Vegetative propagation of bottle brush buckeye (*Aesculus parviflora*) and Florida flame azalea (*Rhododendron austrinum*) by mound layering

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Significance to Industry: Stem cutting propagation is the principle method for mass production of clonally derived plant material, however, vegetative propagation of many of the deciduous plants native to the Eastern United States has been difficult (1). The utility of these plants in the landscape on a commercial scale is dependent upon reliable, productive propagation protocols. Successful propagation of these plants without expensive overhead would also be significant to many potential growers eager to enter the ornamentals industry.

Nature of Work: Mound layering is a method of in-field propagation whereby stock plants are hedged severely and emerging shoots are covered with substrate allowing for adventitious root formation. Subsequent roots grow into the surrounding substrate and rooted stems can then be severed from the stock plant. The severe pruning helps to maintain vegetative, juvenile growth that typically has a higher capacity for adventitious root formation (3). Covering the shoots also results in etiolation, which can decrease the light-induced breakdown of endogenous indole acetic acid (IAA) and retard tissue differentiation, resulting in more parenchyma cells with greater potential for root initiation and development (2). Wounding, an application of a rooting hormone, or a combination of both can be used during mounding to increase rooting percentages (4). Mounding is a viable option for propagating difficult-to-root plants and is utilized extensively with temperate fruit trees and to a lesser extent with *Aesculus* species (5, 6). This technique also lends itself to mechanization in field situations. Upright habit and the ability to produce many new shoots following pruning are characteristics of plants that might be successfully propagated by mound layering (3). The objective of this study was to evaluate the potential of successful propagation of *Rhododendron austrinum* (Small) Rehder, Florida flame azalea and *Aesculus parviflora* Walter, bottlebrush buckeye by mound layering and to determine the effects of timing of mounding, wounding or the application of the potassium salt of indole butyric acid (K-IBA) on rooting percentage, the number of plants produced, and root system quality.

Three gallon (12 L) plants of *R. austrinum* and one gallon plants of *A. parviflora* were field planted in fall 2005 and pruned to 6 in (15 cm) above the root collar the following March 2006. Plants were then mounded either in mid-March or mid-June. Mounding

consisted of covering plants with 18 in (46 cm) of composted pine bark that was held in place by a 24 in (61 cm) diameter cylinder constructed from chicken wire. Prior to mounding in June, stems on each plant were either wounded or not wounded and treated or not treated with 5,000 ppm K-IBA using a spray bottle, which represented a 2 × 2 factorial. All shoots were harvested in March of the subsequent year and evaluated for rooting percentage, number of rooted plants produced per mound, root collar diameter (RCD), relative root score, and root system symmetry. Root system quality was analyzed using RCD, root score, and root system symmetry measurements. Root collar diameter was measured at the stem to root interface using a caliper. A relative root score was based visually on size of the root ball with small roots systems receiving a 0, intermediate sized root systems receiving a 1, and large root systems receiving a 2 (Fig. 1). Symmetrical root systems had at least two roots 130° apart around the stem (Fig. 1). The experimental design was a randomized complete block design with 5 blocks of 10 plants. The treatments were randomly applied to pairs within the blocks with one set of two being mounded in early March and the other 4 sets of 2 pairs (8 plants total per block) being mounded in June. The experiment was repeated over two years and the data presented represents harvests from 2008 and 2009.

Results and Discussion: In *A. parviflora*, rooting percentage, number of rooted layers produced, and root collar diameter were not affected by any of the treatments. Regardless of when plants were mounded, 65% of shoots present on each mound produced rooted layers. Each mound produced 3.5 rooted layers. Each rooted layer had a RCD of 0.3 in (7 mm) and 8 roots per layer. During year 1, the average length of the longest root on all plants was 10.2 in (26 cm), however in year two it was 8.3 in (21 cm) on June mounded plants and 5.9 in (15 cm) on March mounded plants. Although a 2-4 in (5-9 cm) difference is significant, it is difficult to explain why this occurred as all other parameters between years and season of mounding were similar. Most rooted layers were potted immediately for production, while rooted layers with the appearance of a larger root system were lined out in field production. All survived and overwintered. These results differ from McNiel and Elkins (2), who reported an average of 16.7 rooted stems per plant. Plants in that study, however, had been planted for 15-18 years prior to mounding, while plants in the present study had been planted for 6 months. Both studies confirm that mound layering of buckeye is feasible on a nursery scale and that simply mounding plants after hedging produces rooted layers within a year as long as irrigation is provided.

Rooting percentage and the number of rooted layers produced per mound for *R. austrinum* was not affected by mounding time (Table 1). Mean rooting percentage was 52.5% for mounds mounded in either March or June and each mound produced a mean of 11.5 rooted layers (Table 1). Within the June mounding time, rooting percentage was 66% for the wounding minus K-IBA treatment, which was similar to all treatments, except the minus wounding plus K-IBA treatment at 45%. The wounding plus K-IBA treatment produced 13 rooted layers, whereas all other treatments produced approximately 8.2 layers (Table 1).

Root system symmetry was not affected by mounding time, wounding, or K-IBA application (Table 2.). Approximately 44% of root systems were symmetrical. RCD of June mounded plants was 0.2 in (4.3 mm), whereas that of March mounded plants was 0.1 in (3.5 mm) (Table 2). Within June, mounds treated with nothing (no wounding, no K-IBA) or just wounded (wounded but no K-IBA) had a RCD of 0.2 in (4.4 mm), whereas all others were 0.1 in (3.9 mm). Root score was 0.69 overall for March or June mounded plants and was not affected by mounding time. Within June mounding, however, plants that were wounded (wounding plus K-IBA, and wounding no K-IBA) had a 0.81 root score whereas those not wounded were less (Table 2).

The results of this study indicate mound layering is a practical approach for successful propagation of both Florida flame azalea and bottlebrush buckeye. Both mounding times were effective and the use of wounding, K-IBA applications, or both is not necessary to improve rooting percentages, number of rooted plants, or percentage of symmetrical root systems. The June mounding time did allow for slightly larger root collar diameters in Florida flame azalea but not visually superior root systems. For the grower, this information provides flexible timing for in-field propagation of *Rhododendron austrinum* and *Aesculus parviflora*. Because mounding in March on a yearly basis might prove stressful for plants, growers can alternate mounding times during production to allow for plants to recover between mounding. Plants could be mounded in March during year one, but be mounded in June during year two. When mounding plants of R. austrinum in June, wounding stems might increase the overall quality of the root system.

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Table 1. Rooting percentage and number of plants produced per mound for March and June mounding treatments of *Rhododendron austrinum*.

Treatment	Number Rooted[1]	Rooting %
March Mounding	12±2.5a	47±7.7A
June Mounding	9±0.71a	58±3.6A
Wounding and K-IBA	13±1.5a	61±6.0ab
No Wounding and No K-IBA	8.9±1.3b	65±6.6ab
Wounding and No K-IBA	8.8±1.5b	66±7.9a
No Wounding and K-IBA	6.8±1.2b	45±7.3b

[1]Values represent means ± 1 SEM for 10 replications. Means followed by a different letter, within columns, represent significant differences, $P<0.05$.

Table 2. Root system quality of *Rhododendron austrinum* indicated by root system symmetry, root collar diameter, and relative root score (see Figure 1 for visual descriptions).

Treatment	Symmetry (%)[1]	RCD[2] (mm)	Root Score
March Mounding	45±0.10A	3.5±0.39B	0.77±0.16A
June Mounding	43±0.04A	4.3±0.16A	0.61±0.06A
Wounding and K-IBA	45±7a	3.9±0.35b	0.81±0.10a
No Wounding and No K-IBA	44±7a	4.4 ±0.31a	0.51±0.09b
Wounding and No K-IBA	50±7a	4.7±0.31a	0.80±0.11a
No Wounding and K-IBA	34±9a	3.9±0.29b	0.32±0.10b

[1]Values represent means ± SEM for 10 replications. Means followed by a different letter, within columns, represent significant differences, $P<0.05$.
[2]RCD = Root collar diameter.