HRI's Mission:

To direct, fund, promote and communicate horticultural research, which increases the quality and value of ornamental plants, improves the productivity and profitability of the nursery and landscape industry, and protects and enhances the environment.

nutrient response and plant growth it appeared that compost adequately replaced the dolomitic limestone, micronutrients, and macronutrients added to the commercial substrate.

Literature Cited

1. Bilderback, T.E. and W.C. Fonteno. 1991. Use of horticultural rockwool, poultry litter compost and pine bark as container media. Proc. Southern Nurserymen's Assoc. Annu. Res. Conf. Vol. 36. p. 61–63.

2. Brouwer, R. 1962. Nutritive influences on the distribution of dry matter in the plant. Neth. J. Agric. Sci. 10. p. 399–408.

3. Bugbee, G.J., C.R. Frink, and D. Migneault. 1991. Growth of perennials and leaching of heavy metals in media amended with a municipal leaf, sewage sludge and street sand compost. J. Environ. Hort. 9:47–50.

4. Chaney, R.L., J.B. Munns, and H.M. Cathey. 1980. Effectiveness of digested sewage sludge compost in supplying nutrients for soilless potting media. J. Amer. Soc. Hort. Sci. 105:485–492.

5. Chong C., R.A. Cline, and D.L. Rinker. 1991. Growth and mineral nutrient status of containerized woody species in media amended with spent mushroom compost. J. Amer. Soc. Hort. Sci. 116:242–247.

6. Falahi-Ardakani, A., J.C Bouwkamp, F.R. Gouin, and R.L. Chaney. 1988. Growth response and mineral uptake of lettuce and tomato transplants grown in media amended with composted sewage sludge. J. Environ. Hort. 6:130–132.

7. Hemphill, D.D. Jr., R.l. Ticknor, and D.J. Flower. 1984. Growth response of annual transplants and physical and chemical properties of growing media as influenced by composted sewage sludge amended with organic and inorganic materials. J. Environ. Hort. 2:112–116.

8. Hicklenton, P.R. 1990. Growth analysis of 'Plumosa Compacta' juniper and 'Coral Beauty' cotoneaster subjected to different nitrogen fertilizer regimes. J. Environ. Hort. 8:192–196.

9. Levitt, J. 1972. Water deficit (or drought) stress. p. 322–352. *In*: Responses of plants to environmental stresses. Academic Press. New York.

10. Lumis, G.P. and A.G. Johnson. 1982. Boron toxicity and growth suppression of *Forsythia* and *Thuja* grown in mixes amended with municipal waste compost. HortScience. 17:821–822.

11. Marcotrigiano, M., F.R. Gouin, and C.B. Link. 1985. Growth of foliage plants in composted raw sewage sludge and perlite media. J. Environ. Hort. 3:98–101.

12. Potter, J.R. and J.W. Jones. 1977. Leaf area partitioning as an important factor in growth. Plant Physiol. 59:10–14.

13. SAS Institute. 1985. SAS User's Guide: Statistics. Version 5 Edition. SAS Institute, Cary, N.C.

14. Ticknor, R.L. and D.D. Hemphill, Jr. 1990. Evaluation of yard debris compost as a growing medium for annual transplants and woody nursery stock. The Digger. June, 1990. p. 32, 34–35.

15. Tyler, H.H., S.L. Warren, T.E. Bilderback, and W.C. Fonteno. 1992. Composted turkey litter: I. Effect on the chemical and physical properties of a pine bark substrate. in review.

16. Wright, R.D. and A.X. Niemiera. 1987. Nutrition of container-grown woody nursery crops. p. 76–101. *In*: J. Janick (ed.) Hort Reviews. AVI publishing Co., Inc. Westport, CT.

Promotion of Branching in Nandina *(Nandina domestica* Thunb.) 'Harbour Dwarf' with ASC-66952[1]

Gary J. Keever[2]
Department of Horticulture
Alabama Agricultural Experiment Station
Auburn University, Auburn, AL 36849

Abstract

Axillary and aerial rhizomic shoot development of *Nandina domestica* Thunb. 'Harbour Dwarf' was promoted by a single foliar application of 25-200 ppm ASC-66952. Chlorosis of immature leaflets occurred within 2 weeks of 100 or 200 ppm treatment, but was not present 4 weeks after treatment. Growth indices [(height + width in perpendicular directions) ÷ 3] of treated plants were 2–10% less than those of non-treated control plants. *Ilex* × *Meserveae* S.Y. Hu. 'Blue Girl', *Ilex* × 'Nellie R. Stevens', *Rhododendron* 'George L. Tabor', *Rhododendron* 'Trouper', *Trachelospermum asiaticum* (Siebold & Zucc.) Nakai, and *Viburnum* × *pragense* Hort. were not affected by application of ASC-66952.

Index words: growth regulator, branching.

Growth regulators used in this study: ASC-66952 (proprietary compound of ISK Biotech).

Species used in this study: Blue Girl holly (*Ilex* × *Meserveae* S.Y. Hu. 'Blue Girl'); Nellie R. Stevens holly (*Ilex* × 'Nellie R. Stevens'); Harbour Dwarf nandina (*Nandina domestica* Thunb. 'Harbour Dwarf'); George L. Tabor azalea (*Rhododendron* 'George L. Tabor'); Trouper azalea (*Rhododendron* 'Trouper'); Asiatic jasmine (*Trachelospermum asiaticum* (Siebold & Zucc.) Nakai); Prague viburnum (*Viburnum* × *pragense* Hort.).

Significance to the Nursery Industry

Harbour Dwarf nandina develops few axillary or aerial rhizomic shoots when produced in containers, a condition that limits propagation material. ASC-66952 promoted the development of axillary and aerial rhizomic shoots, providing an important source of propagation material. A temporary chlorosis of immature leaflets and a slight inhibition of overall growth with the higher rates of ASC-66952 did not adversely impact plant quality. Lack of response of 'Blue Girl' and 'Nellie R. Stevens' hollies, 'George L. Tabor' and 'Trouper' azaleas, Asiatic jasmine and Prague viburnum to ASC-66952 indicates a species-dependent response to the compound.

[1]Received for publication March 19, 1993; in revised form May 7, 1993.

[2]Associate Professor of Horticulture.

Introduction

Many woody landscape species require repeated pruning to produce well-branched, quality plants for market. Shoot-tip pruning removes the source of apical dominance, a process controlled by a balance between auxin and cytokinin levels (7, 9), and stimulates lateral bud development but is labor-intensive. Exogenously applied cytokinins, including BA and PBA, promote axillary bud growth and branching of woody and herbaceous plants (6, 8, 10). Pinching also may be achieved chemically with a foliar spray of dikegulac, a compound that is translocated to the shoot apex, temporarily suppressing apical dominance and stimulating lateral branching (1). Other compounds, such as the triazole retardant paclobutrazol, were reported to induce branching in a wide range of plants (5).

ASC-66952 is a proprietary chemical developed by ISK Biotech Corp., formerly Fermenta ASC Corp. Early development of ASC-66952 was done by Ricerca, Inc. (Painesville, OH), a contract research company of Fermenta ASC. An acetone-soluble formulation (R-50629) and the potassium salt of R-50629 (R-65258) were evaluated. At high concentrations ASC-66952, the current designation of R-65258, acted as a selective broadleaf herbicide but at lower rates induced branching of azalea and maple, and tillering of wheat (2). Timing of ASC-66952 application relative to pruning affected plant response. When hibiscus was pruned just prior to treatment, lateral buds were inhibited rather than released. When pruning was delayed until 2 weeks after treatment, vigorous lateral bud outgrowth was obtained (Technical Data Sheet ASC-66952, Fermenta ASC Corp., Mentor, OH). This study was conducted to determine the effectiveness of ASC-66952 in inducing axillary or aerial rhizomic shoot development of several woody landscape species during nursery production. Species used in this research typically require multiple pruning during production for the development of well-branched, compact plants or, as with Harbour Dwarf nandina, develop few axillary or aerial rhizomic shoots in containers.

Materials and Methods

Uniform liners of 'Harbour Dwarf' nandina, 'George L. Tabor' azalea, 'Trouper' azalea, 'Blue Girl holly,' 'Nellie R. Stevens' holly, Asiatic jasmine and Prague viburnum were potted April 26, 1990, in 3.8 liter (#1 full gal) containers. A pine bark:sand growth medium (7:1, by vol) was amended per m^3 (yd^3) with 8.3 kg (14 lb) Osmocote 18N-2.6P-10K (18-6-12), 3.0 kg (5 lb) dolomitic limestone, and 0.9 kg (1.5 lb) Micromax micronutrient fertilizer. Nandina and azalea cultivars were grown in a shade house with 47% light exclusion; other plant types were grown in full sun. All plants were irrigated as needed from overhead sprinklers. On June 13, 1990, a single foliar spray of ASC-66952 at 0, 25, 50, 100, or 200 ppm was applied just prior to runoff to all species. Foliar sprays included 0.25% (v/v) Triton AG-98, a non-ionic spray adjuvant, and were applied with pump-type hand sprayers. On June 27, two weeks after treatment, all plant types, except nandina which is not typically pruned during production, were pruned to a uniform size, and the number of axillary shoots on all plants was determined. Initial axillary shoot numbers were statistically the same within a plant species, hence no adjustments were made in subsequent data.

In August 1990 axillary and aerial rhizomic shoots of nandina longer than 2 cm (0.8 in) were counted, and in January 1991 growth indices were determined. Growth index was equal to the mean of plant height, width at the widest point and width perpendicular to the widest point. In August 1990 and February 1991 growth indices, axillary shoot numbers and lengths of the three longest axillary shoots were determined for the two azalea and holly cultivars and viburnum. The numbers of axillary shoots and shoots longer than 30.5 cm (12 in) and the length of the longest shoot per plant of Asiatic jasmine were determined in August 1990 and February 1991. There were 6 replicates of 3 plants per treatment of nandina and 9 single-plant replicates of other plant species completely randomized within species. The response to rates of ASC-66952 was determined by regression analysis.

Results and Discussion

Axillary, aerial rhizomic and total shoot numbers of 'Harbour Dwarf' nandina increased linearly or quadratically with increasing rates of ASC-66952. Increases in numbers of axillary shoots over those of control plants ranged from 350% with 25 ppm to 950% with 200 ppm (Table 1), while the numbers of aerial rhizomic shoots increased 144% to 478%. Newly formed axillary and aerial rhizomic shoots developed at least one leaf each and were considered sufficient in size for tip-cutting propagation and division, respectively (4). Growth indices decreased linearly with increasing rates of ASC-66952. Treated plants were 2% to 10% smaller than control plants but were noticeably denser and more compact. Immature foliage of nandina sprayed with 100 or 200 ppm of ASC-66952 became chlorotic within two weeks of treatment; however, leaflets had developed normal coloration four weeks after treatment.

Application of ASC-66952 to the other plant species did not affect axillary shoot numbers or lengths, or growth indices (data not shown). Neither was chlorotic foliage observed on any plants. Treated and untreated plants were consistently uniform in size, foliage color and branching.

Plants in this test treated with ASC-66952 either formed large numbers of axillary or aerial rhizomic shoots ('Harbour Dwarf' nandina) or were unaffected by treatment (all other plant species). These results are inconsistent with earlier

Table 1. Effects of ASC-66952 on shoot development and growth of 'Harbour Dwarf' nandina.

ASC rate[z] (ppm)	Shoot number			Growth index[y]
	Axillary	Aerial rhizomic	Total	
0	0.2	0.9	1.1	38.0
25	0.9	2.2	3.1	37.2
50	1.4	3.9	5.3	36.8
100	1.7	4.3	6.0	36.2
200	2.1	5.2	7.3	34.3
Significance of rate[x]	L**Q*	L**	L**Q**	L**

[z]Triton AG-98 (0.25%, v/v) added to all solutions.

[y]Growth index = (height + width at widest point + width 90° to the first width) ÷ 3, in cm; determined January 1991.

[x]Significance of regression at $P = 0.05$ (*) or $P = 0.01$ (**); L = linear, Q = quadratic.

research in which a wide range of species responded to the chemical with an increase in axillary shoot development (2). For example, in this earlier work 'Elsie Lee' azalea treated with 80 ppm of ASC-66952 formed seven times as many flower buds per plant as a result of increased branching than did non-sprayed control plants. Neither azalea cultivar in this current experiment was affected by ASC-66952 rates up to 200 ppm. Differences in response may relate to cultivar differences, to 'Elsie Lee' not being pruned two weeks after treatment (2), to use of different adjuvants, or to environmental or nutritional status of tested plants (3). Although most plant species did not respond to ASC-66952 application in this study, results with 'Harbour Dwarf' nandina are encouraging. Increased numbers of axillary and aerial rhizomic shoots represent an important source of propagation material for the grower from a cultivar that does not readily branch or form aerial rhizomic shoots during production.

(Ed. note: This paper reports the results of research only, and does not imply registration of a pesticide under amended FIFRA. Before using the product mentioned in this research paper, be certain of its registration by appropriate state and/or federal authorities.)

Literature Cited

1. Arzee, T., H. Langenauer, and J. Gressel. 1977. Effects of dikegulac, a new growth regulator on apical growth and development of three Compositae. Bot. Gaz. 138:18–28.

2. Crosby, K.E., H.S. Ku, L.E. Limpel and L.J. Powers. 1989. Modification of branching using a new PGR, R-50629. Proc. Plant Growth Reg. Soc. Amer. 16:192–199.

3. Gregory, F.C. and J.R. Veale. !957. A reassessment of the problem of apical dominance. Symp. Soc. Exp. Biol. 11:1–20.

4. Gwaltney, T. 1983. Propagation of dwarf nandina cultivars. Proc. Intern. Plant Prop. Soc. 33:624–628.

5. Keever, G.J., W.J. Foster, and J.C. Stephenson. 1990. Paclobutrazol inhibits growth of woody landscape plants. J. Environ. Hort. 8:41–47.

6. Lewnes, M.A. and B.C. Moser. 1976. Growth regulator effects on apical dominance of English ivy. HortScience 11:484–485.

7. Phillips, I.D.J. 1975. Apical dominance. Annu. Rev. Plant Physiol. 26:341–367.

8. Ryan, G.F. 1985. Branching of *Photinia* × *fraseri* in response to growth regulators and fertilizer. J. Environ. Hort. 3:15–18.

9. Sachs, T. and K.V. Thimann. 1967. The role of auxins and cytokinins in the release of buds from dominance. Amer. J. Bot. 54:136–144.

10. Wright, R.D. 1976. 6-benzylaminopurine promotes axillary shoots in *Ilex crenata* Thunb. HortScience 11:43–44.

Nontarget Losses of Granular Herbicide Applied to Container-grown Landscape Plants[1]

Wayne C. Porter and Richard L. Parish[2]

Hammond Research Station and Biological and Agricultural Engineering Department
Louisiana Agricultural Experiment Station
Louisiana State University Agricultural Center
21549 Old Covington Highway
Hammond, LA 70403

Abstract

Nontarget losses of granular material applied over widely spaced containers were reduced from 87% with a broadcast rotary applicator to 72-86% with a drop-type spreader and to 48-75% with a drop spreader modified to band apply the material. Plant species and container spacing configuration had a significant effect on material loss. With a drop spreader, losses ranged from a low of 10% with pot-to-pot spaced juniper to 86% with liriope on 30-cm centers. With a pot-to-pot hexagonal configuration, the losses varied from 10.2% with juniper to 19.9% with liriope. With a pot-to-pot square configuration, the losses varied from 15.1% with azalea to 31% with liriope. There were no significant differences in loss with the wide-spaced configuration with respect to plant species.

Index Words: herbicide application, weed control, granular herbicides, container-grown.

Species used in this study: liriope [*Liriope Muscari* (Decne.) L.H. Bailey]; prostrate juniper (*Juniperus horizontalis* Moench); dwarf lilyturf [*Ophiopogon japonicus* (Thunb.) Ker-Gawl.]; azalea (*Rhododendron* × *'Carror'*); dwarf gardenia (*Gardenia jasminoides* Ellis).

Significance to the Nursery Industry

Application of herbicides formulated on granular carriers is a common practice in container nurseries. Depending on container arrangement and plant species, a high percentage of the material applied may not be retained in the containers–particularly when the material is applied with a broadcast rotary spreader. The material loss represents a significant unproductive cost to the nurseryman and can also contribute to surface or groundwater pollution. This research demonstrated the increased efficiency of application possible with a drop-type spreader. The differences in application efficiency among different plant species are also reported.

Introduction

Container production of landscape plants is a major industry in the United States. Controlling weeds in the containers requires the use of herbicides. In many cases, herbicides are

[1]Received for publication February 26, 1993; in revised form May 10, 1993. Approved for publication by the Director of the Louisiana Agricultural Experiment Station as manuscript number 93-68-7069.

[2]Associate Professor and Professor, respectively.