Proc. Fla. State Hort. Soc. 102:269-271. 1989.

RESPONSE OF *LIGUSTRUM* AND AZALEA TO SURFACE AND GROWTH MEDIUM-INCORPORATED FERTILIZER APPLICATIONS

THOMAS H. YEAGER, DEWAYNE L. INGRAM
AND CLAUDIA A. LARSEN
University of Florida, IFAS
Ornamental Horticulture Department
Gainesville, Florida 32611

Additional index words. container plants, nutrition.

Abstract. **Ligustrum japonicum Thunb. grown in a 2 pine bark : 1 Canadian peat : 1 builder's sand (by volume) medium that received a surface application of either a 150 or 200-day release fertilizer blend (21N-1.7P-8.3K) containing plastic coated potassium nitrate (CKN) or a blend (15N-2P-8.3K) containing potassium silicate (KSIL) had greater shoot dry weights after 8 months than plants with the same fertilizers incorporated into the medium before planting. Shoot dry weights of *L. japonicum* were greater for incorporated than surface-applied Osmocote (OSMO [18N-2.6P-10K]). Azalea (*Rhododendron* sp. 'Mrs. G. G. Gerbing') shoot dry weights were not different due to placement of the 200-day fertilizer or OSMO; whereas, surface application of the 150-day and KSIL blend resulted in greater shoot dry weights than the same fertilizer incorporated into the medium. Shoot dry weights of both genera were greater for plants grown in the medium incorporated with OSMO compared to other fertilizer incorporations. Shoot dry weights of plants that received the surface application of OSMO were not different from other surface-applied treatments. Potassium (K) and nitrate nitrogen (NO_3^--N) leachate levels at day 7 were generally higher for the growth medium incorporated with fertilizer compared to the respective surface-applied treatment. Potassium leachate levels for the medium incorporated with fertilizer ranged from 323 ppm on day 7 for the 150-day fertilizer to about 7 ppm on day 150 and 200 for all fertilizers incorporated into the medium. Nitrate N levels ranged from 146 ppm for the OSMO incorporated medium on day 7 to about 2 ppm on day 150 and 200 for all fertilizers incorporated into the medium. Leachate NO_3^--N and K levels for the medium with incorporated fertilizers dropped precipitously by day 150. This decrease could be related to growth medium temperatures that averaged 36°C, at 1500 HR during the first 3 months of the experiment.**

Slow-release fertilizers facilitate efficient utilization of applied nutrients (4) and are used to provide a long-term release of nutrients whether surface applied or incorporated into the container medium. Conover and Poole (1) determined that surface-applied or incorporated Osmocote 14N-6P-11.6K or Nutricote 14N-6P-11.6K resulted in similar growth of 4 foliage plants. Ingram and Yeager (6) obtained similar shoot growth for *Rhododendron* sp. 'Mrs. G. G. Gerbing' fertilized with a surface application of Woodace briquettes or Osmocote 18N-2.6P-10K incorporated into the 3 pine bark : 1 Canadian peat : 1 builder's sand (by volume) growth medium.

The release characteristics of slow-release fertilizers are usually documented by the manufacturer for about 20 to 32°C; however, the west side of a container medium often exceeds 40°C for 4 hours during the summer in Florida (5). Harbaugh and Wilfret (3) determined that about 70% of nutrients in Osmocote 18N-2.6P-10K were released in 96 days at 30°C. Patel and Sharma (8) conducted incubation studies (26°C) with Osmocote 18N-2.6P-10K and determined that at least 45% of the N leached after 119 days. Lamont et al. (7) also conducted incubation studies and determined that 72% of Osmocote 18N-2.6P-8.7K and 64% of Nutricote 16N-4.4P-8.3K was released after 133 days at 45°C. The purpose of this study was to determine plant growth response to surface-applied and incorporated slow-release fertilizers and to evaluate the release rate of K and NO_3^--N when container medium temperature averaged 30°C.

Materials and Methods

Multiple branched liners of *Ligustrum japonicum* and *Rhododendron* sp. 'Mrs. G. G. Gerbing' were potted 5 May 1987 in a 2 pine bark : 1 Canadian peat : 1 sand (by volume) medium in 3-liter (trade 1-gallon) containers. The medium was amended with dolomitic limestone and Perk (micronutrient formulation of Vigoro Industries, Inc., Fairview Heights, Illinois) at 3 and 1.8 kg/m^3, respectively. A 21N-1.7P-8.3K 200-day or 150-day release fertilizer blend (Vigoro Industries, Inc., Winter Haven, Florida), a 15N-2P-8.3K blend (Vigoro Industries) or Osmocote 18N-2.6P-10K (Sierra Chemical Co., Milpitas, California) were incorporated in the growth medium or applied to the growth medium surface of each plant at 16.8 g for the 21N-1.7P-8.3K, 150 or 200-day fertilizers and for the 15N-2P-8.3K. Osmocote was surface-applied at the recommended rate of 14 g per container. Potassium rate (1.16 g K per container) was equivalent for both the incorporated and surface-applied treatments. Both the 150 and 200-day fertilizers contained 200-day plastic coated urea and 150-day or 200-day plastic coated potassium nitrate (CKN), respectively, and triple superphosphate. The 15N-2P-8.3K blend contained potassium sulfate and potassium silicate (KSIL), plastic coated urea and triple superphosphate. Osmocote (OSMO) contained resin coated ammonium nitrate, potassium sulfate, ammonium phosphate and calcium phosphate.

One plant for each treatment was randomized on black polypropylene ground cover in each of 8 blocks under 30% polypropylene shade and watered as needed with 460 ml (1 inch) of water per container per application via Dramm drip rings. Leachates were collected from azalea containers on days 7, 50, 150 and 200 by pouring 150 ml of deionized water on the surface of each container. Leachate NO_3^--N and K were determined according to the procedures of the University of Florida Soil Testing Laboratory (2).

Container medium temperatures were determined weekly at 1500 HR using a Technoterm 7200 C digital

Florida Agricultural Experiment Stations Journal Series No. N-00107. The authors gratefully acknowledge Estech Chemical Co., Winter Haven, Florida for their financial support. Trade names and companies are mentioned with the understanding that no endorsement is intended nor discrimination implied for similar products not mentioned.

thermometer (Testoterm, Inc., Randolph, New Jersey). The temperature probe was placed 8 cm into the medium on the west side of the container and half way between the container wall and plant stem of 5 replicate plants located in the north, south, east, west and middle area of the experimental plot. After 8 months, stems were severed above the uppermost roots and shoot dry weights determined after drying for 48 hours at 70°C.

Results and Discussion

Shoot dry weights of *L. japonicum* were not different for the surface application of any of the fertilizers (Fig. 1). Plants that received a surface application of CKN150, CKN200 or KSIL had greater shoot dry weights after 8 months than plants with the same fertilizer incorporated into the medium before planting (Fig. 1). Shoot dry weights of *L. japonicum* were larger for the incorporated compared to surface-applied OSMO and the shoot dry weights for the incorporated OSMO treatment were not different from the surface-applied CKN150 or CKN200. Azalea (*Rhododendron* sp. 'Mrs. G. G. Gerbing') shoot dry weights were not different due to placement of the CKN200 or OSMO while the surface application resulted in larger plants for CKN150 and KSIL (Fig. 2). Surface-applied CKN150, CKN200 and KSIL resulted in comparable shoot dry weights to the surface-applied OSMO treatment; although, surface-applied CKN150 and CKN200 were not comparable to the incorporation of OSMO. Shoot dry weights of both genera were greater for plants grown in the medium incorporated with OSMO compared to incorportation of the other fertilizers.

Potassium (K) and nitrate nitrogen (NO_3^--N) leachate levels at day 7 were generally higher for each incorporated fertilizer compared to the respective surface-applied treatment (Figs. 3 and 4). Poole and Conover (1) noted that leachate electrical conductivity was not consistently higher for incorporated Osmocote (14N-6P-11.6K) and Nutricote (14N-6P-11.6K) compared to surface-applied treatments 14 and 25 days after application. Potassium leachate levels for the medium incorporated with fertilizer ranged from 323 ppm on day 7 for the CKN150 to about 7 ppm on day 150 and 200 for all fertilizers incorporated into the medium. Nitrate-N levels ranged from 146 ppm for the OSMO incorporated medium on day 7 to about 2 ppm on day 150 and 200 for all fertilizers incorporated into the medium. Growth medium nutrient levels 50 days after potting were higher for the medium incorporated with OSMO compared to the surface application. Leachate K and NO_3^--N levels dropped precipitously by day 150 for the medium incorporated with fertilizer. This decrease could be related

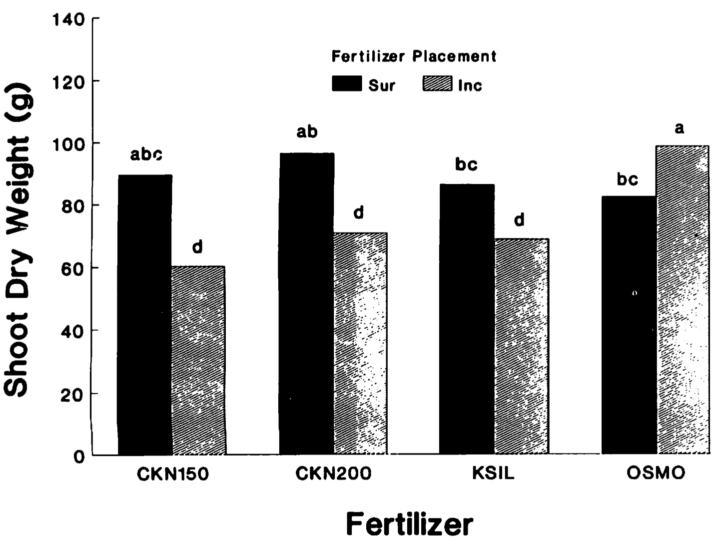

Fig. 1. Shoot dry weights of *Ligustrum japonicum* after 8 months growth in a 2 pine bark : 1 Canadian peat : 1 builder's sand (by volume) growth medium that received either a surface (Sur) application or incorporation (Inc) of a fertilizer blend that contained either plastic coated potassium nitrate (21N-1.7P-8.3K) 150 (CKN150) or 200 (CKN200) day release, potassium silicate (KSIL [15N-2P-8.3K]), or Osmocote (OSMO [18N-2.6P-10K]). Means separated by Waller Duncan at 5% level.

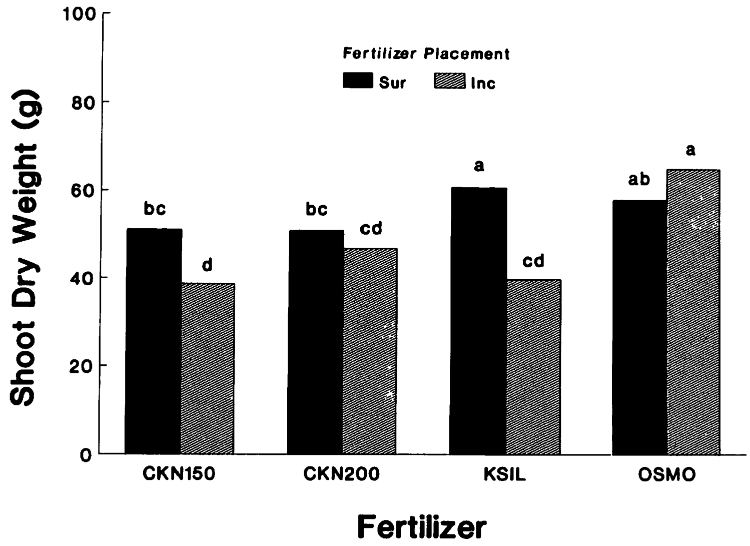

Fig. 2. Shoot dry weights of *Rhododendron* sp. 'Mrs. G. G. Gerbing' after 8 months growth in a 2 pine bark : 1 Canadian peat : 1 builder's sand (by volume) growth medium that received either a surface (Sur) application or incorporation (Inc) of a fertilizer blend that contained either plastic coated potassium nitrate (21N-1.7P-8.3K) 150 (CKN150) or 200 (CKN200) day release, potassium silicate (KSIL [15N-2P-8.3K]), or Osmocote (OSMO [18N-2.6P-10K]). Means separated by Waller Duncan at 5% level.

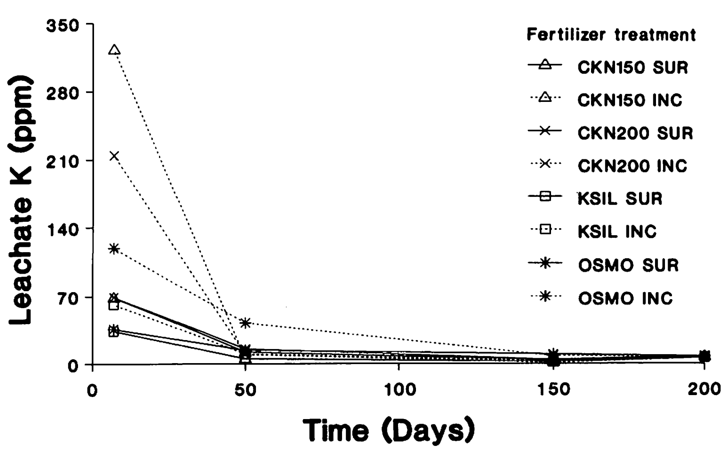

Fig. 3. Leachate K levels for a 2 pine bark : 1 Canadian peat : 1 builder's sand (by volume) growth medium that received either a surface (Sur) application or incorporation (Inc) of a fertilizer blend that contained either plastic coated potassium nitrate (21N-1.7P-8.3K) 150 (CKN150) or 200 (CKN200) day release, potassium silicate (KSIL [15N-2P-8.3K]), or Osmocote (OSMO [18N-2.6P-10K]).

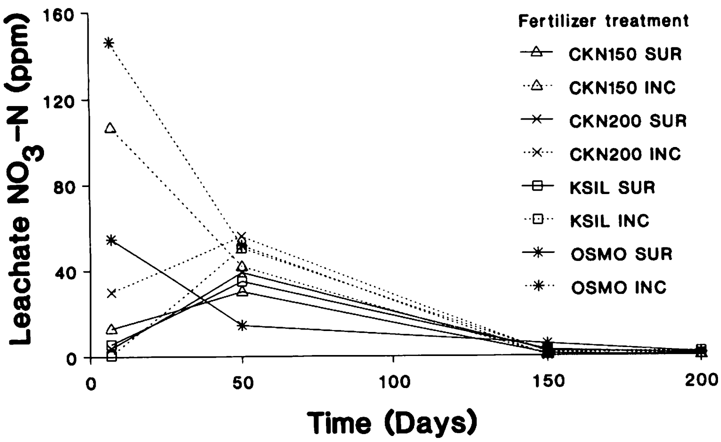

Fig. 4 Leachate NO_3^--N levels for a 2 pine bark : 1 Canadian peat : 1 builder's sand (by volume) growth medium that received either a surface (Sur) application or incorporation (Inc) of a fertilizer blend that contained either plastic coated potassium nitrate (21N-1.7P-8.3K) 150 (CKN150) or 200 (CKN200) day release, potassium silicate (KSIL [15N-2P-8.3K]), or Osmocote (OSMO [18N-2.6P-10K]).

to growth medium temperatures that averaged 30°C during the experiment. Harbaugh and Wilfret (3) determined that at 30°C, 70% of Osmocote (18N-2.6P-10K) was released in 96 days. Growth medium temperatures averaged 36°C at 1500 HR during the first 3 months of this experiment (Table 1) and were generally higher (3 to 4°C) in the middle location rather than on the perimeter of the experimental plot. The highest temperatures were recorded in June, July, August and September but dropped and remained below 34°C after September 23.

These data indicate that maximum growth for *L. japonicum* and 'Mrs. G. G. Gerbing' azalea was obtained when Osmocote (18N-2.6P-10K) was incorporated in the container medium, or when 150 or 200-day plastic coated potassium nitrate blends (21N-1.7P-8.3K) or a potassium silicate blend (15N-2P-8.3K) was surface-applied. Potassium and NO_3^--N levels in the growth medium decreased rapidly for both surface and incorporated placements and 150 days after application were below optimum (9). The rapid decrease in nutrient levels was associated with container medium temperatures that during June to October consistently exceeded 21°C. The 8 to 9 month release characteristic of Osmocote (18N-2.6P-10K) is based on a constant 21°C (Sierra Chemical Co.) and for Estech fertilizers from Vigoro Industries, 20°C will result in 80% release in 200 days (Mr. Bob Rehberg, personal communication). Thus, throughout most of the experiment, temperatures exceeded guidelines for these fertilizers and could be expected to be higher in most locations in Forida during the summer. Regardless of slow-release fertilizer placement, nutrient levels need to be monitored and supplemented if necessary to maintain optimal levels.

Table 1. Average temperatures in a 2 pine bark : 1 Canadian peat : 1 builder's sand (by volume) medium determined at 1500 HR half way between plant stem and 3-liter (trade 1-gallon) container wall, 8 cm below the growth medium surface on the west side of containers located in the north, south, east, west and middle of the experimental plot.

Month	Average container temperature (°C)
June	35
July	37
Aug.	36
Sept.	33
Oct.	26
Nov.	20
Dec.	21

Literature Cited

1. Conover, C. A. and R. T. Poole. 1989. Fertilization of four foliage plants with Osmocote or Nutricote. J. Environ. Hort. 7(3):102-108.
2. Hanlon, E. A. and J. M. De Vore. 1989. IFAS extension soil testing laboratory chemical procedures and training manual. University of Florida Extension Circular 812.
3. Harbaugh, B. K. and G. J. Wilfret. 1981. Factors to consider when using Osmocote for poinsettia production in Florida. Bradenton AREC Res. Rep. GC1981-15.
4. Hauck, R. D. and M. Koshino. 1971. Slow-release and amended fertilizers, 455-487. In: R. A. Olson (ed.). Fertilizer Technology and Use. Soil Science Society of America, Inc., Madison, Wisconsin.
5. Ingram, D. L. 1981. Characterization of temperature fluctuations and woody plant growth in white poly bags and conventional black containers. Hortscience 16:762-763.
6. Ingram, D. L. and T. H. Yeager. 1987. Evaluation of slow-release fertilizers in Florida. Proc. So. Nur. Res. Conf. 32:142-144.
7. Lamont, G. P., R. J. Worrall, and M. A. O'Connell. 1987. The effects of temperature and time on the solubility of resin-coated controlled-release fertilizers under laboratory and field conditions. Scienta. Hortic. 32:265-273.
8. Patel, A. J. and G. C. Sharma. 1977. Nitrogen release characteristics of controlled-release fertilizers during a four month soil incubation. J. Amer. Soc. Hort. Sci. 102(3):364-367.
9. Wright, R. D. and A. X. Niemiera. 1985. Influence of N, P, and K fertilizer interactions on *Ilex crenata* 'Helleri'. J. Environ. Hort. 3:8-10.