 rounds.

Table 1. Pot volume and depth.

Size	Volume (cc)	Depth (mm)	Rating[Z]
32 squares	240	85	5
50 squares	80	55	4, 5 (1)
70 squares	50	50	2 to 3
50 round	60	55	1 to 3
70 round	50	60	1 to 3

[Z]5 is highest, 1 is lowest.

Table 2. *Callicarpa dichotoma* 'Alba' rooting results.

Size	Rating	Root length (mm)	Roots (no.)
32 squares	5	15	25
50 squares	5	8	21
70 squares	2	10	26
50 round	1	2	16
70 round	1	2	23

[Z]5 is highest, 1 is lowest.

DISCUSSION

All of the species clearly demonstrated the superiority of 32 squares over the other types of rooting cells. It is also apparent that square cell types have advantages over round cell types regardless of cell size as volume or depth. Since *Callicarpa* and *Hydrangea* are easy-to-root plants it is possible that the speed at which they root compensates for problems that depth and volume might cause. Specifically, they root too fast for depth and volume to be a factor. However, in both of those species, cell shape does seem to influence rooting by influencing the rooting time. Perhaps this occurs by altering the physics of water and air flow through the cell. *Acer rubrum* being much slower to root, 21 days vs. 10 days for *Callicarpa* and 14 days for *Hydrangea*, seems highly sensitive to volume and depth differences and this over rides the difficulties presented by differing cell shape. Here too, oxygen diffusion within the rooting media may be significantly altered by the depth and volume of the pots. It would seem that a woody plant such as *A. rubrum* can not be effectively produced in anything but containers with larger volumes and depth.

Another factor possibly affecting rooting is the close proximity of the cuttings in the blow-molded trays. This causes for a serious overlap of leaves, particularly in larger types of cuttings, such as *A. rubrum* and *Hydrangea*. This greatly cuts down

Table 3. *Hydrangea macrophylla* 'Tokyo Delight' rooting results.

Size	Rating	Root length	Roots (no.)
32 squars	5[y]	nsd[z]	>100
50 squars	4	nsd	>10>100
70 round	1	nsd	approx. 50

[Z]5 is highest, 1 is lowest.
[Z]nsd = no significant difference.

Table 4. *Acer rubrum* 'Franksred' Red Sunset ® red maple rooting results.

Size	Rating	Root length (mm)	Roots (no.)	Rooted (%)
32 squares	5	25	10	98
50 squares	1	3	4	81
70 squares	2	12	5	72
50 round	3	17	11	60
70 round	2	14	6	80

[Z]5 is highest, 1 is lowest.

on the amount of light available to any one particular cutting save for those on the outside edges. It also reduces coverage of the mist for those cuttings on the interior of the trays and provides an area of little or no air movement, possibly resulting in fungal problems.

CONCLUSIONS

Conclusions would be to recommend the use of 32-celled squares approaching volume of 200 cc for the rooting of woody plant species. If for some reason an insert cell-rooting system is needed due to space allocations then it is suggested that square cells be given consideration over round cells. It is clear that round cells allow for root formation but they cause serious impediments with respect to accentuating rooting and root quality. The rooting of cuttings is a time-sensitive process, seasons change and rooting conditions within a season change dramatically. Use of cell inserts that do not allow the propagator to maximize production through shorter propagation times can be costly. By taking advantage of the decreased rooting times for square cells over round cells the propagator can conceivably get an extra crop for the year over the same space.