# Incorporation of Slow-Release Fertilizer Accelerates Growth During Adventitious Rooting of *Artemisia*, *Gaura*, and *Nepeta*©

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## INTRODUCTION

Accelerating growth of nursery stock can produce marketable plants in less time, thus potentially increasing profits. In most production systems, fertilizers are normally applied sometime after rooting or transplanting. However, the optimal quantity, formulation, and time is unclear. If slow-release fertilizer is incorporated into the rooting substrate, then optimal nutrients can be available when adventitious roots emerge. This would also eliminate the labor involved to fertilize liners. Therefore, the objectives of this study were to: (1) compare adventitious rooting and subsequent growth of rooted liners of three herbaceous species in response to two formulations of slow-release fertilizer incorporated into the propagation media, and (2) determine optimal levels of incorporated slow-release fertilizer to accelerate plant growth.

## MATERIALS AND METHODS

Tip cuttings of *Artemisia ludoviciana* 'Valerie Finnis' (white sage), *Gaura lindheimeri* 'Whirling Butterflies' (white gaura), and *Nepeta* 'Six Hills Giant' (catmint) were collected from landscape plantings on 1 July, recut to 7.6 cm (3 inches), dipped in a solution of IBA at 1000 mg liter$^{-1}$ (1000 ppm), and placed in 36-cell flats of 5.7 cm (2.25 in) cells containing a commercial soilless substrate (BioComp BC-5S, BioComp, Inc., Edenton, North Carolina). Nutrient treatments consisted of a control, and four treatments each of Nutricote™ 13N-13P-13K Type 180 and 18N-6P-8K Type 180 at 3, 6, 9, and 12 g liter$^{-1}$ (5, 10, 15, and 20 lb yd$^{-3}$) incorporated into the substrate. These treatments equate to actual N rates of 0, 0.38, 0.77, 1.16, 1.54, 0.53, 1.07, 1.6, and 2.13 g liter$^{-1}$ (N at 0.65, 1.3, 1.95, 2.6, 0.9, 1.8, 2.7, and 3.6 lb yd$^{-3}$), respectively. The study consisted of 4 blocks, 3 species, 9 nutrient treatments, and 4 cuttings per replication within each block/nutrient, species treatment. There were 144 cuttings per species for a total of 432 cuttings.

Flats were placed under intermittent mist in a glass greenhouse under natural photoperiod and irradiance and provided with bottom heat. Air and substrate temperatures were maintained at $23 \pm 2.5^{o}C$ ($73 \pm 4^{o}F$) and $26 \pm 1^{o}C$ ($79 \pm 2^{o}F$), respectively. Mist frequency was controlled by irradiance level with continuous adjustment of frequency as a function of relative humidity.Vapor pressure deficit (VPD) was set not to exceed 0.7 kPa. After 21 days, misting was discontinued, and plants were moved to another bench and grown for an additional 21 days. At Day 42, plants were evaluated with a visual rating (ranging from 0 to 5, with a higher number representing higher quality) and rooting percentages, root number, and shoot and root dry weights were recorded. Data was subjected to analysis of covariance, analysis of variance, and linear regression.

**Table 1.** Variation due to species. (Means based on 36 sets of 4 cuttings).

| Species | Visual rating | Rooting (%) | Root number | Shoot dry wt (mg) | Root dry wt (mg) |
|---|---|---|---|---|---|
| *Artemisia* | 2.65 b | 86.5 ab | 8.7 a | 747 a | 107 a |
| *Gaura* | 2.58 b | 81.2 b | 6.9 a | 205 c | 38 b |
| *Nepeta* | 3.23 a | 93.1 a | 6.3 a | 380 b | 125 a |

Mean separation among species by Tukey's Studentized Range (HSD) Test, P 0.05, means with same letter are not significantly different.

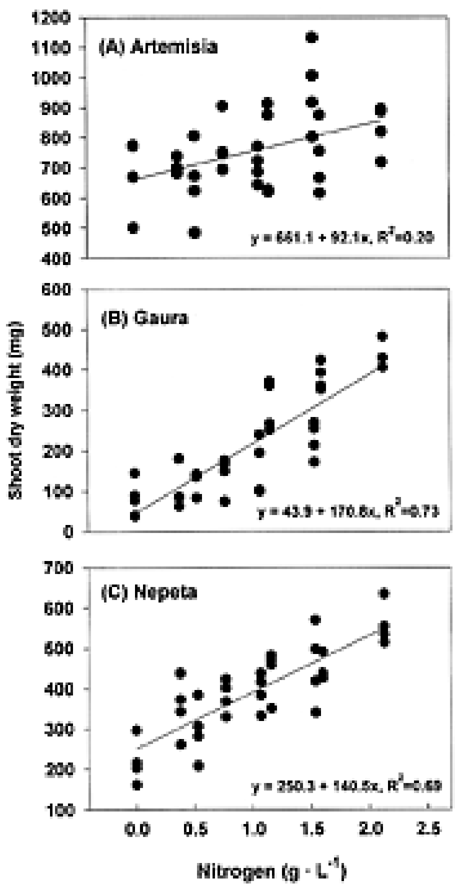


**Figure 1.** Effect of slow-release fertilizer incorporated into propagation media at 0, 0.38, 0.53, 0.77, 1.07, 1.16, 1.54, 1.60, and 2.13 g liter$^{-1}$ on shoot dry weight of (A) *Artemisia ludoviciana* 'Valerie Finnis', (B) *Gaura lindheimeri* 'Whirling Butterflies', and (C) *Nepeta* 'Six Hills Giant'. Each symbol is a mean of four observations.

## RESULTS AND DISCUSSION

Analysis of covariance indicated that there were no differences in response between the two formulations of Nutricote (13N-13P-13K and 18N-6P-8K), thus data were analyzed on amount of actual N incorporated into the substrate. Rooting percentage was significantly different among species (Table 1), but N treatment had no effect on rooting of individual species.

Except for *Artemisia*, visual ratings and shoot dry weights increased linearly with increasing levels of N incorporated into the propagation substrate (Fig 1). The effect of N on the number of primary roots per cutting and total root dry weight was significant only for *Gaura*. Both characteristics increased linearly with increasing N level, however the $R^2$ values are low and only account for a small portion of the variation. When all N treatments are compared to the control with Dunnett's test, visual ratings are improved for all levels of N except the lowest at 0.38 g $liter^{-1}$. Likewise, shoot dry weights are increased for all N treatments except 0.38 and 0.53 g $liter^{-1}$.

In conclusion, the incorporation of slow-release fertilizer into the rooting substrate improved visual appearances of the plants as well as shoot dry weights. Fertilizer had no effect on adventitious rooting and little influence on root number or root dry weight and there was no difference between the two formulations. An optimal level was not determined as it appears that a rate high enough to cause plant damage to these species was not present in the study. However, the greater response for shoot growth relative to root growth suggests that N promotes shoot growth more than root growth.